



SAFETY ANALYSIS OF EMCIP DATA

ANALYSIS OF MARINE CASUALTIES AND INCIDENTS INVOLVING CONTAINER VESSELS

SUMMARY REPORT

September 2020

List of Abbreviations / Glossary

AE	Accidental Event - is an event that is assessed to be inappropriate and significant in the sequence of events that led to the marine casualty or marine incident (e.g. human erroneous action, equipment failure) ¹
ARPA	Automatic Radar Plotting Aid
AT	Action Taken - refers to any safety action that have been taken by a stakeholder to prevent marine casualties
AIB	Accident Investigative Body
AI Directive	Directive 2009/18/EC establishing the fundamental principles governing the investigation of accidents in the maritime transport sector and amending Council Directive 1999/35/EC and Directive 2002/59/EC of the European Parliament and of the Council
AoC	Area of Concern - are categories generated by homogenous contributing factors
BNWAS	Bridge Navigational Watch Alarm System
CF(s)	Contributing Factor - is a condition that may have contributed to an accident event or worsened its consequence (e.g. man/machine interaction, inadequate illumination) ¹
ECFA	Event and Contributing Factors Analysis - this is a methodology used for analysing accidents by depicting the necessary and sufficient events and the contributing factors that led to the occurrence
EMCIP	European Marine Casualty Information Platform
GPS	Global Positioning System
LOA	Length Overall
MAS	Maritime Assistance Service
MS	Member States
Occurrence	In the context of this analysis, occurrence refers to marine casualties and incidents
OOW	Officer of the Watch
OWS	Occurrence with ship - this indicates an unwanted event in which there was some kind of energy release with impact on people and/or ship and its cargo or environment (e.g. fire, collision, grounding etc)
OWP	Occurrence with person(s) - this indicates an unwanted event in which a person (crewmember, passenger or other person) resulted killed or injured. It includes the occupational accidents such as falling overboard, etc.
PoR	Places of Refuge
SA	Safety Area - represent areas of interest identified on the basis of the attributes that are available in EMCIP e.g. vessel types or size, events which are the manifestation of the casualty (i.e. "Casualty Event" and "Deviation"), operational modes of the vessel, or any other attribute from the taxonomy provided that enough data is available for analysis
SI	Safety Issue - is an issue that encompasses one or more contributing factors and/or other unsafe conditions ¹
SMS	Safety Management System
SOP	Standard Operating Procedures
SR	Safety Recommendation - refers to any proposal made by AIB conducting the safety investigation on the basis of information derived from that investigation
TEU	Twenty-Foot Equivalent Unit – a unit used to describe the measurement of containers
TSS	Traffic Separation Schemes

¹ As defined in IMO A.28/Res.1075 dated 24/02/2014.

UMS-AUT	A class notation concerning automation for unattended machinery spaces
VGM	Verified Gross Mass. This is the weight of the cargo including dunnage and bracing plus the tare weight of the container carrying this cargo

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Cover image:

Grounding of *Yusuf Cepnioglu* on Mykonos Island on 08/03/2014 (Source: HBMCI – Greece)

1. Introduction



Figure 1 - Top view *MSC Zoe* following the loss overboard of containers (Source: BSU / Netherlands Coastguard)

1.1 Why container vessels?

This safety analysis of the European Marine Casualty Information Platform (EMCIP) data is produced in a context where container vessels have gained increasing visibility and relevance in international trade. More than 90% of the world non-bulk cargo carried by sea makes use of containers. Consequently, container vessels have become an increasingly important part of the global logistics value chain in a market which has recorded a constant growth from the '80s onwards (with the exception of 2009 due to the consequences of the financial crisis²).

The relevance of looking at container vessels now is supported by the following rationale:

- the relevance of the fleet in terms of growth and ship size;
- the critical role of containerships for the intermodal economy; and,
- the public visibility of accidents involving container vessels, namely cargo fires, container losses and other non-ship-specific accidents. Notable examples of major marine casualties affecting container vessels include, amongst others, loss of control of *Jolly Nero* (07/05/2013), fires on *MSC Flaminia* (14/07/2014) and *Yantian Express* (03/01/2019), loss of control on *Maersk Jaipur* (08/10/2018) and loss of 342 containers by *MSC Zoe* (01/01/2019).

Moreover, the EMSA 5-year strategy 2019-2024, prioritises specific safety issues related to container vessels, particularly fires on board and the loss of containers.

1.2 The EU framework for Accident Investigation

Directive 2009/18/EC (AI Directive) was adopted to establish “*the fundamental principles governing the investigation of accidents in the maritime transport sector*”. Its purpose is “*to improve maritime safety and the prevention of pollution by ships, and so to reduce the risk of future marine casualties, by (a) facilitating the expeditious holding of safety investigations and proper analysis of marine casualties and incidents in order to*

² Source: Gard guidance on freight containers, 2016 Gard AS

*determine their causes; and (b) ensuring the timely and accurate reporting of safety investigations and proposals for remedial action”.*³

The AI Directive lays down obligations regarding the organisation, conduct, reporting and undertaking safety investigations on marine casualties and incidents by the Member States. It applies to:

- casualties involving ships flying a flag of one of the EU Member States, or
- those that occurred within a Member State’s territorial sea and internal waters as defined in UNCLOS⁴, or
- those involving other substantial interests of the Member States,

The AI Directive mandates MS to establish an impartial and permanent AI body (AIB), with emphasis on impartiality and the identification of possible safety recommendations for accident prevention purposes.

The AIB shall be an independent organisation, provided with sufficient resources, including trained and qualified investigators and enabled to respond immediately to the notification of a marine casualty or incident.

Safety investigations are conducted with the sole objective of preventing marine casualties and marine incidents in the future. Under no circumstances, they are used to determine liability or apportion blame.

The implementation of the AI Directive and its Common Methodology⁵, in addition to the international legal framework⁶, facilitates a harmonised approach across EU in conducting safety investigations, thus contributing to make the AIB community an asset for the safety of navigation.

Moreover, the establishment of EMCIP has increased the reporting of occurrences and facilitated the sharing of information.

The minimum data stored on EMCIP for each occurrence provides the factual information of the event according to the mandatory notification data requested in Annex II of the AI Directive.

A complementary system’s taxonomy has been defined by EMSA, the European Commission and the MS to report, in a harmonized way, details derived by safety investigations, including the relevant findings stemming from the analysis process and a further input of the investigative bodies.

1.3 Finding potential safety issues through the analysis of EMCIP data

EMCIP provides the means to store data and information related to marine casualties and incidents involving all types of ships, including occupational accidents related to ship operations. It also enables the production of statistics and analysis of the technical, human, environmental and organisational factors involved in accidents at sea.

EMSA has developed a methodology to analyse the findings of the safety investigations reported in EMCIP with the view to detect potential safety issues, by assessing “core” EMCIP attributes in detail, like the accident events and the factors that contributed to the occurrences.

Such a methodology has been applied to conduct an analysis focused on container vessels whose occurrences were reported in EMCIP by the EU/EEA Member States⁷ between 2011 and 2019.

The full analysis, including statistics, is available in the EMSA website⁸.

³ Article 1.1 of the Directive.

⁴ United Nations Convention on the Law of the Sea, 1982.

⁵ Commission Regulation (EU) nr. 1286/2011.

⁶ <http://www.imo.org/en/OurWork/MSAS/Casualties/Pages/Applicable-IMO-instruments-on-casualty-matters.aspx>

⁷ The analysis encompasses a timeframe between 17/06/2011 (date of transposition of Directive 2009/18/EC by the EU Member States) and 31/12/2019.

⁸ <http://emsa.europa.eu/accident-investigation-publications/safety-analysis.html>

It offers a high-level overview of the safety issues reported in the system and explains the methodology, providing as well general information on EMCIP and the database model which is based on an Event and Contributing Factor Analysis (ECFA).

This summary report is based on the full analysis and outlines the six vessel-specific issues that have been detected from various safety investigations:

- lack of proper cargo documentation;
- handling of specific goods;
- response to fire on containers;
- unsafe conditions leading to loss of containers;
- working practices to handle containers on board; and
- response of coastal Authorities following major marine casualties.

These findings derive from a qualitative assessment of their importance for the transport mode at stake, independently by their reporting frequency in EMCIP.

For each safety issue, the safety recommendations proposed by the AIBs and the measures autonomously taken by the relevant parties (so called “actions taken”) have been indicated, as well as a reference to the relevant safety investigations undertaken by the AIBs.

Furthermore, this summary incorporates the consolidated findings concerning marine casualties and incidents involving container vessels that have been subject to safety investigations, with the view to provide a better understanding of the areas of concern that contributed to the occurrences.

1.4 Acknowledgement

EMSA wishes to acknowledge the efforts by the AIBs of the EU Member States for their effort in reporting high-quality information in EMCIP, thus making possible conducting meaningful analysis of this data.

The Agency particularly thanks the consultation Group composed by experts from the French Marine Casualties Investigation Board (BEAmer – France), Federal Bureau for Maritime Casualty Investigation (BSU – Germany), Danish Maritime Accident Investigation Board (DMAIB (Denmark), Dutch Safety Board (DSB - the Netherlands), Hellenic Bureau for Marine Casualties Investigation (HBMCI - Greece) and Marine Safety Investigation Unit (MSIU - Malta) for their active contribution to this work.

1.5 Disclaimer

The marine casualty and incident data presented is strictly for information purposes only. The analysis presented in this document derives from the data that the AIB of the Member States have reported in EMCIP. While every care has been taken in preparing the content of the report to avoid errors, the European Maritime Safety Agency (EMSA) does not guarantee the accuracy, completeness or recurrence of the statistics in the report. EMSA shall not be liable for any damages or other claims or demands incurred as a result of incorrect, insufficient or invalid data, or arising out of or in connection with the use, copying or display of the content, to the extent permitted by European and national laws. The information contained in the report should not be construed as legal advice.

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2. Containership-specific issues



Figure 2 – Smoke from cargo hold nr.2 of *MV Barzan* on 07/09/2015 (MSIU)

This chapter presents the safety issues with a potential horizontal impact on containerships.

Each section provides an excerpt from a specific case, the description of the issue at stake and a list of similar investigations backing up the findings.

2.1 Lack of proper cargo documentation

Caroline Mærsk - Fire in containers on 26 August 2015 (DMAIB)

In the afternoon of 26 August 2015, a fire broke out in a container in a cargo hold on board the container ship Caroline Mærsk. At the time of the accident, the ship was positioned approximately 50 nm from the coast of Vietnam. The fire broke out as a result of charcoal self-igniting in a cargo container below deck. According to the cargo manifest, the contents were described as 'tablet for water pipe'. The IMDG Code states that charcoal is a Class 4.2 cargo, which covers substances liable to spontaneous combustion; however, the cargo of the burning containers had not been declared as dangerous cargo. These facts indicate that the container contents should have been declared as dangerous cargo from the shipper's side, but they were not.



Figure 3 - Burning container on board of *Caroline Mærsk* with spike nozzle inserted (Source: Source: DMAIB / MÆRSK Line)

Mis-declared or missing documentation regarding the nature of the containerized cargo have an impact on both its correct storage/separation and the effective response of the crew in case of an emergency, particularly fire.

This is a known issue by the ships' operators. Considering the scale of container shipping transported world-wide, it is hard to consider that widespread manual inspection of each individual container is feasible. As a logical consequence, except for containers with declared dangerous cargo, shipping containers are only subjected to sporadic spot-checks with regards to contents.

Moreover, incorrect Verified Gross Mass (VGM) declaration for containers have resulted in accidents. The VGM requirements have been brought by IMO to improve the vessel stability and prevent the collapsing of container stacks. Incorrect information on the weight of the containers could compromise their safe carriage, leading to loss of cargo and putting the life of seafarers at risk.

2.1.1 Safety recommendations / actions taken

Data reported in EMCIP did not include safety recommendations or mitigation actions specifically related to the lack of appropriate documentation concerning the nature of cargo.

This problem cannot be addressed uniquely on a ship perspective but would require a wider investigation involving other actors along the supply chain, particularly the shippers (i.e. the dispatchers of the goods), insurers and regulators.

Safety recommendations to address the issue of VGM discrepancies have been issued to the terminals to ensure that, when containers are weighted prior to loading, the cargo plan is updated with these weights.

2.1.2 Sources

- *Caroline Mærsk* - Fire in containers on 26 August 2015 (DMAIB).
- Fire inside a cargo hold on board the container ship *MV Barzan* on 07 September 2015 (MSIU)
- Charcoal cargo fire on the container vessel *MSC Katrina* on 20 November 2015 and *Ludwigshafen Express* on 21 February 2016 (BSU)
- Loss of containers overboard from CMA CGM G. Washington on 20/01/2018 in the North Pacific Ocean (MAIB)

2.2 Handling specific goods

CMA CGM ROSSINI - Fire in containers on 16 June 2016 in Colombo Port (BEA Mer)

On 15 June 2016 *CMA CGM Rossini* was loading cargo at Colombo (Sri Lanka) when two sailors in charge of lashing securely containers detected a burning smell when they arrived at bay 30 starboard. An explosion occurred coming from the containers loaded in bay 34, in the hold 5 starboard. The officer of the watch was immediately informed and the firefighting procedure enforced. Less than 30 minutes later, a harbour firefighter team arrived on board and the firefighting strategy implemented by the crew was carried on. The source of the fire was one of two 40-foot containers, loaded at Sydney and destined for Antwerp. One of these contained 26 pallets of 104 drums loaded with lithium-ion batteries, which net weigh was 16.692 metric tons.



Figure 4 – Example of used lithium-ion batteries cargo loading (source: BEA Mer / CMA CGM)

In contrast to the previous topic, this issue concerns the product *per se*, not the lack of information on the dangerous good carried onboard.

A number of issues were reported in EMCIP that relate to specific packaged cargoes, like charcoal, lithium batteries, divinylbenzene and thiourea dioxide, that under specific circumstances generated a fire.

The International Maritime Dangerous Goods Code (IMDG Code) is an internationally agreed regulation developed by the International Maritime Organisation (IMO) and sets provisions for the safe transport of dangerous goods by sea. The goal of the IMDG code is to enhance the safe transport of dangerous goods by sea and protect the marine environment.

Safety investigations into some events, that ended up in catastrophic fires, identified that the implementation of the provisions in the IMDG Code was not always properly conducted with respect to the appropriate separation and stowage of the dangerous cargo.

2.2.1 Safety recommendations / actions taken

Safety recommendations have been issued to Maritime Administrations, proposing that they canvass the IMO for legislation improvements concerning the transport of dangerous goods. In particular these include:

- to consider an amendment to the IMDG Code with the view to improve the description of goods in the transport document, in order to specify the special provision (SP) under which the transport should be carried out;
- to propose specific UN numbers for Lithium-ion cells (or batteries) and lithium metal cells (or batteries) falling under Special Provisions SP 376 and SP 377 of the IMDG Code;
- further develop the regulations on dangerous goods to better clarify the chemical properties of substances or transport restrictions. The shipper should be required to declare these properties or restrictions;
- to amend the regulations of the IMDG Code in order to prevent the ignition of charcoal that is not classified as class 4.2 dangerous goods; and,
- to consider stowage requirements that ensure that any type of self-heating substance is always transported on deck with sufficient accessibility.

Other safety recommendations to the Maritime Administrations suggested issuing an Information Notice, highlighting the possible hazards associated with the carriage of thiourea dioxide.

Safety recommendations were also aimed at the companies recommending that they have improved procedural instructions and guidelines pertaining to self-heating substances carried in containers, which should always be transported on deck with sufficient accessibility.

2.2.2 Sources

- Fire and explosion on board the *MSC Flaminia* in the Atlantic on 14 July 2012 (BSU).
- Decomposition of thiourea dioxide on board of *MV Zim Rio Grande* in the Red Sea on 20 July 2012 (MSIU)
- Charcoal cargo fire on the container vessel *MSC Katrina* in the Elbe estuary on 20 November 2015 and *Ludwigshafen Express* in the Red Sea on 21 February 2016 (BSU).
- Fire of the cargo aboard the container ship *CMA CGM Rossini* in Colombo Port on 15 June 2016 (BEA Mer)

2.3 Response to fire on containers

Yantian Express - Fire in containers on 3 January 2019 (BSU)

A fire broke out on the full-container carrier *Yantian Express* early in the morning of 3 January 2019 in the deck cargo in the area of cargo hold 2. The ship was located in the North Atlantic at this point in time. She was scheduled to reach Halifax, Canada on the following day.

The ship's command sounded the general alarm immediately after the fire was discovered. After it was mustered, the crew began to fight the fire in bay 12. Prevailing wind strengths of 8-9 Bft and low temperatures made the conditions for fighting the fire extremely challenging. The crew of the *Yantian Express* continued to fight the fire with passive measures, such as aligning the nozzles so as to cool down the area and for hydro shields, even though the weather conditions deteriorated further.

Since a further deterioration in the weather was predicted, the shipping company decided that all crew members should abandon the *Yantian Express*. Operating systems were left running wherever possible because a return was planned. The burning ship was abandoned in the afternoon of 6 January 2019.



Figure 5 - Firefighting at bay 12, row 3 - *Yantian Express* (Source: BSU)

Over the past decades, container ships have increased considerably in size in the effort to pursue economies of scale, thus enabling them to carry larger numbers of containers, stacked higher than before. The upscaling of the ships and their cargo capacity has partly been accompanied by corresponding amendments to regulations, procedures, equipment, etc. The subsequent regulation amendments have, however, merely added more of the existing equipment, e.g. an increased number of fire hydrants and hoses for larger ships but have not included a reconsideration of the strategies and methods used in emergency situations such as fires⁹.

The response to fire in containers appears a critical issue that affects two domains:

- the fire safety standard concerning the adequacy and the technical requirements of the fire-fighting equipment, as well as its design and maintenance; and,

⁹ CAROLINE MÆRSK - Fire in containers on 26 August 2015 (DMAIB).

- the effective response of the on-board fire-fighting response teams that can be a very challenging task, particularly if the fire involves containers at high stacks or in the holds. Moreover, it was noted that a real fire-fighting event can be a one-in-a-lifetime task in the career of a seafarer, thus their training and the availability of contingency plans are essential for an effective tactical response to fire.

2.3.1 Safety recommendations / actions taken

Safety recommendations have been issued to Maritime Administrations proposing that they canvass the IMO to amend the SOLAS Convention and other international instruments concerning:

- improvement of the technical requirements for the fire-fighting equipment on container vessels. In this respect, the cargo holds intended for the carriage of dangerous goods should be equipped to use water as an extinguishing agent or for cooling containers via a permanently installed system; and,
- the harmonization of existing legislation with respect to the equipment and the shipboard position of first aid devices (first aid boxes, stretchers) on board of seagoing vessels. Future rules should ensure that first aid materials are placed on board in such a way that they are promptly available in case of casualties to the first responders after an accident even on very large ships.

Safety recommendations have been issued to the companies recommending that they review the measures for fighting fire in the context of the SMS, in particular:

- the organisation of the crew and the description of the duties in the muster list;
- the correction of the operating instructions for the CO₂ fire-extinguishing system; and,
- the implementation of realistic drills, and training on the CO₂ fire-extinguishing equipment.

Other measures aimed at the companies recommend installing the drencher system in some of the cargo holds, even if there is no requirement to include this piece of equipment.

2.3.2 Sources

- Fire and explosion on board the *MSC Flaminia* on 14 July 2012 (BSU).
- *Eugen Mærsk* – Fire on 18/06/2013 (DMAIB)
- *Caroline Mærsk* - Fire in containers on 26 August 2015 (DMAIB).
- Fire inside a cargo hold on board the container ship *MV Barzan* on 07 September 2015 (MSIU)
- *Yantian Express* - Fire in containers on 3 January 2019 (BSU)

2.4 Unsafe conditions leading to loss of containers

Svendborg Mærsk – Heavy weather damage on 14 February 2014 (DMAIB)

On 13 February 2014, the container ship *Svendborg Mærsk* departed from Rotterdam, the Netherlands. The ship was bound for the Suez Canal, and subsequently the Far East. The master expected to encounter adverse weather conditions on the route. However, the forecast did not cause any concern.

The following day, as the ship had left the outer English Channel the weather conditions started deteriorating. In the afternoon, the ship suddenly and without warning rolled to extreme angles and a large number of cargo containers fell overboard.

In the early evening, the ship again suddenly rolled violently, reaching an extreme angle of roll of 41° to port. Again a large number of containers were lost over board and the master considered the situation to threaten the safety of the ship. The master sounded the general alarm to muster the crew members. Later in the evening he assessed that the weather no longer posed an immediate danger to the ship.

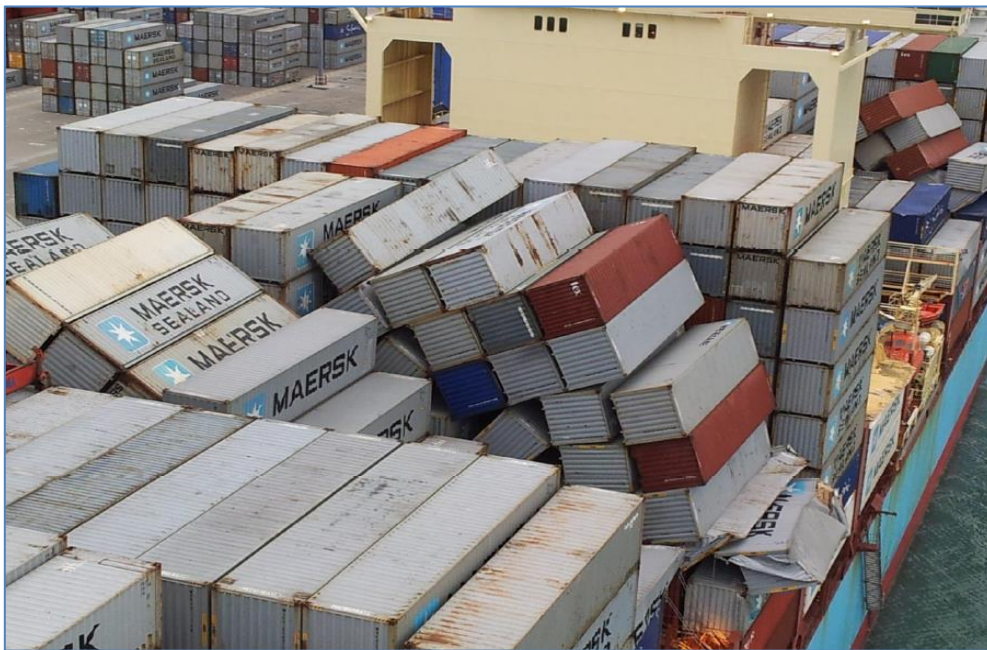


Figure 6 - *Svendborg Mærsk*, aft deck at arrival (Source: DMAIB / MÆRSK)

During cargo handling, loading and unloading, or at sea, container falls and container losses are important hazardous events which might have an impact on ship safety and port operations.

At sea, containers which may fall overboard as a consequence of an environmental factors or other events, like grounding or collision, represent an important risk factor for the ship's safety and environmental protection. Once in the ocean, they can stay afloat for a long time or fill with water and sink if the contents cannot hold air.

Moreover, there are catastrophic events, luckily only a few, where a total loss of ships and their cargoes has occurred.

The number of containers lost annually and reported in EMCIP is rather small as compared to those which are reported globally¹⁰.

Various factors contributed to the loss of containers at sea, including the effect of heavy weather on the stacked boxes, maintenance of lashing equipment and training of the crewmembers.

¹⁰ World Shipping Council – Containers lost at sea, 2020.

The structural design of large container ship is characterized by large deck openings which makes them sensitive to torsional and horizontal bending loads. The flexible response of the ship to dynamic forces cause accelerations in different locations and directions, and different strengths are imposed from the hull to the cargo¹¹.

Amongst these forces, parametric roll resonance is a phenomenon often highlighted in safety investigations. It constitutes a significant amplification of roll motion, which can endanger the ship's stability and contribute to the loss of containers overboard, especially in the presence of several stacks of containers.

Dedicated software has been developed to support the decisions of the Master in reducing the risks of parametric roll resonance. However, safety investigations showed that the output information generated by this tool was not comprehensive and the Master had to rely on his own experience.

High longitudinal rolling, under specific weather conditions and speed, was another reported issue determined by the final ship design following an extensive ship conversion programme that increased the number of container layers on the deck.

The collapse of containers stored on the bottom could also initiate the chain of events leading to the loss of containers overboard. This initial event may derive by various factors, like the excessive stack loads resulting from the mis-stowed or overweight containers, excessive racking loads, contact between containers due to loose lashing or poor structural conditions of containers.

2.4.1 Safety recommendations / actions taken

Safety recommendations have been issued to the Maritime Administrations to explore, within the IMO, improvements in the legislation and technical standards concerning:

- the design requirements for lashing systems and containers;
- the requirements for loading and stability of container ships;
- obligations with regard to instruments providing information to the Master on roll motions and accelerations; and,
- the technical possibilities for detecting container loss.

Recommendations to the Maritime Administrations have also been issued to implement measures for containerships on international voyages on shipping routes to minimize the risk of loss of containers (e.g. by establishing restrictions, recommended routes, precautionary areas etc).

Moreover, with the view to better monitoring sensitive coastal areas, additional safety recommendations have been issued to the Competent Authorities regarding:

- improvement of the traffic control of container ships, such as establishing a VTS area and active disseminating of warnings to shipping about prevailing weather and wave conditions; and,
- conduction of a periodic risk analysis of route-specific risks that can lead to container loss on shipping routes.

Various measures have been proposed to, or adopted by, companies to mitigate unsafe conditions that contributed to the loss of containers, including:

- enhancement of the cargo software providing decisional support to the Master to better predict the motion of the vessel in forecasted wind and wave patterns, whilst considering the cargo loaded on board, and revision of the training package for operators of the system;
- subscription to information systems allowing Masters to identify, and avoid, routes where the ship's motion thresholds are likely to be exceeded considering the weather conditions. These tools provide an automatic

¹¹ Loss of containers overboard from *MSC Zoe*, 1-2 January 2019.

pre-calculation of the vessel's behaviour in the forecasted wind and wave conditions, sparing the Master from undertaking complex manual calculations;

- provision of dedicated training to the Senior Officers to enable them to better understand the expected behaviour of the vessel in heavy weather, including wave theories, vessel response patterns etc.; and,
- revision of the maximum cargo load for twist locks operating in fully automatic mode.

2.4.2 Sources

- *Eugen Mærsk* – Fire on 18/06/2013 (DMAIB)
- *Svendborg Mærsk* – Heavy weather damage on 14/02/2014 (DMAIB)
- Loss of containers overboard from CMA CGM G. Washington on 20/01/2018 in the North Pacific Ocean (MAIB)
- Loss of containers overboard from *MSC Zoe*, 1-2 January 2019 (BSU; DSB, Panama Maritime authority).
- Safe container transport north of the Wadden Islands – Lessons learned following the loss of containers from *MSC Zoe* (DSB)

2.5 Working practices to handle containers on board

MV Boston Trader - Serious injury while lashing containers on deck in the port of Oran, Algeria, on 14 March 2019 (MSIU)

MV Boston Trader was moored at Dar Es Salem Terminal, in the port of Oran, Algeria.

During the morning of 14 March 2019, the third officer received a call over the portable radio that one able seafarer had an accident while securing containers on the cross deck between Bay 06 and Bay 12. On reaching the location, the third officer found the able seafarer standing with the sock and safety shoe of his right foot taken off and bleeding from the toe.

The lower end of a long lashing bar had fallen onto the seafarer's right foot, cutting through his safety footwear. One toe on the seafarer's right foot was severely injured and had to be amputated.

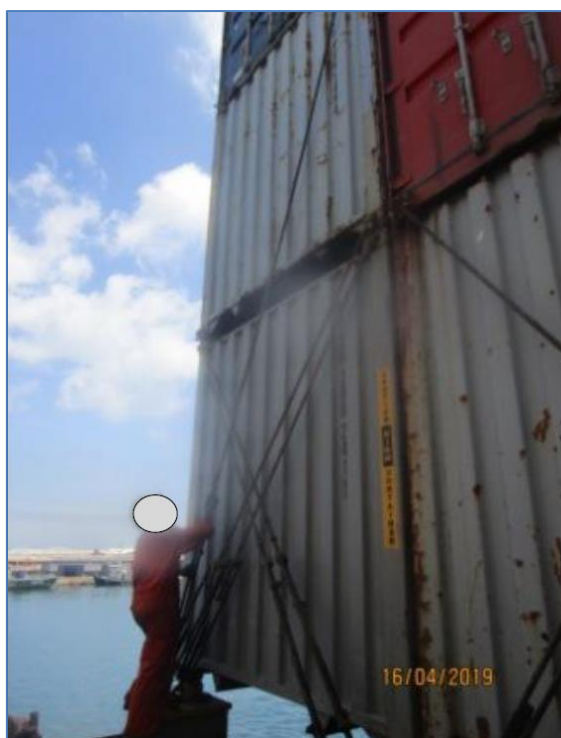


Figure 7 - Connecting a lashing bar to a turnbuckle (Source: MSIU)

Container lashing (the process of securing containers together on-board ship), missing physical safety barriers like handrails, and work at heights are amongst the hazards typically associated with cargo handling on board of container ships.

It was found in EMCIP that the execution of specific work operations, like disconnection of lashing at sea or the effort to unlock the twist-locks during unloading operations, contributed to several occupational accidents, such as falling overboard and to other events with fatal outcome.

Although stevedores are normally responsible for lashing and unlashings containers in port areas, it was reported that some working practices require that the crew members undertake this operation before the ship's arrival in port, in order to save time and to allow containers to be discharged immediately after berthing.

Risks for the workers, both crew members and stevedores, can span from being struck by falling hatch cover or container, stumbling, falling or being trapped by containers.

The level of coordination between the ship and terminal, lack of proper SOP, poorly lit working environment and harsh weather conditions appear as frequent contributing factors for such incidents.

2.5.1 Safety recommendations / actions taken

Safety recommendations to mitigate this issue have been mainly issued to the ship companies and focus on the review of the SMS concerning:

- updated guidance on safe lashing, including a formal system of briefing and familiarization for the crew members;
- risk assessment of walking close to partly open holds and control measures are put in place to prevent personnel from falling into the holds;
- co-ordination and familiarization with the ship with stevedores and external visitors;
- assessment of risks associated with the use of long lashing bars; and,
- the need to achieve cooperation between ships and shore terminals by establishing joint agreements on loading and unloading processes, and to develop a shared safety manual.

Companies were also recommended to install physical barriers in dangerous areas and to study the viability of placing guard rails on lashing platforms.

2.5.2 Sources

- *MV Tempanos* - Fatality from fall into cargo hold t Felixstowe on 17 December 2011 (MAIB – UK)
- *MV Boston Trader* - Serious injury while lashing containers on deck in the port of Oran, Algeria on 14 March 2019 (MSIU)
- Crew member overboard while disconnecting container lashings – *MS Freya*, Humber on 3 September 2014 (DSB)
- Fall of stevedore on container ship *Wes Janine* during cargo loading operation with loss of life in Riga port on 20/02/2017 (TAIIB – Latvia)
- Fatal accident during unloading in Moerdijk - Lessons learned from the accident on board the *A2B Future* (DSB)
- *MV Solong*, occupational accident at St. Petersburg port on 10/07/2018 (GAMA – Portugal)
- *MSC Irene*, occupational accident at Sines on 4 April 2013 (GAMA – Portugal)

2.6 Response of coastal Authorities following major marine casualties

Fire and explosion on board the *MSC Flaminia* on 14/07/2012 in the Atlantic Ocean (BSU)

On 14 July 2012, a smoke detection system alarm sounded on the bridge of the container ship *MSC Flaminia*, while en route from the east coast of the USA to Europe.

The alarm indicated smoke in cargo hold 4. The lookout sent from the bridge to the cargo hold confirmed there was fire in the hatch. CO₂ was discharged into the affected cargo hold to fight the fire. The area around cargo hold 4 was to be cooled down later. A team of seven crew members was working in this area to make the necessary preparations when a heavy explosion occurred. This was accompanied by the rapid development of the fire and the ship's command decided to abandon the vessel due to the overall circumstances. The occurrences resulted in three fatalities, two severely injured crew members, structural and cargo damage due to fire. The flag State, Germany, took responsibility for granting a place of refuge on 15 August 2012.



Figure 8 - Fire and explosion on board the *MSC Flaminia* on 14/07/2012 in the Atlantic Ocean (Source: BSU / German Command for Maritime Emergencies)

The effective response from the shore authorities is crucial to minimise the consequences to the people, environment and property, particularly in the aftermath of catastrophic marine casualties. The safety investigation stressed that a co-ordinated effort and smooth decision-making process are crucial for the success of salvage operations.

2.6.1 Safety recommendations / actions taken

Safety Recommendations have been issued to the EU Commission to:

- further develop instruments on granting a place of refuge aimed at improving the coordination between the various parties and the decision-making process¹²; and,
- Supporting the implementation of IMO Resolution A.950(23) on the establishment and operation of MAS contact points in the EU law.

¹² Following the *MSC Flaminia* marine casualty in 2012, the debate on Places of Refuge resumed momentum. In 2013 the Cooperation Group on Places of Refuge was created under the Chairmanship of the European Commission (the group consists of representatives of EU Member States + EEA). EMSA has been providing support to draft the EU Operational Guidelines on Places of Refuge in 2014. The Guidelines aim at a robust operational process leading to well-advised and, where possible, quicker decision making. More information are available at <http://www.emsa.europa.eu/implementation-tasks/places-of-refuge.html>.

The work of the Places of Refuge group (under the VTMS HLSCG) has been taken further in the IMO and Union Submissions, co-sponsored by relevant industry stakeholders, have resulted in work for the revision of the IMO Guidelines on PoR (expected to be finalised in 2021).

2.6.2 Sources

- Fire and explosion on board the *MSC Flaminia* on 14 July 2012 (BSU).

3. Consolidated findings



Figure 9 - Collision *CSL Virginia - Ulysse* on 7 October 2018, off cap Corse (Source: BEA Mer / Prefecture maritime de la Méditerranée)

3.1. Main areas of concern leading to casualty events

In the context of the present analysis of EMCIP data, the “areas of concern” (AoC) are categories generated by homogeneous contributing factors¹³. This section highlights which areas of concern mainly contributed to the various types of marine casualties and incidents that have been investigated.

Grounding is the safety area scoring the highest number of contributing factors (82) derived from 15 investigations. Approximately 60% of the reported contributing factors are concentrated around the following AoC:

- Use of electronic equipment, particularly ECDIS, ARPA, GPS or BNWAS (18%);
- Situational awareness in bridge operation (12%);
- Work methods for navigation and watchkeeping (10%);
- Preparation of passage plans (7%);
- Ergonomics and design standards (6%); and
- Crew management (6%).

Fifty-one contributing factors have been reported for **collisions** resulting from 18 investigations. Most of these factors (67%) belonged to the following areas of concern:

- Situational awareness in bridge operation (22%);
- Work methods for navigation and watchkeeping (12%);
- Workload and bridge resource management (10%);
- Risk assessment for specific operations (8%);
- Training and skills (8%); and
- External communication with other ships and parties (8%).

Twelve investigations concerning **damage to ship or equipment** included 51 contributing factors that appear concentrated around six areas of concern (67%):

¹³ Further details on the consolidation process can be found in the full analysis.

- Conduction of maintenance (16%);
- Operation of shipborne equipment (14%);
- Ergonomics and design standard of ship's component (12%);
- Failure due to wear (10%);
- Procedures for tests/maintenance (8%); and
- Wind (8%).

Thirty-six contributing factors have been reported in 12 investigations of **fires/explosions**, mostly in the following areas (58%):

- Emergency handling on board (33%) due to the emergency response of the crew and to the hardware functioning and its installation/design, particularly concerning the fixed fire extinguishers; and
- Cargo loading and handling (14%) due to missing or mis-declared documents concerning dangerous goods.

Twenty-one contributing factors relevant to **loss of control/containment** were included in 10 investigations. These factors appear more distributed across various safety issues. Prominent areas of concern are:

- Ergonomics, design standard and installation of appliance used by crew member and other ship's elements (28%);
- Communications, either on board or with third parties, like stevedores and terminals (20%); and
- Maintenance of critical equipment (19%).

Four safety investigations concerning **contacts** detected 13 contributing factors, mainly focused on the following areas of concern:

- Communications, either on board or with 3rd parties (38%);
- Situational awareness in bridge operations (15%); and
- Working with 3rd parties, especially with tugs and pilots (15%).

One occurrence involving **flooding** was investigated and included 4 contributing factors, mainly related to the equipment failure following issues with maintenance planning or execution.

Thirty investigations dealt with **occurrences with persons**. The analysis looked at the 81 contributing factors detected for the top-3 reported safety issues, namely "Work/Operation methods", "Tools and hardware (design or operation)", and "Safety assessment-review". Most of these factors (72%) appear concentrated around the following areas of concern:

- Lack of physical safety barrier on the workplace (20%);
- Work preparation (16%);
- Priorization of personal safety (14%);
- Ergonomics of device and ship's equipment (11%); and
- Safety awareness (11%).

3.2. Safety recommendations and actions taken

The largest proportion of the **safety recommendations** (59%) were addressed to the ships' companies or owners. These recommendations appear oriented to fix company-specific issues related to the SMS implementation that contributed to the marine casualties or incidents.

Around 17% were issued to the Maritime Administrations. Although these recommendations represent a smaller proportion of the total, they aim at improving horizontal safety issues that appear common to the whole industry, thus may require dedicated instruments at international or EU level¹⁴.

Actions taken by the companies include several safety initiatives undertaken by the stakeholders after a marine casualty which mainly appear to be focussed on the revision of the SMS. Other relevant measures include the introduction in the fleet of dedicated software supporting the automatic prediction of the motion of the vessel in the forecasted wind and wave patterns, the deployment of upgraded cargo software and the assessment of the breaking load of the twist-locks during stowage behaviour in various scenarios following a loss of containers.

¹⁴ These SR are further detailed in Chapter 2.

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