

Report on the investigation of
the fatality of an able seaman
on board ro-ro cargo ship

Tyrusland

in Tripoli, Libya

on 15 May 2013



Extract from
The United Kingdom Merchant Shipping
(Accident Reporting and Investigation)
Regulations 2012 – Regulation 5:

“The sole objective of the investigation of an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012 shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of an investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame.”

NOTE

This report is not written with litigation in mind and, pursuant to Regulation 14(14) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012, shall be inadmissible in any judicial proceedings whose purpose, or one of whose purposes is to attribute or apportion liability or blame.

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GLOSSARY OF ABBREVIATIONS, ACRONYMS AND TERMS

2/O	Second Officer
AB	Able seaman
CMA CGM	Company Maritime d’Affrètement, Company General Maritime
C/O	Chief Officer
COSWP	Code of Safe Working Practices for Merchant Seamen
DoC	Document of Compliance
DP	Designated Person
FEU	forty foot equivalent unit
gt	gross tonnage
ILO	International Labour Organization
ISM	International Safety Management (Code)
ISO	International Organization for Standardization
LOLER	The Merchant Shipping and Fishing Vessels (Lifting Operations and Lifting Equipment) Regulations 2006
MCA	Maritime and Coastguard Agency
MGN	Marine Guidance Note
Ro-Ro	Roll on, Roll off
SMC	Safety Management Certificate
SMS	Safety Management System
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended (STCW Convention)
TEU	Twenty foot equivalent unit
UTC	Universal Co-ordinated Time
VHF	Very High Frequency
2/O	Second officer
Twistlock	The male component of a rotating connector used to secure the corner of a cargo container

Times: All times used in this report are UTC + 1 hour

SYNOPSIS

At 1810 on 15 May 2013, able seaman (AB) William Penafiel was crushed between two cargo containers on the main deck of the ro-ro cargo ship *Tyrusland*. He did not survive the injuries sustained.

Tyrusland was berthed in Tripoli and the crew were working with an embarked team of vehicle drivers to discharge a cargo of containers. AB Penafiel's role was to release and remove twistlocks during the cargo discharge operation. This task required him to work in close proximity to moving vehicles that were being used to handle the containers.

At the time of the accident, a full container was being handled using a fork-lift truck. The fork-lift truck driver was conducting a manoeuvre to avoid the container striking an adjacent stack of containers and to realign the container in preparation for loading it onto a waiting trailer. However, the driver could not see AB Penafiel and was, therefore, unaware of his movements. As AB Penafiel attempted to remove a twistlock from the deck, the moving container collided with a static container, fatally crushing him in between.

The MAIB investigation found that the system of work employed by those involved in the cargo handling process was unsafe and that AB Penafiel had entered a hazardous area with insufficient safeguards in place.

The investigation also found that there were weaknesses in the implementation of the company's safety management system (SMS) on board *Tyrusland*, particularly relating to risk assessments and SMS review processes. Although a risk assessment relating to working on deck existed, it did not identify and address the specific hazard of a worker being crushed by a moving vehicle or container during cargo handling operations. The lack of appropriate risk assessments was an issue that had been identified previously in both an internal company audit and an external audit conducted by the Maritime and Coastguard Agency (MCA). However, follow-up action by the company and the MCA in response to this issue was insufficient to prevent the accident.

This was the fourth accident, two of which were fatal, in less than a year involving UK flagged ships managed by Imperial Ship Management AB. The company has since conducted a safety management review and has developed a plan for improving procedures and safety culture across its fleet. The MAIB has previously made a recommendation¹ to the MCA aimed at improving its processes for managing audits and follow-up action. In view of this recommendation and the action taken since by Imperial Ship Management, no recommendations are made in this report.

¹ MAIB Report 18/2014 on the fire on board *Celtic Carrier* on 26 April 2013

SECTION 1 – FACTUAL INFORMATION

1.1 PARTICULARS OF *TYRUSLAND* AND ACCIDENT

SHIP PARTICULARS	
Ship's name	<i>Tyrusland</i>
Flag	United Kingdom
Classification society	Lloyd's Register
IMO number	7718503
Type	Ro-ro cargo ship
Year of build	1978
Registered owner	Tyrusland Limited, UK
Manager(s)	Imperial Ship Management AB
Charterer	CMA CGM
Construction	Steel
Length overall	190.34m
Gross tonnage	20,882
Minimum safe manning	13
VOYAGE PARTICULARS	
Port of departure	Not applicable
Port of arrival	Alongside in Tripoli, Libya
Cargo information	Containers
Manning	17 crew + 8 vehicle drivers + 2 motor engineers
MARINE CASUALTY INFORMATION	
Date and time	15 May 2013, 1810
Type of marine casualty or incident	Very serious marine casualty
Location of incident	Tripoli, Libya
Place on board	Main deck
Injuries/fatalities	Fatal crushing injury to ship's AB



MV Tyrusland

1.2 NARRATIVE

1.2.1 Pre-accident

Throughout the afternoon and early evening of 14 May 2013, *Tyrusland* was berthed in Malta Freeport loading a cargo of containers. Once the loading was complete, the ship sailed for an overnight passage to Tripoli. By 1130 the following day, 15 May 2013, the ship was berthed and preparations had started for cargo discharge. At 1242, container discharge commenced from the ship's main deck and at 1356, simultaneous discharge started from the weather deck.

Able seaman (AB) Penafiel came on watch at 1600 with the ship's second officer (2/O) as duty officer and the bosun as the second deckhand. AB Penafiel was assigned the task of twistlock operator on the ship's main deck. He was responsible for releasing and removing twistlocks from the deck and from containers as they were being discharged. During the watch, AB Penafiel worked together with the fork-lift truck and tugmaster drivers to clear the containers loaded on the main deck.

Between 1700 and 1750, the chief officer (C/O) temporarily relieved the bosun so that he could take a meal break; the bosun then gave AB Penafiel a break for his meal. By 1750, the on-watch personnel were back to their originally assigned positions.

Just before the accident, all the forty foot equivalent unit (FEU) containers on the main deck had been discharged except two (hereafter referred to in this report as 'container A' and 'container B'), which were stacked one on top of the other. In preparation for discharging these two containers, AB Penafiel released the twistlocks which had secured them together (**Figure 1a**).

1.2.2 The accident

At approximately 1810, the fork-lift truck driver manoeuvred his truck in preparation for lifting container A off container B. He lined up the truck at 90° to the containers and then moved it forward, forcing the vehicle's forks into the gap between the stacked containers (**Figure 1b**). At about the same time, a tugmaster and trailer unit was driven onto the main deck and turned through 180° in preparation for being reversed to collect container A (**Figure 1c**). At this point, AB Penafiel was standing on the port side of the main deck, clear of the fork-lift truck.

The fork-lift truck driver then lifted container A from container B, visually checked that the area behind the fork-lift truck was clear, and started reversing his loaded vehicle (**Figure 1d**). Once container A was clear of container B, the fork-lift truck driver started lowering the suspended container. This improved his vehicle's stability but restricted his field of vision ahead (**Figure 1e**).

AB Penafiel then moved forward and removed a twistlock from the port side aft underside corner of container A (**Figures 1f and 1g**). He then turned round and bent down to remove twistlocks from the deck immediately in front of him (**Figure 1h**).

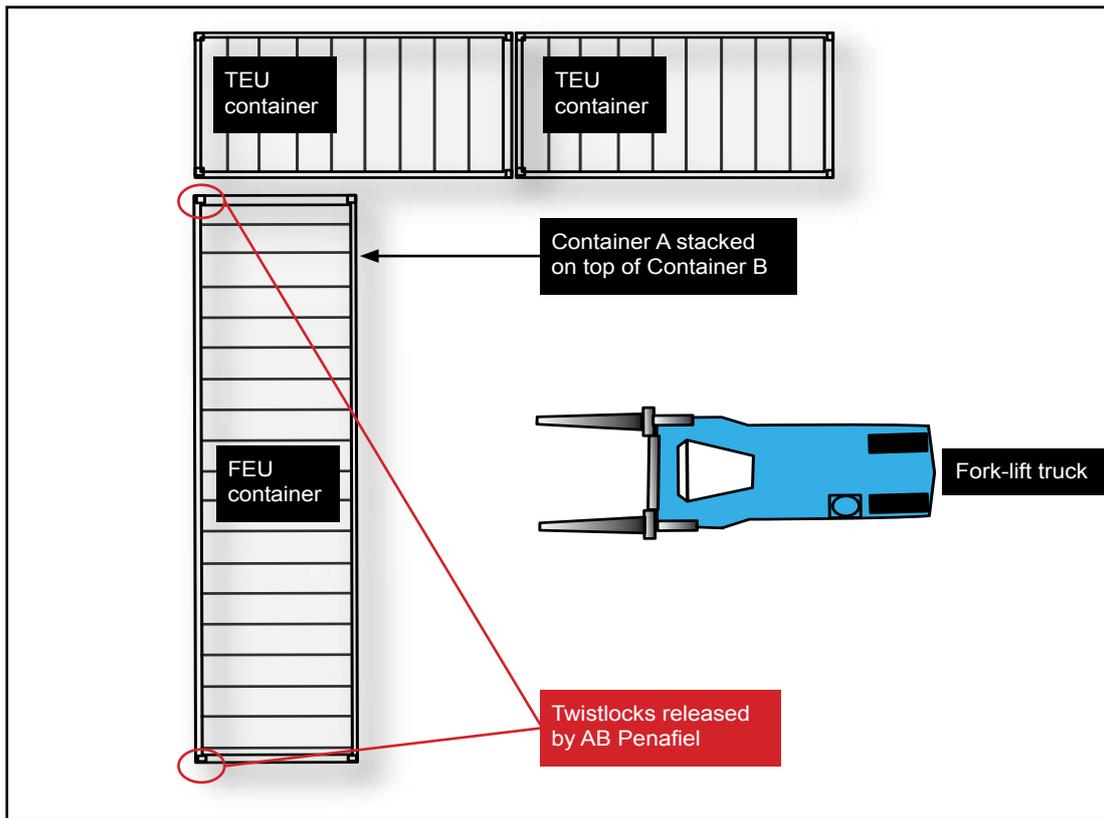


Figure 1a: Accident sequence – AB Penafiel released twistlocks securing containers A and B together

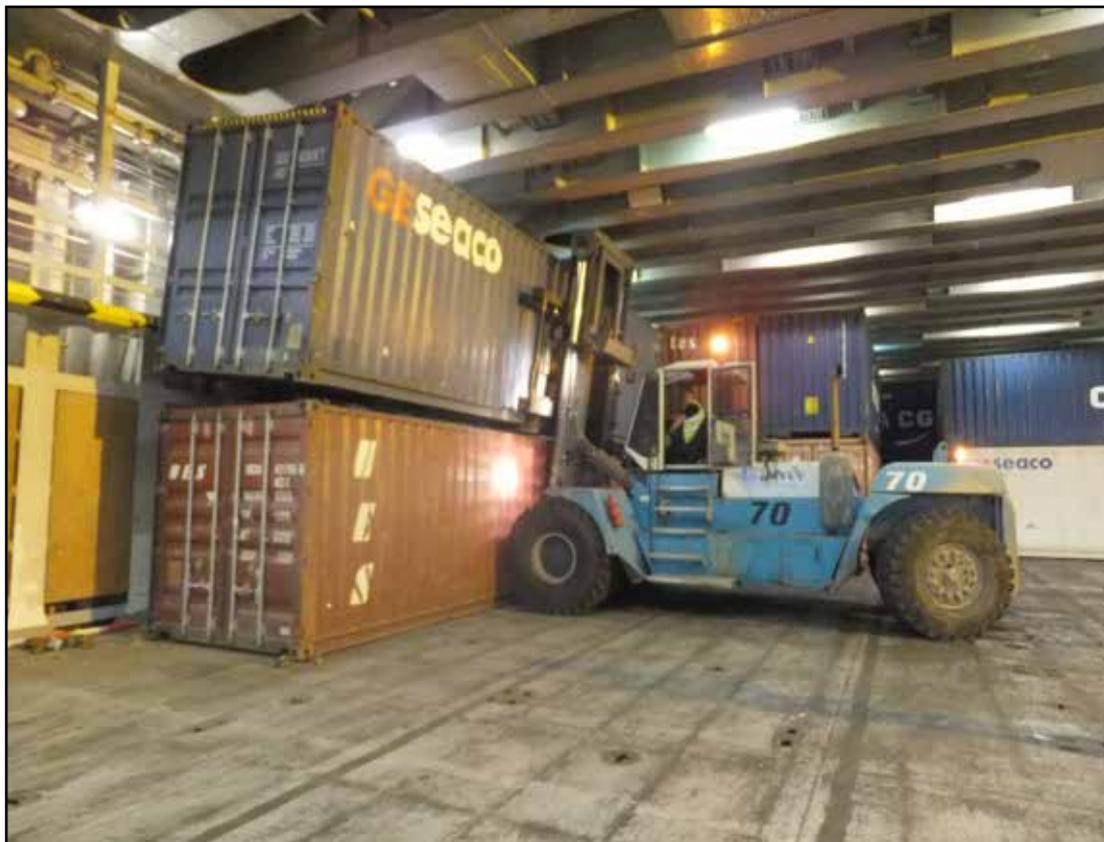


Figure 1b: Reconstruction photograph – fork-lift truck starting to lift container A from Container B

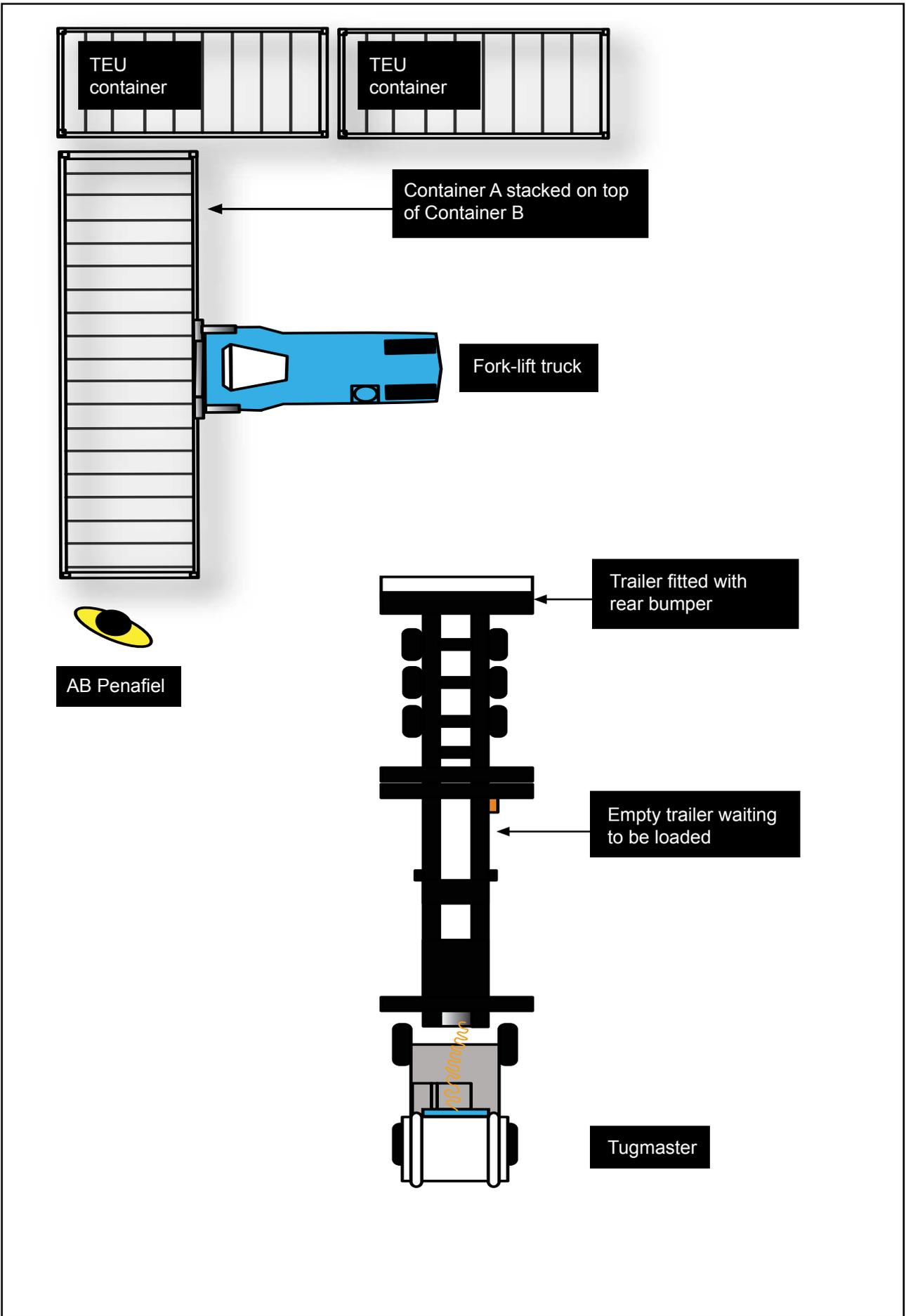


Figure 1c: Tugmaster and trailer in position for loading



Figure 1d: Reconstruction – fork-lift truck reversing to move container A clear of container B

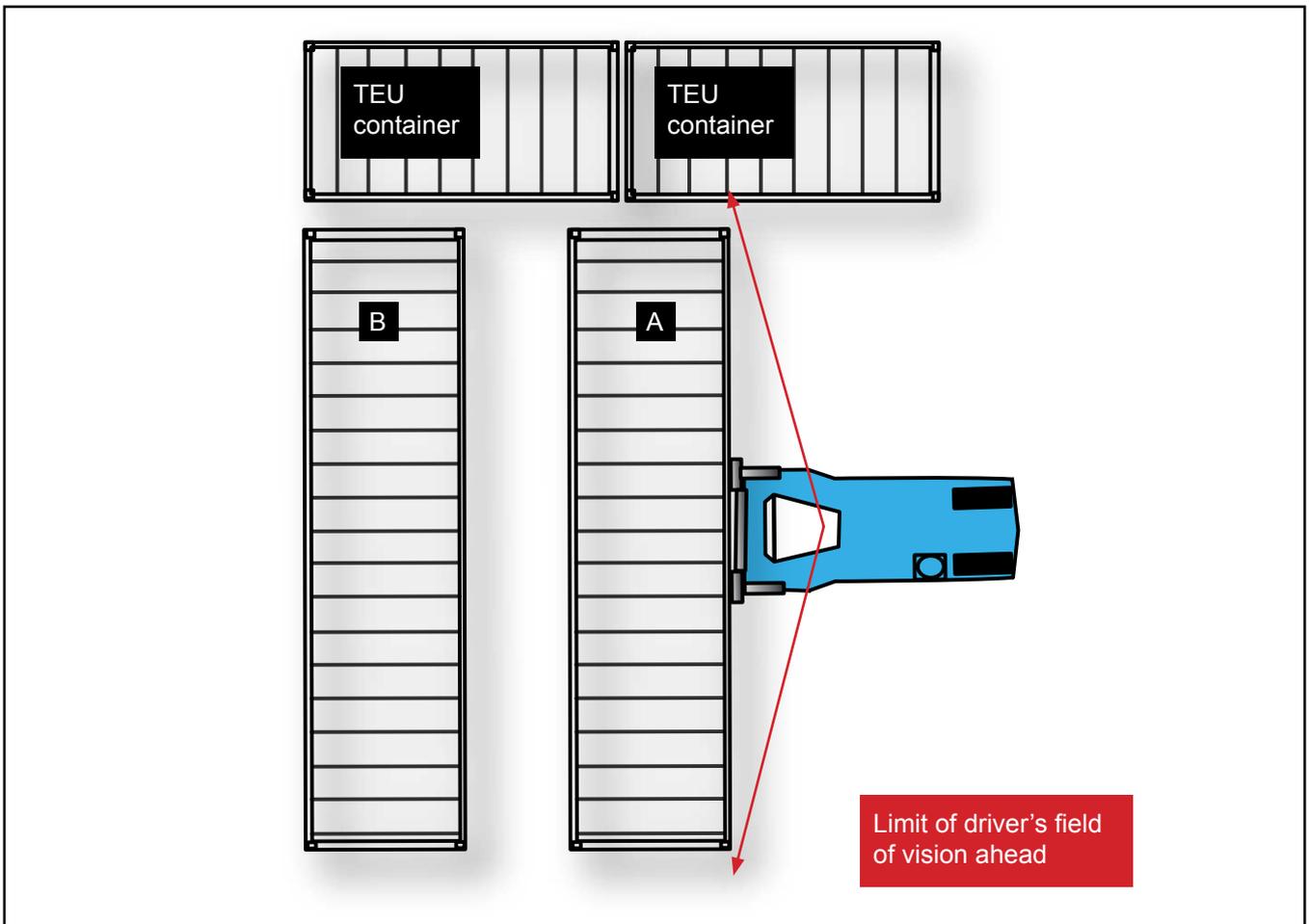


Figure 1e: Driver visibility with container lowered

Meanwhile, the fork-lift truck driver continued to manoeuvre his vehicle in preparation for loading container A onto the waiting trailer. This manoeuvre involved a turn which was necessary for the forward end of container A to clear an adjacent stack of twenty foot equivalent unit (TEU) containers (**Figure 1i**) and to realign it for loading onto the waiting trailer. This manoeuvre caused the port side aft corner of container A to collide with container B, fatally injuring AB Penafiel, who was positioned between them (**Figure 1j**).



Figure 1f: AB Penafiel moves forward to remove twistlock

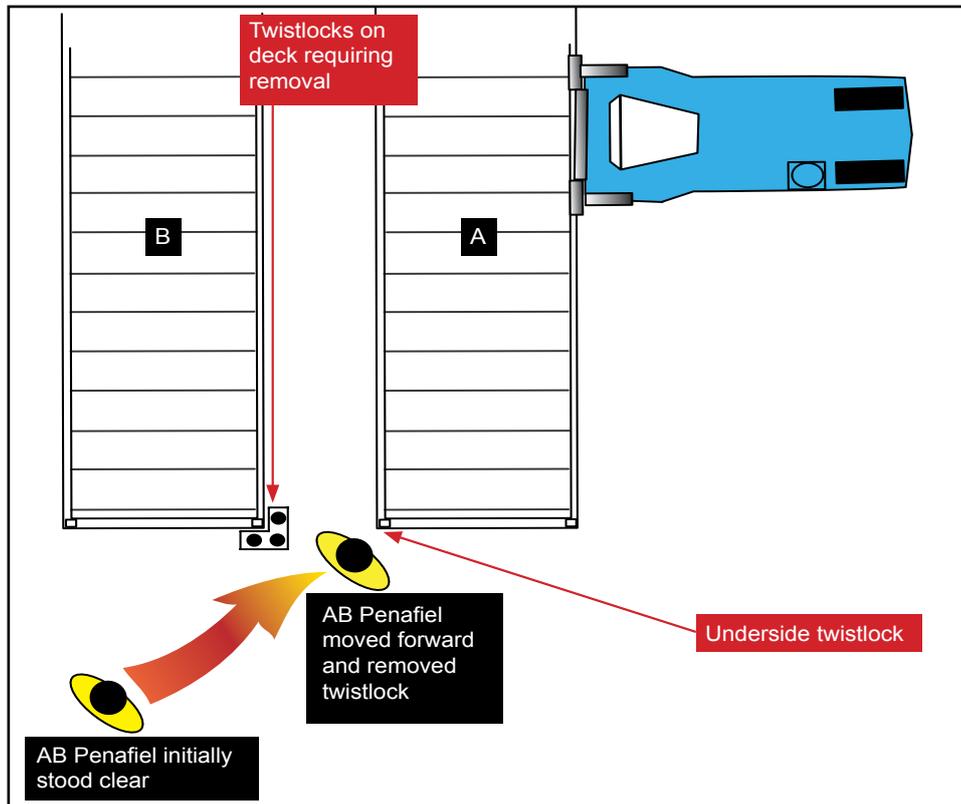


Figure 1g: AB Penafiel moves forward to remove twistlock

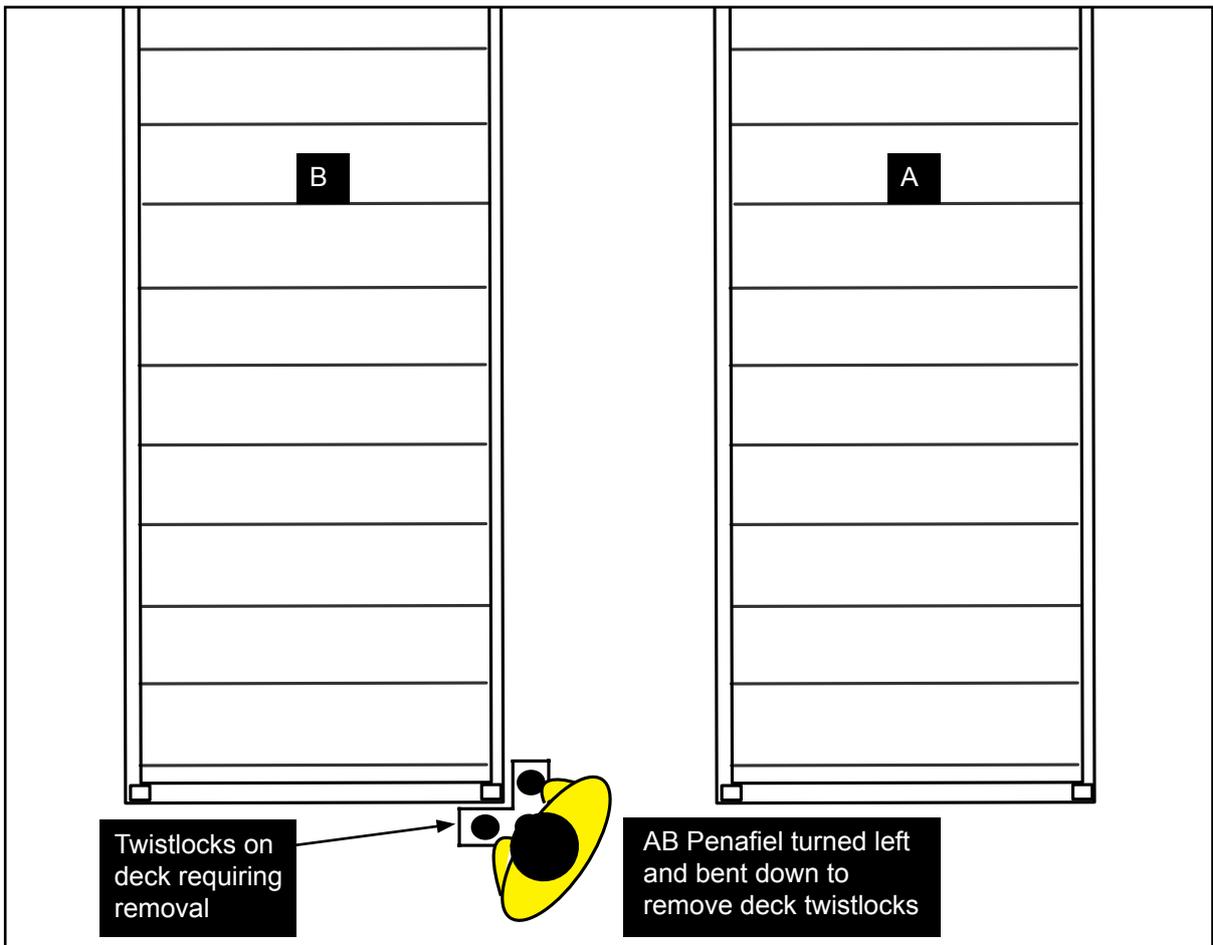


Figure 1h: AB Penafiel turned and bent down

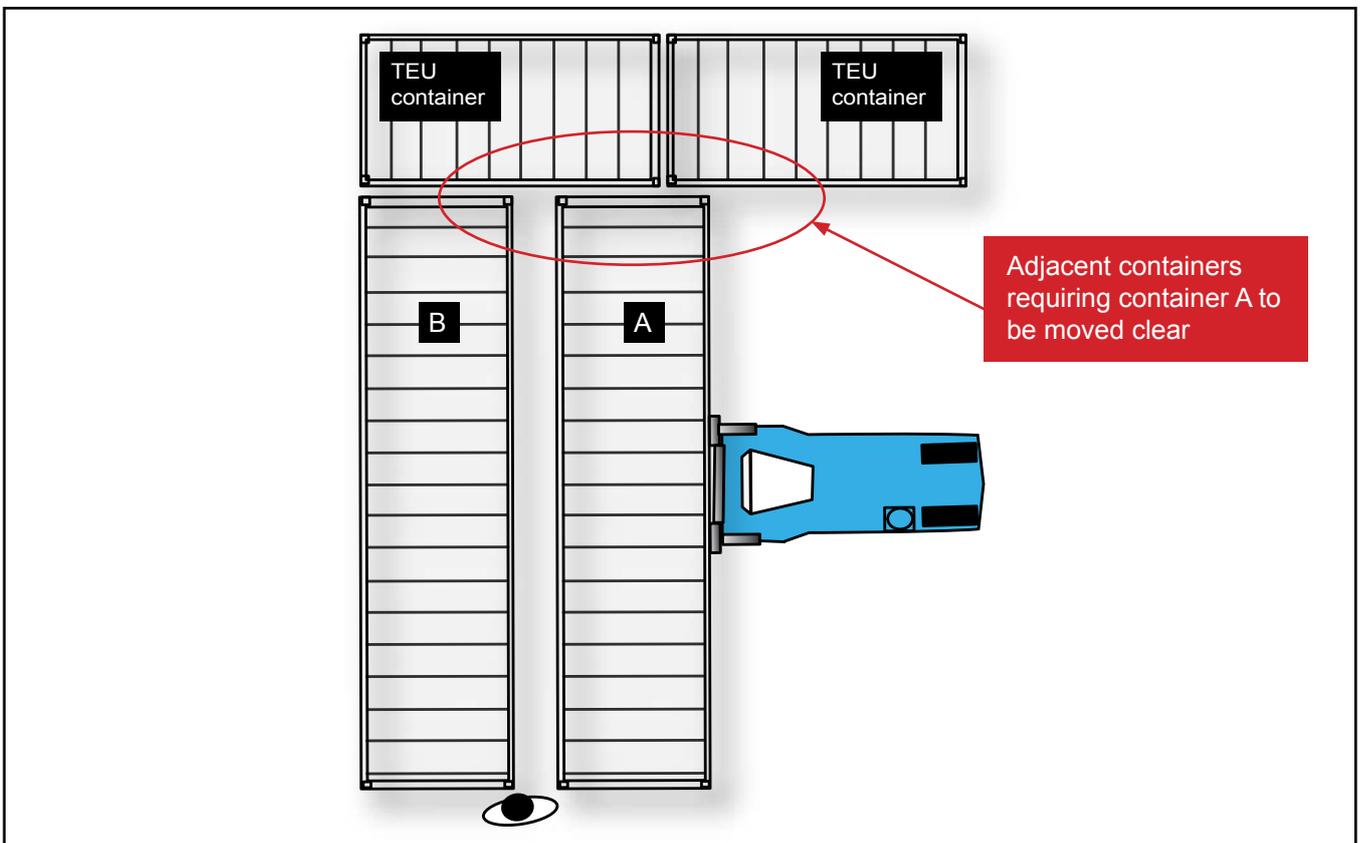


Figure 1i: Adjacent container snagging hazard

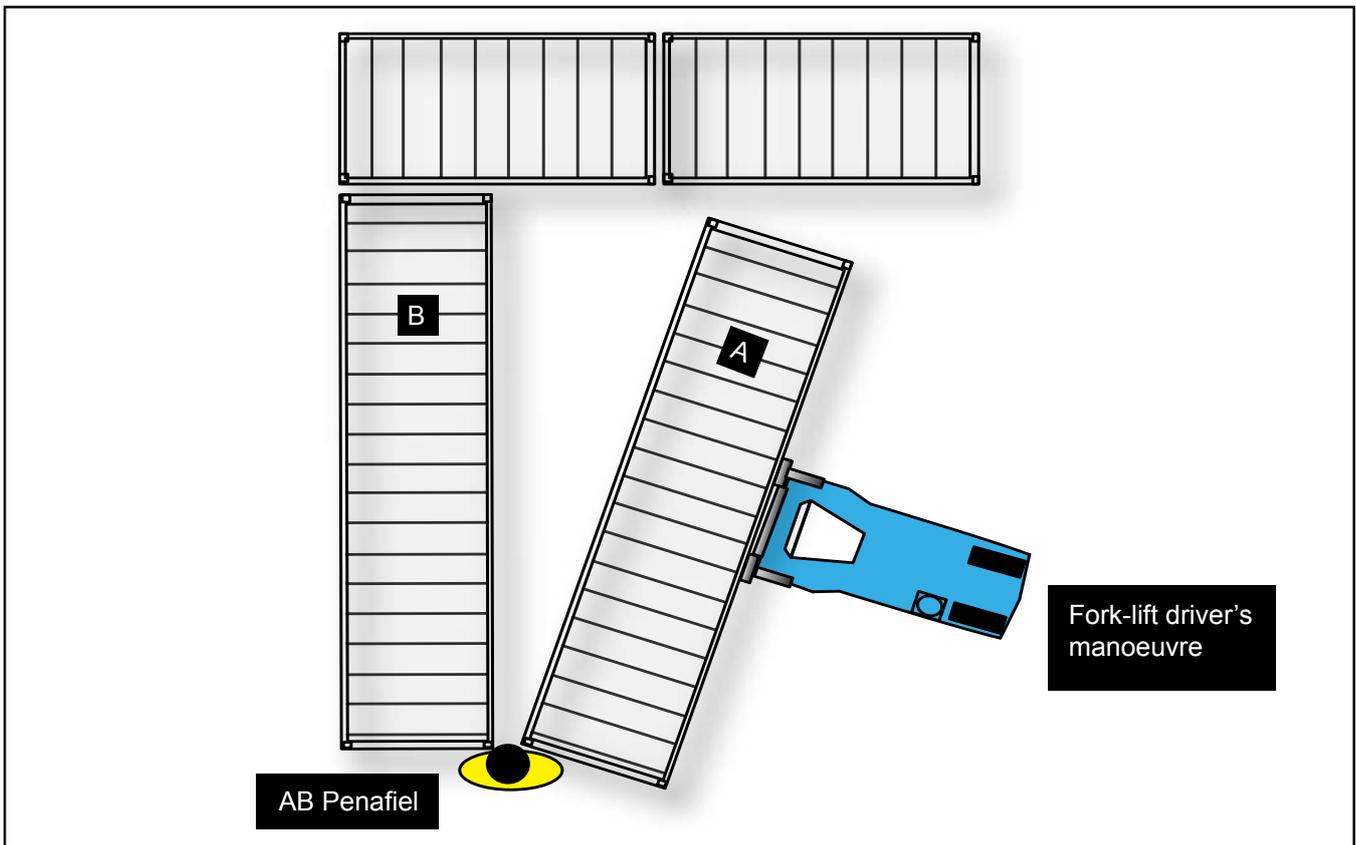


Figure 1j: Fatal manoeuvre

1.2.3 Emergency response

The accident was witnessed by the tugmaster driver, who raised the alarm using his hand-held very high frequency (VHF) radio. He then left his vehicle and rushed towards the casualty. On hearing the tugmaster driver's radio report, the driver foreman, who was on the weather deck, quickly made his way to the accident scene.

On the weather deck, the bosun appreciated that something might be wrong and so called AB Penafiel on the ship's VHF radio channel, but received no reply. The bosun then rushed to the main deck and, seeing the scene there, raised the alarm on the ship's VHF radio channel. This radio call alerted the master, C/O and 2/O to the accident.

The master then raised the alarm externally by calling the ship's agent ashore. The agent informed Tripoli Port Authority, who despatched the dockyard ambulance to the ship. When the 2/O arrived at the scene, he tried to detect a pulse from AB Penafiel but was unable to find one. Soon afterwards, the dockyard ambulance arrived. The attending paramedics assessed AB Penafiel's condition and concluded that, due to the severity of his injuries, nothing could be done to save him.

1.3 TYRUSLAND

1.3.1 Construction

Tyrusland was a 20,882 gross tonnage ro-ro cargo ship built in Japan in 1978. It was lengthened and upgraded in 1995. The original design and layout was intended for vehicles and other cargo; its modified internal dimensions were not optimised for an entire cargo of standard containers.

1.3.2 Trading

Tyrusland had been chartered by Company Maritime d'Affrètement, Company General Maritime (CMA CGM) to transport containerised cargo between Malta Freeport and Libya. The passage time between ports was approximately 12 hours. The ship was managed by Imperial Ship Management from its offices in Gothenburg, Sweden. The company managed a fleet of 13 ships; a mix of general and ro-ro cargo vessels, 7 of which were UK flagged.

1.3.3 Manning

The ship's minimum safe manning certificate required a crew of 13. At the time of the accident, the crew comprised 17 - all Filipino nationals who had been recruited by OSM Shipping, a crew manning agency with an office in the Philippines. The crew were appropriately qualified for their roles. The deck department operated a one-in-three watchkeeping roster at sea. In port, additional overtime hours were worked to meet the demands of dual deck cargo operations.

1.3.4 The deceased

AB William Penafiel was a 41 year old Filipino who was 6 months into a 9 month contract on board *Tyrusland*. He was STCW² II/4 qualified and held a number of additional qualifications including sea survival, first-aid, fire-fighting, hazardous materials, maritime English, port security and anti-piracy. He had completed all the required safety management system (SMS) familiarisation processes. Although he had attended college training to become a deck officer, personal circumstances had prevented him from completing the course. However, while on board *Tyrusland*, he was undertaking personal study towards gaining officer accreditation.

1.4 EMBARKED DRIVERS AND VEHICLES

Resulting from limited stevedore facilities in Libyan ports, CMA CGM's charterparty agreement for *Tyrusland* included the embarkation of equipment and operators necessary for container handling.

1.4.1 Embarked team of vehicle drivers

The embarked team consisted of six vehicle drivers (including a foreman) who were employed by the Malta Dockers' Union. The team of drivers lived and worked on board although they did not keep sea watches; instead they worked whatever hours were necessary in port to load or discharge the ship. In order to mentor and train a new team of drivers, Malta Freeport Terminals provided two additional and very experienced drivers to the ship. These two additional drivers were direct employees of Malta Freeport Terminals and not part of the Union.

1.4.2 Vehicles for container handling

Tyrusland carried a range of vehicles for container handling including tugmasters, trailers, fork-lift trucks, a reach-stacker and a top-lifter. The initial inventory of vehicles had been supplied by CMA CGM, and Malta Freeport Terminals had provided additional vehicles to assist with the operation.

² International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended (STCW Convention)

The vehicle being used to handle container A was an FL70 35 ton (38.58 tonne) lift capacity, rear wheel steered, fork-lift truck (**Figure 2**). This vehicle had been supplied by Malta Freeport Terminals. It was primarily used to handle containers between decks where the limited headroom precluded use of the reach-stacker or top-lifter.



Figure 2: FL70 fork-lift truck

Containers were hauled between ship and shore on trailers towed by tugmaster vehicles; the trailers were all capable of carrying either 1 x FEU or 2 x TEU containers. The trailers were of a 'closed-corner' type, fitted with fixed supports at each corner (**Figure 3**). The presence of these corner supports meant that any underside twistlocks on a container had to be removed before the container could be loaded onto the trailer.

The trailer waiting to be loaded at the time of the accident was also fitted with a steel rear bumper (**Figure 3**) primarily for physical protection. However, when there were obstructions to the rear (as was the case in this accident) the bumper prevented the trailer from being reversed fully in line with the container being discharged. This required the fork-lift truck driver to realign the container before loading it onto the trailer (**Figure 4**).

1.4.3 Fork-lift truck driver

The fork-lift truck driver involved in the accident was one of the additional and more experienced drivers tasked to assist on board *Tyrusland*. He was a 50 year old Maltese national who had 22 years' experience of operating terminal equipment ashore in Malta Freeport. He was qualified to the highest skill level attainable for



Figure 3: Trailer closed-corner and rear bumper fittings

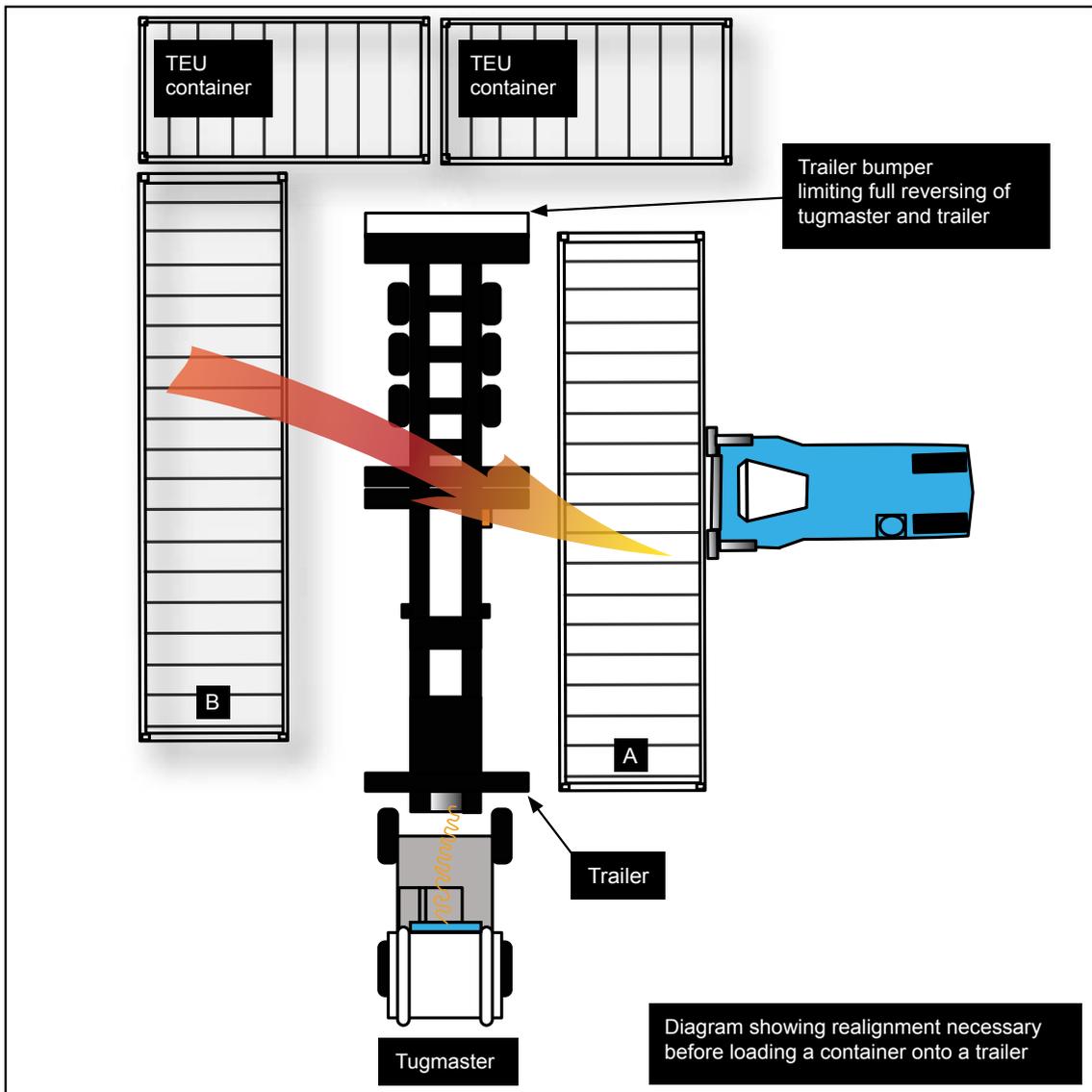


Figure 4: Diagram showing necessary container realignment

a shore-based terminal vehicle driver. Before joining the ship, he had completed a health and safety training programme at Malta Freeport Terminals covering ro-ro safe operating practices and hazard identification. He had also worked for 4 months on board a similar ship undertaking the same driving tasks. He joined the ship on the day before the accident and completed the ship's SMS familiarisation basic introduction checklist (**Annex A**).

1.5 CARGO HANDLING

1.5.1 Containers

Tyrusland was transporting cargo loaded inside FEU and TEU containers. The cargo departure plan for 14 May 2013 is at **Annex B** and shows the location of the accident. A key feature of the TEU containers was the fork pockets built into their lower structure (**Figure 5**). No such pockets were fitted to the FEU containers, whose lower edges were easily damaged if the containers were lifted using a fork-lift truck (**Figure 6**).



Figure 5: TEU container fork pockets

1.5.2 Twistlocks

Containers A and B were secured together (on the outboard side only) using semi-automatic twistlocks (**Figure 7**). This style of twistlock was spring-loaded, locking itself automatically when a container was lowered onto it. It was unlocked manually by pulling a release wire.



Figure 6: FEU container without fork pockets showing fork damage



Figure 7: Semi-automatic twistlock securing two containers together

Container B, and other containers around it which had been discharged before the accident, had been secured to the deck using a mix of stacking cones and manual twistlocks. A manual twistlock had an operating handle which was used to lock and unlock the mechanism by hand.

1.5.3 Ship's crew as twistlock operators

CMA CGM's charterparty for *Tyrusland* included a clause providing for crew assistance during cargo operations (**Annex C**). When employed in this role, the crew were acting as 'charterer's servants' and were paid a bonus directly by the charterer.

As charterer's servants, the crew were responsible for twistlock operations. During cargo discharge, they were to release twistlocks before a container was lifted, and then remove any twistlocks from its underside in preparation for loading it onto a trailer. They were also required to remove any twistlocks left on the deck after a container had been discharged so as not to obstruct vehicle operations.

1.5.4 Local procedures

Although not formally implemented or recorded as a ship's procedure, an arrangement existed between the twistlock operators and the fork-lift truck drivers for the co-ordination of activity during container handling movements. For discharge, the operation was in four stages: initial twistlock release, lifting of a container, removal of any underside twistlocks, and loading of the container onto a trailer. The locally arranged procedure involved the twistlock operator and the fork-lift truck driver exchanging signals at each of these stages to indicate that it was safe to undertake the next step. The signals used were either a visual 'thumbs up' or a toot on the vehicle's horn.

1.5.5 Duty personnel communications

Duty members of the ship's crew were supplied with a hand-held VHF radio for communications while on watch. The embarked drivers also used VHF radios to communicate with one another, but on a different channel to that of the crew's radios.

1.6 COMPANY SAFETY MANAGEMENT SYSTEM

1.6.1 Objectives

Imperial Ship Management operated a computer-based onboard safety management system (SMS), which provided operational instructions and guidance.

The SMS objectives were:

- *'To establish safe practices in ship operations by providing a safe working environment, established safeguards against all identified risks and by planning all essential operational processes in order to ensure that they take place under controlled circumstances.'*

- *To continuously improve the safety management and skills of all personnel by monitoring the proper functioning of the SMS, maintaining a training programme for all personnel and to ensure the protection of health by keeping all personnel informed of identified dangers or hazards.*
- *To always comply with and maintain mandatory rules and regulations and ensure that applicable codes, guidelines and standards are taken into account.’ [sic]*

1.6.2 Cargo operations procedure

As a sub-set of the ‘*General Shipboard Operations*’ section of the SMS, the ‘*Deck Operations*’ chapter contained 13 standing procedures for deck department operations. These included a ‘*Cargo Operations Procedure*’ (**Annex D**), which stated:

- *‘It is the Chief Officer who has the main responsibility for all cargo operations. The Officer on watch has responsibility under the Chief Officer for the operations during his/her watch.’*

It also required that before cargo operations took place, a series of precautions was observed. These included ensuring that the ‘*loading plan are understood by the stevedore foreman*’ [sic]. During cargo operations, the SMS procedure required, among other things, that ‘*safety precautions are observed*’.

On the day of the accident, neither the C/O nor the 2/O had briefed the twistlock operators or the vehicle drivers on the discharge plan or any safety precautions to be taken.

1.6.3 Risk assessments

The SMS contained guidance on the requirement for, and conduct of, risk assessments on board. It set out a requirement for the risk assessment of all work, and the responsibilities of those on board for identifying hazards and mitigating risks. It stated ‘*the ship will need to make and review risks on a regular basis and conduct risk assessments for all that can pose a hazard on board*’ [sic].

The master was responsible for implementing a risk assessment culture on board and the ship’s safety committee was responsible for reviewing risk assessments on a regular basis. Department heads were responsible for conducting new risk assessments when needed, or reviewing existing ones when planning work on board. The ship’s safety officer was responsible for administering the risk assessment system, and the crew were obliged to read and review risk assessments. In support of this process, the SMS contained a standard format for completing a risk assessment.

1.6.4 Risk assessment related to working on deck

A risk assessment related to working on deck was held on board (**Annex E**). Although it had no title descriptor, it was identified by the ship’s safety officer as the document relevant to cargo operations. Dated as being last assessed on 28 April 2013, it identified three hazards: ‘*head injury*’, ‘*foot injury*’ and ‘*tipping and slipping*’ [sic].

All three hazards were assessed as having *'Very Low Risk'*. Control measures included *'Always work on deck with radio'* and *'Always wear High visibility vest, clothing while working on deck'* [sic].

1.6.5 SMS reviews

The SMS set out the requirement for a ship's safety committee. It stated:

'In order to ensure the safety of work and that the SMS is effectively operating on board the ship, and also in order to improve the safety of work, a safety committee must be established on board. The committee is a decision-making and advisory body and their specific duties and authority are stated in the legislation of the flag state in question' [sic].

The SMS also included a requirement for the master to periodically review the SMS. It stated:

'The master's review should be a critical review of the SMS and all of its sub components. It is an important tool for ensuring that the SMS is implemented, efficient and in compliance.' [sic].

1.6.6 Familiarisation

The SMS set out a requirement for familiarisation of all personnel on board the ship. Familiarisation phase 1 was *'a basic introduction to the new employee'* which was *'done by a general tour around the ship'*. This tour was used to point out the key safety equipment for new joiners, including muster stations and actions to be taken in the event of an emergency. It did not cover safety requirements for an individual's specific employment on board. Phases 2 and 3 required increasing levels of detail and ship knowledge.

1.7 REGULATIONS

1.7.1 Health and safety at work

The Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997 require employers to ensure the health and safety of workers and other persons so far as is reasonably practicable. General principles of the regulations include the evaluation of unavoidable risks and the taking of action to reduce them. It also requires the adoption of work patterns and procedures which take account of the capacity of the individual, especially in respect of the design of the workplace and the choice of work equipment.

Regulation 7 states:

'(1) A suitable and sufficient assessment shall be made of the risks of the health and safety of workers arising in the normal course of their activities or duties, for the purpose of identifying –

(a) groups of workers at particular risk in the performance of their duties; and

(b) the measures to be taken to comply with the employer's duties under these Regulations,

and any significant findings of the assessment and any revision of it shall be brought to the notice of workers...’.

Regulation 13 states:

‘Where there are workers on board a United Kingdom ship not employed by the Company³, the Company shall –

- (a) consult every other employer of those workers regarding the arrangements for health and safety...;*
- (b) co-ordinate arrangements for the protection of all workers and the prevention of risk to their health and safety; and*
- (c) ensure that all workers are informed of the significant and relevant findings of the risk assessment carried out..., and of the arrangements for their protection...’.*

Regulation 21 states:

‘(1) It shall be the duty of every worker aboard a ship to which these Regulations apply –

- (a) to take reasonable care for the health and safety of himself and of any other person aboard ship who may be affected by his acts or omissions...’.*

Practical guidance for the implementation of the Regulations is contained in the Maritime and Coastguard Agency’s (MCA) Marine Guidance Notice (MGN) 20(M+F). Additionally, and since this accident happened, the MCA has issued further guidance on the protection of those on board ships but not employed by the ship owner in MGN 492(M+F).

1.7.2 Lifting operations

The Merchant Shipping and Fishing Vessels (Lifting Operations and Lifting Equipment) Regulations 2006 (LOLER) impose health and safety requirements with respect to lifting operations and the provision and use of lifting equipment.

Regulation 10 relates to the organisation of lifting operations. It requires an employer to ensure that adequate and effective procedures and safety measures are established to secure the safety of workers during lifting operations, and includes the following particular requirements:

- ‘(e) if the operator of lifting equipment cannot observe the full path of the load, either directly or by means of auxiliary devices, a responsible person has appropriate means of communication to guide the operation;*
- (g) measures are taken to prevent the load striking anything or any person’.*

³ The Regulations define ‘Company’ as ‘...the owner of the ship or any other organisation or person such as the manager, or bareboat charterer, who has assumed the responsibility of the operation of the ship from the owner’.

Practical guidance for the implementation of LOLER is contained in MGN 332 (M+F). Guidance on Regulation 10 includes: *'All lifting operations must be properly planned, appropriately supervised and carried out to protect the safety of workers...'* It also recommends that all reasonable measures should be taken to avoid personnel being positioned in the path of a suspended load.

With regard to training, MGN 332 (M+F) states:

'4.1 Only those trained and competent to do so should operate any lifting appliance...It will be for the employer to decide the most appropriate form of training to be provided having regard to the lifting appliance to be operated and the lifting operation to be undertaken.'

1.2 Instruction should be given to the vessel's personnel to enable them to appreciate factors affecting the safe operation of lifting appliances.'

1.3 ...training and safety information for those on board should include an understanding of the relevant sections of the MCA "Code of Safe Working Practices for Merchant Seamen".'

1.7.3 Safety management

In accordance with The Merchant Shipping (International Safety Management (ISM) Code) Regulations 1998, Imperial Ship Management had an obligation to comply with the requirements of the ISM Code as it applied to that company and to *Tyrusland* for which it had responsibility.

1.8 CODE OF SAFE WORKING PRACTICES FOR MERCHANT SEAMEN

1.8.1 Employment relationships

Paragraphs 13 and 14 of the Introductory and Regulatory Framework of the Code of Safe Working Practices for Merchant Seamen (COSWP) highlights the complexity of employment relationships on board a ship in respect of, among other things, contractors and sub-contractors. It advocates that, in such circumstances, there is no single 'person' on whom it is appropriate to place the entire 'employment' responsibility for health and safety on board, and that the applicable regulations therefore recognise two levels of 'employment' responsibility; the 'employer' and the 'company'.

1.8.2 Guidance on risk assessment

Chapter 1 of COSWP contains detailed guidance for the conduct of risk assessments. Relevant extracts are:

'1.3.1 A risk assessment is intended to be a careful examination of what, in the nature of operations, could cause harm, so that decisions can be made as to whether enough precautions have been taken or whether more should be done to prevent harm. The aim is to minimise accidents and ill health on board ship.'

1.5.1 *The assessment should cover the risks arising from the work activities of workers on the ship. The assessment is not expected to cover risks which are not reasonably foreseeable.*

1.6.1 *In all cases, individual employers have responsibility for assessing the risks to their workers and other persons who may be affected by their activities. The Company will be responsible for co-ordinating the risk assessments covering everyone on the ship, including workers directly employed by itself, taking account of the other employers' assessments.'*

1.8.3 Guidance on lifting operations

Chapter 21 of COSWP contains detailed guidance on the conduct of lifting operations. Relevant extracts are:

'2.10.4 Where the operator of the lifting appliance does not have a clear view of the whole path of travel of any load carried by that appliance, appropriate precautions should be taken to prevent danger. Generally this requirement should be met by the employment of a competent and properly trained signaller designated to give instructions to the operator. A signaller includes any person who gives directional instructions to an operator while they are moving a load, whether by manual signals, by radio or otherwise.'

2.10.5 The signaller should have a clear view of the path of travel of the load where the operator of the lifting appliance cannot see it.

2.10.6 Where necessary, additional signallers shall be employed to give instructions to the first signaller.

2.10.7 Every signaller should be in a position that is:- (a) safe; and (b) in plain view of the person to whom they are signalling unless an effective system of radio or other contact is in use.

2.10.8 All signallers should be instructed in and follow a clear code of signals, agreed in advance and understood by all concerned with the operation...'

1.9 HEALTH AND SAFETY IN PORTS

The International Labour Organization's (ILO) code of practice 'Safety and health in ports' (2005) contains advice on container operations in port, specifically:

- Section 6.3.3, paragraph 8 states: *'Containers should only be handled by forklifts... if they are fitted with forklift pockets...in accordance with ISO 1496⁴'.*
- Section 6.3.3, paragraph 14 states: *'The insertion of twistlocks into, or removal of twistlocks from, corner fittings of containers...should be carried out in accordance with a safe system of work that protects workers from the hazards of container-handling vehicles...'*
- With regard to operations on a ro-ro cargo ship, section 7.9.2, paragraph 4 states: *'All large vehicles and trailers being reversed or manoeuvred into stowage*

⁴ Section 5.8.1.1 of International Standard ISO 1496-1:1990(E) requires that fork-lift pockets shall not be provided on FEU containers.

positions on deck should do so under the direction of a signaller... Signallers should satisfy themselves that no person is in a position of danger, particularly in any trapping area behind a reversing vehicle. Drivers should not move their load/vehicle unless a signaller so directs. Drivers should immediately stop their vehicles at any time the signaller is not within their field of vision'.

1.10 INTERNATIONAL SAFETY MANAGEMENT CODE

1.10.1 Requirements

The following extracts from the ISM Code are relevant to this investigation:

'1.2.1 The objectives of the Code are to ensure safety at sea, prevention of human injury or loss of life, and avoidance of damage to the environment, in particular to the marine environment and to property.

1.2.2 Safety management objectives of the Company should, inter alia:

- 1. provide for safe practices in ship operation and a safe working environment;*
- 2. assess all identified risks to its ships, personnel and the environment and establish appropriate safeguards; and*
- 3. continuously improve safety management skills of personnel ashore and aboard ships, including preparing for emergencies related both to safety and environmental protection.*

1.2.3 The safety management system should ensure:

- 1. compliance with mandatory rules and regulations; and*
- 2. that applicable codes, guidelines and standards recommended by the Organization, Administrations, classification societies and marine industry organizations are taken into account.*

1.4 Every Company should develop, implement and maintain a safety management system which includes the following functional requirements:

- 2. instructions and procedures to ensure safe operation of ships and protection of the environment in compliance with relevant international and flag State legislation...*
- 3.2 The Company should define and document the responsibility, authority and interrelation of all personnel who manage, perform and verify work relating to and affecting safety and pollution prevention.*
- 5.1 The Company should clearly define and document the master's responsibility with regard to:*
 - 5. periodically reviewing the safety management system and reporting its deficiencies to the shore based management.*

- 6.3 *The Company should establish procedures to ensure that new personnel and personnel transferred to new assignments related to safety and protection of the environment are given proper familiarization with their duties. Instructions which are essential to be provided prior to sailing should be identified, documented and given.*
- 6.7 *The Company should ensure that the ship's personnel are able to communicate effectively in the execution of their duties related to the safety management system.*
- 7 *The Company should establish procedures, plans and instructions, including checklists as appropriate, for key operations concerning the safety of the personnel, ship and protection of the environment. The various tasks should be defined and assigned to qualified personnel.*
- 12.1 *The Company should carry out internal safety audits on board and ashore at intervals not exceeding twelve months to verify whether safety and pollution-prevention activities comply with the safety management system. In exceptional circumstances, this interval may be exceeded by not more than three months.'*

1.10.2 Document of compliance audit

MCA surveyors from an assigned MCA marine office conducted an ISM Code document of compliance (DoC) audit at the offices of Imperial Ship Management on 4 June 2012. This audit report established that the company's SMS complied with the requirements of the ISM Code and resulted in the issue of a DoC. However, the audit raised two non-conformities and two observations.

One of the non-conformities referred to a requirement for the company to '*establish safeguards against all identified risks*' and commented that '*ships were not producing risk assessments as required by SMS*' [sic]. The comment referred to an accident that had occurred on 1 June 2012 during the maintenance of a crane for which no risk assessment had been in place. Under the heading '*Corrective Action*', the company stated that it would "*implement the risk assessment procedure to a better standard onboard our vessels*" [sic]. Corrective action was to be completed by 1 September 2012. However, the company requested additional time to complete this action. This plan was discussed with the lead MCA surveyor who agreed to an extension, although no fixed time period was stated and this decision was not recorded on the MCA non-conformity form.

One of the observations in the audit report referred to a requirement for the company to clearly define and document the master's responsibility with regard to reviewing the SMS and reporting its deficiencies to shore-based management. The note commented to the effect that the master's review of the SMS, through the ship's safety committee, was not functioning effectively; the comment was based on a lack of critical remarks, despite a need for changes to the SMS being otherwise identified.

Each of the above non-conformities and observations was recorded on a standard MCA form⁵. The form contains guidance notes for its completion. For follow-up and close-out action of non-conformities, the guidance states:

⁵ MSF 1902/Rev.03/10

'The non-conformity is to be closed out by the auditor on receipt of acceptable evidence from the company that the agreed corrective action has been completed and that the root cause(s) have been addressed...'

The completed audit report and non-conformity forms were retained in a file at the assigned MCA marine office. Additionally, scanned copies of the audit report, audit plan, non-conformities and observations were also sent to the ISM section in the MCA headquarters.

1.10.3 Company internal safety audit

Imperial Ship Management's Designated Person (DP) conducted an internal safety audit of *Tyrusland* on 9 August 2012. The report summary commented that compliance levels were high; however, the audit identified five non-conformities including one which raised a concern regarding risk assessments. The report stated that the *'deck department was lacking risk assessments for some hazardous work on board, also poor implementation of risk assessments among the crew'*. However, it did not go on to explain which hazardous work had not been subject to risk assessment or which risk assessments had been poorly implemented by the crew. There is no evidence of any follow-up action having been taken to address this non-conformity.

1.10.4 Safety management certificate audit

MCA surveyors conducted an ISM Code safety management certificate (SMC) audit on board *Tyrusland* on 10 and 11 September 2012. This audit was combined with:

- an international ship security certificate audit;
- an ILO Convention 178⁶ inspection; and
- a trial Maritime Labour Convention audit.

The audit raised two non-conformities and one observation. The observation was raised because *'when risk assessments were discussed with crew members some complained for finding the generic risk assessments provided by the company to be confusing and not to improve operational safety in any way...'*[sic]. The observation went on to the effect that the master had been advised by the lead auditor that if he considered the issue to be a valid problem he should raise it through the master's SMS review procedure.

However, the audit report established that *Tyrusland* complied with the requirements of the ISM Code and resulted in the issue of a full term SMC.

1.10.5 Instructions for the guidance of surveyors

Chapter 4 of the MCA's ISM Code instructions for the guidance of surveyors provides instructions on conducting DoC and SMC audits. The following extracts are relevant to this investigation:

'4.3 The responsibilities of the lead auditor include the following:

⁶ International Labour Organization (ILO) 178 – The inspection of seafarers' working and living conditions

- *After completion of the audit report the auditor should send the audit report with non conformity notes to HQ ISM/ISO Branch by fax or e-mail prior to sending the complete file. The file should be sent after closure of all non-conformities...*
- 4.5 *...During the course of the audit the auditor(s) may raise non-conformities against the SMS. Non-conformities are identifiable deviations within the SMS...*
- 4.7 *An observation means a statement of fact made during a safety management audit and substantiated by objective evidence. The company/ship is not liable to provide evidence of the corrective action taken for an Observation.*
- 4.8 *A non-conformity means an observed situation where objective evidence indicates the non-fulfilment of a specified requirement of the ISM Code. A non-conformity should be normally closed out within three months from the date of the audit.*
- 4.10 *Non-conformities should be recorded on the form MSF 1902 (“Non-Conformity Note”). The form is in duplicate. The top copy should be given to the Client, the second copy for the MCA’s file. Auditors should refer to the guidelines for filling up the form given on the back of the form.*
- 4.14 *...When an auditor identifies a potential minor non-conformity, agreement must be reached with the manager of the department or area concerned that the perceived non-conformity actually exists...Suitable corrective actions and appropriate corrective action time-scales must also be discussed and agreed with the company. Auditors are reminded that corrective action times cannot exceed three months. In the event that a company cannot complete a corrective action within the maximum time of three months, the non-conformity note is to be closed out and another raised...*
- 4.15 *...Closing-out of minor non-conformities will not normally require a revisit by an auditor. Written notification of the completion of corrective action, accompanied where possible by objective evidence, shall be forwarded to the lead auditor through the Designated Person. This should be accompanied by the appropriate copy of the Non-Conformity Note. When the lead auditor is satisfied that the agreed corrective action has been completed the Non-Conformity Note will be closed out, signed and returned to the Designated Person. During annual audits the opportunity should be taken to confirm that non-conformity notes raised at the previous audit have been closed out on time. The corrective actions may also be verified. In the case of SMC audits the foregoing may be achieved during either the next intermediate audit or a General Inspection.’*

1.11 PREVIOUS ACCIDENTS

1.11.1 Imperial Ship Management

This was the fourth accident, two of which were fatal, in less than a year involving UK registered ships managed by Imperial Ship Management. On 2 May 2013, *Tyrusland* collided with *Munevvar* in Benghazi Harbour, causing significant damage to both ships. On 1 June 2012, a ship’s crane collapsed on board *Timberland*

causing injuries to three crew members. On 25 November 2012, two crewmen died when they were washed overboard from *Timberland*⁷. This latter accident was the subject of an MAIB investigation, which identified that *Timberland*'s SMS contained no detailed requirements with regard to sending crew on deck in heavy weather, and no formal assessment of the risks had been carried out on board.

On 23 May 2013, in *Tyrusland*'s lower hold, a TEU container snagged on the deck head and subsequently fell whilst being handled by a fork-lift truck. The container was damaged by the fall and also caused a hole to be punctured in the deck. The company's investigation identified that the incident was caused by the excess speed of the fork-lift truck and the driver not recognising the effect of the deck's uneven surface. This caused the vehicle to bump up, leading to the container's contact with the deck head. When this incident occurred, MAIB inspectors were on board *Tyrusland* conducting the investigation into the accident which resulted in the death of AB Penafiel. The incident provided further evidence of the absence of safe working procedures on board the vessel.

1.11.2 *Ever Excel*

On 21 April 2010, the chief engineer on board the UK registered container ship *Ever Excel* was killed when he became trapped between the top of the ship's passenger lift and the edge of the lift shaft. The MAIB investigation⁸ found that all the safety barriers that could have prevented the accident had been ignored, reset, or circumvented. The risks associated with lift maintenance and inspection had not been considered. This was the third fatal accident in an 8-month period on board ships operated by the same company. The investigation found that the company's SMS was compliant with the international standard but that there were serious failings in its implementation. Few risk assessments were completed, safe systems of work had not been established and work permits were not used appropriately.

⁷ MAIB Report No 11/2013

⁸ MAIB Report No 6/2011

SECTION 2 - ANALYSIS

2.1 AIM

The purpose of the analysis is to determine the contributory causes and circumstances of the accident as a basis for making recommendations to prevent similar accidents occurring in the future.

2.2 FATIGUE AND ALCOHOL

There is no evidence that any of the crew or the embarked team of drivers were suffering from the effects of fatigue or alcohol and, therefore, these are not considered to be contributing factors to this accident.

2.3 SUMMARY

During cargo handling operations on the main deck of *Tyrusland*, AB Penafiel was crushed between two FEU containers. He was working as a twistlock operator in co-operation with an embarked fork-lift truck driver. Although an informal local procedure existed for co-ordinating operations, it was not followed on this occasion. There were insufficient safeguards in place to prevent AB Penafiel from entering and remaining within a hazardous area, and to prevent the fork-lift truck driver from simultaneously manoeuvring a suspended container so as to cause a fatal crushing injury to AB Penafiel.

2.4 INDIVIDUAL ACTIONS

2.4.1 AB Penafiel

Having released the twistlocks securing containers A and B together, AB Penafiel stood clear of the fork-lift truck on the port side of the main deck. In accordance with the local procedure, he then waited for the fork-lift truck driver to lift container A from container B and to lower container A to a height at which he could remove the twistlock from its port side aft underside corner.

With container A lowered, AB Penafiel moved forward and removed the twistlock without first waiting for a signal from the fork-lift truck driver to indicate that it was safe to do so. As the fork-lift truck driver reversed his vehicle, AB Penafiel maintained his position and bent down to remove further twistlocks from the deck. He was probably unaware of the driver's intention to manoeuvre the container in preparation for loading it onto the waiting trailer.

With container A moving away from him his expectation would have been for this direction of movement to continue. It is therefore unlikely that AB Penafiel anticipated that the container's port side aft corner would subsequently swing back towards him.

It only required a small change of heading by the fork-lift truck to create a relatively large movement of the container ends. For example, a 5° heading alteration by the fork-lift truck would have generated a container end movement of 0.55m (**Figure 8**).

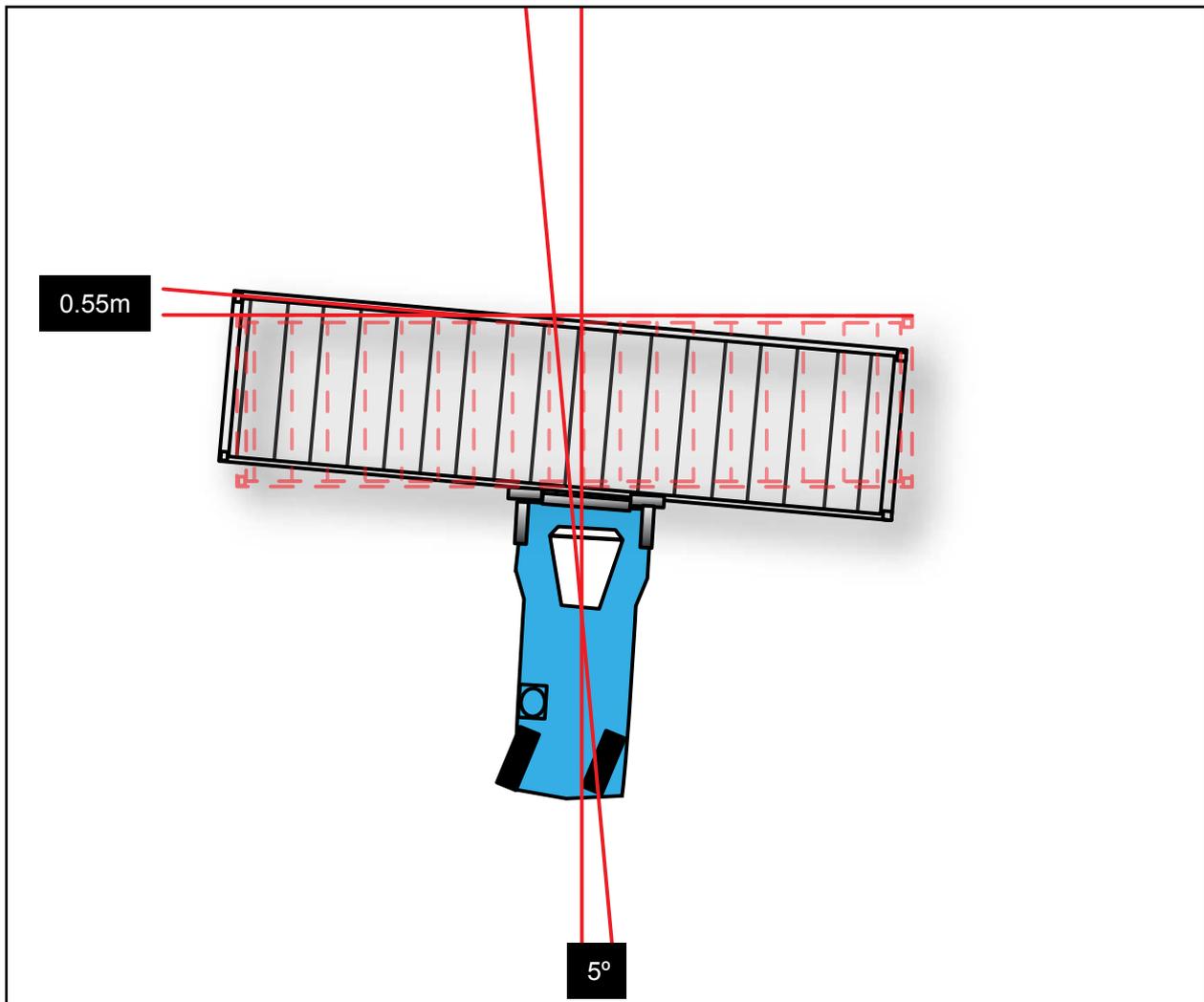


Figure 8: Diagram showing fork-lift truck turning effect

The extent to which the local signalling procedure was routinely followed, and the frequency with which any required realignment of a container was routinely carried out before the underside twistlocks were removed, are uncertain. However, the fact that AB Penafiel was content to move forward before receiving a signal and before the container was realigned suggests that the situation appeared familiar to him and that he considered it safe for him to proceed.

2.4.2 The fork-lift truck driver

The fork-lift truck driver had only joined *Tyrusland* the previous day and, notwithstanding his experience and qualifications, was still gaining familiarity with the environment, local conditions and behaviours on board. His intention was to lift container A from container B, lower it, and then conduct the realigning manoeuvre before stopping and giving a signal to AB Penafiel to proceed.

After lowering container A, the fork-lift truck driver was unable to see AB Penafiel (**Figure 1e**) and had not given any signal, so he had not anticipated that AB Penafiel would move between the containers to remove the twistlocks. The absence of an appropriate safe system of work, including signals, led to an ambiguous situation where the fork-lift truck driver's expectation was different to that of his fellow worker in a very hazardous environment.

2.5 CONTAINER HANDLING

2.5.1 Cargo operations planning

Although the function of handling cargo is often undertaken by shore-based stevedores with limited interaction from the ship's crew, on *Tyrusland* the capability to handle cargo was integral to the ship.

This system of permanently embarking on board the necessary equipment and drivers for cargo handling should have delivered a heightened awareness of the associated risks. Although the SMS '*Cargo Operations Procedure*' required the 'loading plan' to be understood by the stevedore foreman, and that safety precautions were to be observed, no details were provided as to what the loading plan and safety precautions should include.

2.5.2 Container loading plan

Maximum utility of *Tyrusland*'s main deck cargo space meant that containers were packed tightly together, creating potential obstructions to cargo operations.

Given that *Tyrusland* was not optimised for an entire cargo of standard containers, it was necessary to store containers in both athwartship and fore-and-aft orientations. The layout of containers stowed on the deck was a function of the position of the deck fittings for twistlocks.

This style of loading resulted in significant variation of the gaps between containers and, therefore, when these gaps were small, there was a potential for adjacent, stowed containers to obstruct a container being handled by a fork-lift truck.

These obstructions created a requirement for fork-lift truck drivers to routinely make adjustments when handling containers, in addition to having to realign the containers when trailers with rear bumpers were being used. These manoeuvres were potentially difficult for assisting crew members to anticipate, and so required an effective means of communication to exist between the drivers and the twistlock operators to maintain safety.

2.5.3 Use of closed-corner trailers

The use of closed-corner trailers meant that any underside twistlocks remaining on a container had to be removed before the container could be loaded onto the trailer. This requirement necessitated crew members working in close proximity to suspended containers.

Open-cornered trailers do not require the removal of underside twistlocks before loading. Although the twistlocks still need to be removed, it is common industry practice for this to be conducted in a controlled manner ashore after the container has been discharged from the ship.

The use of open-cornered trailers and a systematic process to remove underside twistlocks ashore would have significantly reduced the risk of a crew member being crushed by a moving container.

2.5.4 Communications

The locally arranged procedure involved the twistlock operator and fork-lift truck driver exchanging signals at each stage of the container discharge operation to indicate that it was safe to undertake the next step. Potentially, this was a safe arrangement provided that each of them remained in sight of the other while a container was being handled.

Before lifting container A from container B, the fork-lift truck driver was able to see AB Penafiel standing on the port side of the main deck. However, after lifting container A clear of container B and then lowering it, AB Penafiel was no longer in his field of vision. In the absence of an independent signaller, for the operation to remain safe, the fork-lift truck should then have remained stationary until its driver could again see AB Penafiel or had otherwise received confirmation that AB Penafiel was in a safe position. Although the AB and driver had both been provided with hand-held VHF radios, the radios were operated on different channels and were, therefore, of no value in this regard.

2.5.5 Briefing and supervision

Neither the C/O nor the 2/O had briefed the twistlock operators or the vehicle drivers on the discharge plan or any safety precautions to be taken. This was contrary to the requirements of the ship's SMS. The 2/O was required to supervise cargo operations on both the main deck as well as the weather deck. With no briefing given and the 2/O's limited ability to supervise operations simultaneously on two decks, the locally arranged signalling procedure between twistlock operators and fork-lift truck drivers was not effectively enforced.

2.5.6 Risk assessment

The SMS risk assessment related to working on deck was deficient as it lacked detail with respect to identified hazards and the control measures required to reduce the risk of harm. The risk assessment identified personal protective equipment to enhance visibility and to reduce the consequences of an accident. However, it did not identify the specific hazard of a crew member being crushed by a moving vehicle or container, the potential severity of harm resulting from such an event, and the need to address the increased risk of an unsighted crew member being positioned in the container's path.

The risk assessment's insufficiency was contrary to the requirements of The Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997.

LOLER requires that where the operator of lifting equipment cannot observe the full path of the load, either directly or by means of auxiliary devices, a responsible person has appropriate means of communication to guide the operation. COSWP recommends that the signaller should be in a safe position and, unless an effective system of radio or other contact is used, in plain view of the operator. It also states that all signallers should be instructed in and follow a clear code of signals, agreed in advance and understood by all concerned in the operation. The ILO's code of practice 'Safety and health in ports' specifically requires an operator to stop their vehicle at any time the signaller is not within their field of vision.

The risk of a crew member being crushed by a moving container could have been significantly reduced had the above regulatory requirements and procedural advice been followed.

2.5.7 Use of a fork-lift truck for FEU container handling

The ILO's code of practice 'Safety and health in ports' advises against the use of a fork-lift truck for handling containers not fitted with pockets to accommodate the vehicle's forks. The absence of fork pockets runs the risk of a fork-lift truck damaging the lower edges of a container, and any shift or uneven distribution of the container's internal load could cause the container to fall.

In accordance with International Standard ISO 1496-1:1990(E), the FEU containers on board *Tyrusland* were not fitted with pockets and so should not have been handled by a fork-lift truck. However, the restriction imposed by the low deckhead height inside *Tyrusland's* main deck precluded use of the reach-stacker and top-lifter, which resulted in a fork-lift truck being used.

Had a more formal hazard identification process been undertaken, the risks associated with handling FEU containers using a fork-lift truck ought to have been identified, which might then have prompted an investigation of alternative ways to utilise the ship's internal space for container stowage.

2.6 SMS PROCESSES

2.6.1 Cargo operations procedure

In accordance with the company's SMS objectives, the '*Cargo Operations Procedure*' should have provided for safe practices in compliance with regulatory requirements and taking into account applicable codes, guidelines and standards. The procedure relied on a suitable and sufficient risk assessment being conducted, effective measures being identified to control all identified risks, all workers being informed of those measures, and a robust regime of compliance being implemented.

In accordance with the requirements of the ISM Code, the company appropriately assigned the C/O to conduct new risk assessments and review existing risk assessments related to cargo operations. It also appropriately assigned the ship's safety officer to administer the risk assessment system. Although a risk assessment related to working on deck was held on board, it had no title descriptor and, as discussed in section 2.5.6, was insufficient.

Although the risk assessment omitted to include a need for effective communications, an informal locally arranged signalling procedure had developed. However, this procedure did not feature in the ship's SMS, was not covered in the SMS familiarisation basic introduction checklist completed by the fork-lift truck driver, and was neither briefed to the twistlock operators and vehicle drivers nor enforced by the C/O and 2/O. Collectively, these factors suggest that an underlying cultural safety issue existed within the company.

2.6.2 Complacency

Complacency is recognised as a normal human behaviour in response to repeated exposure to hazardous situations where no adverse consequences are experienced. The repeated exposure induces a false sense of security and, if not corrected, can create an environment where shortcuts are taken and procedures ignored.

The routine nature of an unsighted crew member having to proceed between containers to remove twistlocks, and the informality and lack of enforcement of the locally arranged signalling procedure, inevitably introduced complacent practices on board *Tyrusland*. This conclusion is supported by AB Penafiel's decision to move forward between the containers before receiving a signal from the fork-lift truck driver.

Other evidence of complacency on board in respect of cargo operations includes the lack of any briefing by the C/O or 2/O to the twistlock operators and vehicle drivers on the discharge plan and safety precautions to be taken, and the general acceptance by the ship's crew of limited supervision when cargo was being discharged simultaneously from the main and weather decks.

2.6.3 Contractors

In accordance with COSWP guidance, the company was responsible for co-ordinating the risk assessments covering everyone on the ship. This included the ship's crew as well as the embarked team of drivers. The '*Cargo Operations Procedure*' therefore needed to take account of the other employers' risk assessments.

In accordance with the guidance provided in MGN 332 (M+F), the company needed to be satisfied that the fork-lift truck drivers were appropriately trained and competent to operate their vehicles for container handling on board ship. The company was also guided to provide instruction to ship's crew on factors affecting the vehicles' safe operation, and training and safety information to all on board, including an understanding of the relevant sections of COSWP.

Additionally, in accordance with the requirements of the ISM Code, the company was required to provide proper familiarisation to new personnel, including the embarked team of drivers, on their respective duties.

The '*Cargo Operations Procedure*' made no reference to other employers' risk assessments and contained no instructions on factors affecting the vehicles' safe operation. Although the fork-lift truck driver involved in the accident had completed a shore-based training programme covering ro-ro safe operating practices and hazard identification before joining *Tyrusland*, his familiarisation on joining did not cover safety requirements for his specific employment on board.

2.6.4 Safety audits

That Imperial Ship Management's vessels were not producing risk assessments as required by the SMS, was identified and raised as a non-conformity during an MCA DoC audit of the company on 4 June 2012. The company acknowledged the issue and declared an intention to improve the risk assessment procedure on board its

ships. However, the task received insufficient priority by the company for corrective action to be implemented before the stated deadline of 1 September 2012, or, indeed, before the accident.

The company's internal safety audit of *Tyrusland* conducted on 9 August 2012 identified a similar weakness in its risk assessment regime. This should have prompted the company to review, address and complete the DoC non-conformity by 1 September 2012. However, the issue again received insufficient priority by the company for corrective action to be implemented before the accident.

Although a verbal agreement to extend the deadline for closing the non-conformity regarding risk assessments was reached between the MCA marine office and the company, no fixed time period was stated and records were not updated. This created a situation where the original deadline was allowed to lapse without any evidence of corrective action having been received, and no firm new deadline being set.

At the MCA marine office, there was no 'bring-up' system in existence to ensure outstanding non-conformities were followed up and closed out. Although copies of the audit report, including the non-conformities, had been passed to MCA headquarters, this information was not analysed to identify priorities for any further action across the Imperial Ship Management fleet.

Despite the pressures of conducting a number of parallel audits, an issue relating to risk assessments was again successfully identified and raised as an observation during an MCA SMC audit of *Tyrusland* on 10 and 11 September 2012. It would have been prudent for the MCA surveyors to have reviewed any non-conformities and observations raised during the previous DoC audit before they conducted the SMC audit. Such action would probably have resulted in the SMC audit observation, which also referred to the master's review of the SMC, being further investigated. However, such a review in preparation for an SMC audit is currently not a requirement in the MCAs instructions for the guidance of surveyors.

In summary, the weakness of the risk assessment regime and ineffective SMS review processes on board *Tyrusland*, particularly with regard to cargo operations, would probably have been addressed had:

- The company given higher priority to implementing corrective action in respect of the relevant non-conformities and observations raised during the MCA's DoC audit of the company and its own internal safety audit of *Tyrusland* and *Timberland*.
- The assigned MCA marine office surveyors complied fully with the MCA's ISM Code instructions for the guidance of surveyors.
- The MCA's headquarters provided greater oversight of the management of ISM Code audits and follow-up action in respect of *Tyrusland* and across the Imperial Ship Management fleet.

SECTION 3 - CONCLUSIONS

3.1 SAFETY ISSUES DIRECTLY CONTRIBUTING TO THE ACCIDENT THAT HAVE BEEN ADDRESSED

1. AB Penafiel was probably unaware of the fork-lift truck driver's intention to manoeuvre the container in preparation for loading it onto the waiting trailer. It is therefore unlikely that he anticipated that the container would subsequently swing towards him. [2.4.1]
2. The fact that AB Penafiel was content to move forward before receiving a signal and before the container was realigned suggests that the situation appeared familiar to him. [2.4.1]
3. The fork-lift truck driver did not anticipate that AB Penafiel would move forward to remove the container's twistlocks before he had realigned the container and had given a signal for him to proceed. [2.4.2]
4. The use of closed-corner trailers necessitated crew members working in close proximity to suspended containers. [2.5.3]
5. The locally arranged signalling procedure was not effectively briefed and enforced, and was potentially unsafe in that it did not require the fork-lift truck driver to stop his vehicle when the twistlock operator was no longer in his field of vision. This lack of a safe system of work led to an ambiguous situation where two operators on the same task had different expectations of each other's actions. [2.5.1, 2.5.4, 2.5.5]
6. The fact that the locally arranged signalling procedure did not feature in the ship's SMS, was not covered in the familiarisation process, and was neither briefed nor enforced suggest that an underlying cultural safety issue existed within the company. [2.6.1]
7. The routine nature of an unsighted crew member having to proceed between containers to remove twistlocks, and the informality and lack of enforcement of the locally arranged signalling procedure, inevitably introduced complacent practices on board *Tyrusland*. [2.6.2]
8. The SMS risk assessment related to working on deck was insufficient. It did not identify the specific hazard of a crew member being crushed by a moving container, the potential severity of resulting harm, and the need to address the increased risk of an unsighted crew member being positioned in the container's path. [2.5.6]
9. The identified weakness of the risk assessment regime and ineffective SMS review processes on board *Tyrusland* would probably have been addressed before the accident had the company given a higher priority to the issues and had the MCA's management of ISM Code audits and follow-up action been more effective. [2.6.4]

3.2 OTHER SAFETY ISSUES DIRECTLY CONTRIBUTING TO THE ACCIDENT⁹

1. Small gaps between containers stowed on the deck and the use of trailers with rear bumpers required fork-lift truck drivers to conduct manoeuvres that were difficult for assisting crew members to anticipate. [2.5.2]

3.3 SAFETY ISSUES NOT DIRECTLY CONTRIBUTING TO THE ACCIDENT THAT HAVE BEEN ADDRESSED

1. The use of a fork-lift truck for handling containers not fitted with fork pockets runs the risk of damage to the lower edges of a container, and any shift or uneven distribution of the container's internal load could cause the container to fall. [2.5.7]

⁹ These safety issues identify lessons to be learned. They do not merit a safety recommendation based on this investigation alone. However, they may be used for analysing trends in marine accidents or in support of a future safety recommendation.

SECTION 4 - ACTION TAKEN

4.1 IMPERIAL SHIP MANAGEMENT AB

In consideration of this and other accidents which have involved or occurred on board its ships, Imperial Ship Management has taken the following action:

- Conducted a thorough and detailed management review and developed a plan for improving the safety culture within the company.
- Conducted an internal investigation into this accident and highlighted the lessons learnt to all vessels in its fleet.
- Specifically, in *Tyrusland*:
 - Formalised the requirement for meetings between the C/O and the foreman of drivers.
 - Fully risk assessed cargo handling operations and developed appropriate safety procedures.
 - Ceased use of fork-lift trucks to lift FEU containers.
 - Ceased use of closed-corner design trailers.
 - Included operational procedures training as a formal part of the familiarisation process.

The company has also undertaken to:

- Organise seminars with crew and company management to improve safety culture.
- Publish a revised SMS containing:
 - Improved cargo operations risk assessments and procedures.
 - Improved guidance for risk assessments, safety committee meetings and master's SMS reviews.

4.2 MCA

The MCA has conducted a further ISM Code DoC audit of Imperial Ship Management. The audit was conducted at the company's offices in Gothenburg on 13 December 2013 and was undertaken by an MCA surveyor who had not previously visited the company. The summary section of the MCA's report stated:

- *'The company have made a great effort to establish what the problems have been with the safety management system and how it is implemented on the ships. Time and money have been invested in making improvements to the system and this is all being closely monitored by office staff. Many SMS procedures have been changed, simplified, added and improved and many operational forms have also been improved. This has all been done with*

proper consultation process and new procedures introduced on some vessels for operational trials.'

The audit report concluded that the SMS of Imperial Ship Management met the provisions of the ISM Code and was implemented and understood at all levels within the company. This resulted in a full term DoC being issued to the company.

4.3 CMA CGM

As the charterer, CMA CGM conducted a safety assessment on board *Tyrusland* on 27 June 2013, which resulted in the following actions:

- Replacement of the closed-corner style trailers by open-cornered versions in January 2014.
- Prohibition of the use of fork-lift trucks for FEU container handling.
- Supply of 600 semi-automatic twistlocks.

SECTION 5 - RECOMMENDATIONS

In view of the actions taken by Imperial Ship Management, which have been audited by the MCA, and the previous recommendation¹⁰ made to the MCA regarding audit management processes, no recommendations are made in this report.

Safety recommendations shall in no case create a presumption of blame or liability

¹⁰ MAIB 2014/132 – Recommendation in *Celtic Carrier* report

Completed SMS familiarisation basic introduction checklist



SMS - Manual – Appendix (FC) Forms and checklists

Doc No:	2103	Doc Name:	Familiarization.		
Date of Issue:	2011-08-29	Date of last Rev:	2012-05-01	Ver:	2
Reg. Ref:	62-02 Familiarization Ship personnel			App by:	LAI
				Issued by:	AN
				Pages:	1 of 5

Familiarization Checklist Part 1

According to: STCW Section A-I/14.4

The basic introduction of the new employee shall be made prior departure.

The whole introduction shall be made within two weeks from signing on the vessel.

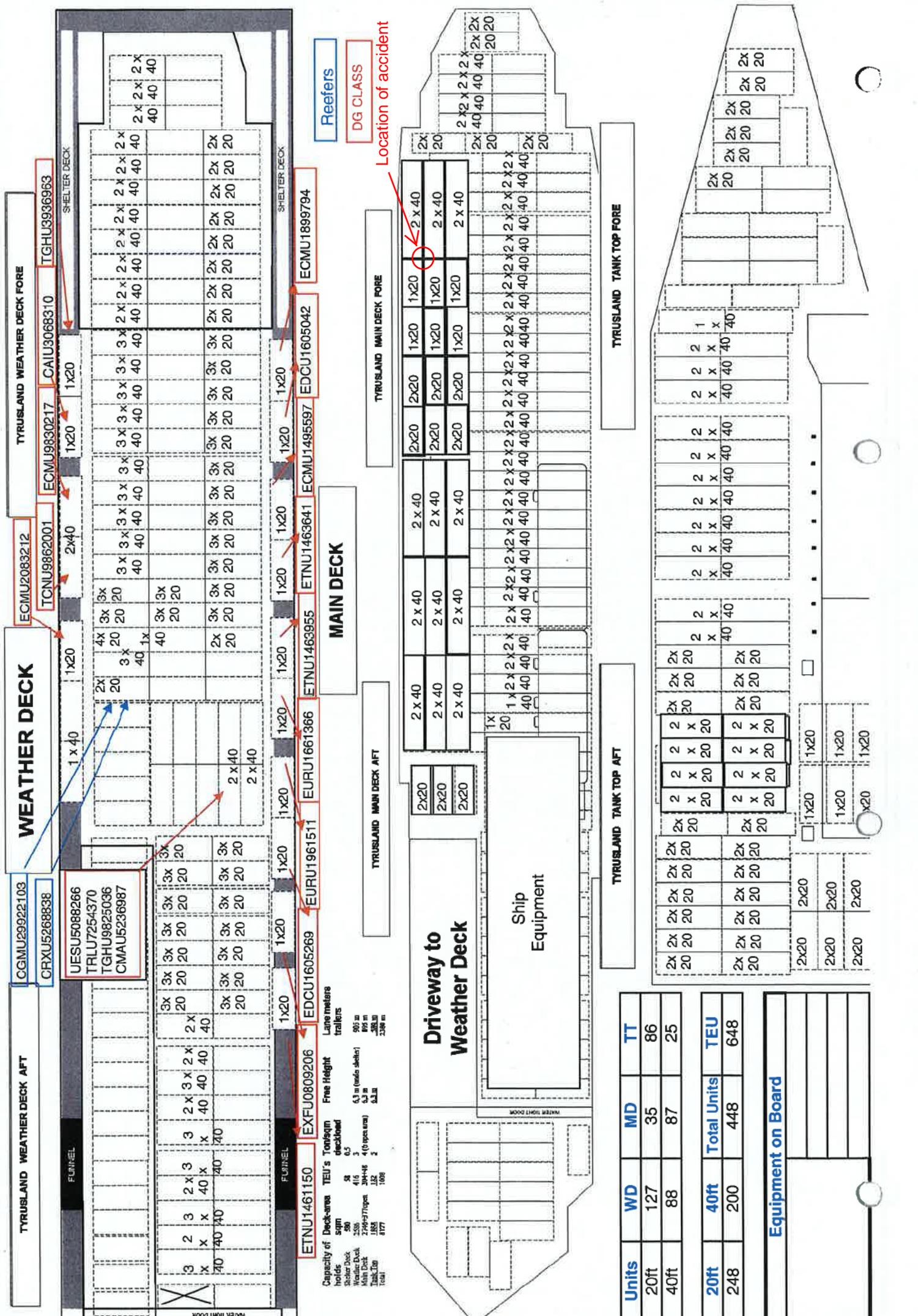
Vessel Name	Date Signe on	Place signed on
TYRUSLAND	14 MAY 2013	MARSAXLOKK, MALTA
Name of Crewmember	Rank	Sign
[REDACTED]	DRIVER	[REDACTED]
Name of Supervisor	Rank	Sign
[REDACTED]	2/OFF.	[REDACTED]

Checklist Basic Introduction

The basic introduction is done by a general tour around the vessel where the following are introduced.

	Sign.
The alarm signals in use on-board	[REDACTED]
Muster cards and muster list	[REDACTED]
Fire - muster stations	T
Abandoning ship - muster stations	
Lifebelts - location and use	
Immersion suits - location and use	
Lifeboats - location and use	
Pyrotechnical flares, rockets and smoke - location and use	
Fire alarm buttons - location	
Fire extinguisher - location	
Fire Dampers and quick closing valves - Location	
Training manual - introduction	
Actions in case of Man Over Board	
Actions in case of Fire	
Actions in case of accidents	
Smoking on-board	
Use of alcohol on-board	
Food, work hours, laundry and recreational areas and equipment	
Other relevant Safety information / equipment.	[REDACTED]

Cargo departure plan showing location of accident



Capacity of Deck-area

Deck	TEU's	Tonnage	deckload
Shelter Deck	58	6.5	
Weather Deck	416	3	
Main Deck	2748-2770pm	304-145	4 (to open area)
Tank Top	136	2	
Total	4177		

Lane meters trailers

900 m
895 m
885 m
208 m

Units	WD	MD	TT
20ft	127	35	86
40ft	88	87	25

20ft	40ft	Total Units	TEU
248	200	448	648

Equipment on Board	

Extract from charterparty

**Rider Clauses to the Charter-Party m/v "TYRUSLAND"
Dated Geneva, 10th December 2012**

65. CREW ASSISTANCE

Hire to include the following services from crew provided same are allowed by local and/or Union rules and regulations :

- 01) Shifting the ship during loading and/or discharging alongside the berth or from one berth to another, if occasionally needed.
- 02) Bunkering
- 03) Preparation for loading and discharging / cleaning of decks – intermediate cleaning and if redelivered unclean lumpsum USD 1'600.- payable over hire. Normal cleaning work can be undertaken by crew if permitted by local authorities/regulations. In case exceptional cleaning is required same to be carried out by Charterers at their expense.
- 04) Operating of vessel's doors/ramps/lifts including during cargo operations. Lifts' operations during Charterers' cargo handling operations to be performed by crew members and such service to be included in the time charter hire.
- 05) Officers and crew to prepare vessel's doors/ramps/lifts as much as possible according to good seamanship, as far as weather permits prior to vessel's arrival at loading and/or discharging docks or places so as to commence loading and/or discharging operations as promptly as possible.
- 06) Deleted
- 07) Dunnage : Removing/stowing away on deck as instructed by the Charterers.
- 08) Lashing / unlashng / securing / unsecuring to be always excluded from time charter hire. However, if required by the Charterers and provided permitted by local regulations, crew to perform lashing / securing / unlashng / unsecuring / tallyng operations, including collecting and tidying up of equipment, against payment of a lumpsum bonus to be agreed between Master/crew and Charterers' directly. Bonus to be re-negotiated after one (1) month in case work-load with lashing should be too heavy for the present crew on board. Whilst doing lashing/unlashng crew to be considered as Charterers' servants. Charterers to hold Owners and Master free from all consequences arising out of the fact that crew secure/unsecure and lash/unlash cargo.
- 09) Deleted

Rider Clauses to the Charter-Party m/v "TYRUSLAND"
Dated Geneva, 10th December 2012

- 10) Minimum two crew members including officer(s) supervising cargo operations on deck during loading and/or discharging.
- 11) Deleted
- 12) Master shall keep a full and correct log of the voyage showing the course of the vessel and the distance run and consumption of bunkers. A true copy of which to be sent to the Charterers after completion of the voyage. In addition, Master to submit within 48 (forty eight) hours of arrival at discharging port to the Charterers or their agents log abstracts in English in any standard format to include :
 - 1) In port, daily cargo working time, weather conditions, bunker consumption and bunkers remaining onboard.
 - 2) For sea passage, every second day, average speed over past 48 (forty eight) hours, total distance covered, weather conditions, fuel and diesel oil consumption and bunkers remaining onboard.

66. LASHING CLAUSE

Lashing material as on board on delivery, but Owners guarantee that the quantities and type of material as per submitted Inventory List from October 2012 (as attached hereto) will follow the submitted Inventory List with an allowed tolerance of plus/minus 10 percent.

The Charterers shall have free use of all lashing material on board the vessel. The vessel to be redelivered with the same amount of lashing/securing material as on delivery, normal wear and tear excepted. During the currency of this Charter Party, the Charterers are to replace damage or lost lashing material, if any, at their expense.

67. LOADING OF CONTAINERS

The vessel can load containers on all decks as per container and deck load plan.

68. STUFFING OF CONTAINERS

Condition and amount of cargo as well as securing of the cargo inside containers and/or other unit loads shall be entirely Charterers' concern and responsibility. Any damage to the vessel, her tackle, apparel, furniture or anything else resulting from insufficient securing of cargo within containers and/or other unit loads shall be repaired immediately at the Charterers' expense and time.

69. TWIST-LOCKS

Deleted.

Rider Clauses to the Charter-Party m/v "TYRUSLAND"
Dated Geneva, 10th December 2012

70. **CONTAINERS WEIGHTS**

Whenever possible, Charterers or their Agents to furnish Master with Shippers' declared weights for containers. Charterers to be responsible for any consequences, delays and expenses as may arise from lack of container weights and/or discrepancies between manifest and actual container weights.

71. **DECK CARGO**

Charterers have the option to load on deck ro-ro breakbulk cargo (cases, drums, tanks, pallets) not affecting deck fittings but always at Master's discretion always in accordance with vessel's description/capacity; cargo on deck to be loaded at Charterers' risk. Bills of lading issued for such deck cargo to be clausured "carried on deck without liability for loss or damage however caused". See also line 47.

SMS cargo operations procedure

Cargo Operations Procedure

This procedure is documented to ensure that the cargo operation on-board will be conducted in such a safe and efficient manner as possible.

Responsibility

It is the Chief Officer who has the main responsibility for all cargo operations. The Officer on watch has responsibility under the Chief Officer for the operations during his/her watch.

For procedures on Cargo securing see SMS document [72-11 Cargo securing procedures](#) and for procedures regarding dangerous goods see SMS document [72-12 IMDG procedures](#)

Before cargo operations

Request well before cargo planning and loading operation:

- Types of cargo, cargo weights, position, stowage
- Cargo information according to [SOLAS - Chapter VI - Part A - General provisions - Regulation 2](#); (IMDG, temperatures, weather protection etc.)
- Different ports and discuss cargo distribution with cargo planner.

Carry out stability calculations based on the:

- Information from Cargo Planner
- Draught
- Trim/List
- Ballast and bunker status

Ensure well before cargo operations that the:

- Cargo holds are clean
- Cargo stowage and securing equipment are fit and available
- Ship's stability and ballast capacity is sufficient
- Officers on watch during the loading operations are informed about and aware of ballast operations to be undertaken during the cargo operation

Post-Cargo Operations

Check after completion of the cargo operations that the:

- All cargo to the port in question has been discharged
 - Shifted cargo (if applicable) has been brought back on-board
 - Cargo handling materials including ship's forklift and tugmaster have been properly lashed
 - Cargo-securing material are retrieved, collected and stowed
 - No safety functions has been damaged
 - Defective securing material are removed
 - Ballast operations have been completed
 - A fore and aft draft been taken
 - Cargo areas are cleaned
 - All cargo documents have been received
 - The cargo documents are filed and IMDG plan and manifest sent to company.
 - Cargo hold fans have been stopped (if not needed for the cargo)
 - All water tight compartments are closed
 - Local authorities informed
-

Damage to cargo or vessel.

If any damage to cargo or vessel is observed a "[2305. Cargo-Vessel Damage Report](#)" is to be issued the report is to be used in reference with the [72-10 Cargo operation procedure](#) ; [72-11 Cargo securing procedures](#) when damages or loss is identified to cargo and / or vessel. The report to be sent to Charterer, Operator and Safety@imperialshipping.com.

The Technical Superintendent to retain any copies of cargo damage for at least the period of the charter.

Archive of relevant documentation.

The procedure for archiving relevant documentation such as, forms, checklists, reports etc. can be found under the SMS document [115 Archiving procedure](#)

Risk Assessment

Risk assessment related to working on deck



SMS - Manual – Appendix (FC) Forms and checklists

Doc No: **2102** Doc Name: **Risk Assessment**

Date of Issue: **2011-08-29** Date of last Rev: **2013-02-04** Ver: **2** App by: **LAI** Issued by: **AN**
 Reg. Ref: **91-04 Risk Assessments; COSWP Chapter 1 ; WEM** Pages: **1 of 2**

Section 1 Established risks and controlling measures

Vessel Name:	Assessment record No	Date Of Assessment	Date of last assessment:
TYRUSLAND		28 Apr. 2013	04 Jan. 2013

Risk assessment heading/description:

Hazard No.	Description of Identified Hazards	Existing Control Measures to Protect Personnel from Harm
1	Head injury	Wear Helmet
2	Foot injury	Wear safety shoes; always watch out for scattered lashing Equipment such as twist locks and lashing bars.
3	Tipping and slipping	Wear Safety shoes, Adequate illumination around cargo holds, wipe and clean oil drops from trucks
4		
5		
6		
7		
8		
9		
10		

Section 2 Assessment of Risk Factor:

Likelihood of Harm	Severity of Harm		
	Slight Harm	Moderate Harm	Extreme Harm
Very Unlikely	Very Low Risk	Very Low Risk	High Risk
Unlikely	Very Low Risk	Medium Risk	Very High Risk
Likely	Low Risk	High Risk	Very High Risk
Very Likely	Low Risk	Very High Risk	Very High Risk

Hazard No	Likelihood of Harm	Severity of Harm	Risk Factor
1	Unlikely	Slight	Very Low Risk
2	Unlikely	Slight	Very Low Risk
3	Unlikely	Slight	Very Low Risk
4			
5			
6			
7			
8			
9			
10			

Section 3 Additional Control Measures to Reduce the Risk of Harm

Hazard No.	Further Risk Control Measures.	Remedial Action Date	Review Date
1	Always work on deck with radio	04 Jan 2013	
2	Always wear High visibility vest, clothing while working on deck	28 April 2013	
3			
4			
5			
6			
7			
8			
9			
10			

