Marine Safety Investigation Unit

Transport Malta

SAFETY INVESTIGATION REPORT

202002/038 REPORT NO.: 07/2021 February 2021

MV *CROATIA*
Cargo explosion
in position 03° 38.7' N 105° 37.7' E
23 February 2020

SUMMARY

Whilst underway towards Singapore, an explosion occurred in *Croatia*'s cargo hold no. 7. A fire party was immediately mustered by the master to assess the situation inside the cargo hold.

An inspection of the area revealed that an explosion had occurred inside one of the containers stowed in the cargo hold, damaging five other containers and several ship fittings. The charterers were contacted, following which it was confirmed that no other explosion risks were foreseen.

The cargo manifest revealed that the container carried scrap metal and used car parts.

The MSIU concluded that flammable vapours had accumulated inside, resulting in an explosive atmosphere.

Considering the actions taken by the Company and the vessel's charterers, no recommendations have been made.

MV *Croatia*

FACTUAL INFORMATION

The vessel

Croatia (Figure 1) was a 94,684 gt, Maltese registered container vessel, built by Hanjin Heavy Industries & Construction Subic, Philippines, in 2016. The vessel had a length overall of 299.98 m, a moulded breadth of 48.2 m, and a moulded depth of 24.8 m. She had a summer deadweight of 111,530 metric tonnes (mt), corresponding to a summer draught of 14.521 m. *Croatia* was owned by Croatia Maritime Limited, managed by *Ciner Gemi Acente Isletmeleri Sanayi Ve Ticaret A.S.* and classed with the American Bureau of Shipping (ABS).

The vessel had a total carrying capacity of 9,019 TEUs[1], which could be loaded on deck and under deck. The vessel was fitted with eight cargo holds. Seven cargo holds were located forward of the accommodation block. The vessel was certified to carry dangerous goods, in accordance with her Document of Compliance for the carriage of dangerous goods, issued by ABS. At the time of the occurrence, *Croatia* was carrying 15,074.1 mt of cargo inside the containers.

Propulsive power was provided by an 8-cylinder, two-stroke, slow speed, Wärtsilä X92 diesel engine, which produced a power of 38,590 kW at 74 rpm. This engine drove a single, fixed-pitch propeller, which enabled *Croatia* to reach a service speed of 22 knots.

Crew

Croatia's Minimum Safe Manning Certificate stipulated a crew of 15. At the time of the accident, the vessel was manned by a crew of 20.

The master was a 49-year-old national of the Republic of Korea. He had 16 years of sea-going experience, 7.8 years of which were served in the rank of a master with

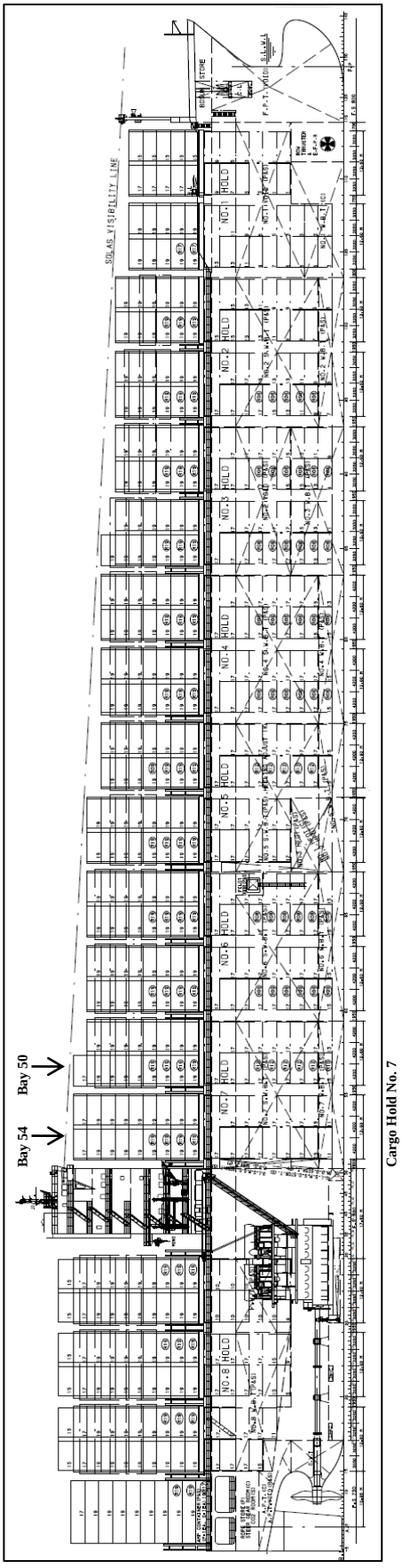

Figure 1: Extract from the general arrangement plan

[1] Twenty-foot equivalent unit.

STCW II/2 qualifications[2]. His Certificate of Competency was issued by the Busan Regional Office for Oceans and Fisheries, in 2011. He had joined the vessel from the port of Singapore, on 26 August 2019.

The chief officer was a 49-year-old Filipino national. He had 22 years of sea-going experience, seven years of which were served in the rank of chief officer with STCW II/2 qualifications for a master mariner. His Certificate of Competency was issued by the Maritime Industry Authority of the Philippines in 2012. He had joined *Croatia* on 12 November 2019, from the port of Busan, Republic of Korea.

The third officer had three years of sea-going experience, two years of which were served in the rank of a third officer with STCW II/1 qualifications. His Certificate of Competency was issued by the Maritime Industry Authority of the Philippines, in 2016. The third officer had embarked *Croatia* on 05 August 2019, from the port of Singapore.

Environment

On the day of occurrence, the sky was overcast, and a fresh breeze was blowing from a Northeasterly direction. The sea state was reported to have been moderate, with a 2.0 m swell. The air and sea temperatures were 27 ℃ and 25 ℃, respectively.

Narrative[3]

On the morning of 23 February 2020, *Croatia* was in transit to Singapore. At around 1000, during the third officer's watch, an explosion was heard by several crew members.

Looking through the bride windows, the two crew members soon observed smoke emanating from cargo hold no. 7.

The OOW immediately sounded the fire alarm and announced the location of the emergency on the public address system. The master, in the meantime, organized a fire-fighting team to investigate the area. All necessary precautions, such as gas measurements, were taken prior to entry into the cargo hold.

Once inside the cargo hold, the fire-fighting team found that one container had explosion damages (Figure 2), but no active fire was raging. Debris from the container was seen lying in various locations of the cargo hold (Figure 3). The fire-fighting team also reported that five other containers were partially damaged and that some of the vessel's fittings had been affected.

Figure 2: The exploded container in the cargo hold

Figure 3: Container and Cargo debris on tank top

[2] International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended.

[3] Unless otherwise stated, all times are local time (UTC +8).

The charterers were contacted, and a confirmation was received that no other container carried the same cargo and that no other explosive risks were foreseen. In the meantime, the Company's emergency team ashore was alerted and the vessel was instructed to proceed to Singapore anchorage for shore side investigations.

None of the crew members witnessed the explosion, and there were neither injuries nor fatalities.

Damages to the vessel

The damages to the vessel which were reported to have occurred because of the explosion were:

- ventilation ducts nos. 1, 2 and 3 on port side were found distorted and damaged (Figure 4);
- the safety railing on deck platform no. 2 was noted to be bent for about 2 m in length;
- the steel walkway on no. 2 deck platform was found distorted (Figure 5); and
- the safety steel wire no. 2 deck platform was found parted for approximately 2 m in length.

Figure 4: Mechanical ventilation duct damaged

Figure 5: Distortion of steel walkway platform

Moreover, after the cargo hold was unloaded and the debris from the explosion was cleared, two moderate indentations were sighted on the tank top plating.

Damages to the cargo units

Once the vessel was safely berthed at Singapore, a P&I Surveyor attended the vessel. In the Surveyor's assessment it was concluded that further to the container in which the explosion had happened, seven containers had been affected by the explosion.

The container inside which the explosion had happened was in position Bay 50, Row 06, Tier 12 (500612) (Figure 6). As a result of the explosion, the entire right panel and the access door were ripped off, exposing the cargo contents (Figure 7).

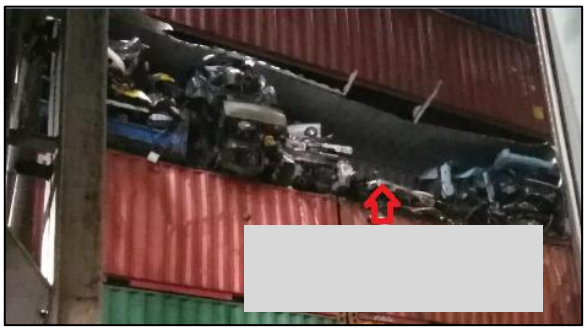

Figure 7: Exposed cargo contents

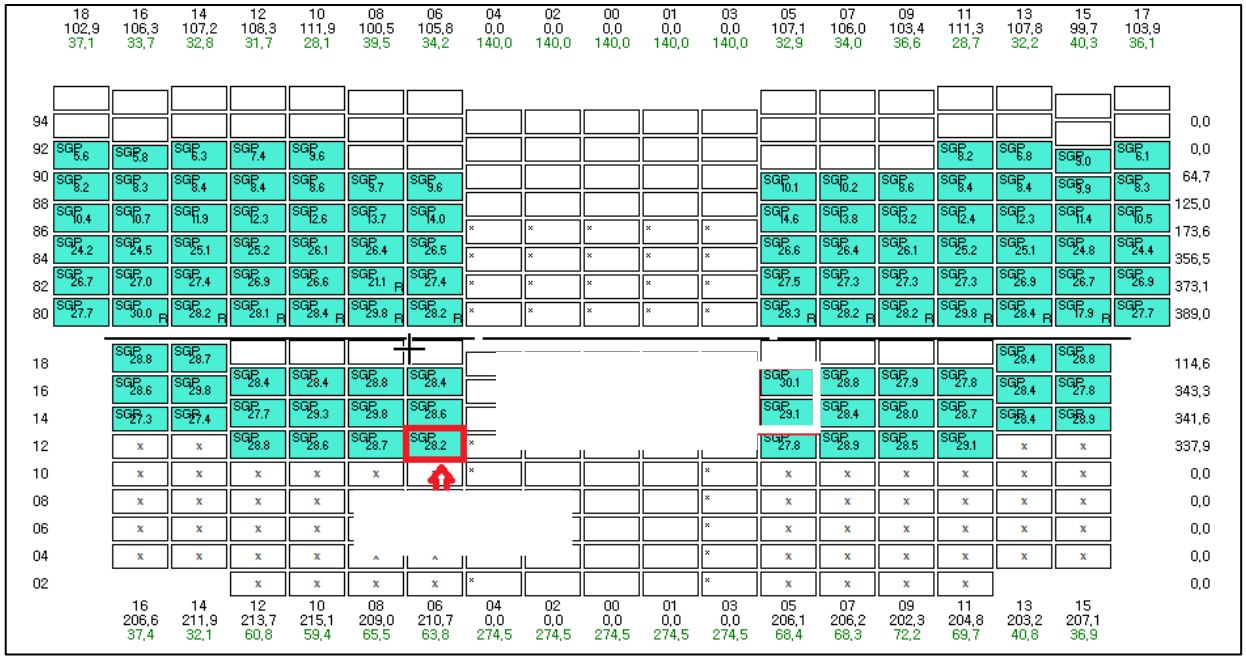

Figure 6: Plan of Bay 50 indicating the location of the exploded container

The following list contains the positions of the other affected containers and their respective damages:

1. 500616 – right panel dented and torn at around corrugated no 8 – 11;
2. 510610 – right panel bulged, and roof dented;
3. 490610 – right panel bulged, and roof dented;
4. 500516 – left panel dented and torn (Figure 7);
5. 500514 – left panel dented and torn/hole;
6. 500812 – right door dent, locking bar damaged, right panel dented and left panel bulged; and
7. 490810 – right panel slightly dented.

Figure 7: Damages sustained to containers in positions 500516 and 500514

All 79 containers which were loaded on deck in Bay 50, were in apparent sound condition and were subsequently discharged successfully.

The container

The container which sustained the explosion, had been loaded on *Croatia* at the port of Busan on 11 February 2020. The unit was scheduled to be discharged at Singapore, for transhipment. Its destination, as listed in the container's bill of lading, was Karachi,

Pakistan. The container was a 40-foot, high cube[4] container, packed with a net weight of 24.319 mt of used automotive parts. Cargo declarations indicated that it contained no dangerous cargo.

A fire expert and a P&I surveyor were deployed on behalf of the Owners, who attended the vessel upon her arrival at Singapore. The container was off loaded from the vessel, and its contents recovered, by an external contractor while the vessel was berthed at the Pasir Panjang Terminal of Singapore, between 24 February and 25 February 2020.

On 09 March, a re-working of the exploded container's contents into another intact container was carried out. The inspection report on the container's contents, revealed the presence of a partially filled fuel tank, car batteries, a cigarette lighter and several flares (Figures 8 and 9).

Figure 8: Fuel tanks and batteries

Figure 9: Flares and cigarette lighter

ANALYSIS

Aim

The purpose of a marine safety investigation is to determine the circumstances and safety factors of the accident as a basis for making recommendations, and to prevent further marine casualties or incidents from occurring in the future.

Cause of the explosion

Evidence submitted to the MSIU revealed that the container stowed in position 500612 had sustained substantial internal overpressure and one of its side walls and the door-leaves had been blown off. Reportedly, the container was loaded with used auto parts.

An examination of the ejected debris revealed the presence of at least eight automotive metal fuel tanks, four of which had a ballooned appearance, consistent with the effects of internal over pressurization. The information available to the safety investigation revealed that gas measurements of the internal atmosphere of several of these fuel tanks, indicated the presence of flammable vapours within the explosive range.

[4] Internal dimensions: 12,032 mm by 2,350 mm by 2,700 mm and with a capacity of 76.3 m^3.

It was not excluded that fuel may have leaked from one or more of the tanks, which gradually led to an explosive atmosphere within the container. Although no old / damaged batteries were sighted in the container, it was not excluded that an intermittent electrical spark, could have been the likely source of ignition.

Dangerous goods

As mentioned elsewhere in this safety investigation report, the container's contents were not listed as dangerous goods by the shipper. Although the MSIU was not privy to the condition of the cargo, prior to the accident, however, reports requested from the Company and based on the outcome of this occurrence, the safety investigation believes that some of its contents could have been categorized under the IMDG Code[5].

Amongst items from the container that were sighted were automotive metal fuel tanks which had a 'ballooned' appearance. This indicated that the vehicle's tanks were not completely empty from fuel. Considering the flammable liquids present in these tanks, this cargo could have been considered to fall under Class 3[6] of the IMDG Code. Moreover, several vehicles' batteries were found amongst the debris and depending on their type (*i.e.*, alkaline or lithium), these had to be classified either under Class 8[7] or Class 9[8].

The safety investigation neither came across specific details on the flares and the cigarette lighter, nor the reason why these were stored inside the container. However, flares are considered as pyrotechnics[9] and would have to be classified under the appropriate hazard division of Class 1[10] of the IMDG Code.

Accurate declaration of cargo

One of the main steps of risk assessment is the capability to identify changes in the condition and/or physical status of a system, to an extent that these may alter the risk level. Without an accurate, *a priori* knowledge of the contents of the container, the crew members had no way to comprehend the situation and anticipate potential developments which would have necessitated mitigating actions from their end. Thus, information (and perhaps instructions are an essential element of organisational safety - the analysis of a given status and potential deviations from that status.

Safety researchers proclaim that an accident may be an indication of an organisation's resilience or otherwise. In fact, the accident on board *Croatia* clearly indicated a situation, which exposed the brittleness of a system, simply because neither the Company nor the crew members were able to take mitigating measures.

Per se, this revealed the vulnerability of the system, which has already been in the industry's limelight, following concerns on undeclared container weights. In terms of fire safety, this would not have been the first occurrence where dangerous cargo was either not declared or inadequately declared.

On 14 July 2012, a fire and explosion occurred inside one of the cargo holds of the German-flagged container ship *MSC Flamina*. Although the dynamics of the accident were not identical, and

---

5 The International Maritime Dangerous Goods Code outlines the mandatory provisions governing the carriage of dangerous goods in packaged form or in solid form in bulk.

6 Flammable liquids.

7 Corrosive substances.

8 Miscellaneous dangerous substances and articles and environmentally hazardous substances.

9 Flares contain a substance, or a mixture of substances designed to produce an effect by heat, light, sound, gas or smoke or a combination of these as the result of non-detonative self-sustaining exothermic chemical reactions.

10 Explosives.

notwithstanding that the consequences of the fire and explosion on *MSC Flamina* were very serious, issues with inaccurate cargo declarations had been identified by the Federal Bureau of Maritime Casualty Investigation[11].

Other findings

The vessel's Document of Compliance for the Carriage of Dangerous Goods prohibited the transport of Class 3 and Class 9 (goods which contained hydrogen or hydrogen mixtures) in cargo hold no. 7. Since the container was not adequately labelled, the vessel's crew were unaware of the hazards that the container posed.

Cargo hold no. 7 was fitted forward of the vessel's accommodation and adjacent to the engine-room compartment. Moreover, two low sulphur marine gas oil bunker tanks were fitted below the cargo hold. An explosion inside cargo hold no. 7 could lead to structural damages to the bunker tanks, with potential severe safety and pollution consequences.

CONCLUSIONS

1. Contents inside a container which had been loaded inside cargo hold no. 7, exploded;
2. It was hypothesized that fuel had leaked from a cargo of vehicle fuel tanks inside the container, generating an explosive atmosphere within;
3. An intermittent electrical spark, may have been the source of ignition which may have caused the explosion;
4. The container was not marked as containing any dangerous goods;
5. Without an accurate, *a priori* knowledge of the contents of the container, the crew members had no way to comprehend the situation and anticipate potential developments which would have necessitated mitigating actions from their end;
6. Considering the contents of the container, and the location of the bunker tanks below cargo hold no. 7, the stowing of this container inside cargo hold no. 7 posed a serious hazard to the vessel.

SAFETY ACTIONS TAKEN DURING THE COURSE OF THE SAFETY INVESTIGATION[12]

During the safety investigation, the Company contacted the charterers to inquire on the steps that would be taken to prevent reoccurrence of such accidents.

By means of a circular, the Charterers drew the attention of their shippers to their cargo policies, which addressed measures to be followed when classifying used auto parts commodities / components. Furthermore, it raised awareness on the importance of making a correct declaration for used auto parts, making specific reference to the accident involving *Croatia*.

RECOMMENDATIONS

In view of the safety actions taken by the Company and their charterers, no safety recommendations were made.

[11] Federal Bureau of Maritime Casualty Investigation. (2012). *Fire and explosion on board the MSC FLAMINA on 14 July 2012 in the Atlantic and the ensuing events*. (Investigation Report 255/12). Hamburg: Author. Retrieved from http://www.bsu-bund.de/SharedDocs/pdf/EN/Investigation_Report/2014/Investigation_Report_255_12.pdf?__blob=publicationFile

[12] **Safety actions shall not create a presumption of blame and / or liability.**

SHIP PARTICULARS	
Vessel Name:	*Croatia*
Flag:	Malta
Classification Society:	American Bureau of Shipping (ABS)
IMO Number:	9723277
Type:	Container
Registered Owner:	Croatia Maritime Limited
Managers:	Ciner Ship Management
Construction:	Steel
Length Overall:	299.98 m
Registered Length:	286.06 m
Gross Tonnage:	94,684
Minimum Safe Manning:	15
Authorised Cargo:	Containers

VOYAGE PARTICULARS	
Port of Departure:	Hong Kong
Port of Arrival:	Singapore
Type of Voyage:	International
Cargo Information:	Containerised cargo (54,074.1 mt)
Manning:	20

MARINE OCCURRENCE INFORMATION	
Date and Time:	23 February 2020 at 0959 (LT)
Classification of Occurrence:	Less Serious Marine Casualty
Location of Occurrence:	03° 38.7’ N 105° 37.7’ E
Place on Board	Cargo hold no. 7
Injuries / Fatalities:	None reported
Damage / Environmental Impact:	Cargo damage and damage to ship structure
Ship Operation:	Transit
Voyage Segment:	In passage
External & Internal Environment:	The sky was overcast, fresh breeze from North East. Sea state was moderate. Air temperature and sea temperature were 27 ℃ and 25 ℃ respectively.
Persons on board:	20