
# MINISTRY FOR INFRASTRUCTURES AND TRANSPORTS

## Directorate General for Rail and Maritime Investigations

3rd Division – Marine Investigations

# M/V GRANDE AMERICA

**Fire on board and subsequent sinking off Cape Finisterre**

**10th March 2020**

**Final Report**

## Summary

1. SUMMARY ....3
2. FACTUAL INFORMATIONS ....4
2.1 Picture of M/V GRANDE AMERICA ....4
2.2 Ship's particular ....4
2.3 Voyage particulars ....6
Crew list ....7
2.4 information on the casualty ....8
2.4.1 Actions taken ....9
2.4.2 Obtained results ....9
3. NARRATIVE ....10
3.1 HMS ARGYLL intervention ....12
3.1.1 Excerpt SAR Chronology HMS Argyll ....12
3.2 French Authority intervention ....15
3.3 Oil spill ....17
4. Analisys ....20
4.1 SMS procedures and emergency analysis ....20
4.2 Fire origin and propagation analysis ....20
4.2.1 Origin of fire and analysis of the causes ....20
4.2.2 Fire propagation ....23
4.3 Inspection on board M/N GRANDE ARGENTINA (sister ship) ....24
4.3.1 Inspection of deck 2 and CO2 room. ....25
4.3.2 Cargo on board ....27
5. Conclusions ....28

This final report on the investigation is carried out on the basis of Dlgs. 165/11 (Article 14.2 of the 2009/18/CE Directive) as the final investigative report will not be published within 12 months of the date of the occurrence.

The aim of the investigation carried out under the provisions of the decree is to prevent future similar incidents by ascertaining and analysing the relevant causes and circumstances.

The investigations, carried out on the basis of the discipline contained in the decree, are not about determining liability. Investigative reports, including in relation to the factual investigations and conclusions represented, are not a source of evidence in any administrative or criminal proceedings.

The present investigation is carried out in cooperation with French marine accident investigation body – BEAMER according to Decision nr. 5 on 18th of March 2019 and Italy covers the role of Leading Investigating State has established by relevant rules.

**DISCLAIMER**:

The results and conclusions in the final report may not reflect the content of this interim report if further information or evidence is revealed.

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# 1. SUMMARY

The ship, which sailed from Hamburg, was directed towards Casablanca, when, on the night between 10 and 11 March 2019, a fire broke out on board while it was off Cape Finistère, in north-western France, that became uncontrollable and caused the sinking the next day at about 180 nautical miles from the Breton coast, in an area where, according to reports from the maritime prefecture of Brest, the waters reach 4,600 meters deep. The vessel transported cars as well as other vehicles in the garages and numerous containers on the upper decks.

The ship master declared the abandon ship at around midnight, all twenty-six crew members and the only passenger aboard the lifeboat were rescued by the British frigate HMS Argyll in the night between Sunday and Monday, at around 4 in the morning. The SAR operations were supervised by the Italian Maritime Rescue Coordination Center (MRCC) in Rome and coordinated locally by MRCC Brest.

# 2. FACTUAL INFORMATIONS

## 2.1 Picture of M/V GRANDE AMERICA


## 2.2 Ship's particular

| | |
|---|---|
| Name: | GRANDE AMERICA |
| Flag: | ITALY |
| IMO number: | 9130937 |
| Registration number: | Nr. 061. RI - Palermo |
| Ship type: | MULTIPURPOSE/RO-RO CONT |
| Call sign: | IBPG |
| Owners and managers: | GRIMALDI DEEP SEA - Palermo Via Emerico Amari n.8. |
| Manufacturer / year of construction | 1997 – Fincantieri |
| Keel laid: | 1995 |
| LOA .: | 213 mt |
| Width: | 32.25 mt |
| Height: | |
| Immersion: | 12 mt |

| | |
|---|---|
| Tonnes gross / net: | 65.642 GT |
| Length between perpendiculars: | 195.00 |
| Hull material: | Steel |
| Load capacity: | 2500 mtl |
| Propulsion type: | propeller |
| Main engines: | 2 |
| Electric generators: | |
| Propellers: | 2 variable pitch propellers |
| Thrusters: | |
| Maximum speed: | 21 kts |

## 2.3 Voyage particulars

Departure: Port of Hamburg

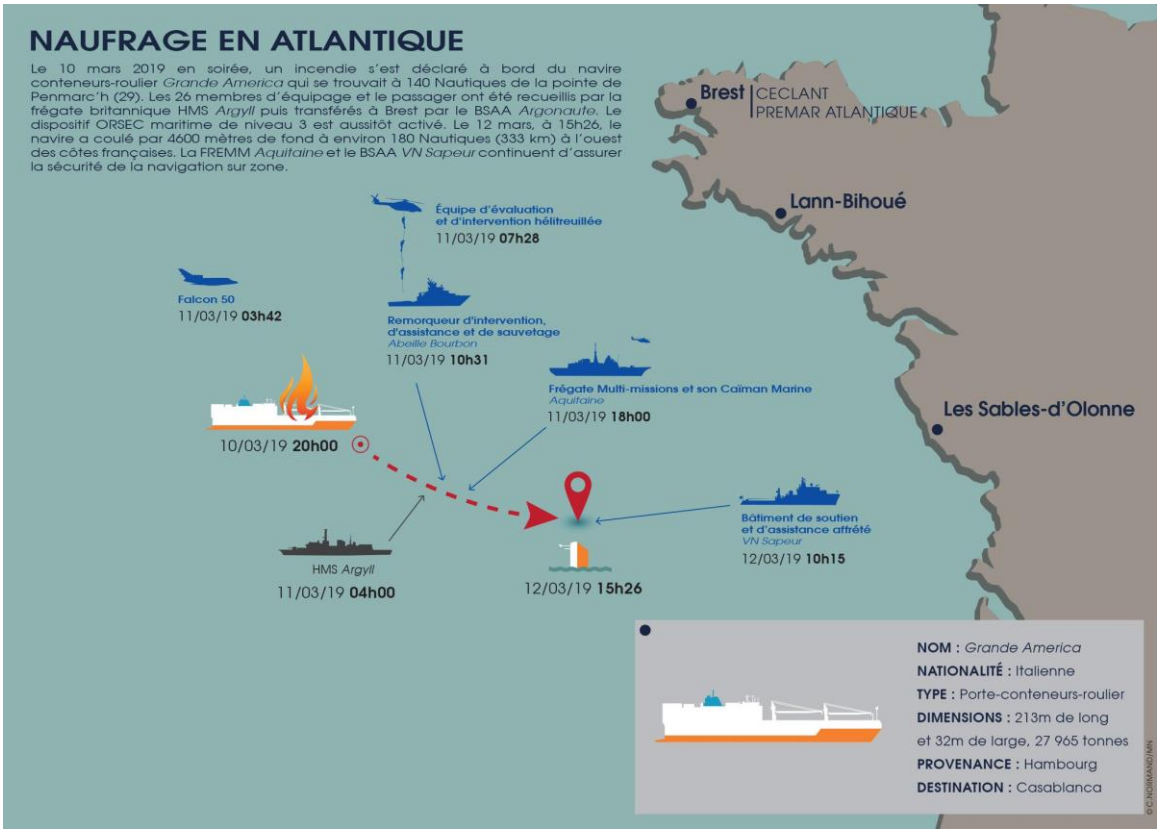
Arrival: Casablanca (Morocco)

Trip type: loading

Number of passengers: 1

Other people on board: -

Crew composition: 26




**Picture 1: Area of the accident and ship's position (source French Navy)**

# IMO CREW LIST

☑ ARRIVAL

| 1. Name of the ship | | |
|---|---|---|
| ***M/V GRANDE AMERICA*** | | |
| 4. Nationality of ship | **PORTO DI PARTENZA** | **data di partenza** |
| ***ITALIAN*** | ***HAMBURG*** | **08/03/2019** |

| 0 | 7. No | | Rank | NAZIONALITA | | |
|---|---|---|---|---|---|---|
| | 1 | | Captain | Italian | | |
| | 2 | | Chief Mate | Italian | | |
| | 3 | | 2nd mate | Italian | | |
| | 4 | | 3rd mate | Filipino | | |
| | 5 | | 3rd mate | Italian | | |
| | 6 | | Cadet | Italian | | |
| | 7 | | Bosun | Filipino | | |
| | 8 | | Trattorista | Romeno | | |
| | 9 | | Trattorista | Romeno | | |
| | 10 | | Able seaman | Filipino | | |
| | 11 | | Able seaman | Filipino | | |
| | 12 | | Able seaman | Filipino | | |
| | 13 | | Able seaman | Filipino | | |
| | 14 | | Able seaman | Filipino | | |
| | 15 | | Able seaman | Filipino | | |
| | 16 | | Chief Eng. | Filipino | | |
| | 17 | | 1st Eng. | Filipino | | |
| | 18 | | Eng. Officer | Filipino | | |
| | 19 | | Eng. Officer | Filipino | | |
| | 20 | | Cadet | Italian | | |
| | 21 | | Electrician | Filipino | | |
| | 22 | | Eng op | Filipino | | |
| | 23 | | Eng op | Romeno | | |
| | 24 | | Eng op | Filipino | | |
| | 25 | | Waiter | Filipino | | |
| | 26 | | Cook | Italian | | |

## 2.4 information on the casualty

Event type: Very serious marine casualty (Fire on board and foundering)
Date and time: 08/03/2019 - H 08.00
Place or area of the accident: open sea off Brest
Position: 250 NM N.O. of Cap Finistere on route 208
Weather and sea conditions: very rough sea - wave 4/6 meters;
Wind 11 - 16 knots
Good visibility
Status: in navigation
and part of the journey: from Hamburg to Casablanca
Consequences: Loss of the ship subsequent to a fire and sinking

**Weather Information for MV Grande America – 10th March 2019**

| Time | 1800Z | 0001z | 0600z |
|---|---|---|---|
| Position | N45 36.0 W008 0.0 | N46 45.6 W007 13.2 | N47 35.0 W006 36.0 |
| Height of Lowest Cloud | 2,000-3,000 ft | Unknown due to Darkness | 600-1000ft |
| Visibility | 5.5nm | 5.5nm | 11nm |
| Total Cloud Amount | 6 / 8 | Unknown due to Darkness | 3 / 8 |
| Wind | 300 @ 14kn | 300 @ 10kn | 300 @12kn |
| Air Temperature | 14.0 | 13.0 | 14.0 |
| Dew Point | 9.1 | 7.5 | 6.8 |
| Pressure | 1032.4 | 1033.7 | 1032.7 |
| Present Weather | State of Sky unchanged | State of Sky unchanged | State of Sky generally developing |
| Past Weather | Cloud covering 4 oktas or less throughout the whole period | Cloud covering 4 oktas or less throughout the whole period | Cloud covering 5 oktas or more throughout, intermittent Rain showers. |
| Amount of Low Cloud | 4 / 8 | Unknown due to Darkness | 5 / 8 |
| Type of Cloud | Cumulus of moderate development | Unknown due to Darkness | Strato Cumulus and Cumulus |
| Sea Temp | 11.9 | 11.5 | 11.3 |
| Sea State | 4-5 | 4 | 5 |
| Swell | Long slow W'ly 6-7m | Long slow W'ly 6-7m | Long slow W'ly 6-7m |

### 2.4.1 Actions taken

Immediate intervention by French rescue authorities in coordination with IMRCC Rome
After the shipmaster declared the abandon ship, all twenty-six crewmembers and the only passenger aboard the lifeboat were rescued by the British frigate HMS Argyll on the night between Sunday and on Monday, around 4 in the morning.
In addition to the aforementioned units, French rescue SAR units intervened on the spot (1 fixed-wing aircraft and 2 tugs from the French Coast Guard)

### 2.4.2 Obtained results

All the persons  embarked on the M/V  GRANDE AMERICA were safely rescued.

## 3. NARRATIVE

The M/v GRANDE AMERICA, sailed from Hamburg on 08/03/2019 with destination Casablanca, with a cargo consisting of 2184 new and used vehicles and 365 containers some of which classified IMO 3, 8 and 9. On 10/03/2019 at about 16.10 while sailing at 250 miles NW from Cap Finistère on course 208, she was affected by a fire at deck (garage) 2 in the forward area.

The general alarm then sounded, the Captain ordered the intervention on the spot of the firefighting team n.1 composed of 4 elements coordinated by the Chief Mate who informed that sparks could be seen coming out of one of the trucks in the bow of deck 2.

The firefighting team n.1 therefore attacked the fire initially with 2 powder fire extinguishers and then with a water system. The Chief Mate, in constant communication with the Captain, informed of the presence of a lot of smoke without however an apparent presence of flames.

The Captain arranged to gather all the staff on the command bridge to check if anyone was missing and ascertained the presence of all the people on board, giving instructions for closing the ventilation in the garage and releasing the CO2 in the area affected by the fire.

At the same time information of the fire on board was provided to the competent offices of the shipping company: ship inspector and DPA.

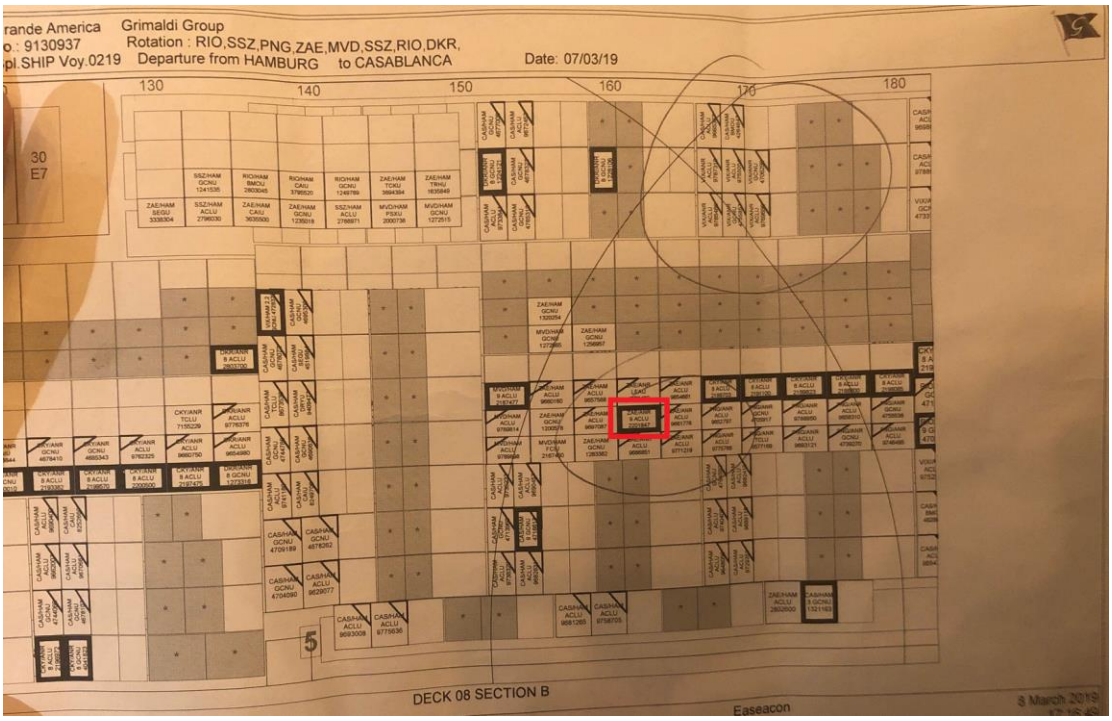
At around 17.00 the same firefighting team n.1; coordinated by the Chief Mate was sent to check the conditions of the garage and communicated the presence of smoke apparently without flames.

Once the team returned to the command bridge, the Captain decided to release further CO2 for greater safety.

The Italian Maritime rescue Coordination Center (IMRCC Rome) alerted by the DPA contacted the shipmaster for updated information on the situation and the same communicated the intention, as soon as the fire was extinguished, to take course to the port of La Coruna for the appropriate investigations and to recharge the CO2 for the fixed fire systems.

However, at around 5.30 pm the 2nd Deck Officer informed the Captain of the presence of white smoke between the containers positioned on the "weather deck" and the presence of

flames between two containers located on the second tier, one of which identified contained dangerous goods classified IMO9.




**Picture 2: Excerpt of the cargo plan (Weather deck) showing the container with IMO9**

The teams were immediately ordered to fight the new fire with the water system: 2 hoses to attack the fire and 2 hoses to cool the deck.

The new emergency situation was immediately communicated to the DPA and to the IMRCC.

At the same time the competent French authorities contacted the M/V Grande America for information on the evolution of the emergency.

At around 11.00 pm, realizing the impossibility of extinguishing the fire with only the on-board equipment, the Master asked for support from the DPA of Grimaldi and to the competent French authorities who ensured in 7/8 hours the intervention of their units departing from the port of Brest.

Shortly after the frigate of the Royal Navy HMS Argyll, on its way back to the English coasts, contacted Grande America, communicating that it was directed to their position to provide assistance.

Until around 01.00 on 11.03.2019 the crew continued to fight the fire with all means available but also as a result of the worsening weather and sea conditions and in the presence of an worsening of the fire that had by now flared up on several containers. At

about 02.00 the Captain declared to proceed with the "abandon ship". DPA of Grimaldi and French authorities were informed of this decision.

The Captain arranged to communicate with the frigate HMS Argyll arrived on site, to agree on how to rescue the crew.

At 03.00 of 11.03.2019 the Captain, after having ascertained the presence on the lifeboat of all the members of the crew and of the only passenger and after having ascertained that the preliminary procedures had been completed (including the emergency backup on the VDR), ordered the small lifeboat with which directed towards the frigate Argyll and then proceeded to the rescue of all personnel embarked.

At about 04.00, the Captain was the last to reach the bridge of the HMS Argyll while the Grande America, that was completely on fire, was drifting with a heeling on the starboard side of about 12 degrees.

Neither the crew member nor the passenger reported physical injuries of any kind.

Only on the evening of 12.03.2019 the competent French authorities notified the Captain of the sinking of the M/V Grande America, which took place at 15.26 pm local time, in position 46 04 8 N / 05 47 4 W.

## 3.1 HMS ARGYLL intervention

At around 23:00 the M/V GRANDE AMERICA was sighted by the frigate HMS ARGYLL.

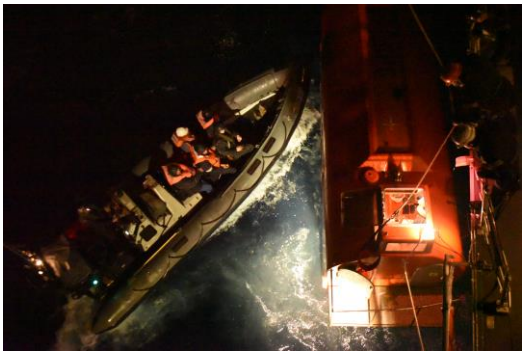
### 3.1.1 Excerpt SAR Chronology HMS Argyll

"Z" time zone

| | |
|---|---|
| 2104:28 | vessel sighted possibly on fire 4640n00721w 104@1.7 |
| 2110:38 | Vessel sighted, stopped in the water, TX NUC on AIS |
| 2111:53 | Vessel ID'd on AIS as Grande America, IMO 009130937, Cargo Hazard Cat X. MMSI 247594000 |
| 2112:15 | PWO Comment ARGL reduced speed to investigate / hold in vicinity. |
| 2127:48 | 5 people sighted moving around the bridge on EOD. |
| 2128:43 | VHF response from Vessel. Vessel experiencing container fire of 1 or 2 containers. Crew attempting to fight the fire, with some success but flames still |

| | |
|---|---|
| | present. Emergency Generator was running. |
| 2129:32 | 26 crew plus 1 passenger reported onboard. |
| 2137:43 | Vessel identified it holds Class 9 hazardous cargo on fire, and had requested Tug assistance. Italian and French CG had been informed. |
| 2140:15 | Flames identified on EOD on weather deck. |
| 2147:28 | ARGL relayed details to Solent CG, who would pass to Fr MRCC (Coordinating). Confirmed no distress had been signalled. |
| 2159:52 | EOD observed smoke from the funnel, poss exhaust active. |
| 2204:58 | Flames dissipating, observed on vessel by EOD and Bridge. |
| 2211:36 | Vessel reports on VHF that they have contained the fire. EOD confirms reduced smoke and flame from vessel. |
| 2311:27 | VHF call from Grande America stating that their fire has escalated and they are considering abandoning ship. |
| 2312:25 | Vessel states that it will wait 30mins before making decision |
| 2317:32 | VHF call received from Vessel Grande America informing ARGL of its intentions to abandon Ship in 30 mins. |
| 2321:08 | ARGL altered course in order to be in vicinity of vessel so as to provide assistance if required |
| 2341:47 | PWO Comment Start recording on EOD, black smoke observed at range on a bearing of 199 range 13.5nm from ARGL |
| 2353:32 | PWO Comment Vessel contacts ARGL to confirm if ARGL can embark their crew if they abandon ship. ARGL responded with ETA of 30 mins to scene |
| 0001:06 | PWO Comment ARGL contacts MV Meleq over VHF to see if it can provide assistance. |
| 0003:45 | PWO Comment ARGL contacts MV Discovery to find out if it can provide assistance. MV Discovery states its davit crane can only operate within 5 degree roll but will carry out tests to see if it can. |
| 0005:54 | PWO Comment Observed smoke on vessel has increased significantly and is blowing over the bridge where all personnel are |
| 0024:17 | PWO Comment ARGL contacts the Vessel in order to find out state of life rafts. Vessel replies that each life raft can carry 25 personnel and are 7 metres long |
| 0036:09 | Away port sea boat |
| 0037:37 | All crew are ready to get in life boats, they are awaiting French CG for clearance |

| | |
|---|---|
| 0045:00 | PWO Comment MV Maleq contacted by ARGL and told that no assistance is required |
| 0100:53 | French CG fixed wing aircraft on its way to scene |
| 0106:49 | French CG Tug boats are 7-8 hours away from Vessel |
| 0140:30 | Piranha (ARGL Seaboat) making approach to lifeboat now |
| 0306:56 | PWO Comment Sea boat returned and all personnel on board receiving medical treatment. |



Picture 4: phases of the crew rescue ops (courtesy HMS Argyll/MAIB)

## 3.2 French Authority intervention

On 10 March 2019, around 20:00, the Etel Regional Operational Rescue and Surveillance Center (CROSS) was informed by the Rome Maritime Rescue Coordination Center (MRCC) of the situation aboard the Italian ship Grande America.

Grande America was therefore located approximately 142 nautical miles (approximately 263 kilometers) southwest of the Pointe de Penmarc'h (southern Finistère). On board 27 people (26 crew members and one passenger).

The air-sea emergency response means intervened as quickly as possible. The British frigate HMS Argyll was sent to provide assistance to Grande America. After initially announcing that the fire was under control and that he wanted to set direction for the port of La Coruña (Spain), the ship's Captain informed the maritime authorities shortly before midnight of the deterioration of the situation on board. The fire, which had been brought under control, started again: several containers were on fire and the ship did not continue its course.

The Maritime Prefect of the Atlantic has ordered RIAS (Intervention, Assistance and Rescue Tugboat) Abeille Bourbon to join the ship Grande America.

Shortly after 2 am, the captain of the Grande America ship decided to abandon the ship by the crew, aboard a single lifeboat.

CROSS immediately coordinated the rescue of the 27 people aboard HMS Argyll.

A French Navy Falcon 50 maritime surveillance aircraft took off from the Lann-Bihoué naval airbase to reach the area and assist in rescue operations.
At around 4am, Royal Navy frigate HMS Argyll picked up the 27 people on board, all in good health conditions.
To assess the situation of the ship, the maritime prefect decided to send an EEI (French acronym for Evaluation and Intervention Team) to RIAS Abeille Bourbon with a French Navy helicopter. RIAS Abeille Bourbon fought the fire for at least 4 hours.
The ro-ro container ship Grande America sank on March 12 in the Bay of Biscay, at a depth of 4,660 meters, causing pollution by floating debris and oil in the following weeks.
To cope with this maritime event, the Atlantic Maritime Prefect subsequently implemented the “search and rescue”, “assistance to ship in distress” and “pollution control at sea” components of the ORSEC maritime system of the Atlantic, which was held at the maximum level for twenty-three consecutive days.
Since the discovery of slicks scattered on several beaches of the Pays de la Loire on Monday 17 and Tuesday 18 February, the maritime authorities have increased the level of vigilance of "maritime pollution" off the Atlantic coast, thanks to satellite, air, nautical and land.
Aerial surveillance was carried out regularly by French Navy and Customs aircraft in the area between the French coast and the sinking point of Grande America, approximately 180 nautical miles (or more than 330 km) offshore.
On February 21, during one of these flights, a heavy oil spill was observed in the area of the sinking. Subsequent flights failed to locate or identify any new ones. The weather conditions, still degraded in the Bay of Biscay, make it difficult to detect pollutants in the sea.

In April 2019, to stop the oil leaks escaping the wreck of the Grande America, the unmanned submarine (ROV) operated by the specialized vessel Island Pride, chartered by the Grimaldi Group, made it possible to block the orifices through the which flowed the propellant fuel of the ship. Island Pride then proceeded to check the water tightness of the fixings carried out on the wreck and a complete survey before leaving the shipwreck area on 19 April 2019.

## 3.3 Oil spill

| Grande America oil spill | |
|---|---|
| **Location** | Bay of Biscay, France |
| **Coordinates** | 46.068889°N 5.784444°WCoordinates: 46.068889°N 5.784444°W |
| **Date** | 12th of March 2019 |
| **Cause** | |
| **Cause** | Foundering of the Grande America cargo ship |
| **Operator** | Grimaldi Lines |
| **Spill characteristics** | |
| **Volume** | ca. 2,200 tonnes (4,900,000 lb) marine fuel (metric tonnes) |
| **Area** | ca. 10 km (6.2 mi) × 1 km (0.62 mi) |

An oil spill of about 10 km (6.2 mi) in length and 1 km (0.62 mi) in width began moving towards the French coast line, threatening the areas around La Rochelle, Biarritz and Vendée. The ship was carrying 365 containers and dozens of vehicles that were to be delivered to Brazilian importers.
The wreck was located by Island Pride (a vessel leased to Ocean Infinity). As arrived, it started inspecting the wreck site using remotely operated underwater vehicles (ROVs). The ROVs were used to seal light leaks of oil discovered during the inspection.

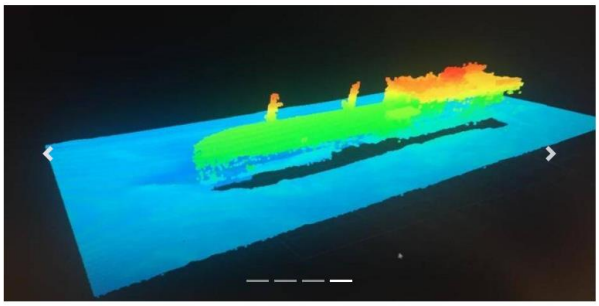
The underwater investigations conducted by the unmanned submarine (ROV), in the presence of an observer appointed by the Atlantic Maritime Prefecture, made it possible to establish that:

- The wreck of the Great America was intact, standing on a sandy bottom, buried several meters in its rear;
- Several light oil leaks have leaked from the vents of some of the ship's seawater ballast tanks from the fuel tanks. These hydrocarbon leaks explain the presence of low intensity iridescence on the surface, vertically above the wreck.

To stop these oil spills, the Island Pride ROV proceeded for several days and until April 16, 2019 to seal the affected vents.

The Norwegian ship Island Pride then proceeded to verify the tightness of the works carried out on the wreck of the Grande America and a complete survey before leaving the sinking area on Friday 19 April.

Air assets continued to regularly monitor the area as well as the EMSA (European Maritime Safety Agency) Cleanseanet satellite system in order to ensure, over time, that there are no oil overhead upwellings. the floor.



The activity carried out by the ROV, among other things, ascertained the absence of the VDR capsule from the wreck.


**Picture 4: M/V GRANDE AMERICA ROV picture taken on 18/04/2019 (no VDR capsule on Deck 9)**

# 4. Analisys

## 4.1 SMS procedures and emergency analysis

Applicable procedures for the fire intervention are 12.7.3.5 and following and by the interviews appear to be correctly applied however, due to the lack of details and of reliable evidences, the various emergency phases could not be analyzed .

The actions put in place by Master and crewmembers are not clear and not appear to be "the best" but this cannot be stated because of the mentioned deep lack of proofs/evidences.

In particular, according to the Master's statement, following elements are not clear:

- How the crew intervened in the two occasions;
- How the CO2 release and subsequent phases were carried out-given that the fire started again even after having declared its extinction;
- Why the EDG was used for all the emergency – including the second part of the fire emergency were the fire was fought with EFP only;
- why it was not possible to switch again on the auxiliary/shaft generators after the initial black out.

## 4.2 Fire origin and propagation analysis

The fire propagation analysis could not be carried out because of the deep lack of evidences, missing VDR, not clear declarations released by the crew and the fact that the ship sunk. However, some hypothesis were laid down.

### 4.2.1 Origin of fire and analysis of the causes

It has to be said that the analysis of a fire dynamic is based on the research of evidence from places and/or objects, which, because of the high thermal stress and, sometimes, due to the many interventions made immediately after the event, have been subject to severe alterations;

To investigate the fire causes, an analytical method is needed. Such method is basically based on the knowledge of combustion mechanisms and uses a systematic and scientific approach when being applied, it uses the so called "semiotics of fires", namely a discipline which studies the marks left by fire.

Once the point of origin is established, its possible causes are analysed.

In this specific case, the fire was unfortunately particularly destructive, with high temperatures for a long time, as a consequence the marks left by the fire could not be easily analysed, so it was very difficult to identify its point of origin and cause.

So, as established by the NFPA 921 (National Fire Prevention Association) ed. 2001 in par. 18.17, in case the cause cannot be easily identified, the possible causes are analysed and the most likely is selected.

The causes which, even in the most diverse situations, lead to a fire breakout are always grouped in a series of well-known categories, which are listed here below:

a) abnormal functioning of gas-powered machineries,
b) cigarette butts,
c) use of flammable liquids,
d) use of open flames,
e) defect in n the electric system,
f) abnormal functioning of devices consuming electricity

So, also in the case analysed, the most reasonable method for identifying the origin of the fire, is to examine each of the above mentioned categories.

In the publication “Investigazione sulle cause d’incendio” (investigation on fire causes) published by the Centro Studi ed Esperienze del Corpo Nazionale dei Vigili del fuoco (Centre for Studies and Experiences of the national Fire-fighting Department) it is written that the temperature of incandescent tobacco “is too low to cause the small portion of incandescent tobacco, in contact with wood or paper or cotton, do something more serious than a simple scorching, like causing the material to reach the ignition temperature”.

In addition to above, it is also stated: “A different evaluation is needed in case the cigarette butt ends up in an upholstered piece of furniture (for example between the armrests and backrests, sufficiently isolated, yet in the presence of a combustive agent): in such case (the cigarette) the isolation would prevent heat dispersion, so that temperature can reach up to 480° C. However, in such a case, the piece of furniture would need no less than an hour and a half to burn with open flames”.

The conclusions above are accepted by technical authorities in all countries, although, in absence of other explanations, the cigarette butt is often empirically and easily identified as the origin of many fire events, while it is not always the case.

Anyway, considered that any cigarette butt falling on the floor wouldn’t have found easily inflammable material, it is possible to state that ***the possibility that a cigarette could have triggered the fire can be excluded***.

a) ***Use of flammable liquids:*** with reference to the presence of any inflammable liquids on the scenario, such liquids can be only the ones contained in truck cisterns and tanks. No other containers of inflammable liquids were found nor could they be manipulated. On deck 4, stern side, there is a room for small repairs, but the presence of inflammable

liquids here is to be excluded. The observations above lead to state, with reasonable certainty, that in this specific case, if a malicious act (spilling inflammable liquid) is excluded, **the possibility that the presence of inflammable liquid caused the fire is to be ruled out.**

b) ***Use of open flames:*** there is no evidence that in the garage, particularly in that navigation phase, equipment or machineries requiring the use of open flames were used. So, this category of ***causes is to be excluded***.

c) ***Defect in n the electric system:*** through an electric system, regularly functioning, electrical currents flow. Such currents are defined by the number, power and features of loads. Such currents are defined operating currents and are the value which, when planning the system, is used to choose electrical cables equipment. In particular, electrical cables shall be able to permanently withstand the operating currents without enabling temperature to reach dangerous values for insulation materials.

When electricity runs through a conductor, due to the resistance encountered, heat is developed and that leads to a temperature increase in the conductor; such temperature is included in the normal range of values when the operating current does not exceed the conductor capacity in conditions of installation considered. So, it is always necessary to check that the operating current is either the same or lower than the conductor capacity.
The electrical breakdowns, which may arise in a system, regardless of their cause, are always characterized by variations of the normal values of two fundamental electrical parameters, namely current and voltage. So, in theory, all possible cases of variations (of these two values) may occur, that is:
- **overcurrent** occurring in two particular breakdown situations: overload and short-circuit;
- **overvoltage** which can be transitional
- **undersupply** of current or voltage, which as extreme case, may lead to the out-of-service status.

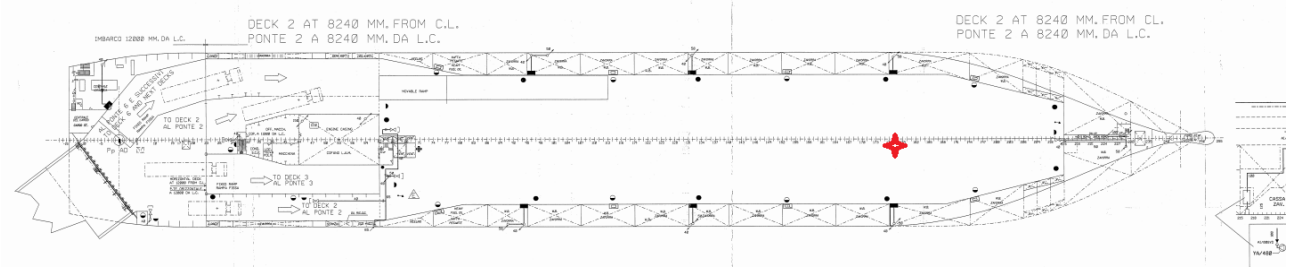
In abnormal functioning situations, due to particular breakdown conditions, if protection devices aren't carefully designed, the system can potentially be a serious danger. The outbreak of fire, of electrical origin, is basically the consequence of the development of heat and so of temperature increase as a consequence of electrical current running through a circuit (Joule effect) or through air following its ionization (electric arc).
The Joule effect causes a temperature increase in the conductor which is proportional to the square of the current passing through it and to the circuit electrical resistance which increases proportional to temperature. In presence of high currents in conductors, in electrical equipment or switchboards, the quantity of heat generated may lead to a temperature increase, which, if exceeds the component maximum permissible temperature, can:
- damage the insulating component up to cause a short-circuit;
- ignite the combustible material of the component or of the cable, if the ignition temperature is exceeded;
- ignite the combustible materials in the nearby of cables or inside the equipment.

So the Joule effect is a consequence of: overcurrent (overload and short-circuit); earth fault currents; localized resistance (poor contact).

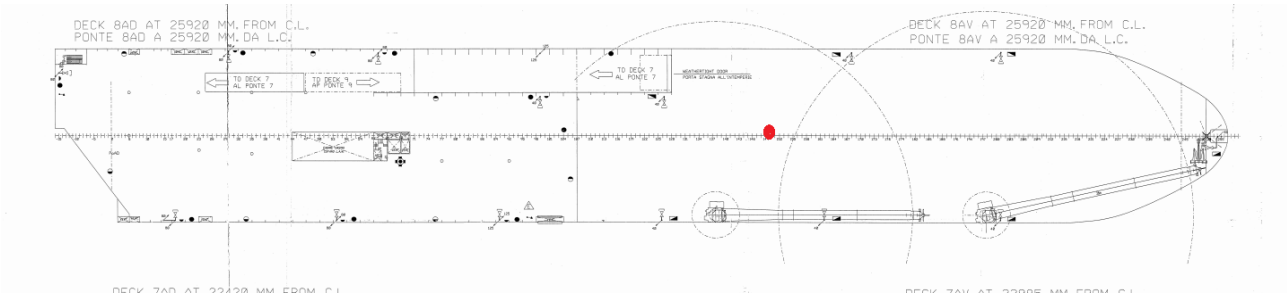
However, in this case a very short analysis was made due to the above-mentioned issues.

### 4.2.2 Fire propagation

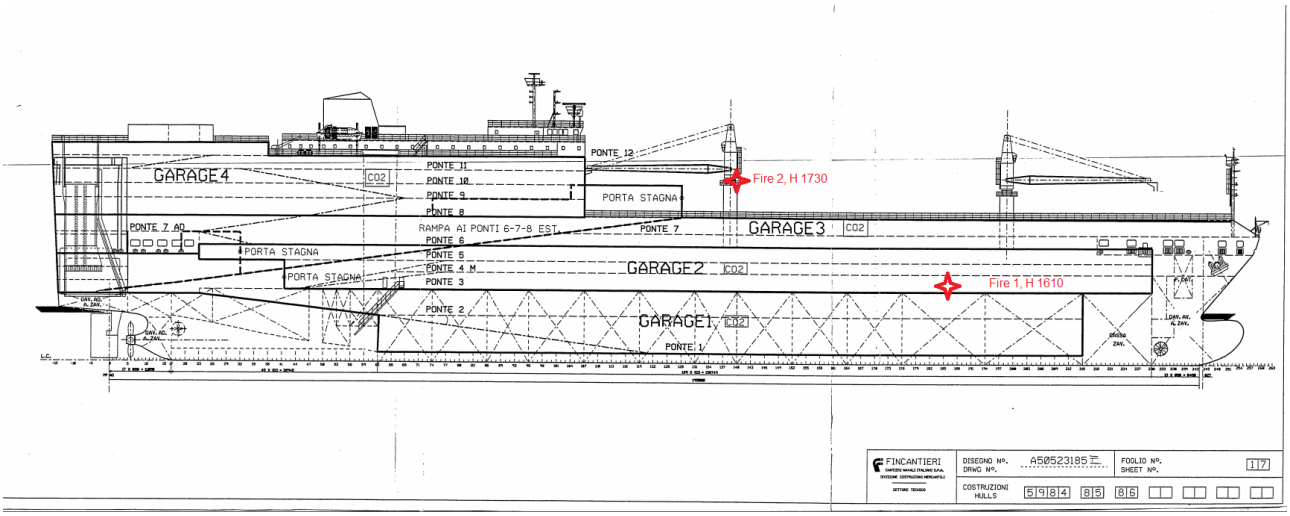
According the declarations released by the crew there were two fires within a short time distance (around one hour and half). Having analysed also the ventilation system of the ship, it does not appear to be a clear correlation between the two fires.




Picture 5: Excerpt  Ship plan, Deck 2




Picture 5: Excerpt of ship plan, deck 8



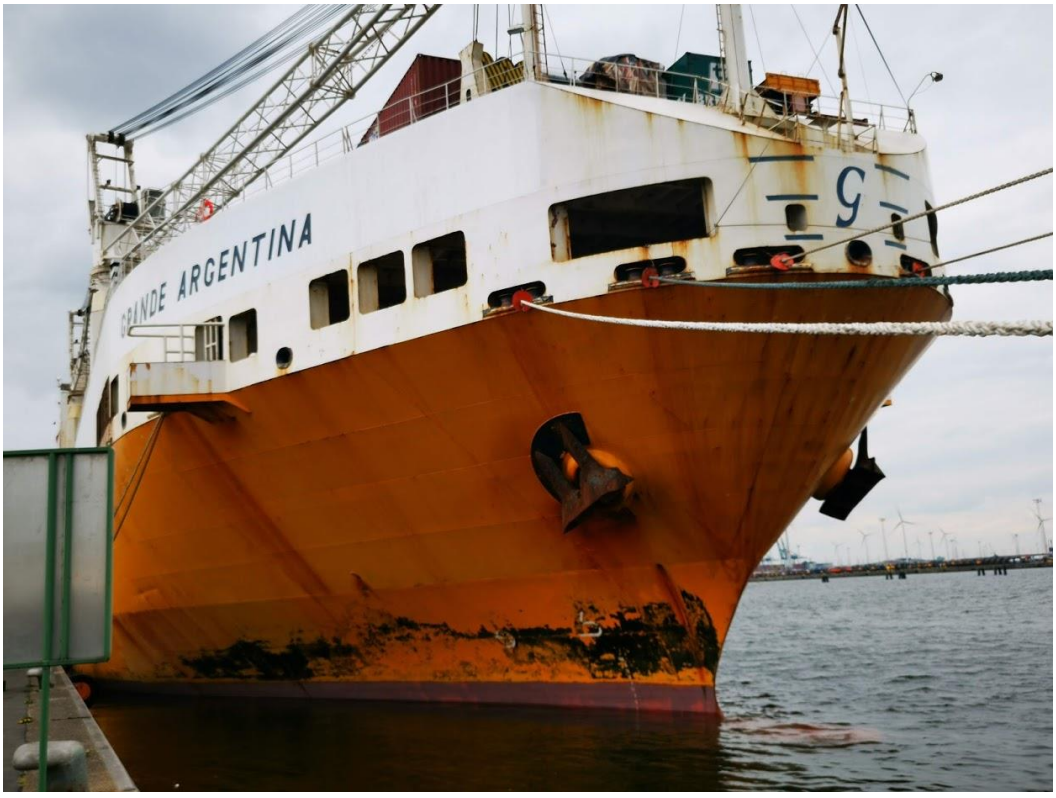

Picture 5: Ex  of long ship plan

## 4.3 Inspection on board M/N GRANDE ARGENTINA (sister ship)

From the evidence collected in the early stages of the accident, consisting mainly of the statements made by the commander of the unit and the crewmembers, some inconsistencies emerged in the sequence of events and in the dynamics of the development of the fire.

In particular, the presence of two distinct fires in two decks of the ship placed at a great distance from each other (deck 2 and deck 8 Weather deck) in completely different situations was not well understood and for what reason following the activation of CO2 in the premises garage, the unit went into blackout immediately with the consequent activation of the EDG.

Therefore, in consideration of other reliable evidence due to the lack of the VDR, DIGIFEMA and BEAMER, established that they had to carry out some checks on board a sister ship, specifically the M / N GRANDE ARGENTINA.




Picture 6: M/V GRANDE ARGENTINA in Antwerp

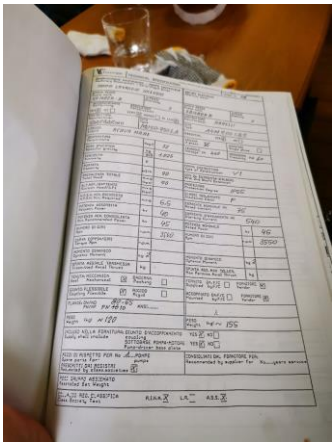
The inspection initially planned at the port of LE HAVRE was then carried out for operational matters in the port of Antwerp on 14 April 2019.

### 4.3.1 Inspection of deck 2 and CO2 room.

Picture 7: deck 2 and CO2 room (controls for CO2 release) pictures

The inspection of deck 2 (Garage 2) made it possible to ascertain the actual arrangement of the places and in particular excluded that in the event of CO2 opening, this could in some way affect the Engine Room, affecting the operation of the on-board generators, since the latter was completely separated and closed by an entrance fire door located in garage 2.

As regards the CO2 room, it was possible to verify that the CO2 release command station for deck 1 and 2 is located in the immediate vicinity of the one dedicated to the Engine room, therefore this suggests that the blackout was caused from the incorrect activation in the initial phase of the planned command station.



Picture 8: Emergency fire pump

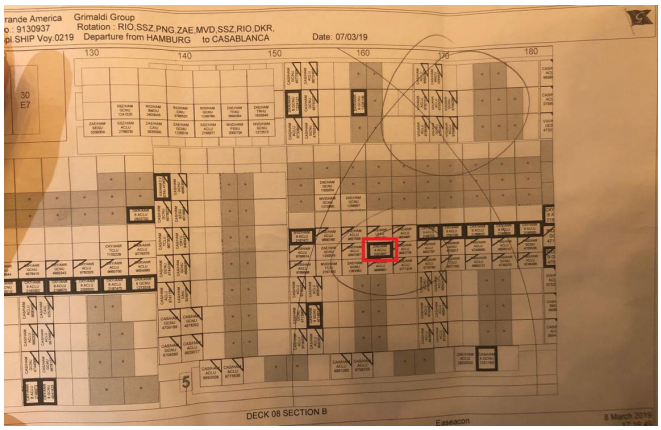
Furthermore, the arrangement of the EFP and its characteristics were examined (capacity 90 m3 per hour)

### 4.3.2 Cargo on board

The ship's cargo was the following:

365 containers (including 247 on deck 8 = on deck / 118 on deck 1 =
in the funds)
• Of which 45 containing hazardous materials within the meaning of IMDG
• 40 containers loaded in Antwerp / 5 loaded in Hamburg
• 16 different hazardous materials
• And 320 containing non-hazardous materials in the IMDG sense
• 2,100 vehicles

The cargo of containers on deck had been loaded entirely in Hamburg, in particular the container from which, according to the declarations made by the ship's Command and from the communications received by the Company, would have been located on the second draft as more precisely identified in the image below




Picture 9a: Container alleged to be the possible the source of fire

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Class: | 8 | Add.lab: | UNno: | 1760 | EmS: | MFAG: | FlPt.: | Net W: |
| 822B24 | 9 | | ACLU | 2201847 | 42DC | 25292 Yes | ARZAE ARZAE | BEANR F |
| Class: | 9 | Add.lab: | UNno: | 3077 | EmS: | MFAG: | FlPt.: | Net W: |

Picture 9b: Container alleged to be the possible the source of fire

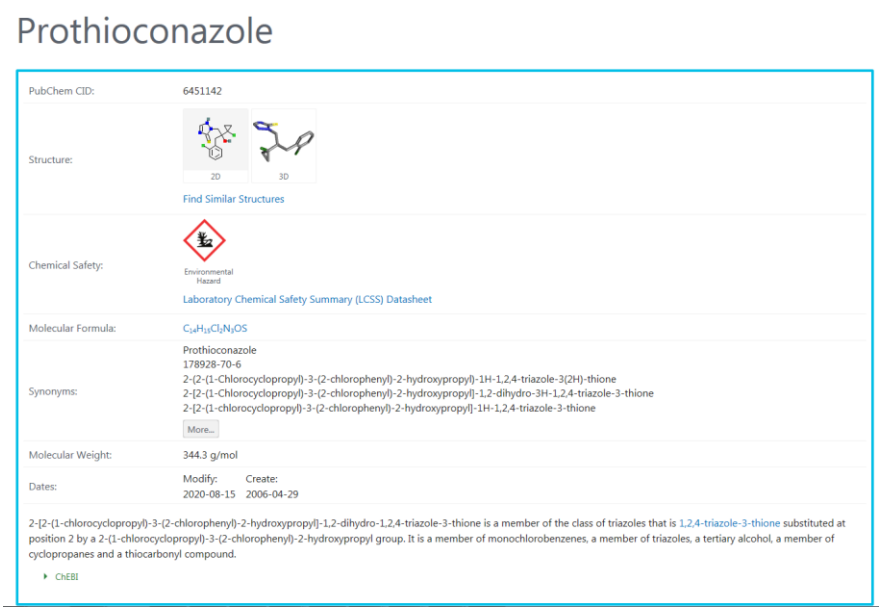
the contents of the container as per cargo manifest was the following:

*ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. 21,632.00 KGS 9 III F-A,S-F*

*PROTIOCONAZOLE*

*Outer Pack: 40 13H2 FLEXIBLE IBC(S)*

*IMO 9*




This substance, classified IMO 9 according to IMDG code, as per the safety data sheet and CLH report [1], is not explosive and has a low degree of flammability, therefore it is difficult to state that the point of origin of the fire may have been exactly that container but rather another container placed nearby containing products with higher flammability characteristics.

## 5. Conclusions

Based on the evidence gathered and the analysis carried out, it is not possible to reach clear conclusions regarding the sequence of events and the causes of the spread of fires on board as well as the subsequent listing and sinking of the ship.

This in particular is due to the failure to recover the VDR data and the VDR repeater capsule (FRM) whose recordings would have allowed a precise examination of the events.

At the end, for conclusion, two hypothesis can be made on the casualty and its result, without any evidence in the two possibilities:

[1] https://echa.europa.eu/documents/10162/f805e6cf-fb76-dd02-76f9-7bcc4eab86a8

- even if it is very unlikely, a double fire at the same time, not linked one with another, can still happened on a ship . Facing such situation is very challenging and destabilizing for the crew. Consequently the crew may not be able to manage the best this very unique situation (loss of main power and propulsion..).

- The second hypothesis is to consider that fire starts could be due to a voluntary act. This hypothesis is not addressed here, as it is not within the purview of the report.

Notwithstanding, given the above mentioned issues, it will not be possible to proceed further with the investigative activity, remaining available for the future in the event of recovering of the aforementioned capsule or new reliable evidences/findings will be available.