



MARINE INCIDENT SAFETY INVESTIGATION¹

Total Loss of Stability - Capsizing of Livestock carrier M/V “QUEEN HIND”

PISR registered

(PRELIMINARY REPORT)

Date: November 24th, 2019

Location: Port of Midia, Constanta, Romania



¹ Marine Safety Investigation Report No. 001/2020 – Preliminary (All times expressed in local time UTC + 2)



1. FOREWORD

Present investigations into marine casualty are conducted under the Provisions of Regulation XI-1/6 of the International Convention for the Safety of Life at Sea (SOLAS) and United Nations Convention for the Law of the Sea, being in line with the Directive 2009/18 EC of the European Parliament of the Council of 23 April 2009.

The main objective of these safety investigations report is precautionary and seeks to avoid recurrence through the understanding of the events of December 24th, 2019. Its sole purpose is confined to the promulgation of **safety recommendations** and therefore may mislead if used for other purpose.

Nonetheless that the most important recommendation, in line with above goals, will be the proposal of a “Livestock Carrier Code” to IMO Maritime Safety Committee, as part of SOLAS Convention.

By fully participating in a marine safety investigation conducted by another substantially interested State, the flag State (PISR) shall be considered to fulfil its obligations under the Marine Casualty Investigation Code MSC 255 (84), SOLAS regulation I/21 and article 94, section 7 of the United Nations Convention on the Law of the Sea.

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For and On behalf of Palau International Ship Registry (herein called PISR),

Marine Investigations Division

Capt. Cristian E. CIORTAN, AFNI

2020



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**List of References and sources of information:**

1. Statements provided by Master, Ch. Mate and Ch. Engineer of M/V 'Queen Hind'
2. Pilot's Statement (Mr. Rosu Florin)
3. Statements given by Masters of maneuvering tugboats
4. Statement given by Mooring man
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6. Midia Harbor Master
7. Information provided by Vessel's Agents
8. Information provided by Vessel's Managers/Operators
9. Information provided by Emergency Services personnel
10. Analysis and interpretation of SVDR data (M/V 'Queen Hind')
11. Vessel's certificates and stability information/documentation
12. Investigation Dept. Romanian Ministry of Transportation and Infrastructure
13. Depths Soundings provided by Port Administration (before and after the incident) and manual soundings taken jointly by the Flag State and Port State investigators.
14. Vessel's Safety Management System (Volumes 01 SMS Manual, 02 Standing Instructions, 03 Emergency and Contingency Procedure, 04 Safety Manual)

***Note:**

Due vessel in flooded/capsized condition, followings were not checked/inspected/surveyed:

- Consequent records related to ISM/Safety Management System, stability, cargo operations, safety training, safety equipment, environment protection, etc.
- No Inspection/Survey of vessel structures, installations, equipment etc. and related maintenance records/condition.



GLOSSARY OF TERMS AND ABBREVIATIONS:

- AIS** - Automatic identification System
- PISR** - Palau International Ship Registry
- LT/lt** - local time
- LOA** - length overall, the maximum length of a ship's hull, measured parallel to waterline
- SOG** - Speed Over the Ground
- ISM** - International Safety Management Code for Safe Operations and Environment Protection, as part of SOLAS Conventions Chapter IX
- SOLAS** - Safety of Life at Sea Convention
- MARPOL** - Convention for Prevention of Marine Environment Pollution from Ships
- SVDR** - Simplified Vessel Data Recorder
- SMS** - Safety Management System, as required by SOLAS Ch IX – ISM (see above)
- GM** - Metacentric height
- G** - Centre of gravity
- Mt** - Transversal Metacenter
- LOLL** - the state of a ship that is unstable when upright and therefore takes on an angle of heel either to port or starboard
- Angle of List** - the degree to which a vessel heels (leans/tilts) to either port or starboard caused by uneven distribution of weights. Angle of list is specific to a stable and at equilibrium vessel. If a listing vessel goes beyond the point where the righting moment will keep it afloat, vessel will capsize and potentially sink.
- Heel** - vessel's lean to one side caused by external forces, e.g. waves, centrifugal forces, wind pressure.
- Uprighting moment** - it is the moment developed by the two forces gravity and buoyancy, acting to bring the vessel in upright position after heeling.
- Initial Stability** - is the resistance of a vessel to heel, at small angles
- Dynamic Stability** - is the work done in inclining a ship
- Unstable equilibrium** – is caused when the vertical position of G is higher than the position of the Metacenter (M). If the condition of a stable equilibrium is not reached by the time the deck is not immersed, the ship is said to capsize.
- Stable equilibrium** – is caused when a vessel in upright position is said to have a positive metacentric height (GM), i.e. when the metacenter (M) is found above the center of gravity (G). This is usually referred to as positive (initial) stability



2. SUMMARY

At around 11340 hrs., It, on November 24th, 2019, the Palau registered livestock carrier, MV “Queen Hind” capsizes in position Lat= 44*19.896N/Long= 028*40.855 E, near MG 7 Starboard side Buoy, on the edge of fairway channel of Port of Midia, Constanta, Romania. At that time, vessel was outbound Port of Midia, with Pilot on board, loaded with 14600 sheep, as per documents presented by ship’s Agent, from Midia to Jeddah, Saudi Arabia.

Vessel completed loading animals and feed on November 24th, 2019 at 1000 hrs, It and Pilot reported on board at 1020 hrs, It. Maneuver commenced with two tugs (as per Master request) secured fore and aft at 1030 hrs, It.

While pulled by tugs, fore & aft, vessel did not move away from the berth and developed a heeling of abt 5 degrees, to port side. Pilot used main engine, running at half ahead and combined with the side pull/trust rendered by tugboats managed to move the vessel away from the berth. Master and the Pilot continued the maneuver outbound. Vessel seemed to come to an upright position after pulling action stopped.

Very soon after casting off, vessel ordered turn to port, under the effect of fore/aft tug and rudder, reaching southerly courses. Immediately after let go the aft tug vessel commenced to list to starboard, similar to the port side one, abt 3-5 degrees, as much could have been ascertained from existing photos/videos and witnesses statements.

Even in this condition, Master and Pilot continued the outbound passage, steering recommended courses and increasing the SOG to 4.0 – 4.2 Kts. The list to starboard did not diminished but furthermore, under the effect of fore tug and rudder port hard over command, vessel continued to quickly heel to starboard. The heeling process continued while yawing around MG9 `Starboard Buoy reaching abt 40-45 degrees. When close to MG 7 Master and Pilot become aware that something is wrong with vessel’s stability and they tried to stop the vessel, stay clear of the fairway channel and decided to return back to any safe berth and thus, they advised the Harbor Master Duty Captain, seeking support of all available tugs.

Even stopped, abt five meters south of MG7 buoy, the list continued and soon reached abt 50-60 degrees to starboard, showing the signs of total loss of stability, moment when Pilot left the vessel with an available tug and Master called for Ship Abandonment.

All crew have been rescued. One crew fall into water but was immediately recovered and transported by ambulance to the hospital where his condition was checked okay and released same day.

After recovering all crew, local authorities commenced searching and removing alive ovine, from the capsized vessel.



Figure 1





3. **FACTUAL INFORMATION:**

3.1 Vessel's photos



3.2 Vessel Particulars:

| | |
|----------------------------|--|
| Name: | QUEEN HIND |
| Flag: | Palau International Ship registry (PISR) |
| Classification Society | NKK (Nippon Kaiji Kyokai) |
| Type of Incident: | Total loss of Stability - Capsizing |
| IMO: | 7920675 |
| Location of Incident: | Port of Midia, Constanta, Romania |
| Type: | Livestock Carrier (Ex Ro/Ro – major conversion 2017) |
| Registered Owner: | Astra Marine Services |
| Managers: | MGM Marine |
| Construction (date/place): | April 1980, Honda Shipbuilding Co. Ltd, Saiki, Japan |
| Major reconversion: | July 2017, Constanta Shipyard, Romania |
| LOA: | 84.51 meters |
| Registered length: | 78.54 meters |
| Gross Tonnage: | 3785 |
| Drafts (F/A): | 6.30 meters (Summer draft) |
| Service Speed: | 13.00 Kts. |
| Hull Material: | steel |
| Hull Design: | single hull |

3.3 Voyage Particulars

| | |
|--------------------------------|-------------------------------|
| Authorized cargo: | livestock & animal feed |
| Port of Departure: | Beirut |
| Port Of Arrival: | Midia, Constanta, Romania, EU |
| Type of voyage: | tramp/voyage charter |
| Minimum safe manning (actual): | 12/23 |



Pilot on Board: yes, Capt. Rosu Florin (Maritime Pilot Srl)
Cargo Information: 14600 sheep (as per cargo documents)
Loading Place: North Quay – Comagra facilities – 2x1 Holding, Midia
Shipyard, Constanta, Romania

3.4 Marine Casualty or Incident information

Type of marine casualty/incident: Loss of stability – capsizing
IMO Class of Incident: Marine Serious Casualty
Date of Incident: 24.11.2019
Time of Incident: 1129 hrs. It (UTC+2)
Location of Incident: Midia, Constanta, Romania, EU
Geographical Position: Lat 44*19.896 N/Long 028*40.855 E
Vessel activities: Port outbound passage from berth (Northern Quay)
with
Persons on board (incident): Crew & Pilot
Injuries/Fatalities: Nil
Environmental Impact (pollutants):

- up to 100 dead sheep bodies in the water – recovered by Romanian authorities. Divers are recovering bodies as figures are increasing every day
- 254 live sheep recovered and in Shipper’s custody
- Dead body, as balance up to 14600 still on board and in decomposition status – high biological risk/high pollutant as per Marpol Annex 5
- 107 mt of diesel oil still on board – high pollution risk as per Marpol Annex 1
- Other Pollutants/chemicals regularly on board of unknown quantities and quality

Ship operation: - vessel loaded 14600 sheep to be discharged at Jeddah, Saudi Arabia
Voyage segment: - port passage
Consequences: - Loss of stability and capsizing
- Cargo lost
- Pollution (Annex 1/5)
- Disruption of traffic as vessel position reduces the width of entering fairway by almost 25%.

3.5 Weather conditions:

- Wind: E -early/3 Bf
- Sea/Swell: 1 Bf
- Current: NA
- Visibility: very good
- Day/Night: day



3.6 Shore authorities involvement and emergency response:

Involved Parties:

- Emergency Situation Inspectorate
- Romanian Naval Authorities
- Port of Midia Harbor Master
- National Sanitary & Veterinary Agency
- Public Health Directorate

Resources Used (Subject to confirmation):

- 4 tugs
- 3 launch boats
- Tents and ancillary equipment
- 1 ambulance

Speed of response – immediate

Actions taken:

- Crew evacuated from listed ship
- One crew fallen into water taken to hospital and in stable condition
- Vessel secured by tugs in capsizing position to prevent sliding down more into channel
- Live sheep removed from vessel
- Animals dead bodies removed from port water
- Recovered VDR and various items

3.7 Ship's relevant Crew:

- Master – 40 years old – never served on board. Just Joined the vessel at Midia, Romania
- Ch Mate – 27 years old – served several trips on board
- Ch Engineer – 60 years old – served several trips on board
- 2nd Engineer – 43 years old – served several trips on board



3.8 Scene of Accident

4

5





NARRATIVE

4.1 Background

At the time of the accident, the livestock carrier “Queen Hind” was owned by Astra Marine Services Ltd, Monrovia, Liberia, registered under PISR flag, managed, as per ISM requirements, by MGM Marine, Constanta, Romania. There were 22 crew members, 21 of Syrian nationality and one Lebanese. The working language on board was Arabic.

“Queen hind” was engaged in trade mostly between Port of Midia and Middle East ports carrying livestock. The vessel called Port of Midia many times, for the past year(s).

Furthermore, vessel has been through a major conversion, in 2017, at Constanta Shipyard, Romania.

4.2 Sequence of events (*Abstract from Romanian Naval Authority log):

- 1020 hrs, It - POB and commenced departure manoeuvre (tugs CS11 & BSV Braila)
- 1105 - Pilot advised Harbour Master Office that the vessel is listed to port side and unstable
- 1120 - Pilot reported that after passing MG 9 buoy, vessel listed severely, abt 45 degrees on her starboard and he ordered engine full stop
- 1130 - vessel stopped at about 5 meters from MG7 buoy and reached a list of abt 60 degrees on her starboard and listing is continuing
- 1140 - pilot advised that Master ordered abandon ship due to severe list of abt 80 degrees on her starboard
- 1140 - four more tugs and RNA launch are sent to assist and evacuate the crew
- 1156 - Emergency services are contacted and ambulance is required for a crew member who called into water
- 1215 - Crew evacuation is completed - all crew alive and safe. One crew at hospital with hypothermia.
- 1600 - Further rescue boats have arrived at location
- 1800 - Floating pollution prevention barrage has been deployed
- 1900 - further intervention boat arrive on location
- 2000 - Divers carried out hull inspection to assess integrity
- 2115 - underwater inspection has been carried out and completed. Outcome - no any hull breaches observed. Oxygen, acetylene and other high risks material posing an immediate risk have been removed from ship.

4.2 The accident

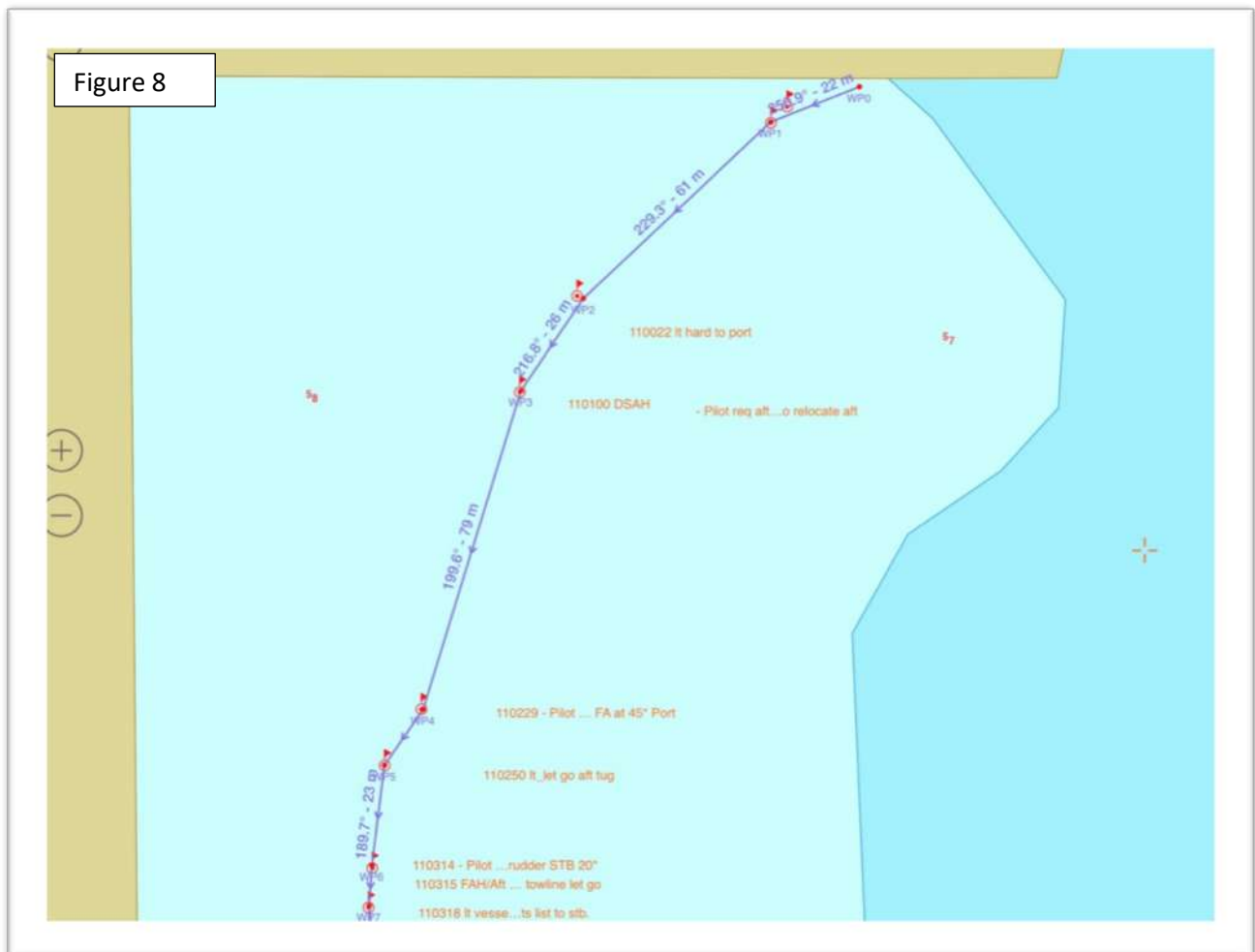


Vessel completed loading livestock (said to be 14.600 heads as per commercial documents) and then truck with animal feed and hay arrived alongside. Crew attempted to load animal feed received in 1 mt big bags, but as found out during witnesses hearing, the installation used to load such feed into silo tanks, was broken at that time and the Master was asked where to load. Master ordered bags to be loaded on top of Sun Deck (upmost deck) and on the deck ahead of bridge. It is assumed, as per statements that between 100 to 120 metric tons have been loaded in these positions.

Pilot reported on board at 1020 hrs, It and commenced information exchange with the Master. Master advised that because he just joined the vessel and has no experience on the trade and vessel, he would like to hire two tugboats, one each end. Master declared drafts as follows:

Draft Fore = 5.90 meters and Draft Aft = 6.45 meters (as advised by Master)

There was a brief discussion between Master and The Pilot and appropriate paperwork exchanged. Tugboats were made fast fore and aft at 1039 hrs, It and Pilot ordered to pull slow ahead. Both Master and Pilot have declared that the vessel's stern area did not move

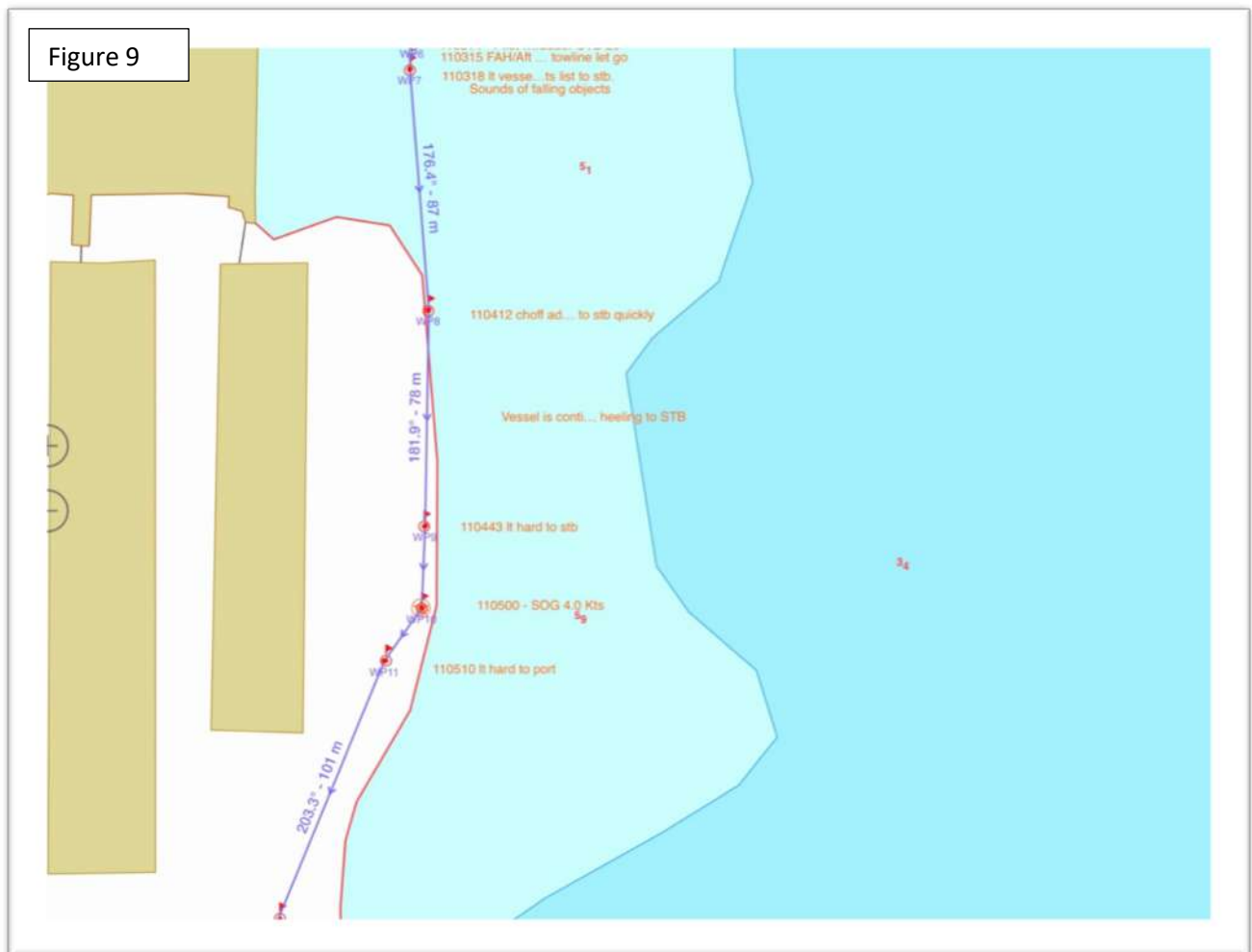


and thus half ahead on tugs was ordered. Under tugs transversal action vessel heeled abt 5-10 degrees, as per Pilot statement. As vessel still not moving off the quay, Pilot ordered slow



ahead on vessel's engine. Vessel was still listed and as no results occurred, he ordered slow ahead and then half ahead. Under half ahead by ship's engine and pulled by tugboats vessel started to move away from the quay and slowly ahead (WP2). Pilot adjusted the thrust of tugs and reduced engine revolutions. Vessel commenced turning to South course under tugboats and main engine (WP4). After tugs thrust ceased vessel come back to upright position. Aft tug is released. Pilot mention in his statement that the vessel was grounded at the aft section.

Soon after completion of port swinging maneuver under fore tug and rudder, while abeam with 2x1 Holding Shipyard, vessel started to list to starboard, for abt 5-10 degrees (WP5). Neither this time Master and/or the Pilot did not understand what is wrong with vessel's stability. Moreover, Pilot increased the main engine revolutions and consequent SOG and shortly, while passing Shipyard area vessel developed already abt 4.0 Kts and heeling to starboard is slightly but continuously increasing.



Course alteration at MG9 Starboard buoy is performed at same speed of 4.0 Kts and with large rudder angles up to hard over and it is noticed that even speeds over the ground of more than 4.2 Kts are been observed.



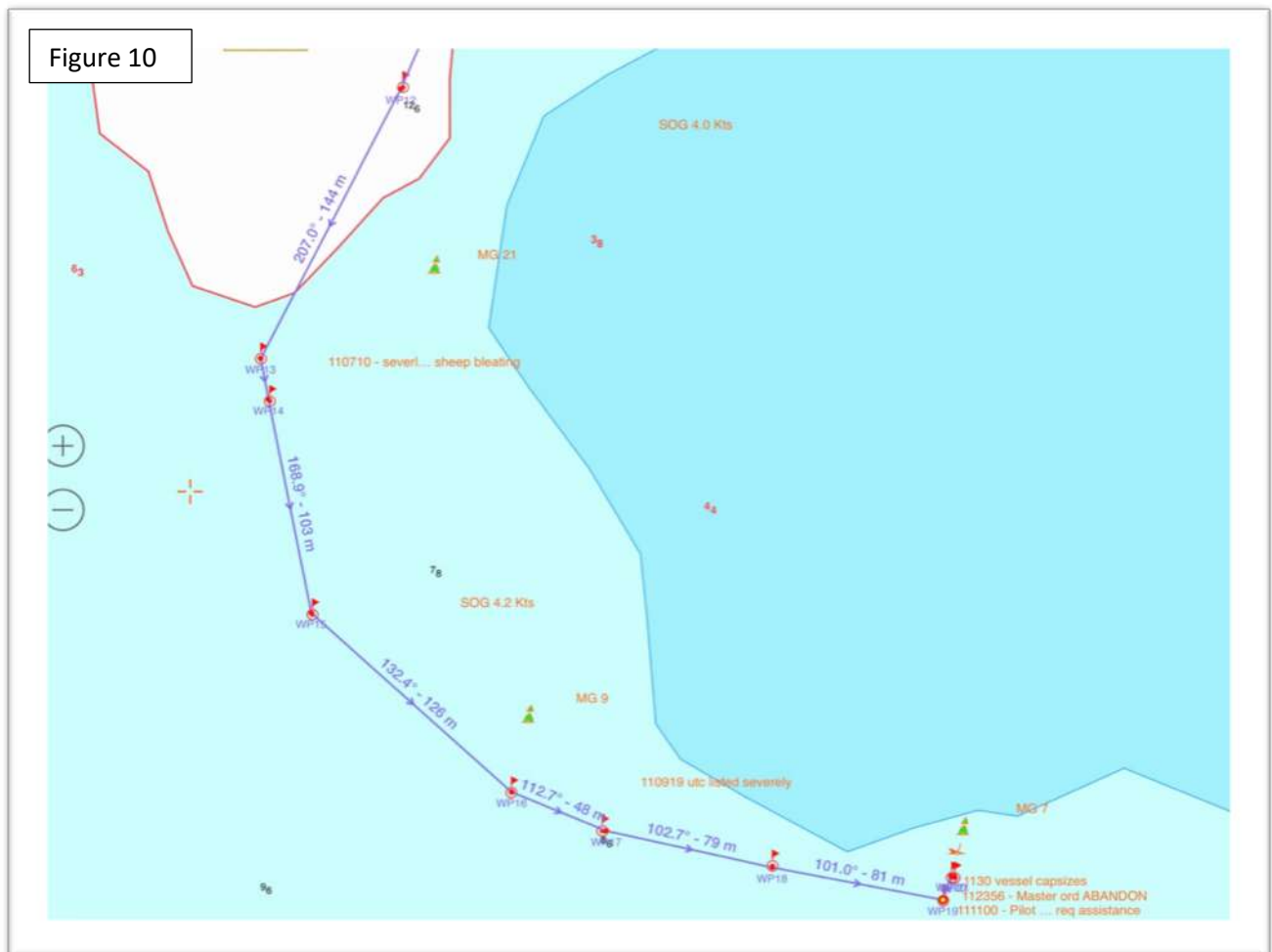
Under the action of speed ahead, rudder hard over and fore tug, vessel is swinging to port and continue heeling to abt 25-30 degrees to starboard. At 1107 hrs, It vessel is so much heeled as thinks are rolling and falling down on the bridge. (WP13)

Pilot continue to drive the vessel outbound and gives orders to the engaged fore tug and vessels rudder and main engine.

Around 1108 hrs, It the heeling is more than 45 degrees and on VDR falling thinks can be heard together with smashed doors (WP15).

Vessel is already in the fairway channel and Pilot realizes that the vessel cannot continue, and something is wrong with vessel's stability. Pilot advised Harbor Master and ask assistance of all available tugs (WP16).

Aft tug is secured again, two more tugs arrived in assistance, but the vessel is severely heeled. Pilot ordered main engine stop and several astern commands are being noticed. Pilot struggles gives contradictory orders probably aiming to keep the vessel away from channel and also to prevent grounding. (WP17)





When the vessel reached several meters from MG7 it is already stopped and heeled abt 80 degrees. Pilot leaves the vessel by Aft tugboat and shortly, at around 1130 - 1140 hrs, It Master ordered Abandon Ship and all crew is evacuated by assisting tugs. Only one crew fall into water but is immediately recovered and send to hospital. All other are safe and sound being disembarked ashore (WP19).

Vessel is capsized on her starboard, lying five meters south of Starboard (green) buoy MG7. At 1800 hrs, It antipollution floating barrages are laid down around the vessel.

At 2115 hrs, It underwater diving survey confirmed that there are no hull breaches. Emergency rescue services are being mobilized to search for live animals.

4.3 Damage assessment

Vessel is lying on her starboard side with almost 40% of her right side flooded. All livestock is lying on starboard side.

Emergency services rescued 254 animals alive. Oxygen and acetylene bottles have been removed from the vessel.

Certainly, there are hull and structure damages which cannot be clearly assessed until vessel will be refloated, in upright position and secured alongside for safe access and survey.

For the time being full extend of damages are unknown. It is clear that except for 254 heads, all other livestock is compromised.

It has to be mentioned the potential pollution risk posed by:

- Animal carcasses
- Marine diesel oil on board
- Other marine pollutants (lub oil, paint, thinner, other chemicals)

5.ANALYSIS

5.1 Findings



Investigations conducted in accordance with IMO Code for Marine Casualty Investigations, common industry practices, based upon crew, witnesses interviews, statements, inspections, surveys, assessments of evidences on hand, photos, sounding diagrams, vessel's certificates, documentations, plans, etc. and certainly, a careful assessment and interpretation of information provided by the ships' VDR, have revealed the followings:

- 1) Judging by the behavior of the vessel, and total loss of stability (capsizing) it is assumed that no assessment of vessel initial/static stability has been carried out, before commencing voyage. (SOLAS & Ship's SMS Ch 8.2.2)
- 2) Vessel was loaded with aft section aground. Even if the Pilot was aware about this fact, he failed to cease maneuver, advise local authorities and investigate the contact of the hull with the bottom. Moreover, he has used the propeller and rudder without being aware of the propulsion/steering system condition
- 3) No seaworthiness/suitability assessment has been done by local Authorities considering the high-risk profile of the vessel caused by this particular kind of cargo and usual low metacentric high
- 4) No evidences of vessel compliance with European Union Regulations - EC Regulation 1/2005, Articles 19/20, providing that vessels planned to load livestock shall be inspected before commencing loading for suitability and fulfilling the required conditions, by an appointed entity. Same checks and tests should have been done upon completion of loading, before commencing the voyage, aiming to ensure proper transport conditions for animals, throughout the voyage, until discharging port.
- 5) No evidence of tally, revealing the real number of livestock loaded has been made available.
- 6) Crew was not able to provide quotes/compliance with loading/unloading procedures from the Safety Management System – Operations Manual
- 7) Crew failed to provide knowledge & understanding in respect with various stability conditions in respect of position of center of Gravity "G" versus "Mt" Transversal metacenter.
- 8) Crew failed to provide information about limitations imposed by Stability booklet in respect with loading conditions with emphasize on weights distribution (big bags) on upper areas of Sun Deck and Bridge Fore deck.
- 9) Before departure Master/Ch Off decided to load a large quantity of big bags (1 mt) each on Sun Deck and Bridge fore deck (more big bags have been loaded in starboard side), against provisions of Stability Booklet and without assessing the initial/intact stability and dynamic stability throughout the voyage intermediary points until arrival destination port. *Probably, because of broke down condition of the animal feed loading conveyor (designed to facilitate/load the animal feed in the silos located at*



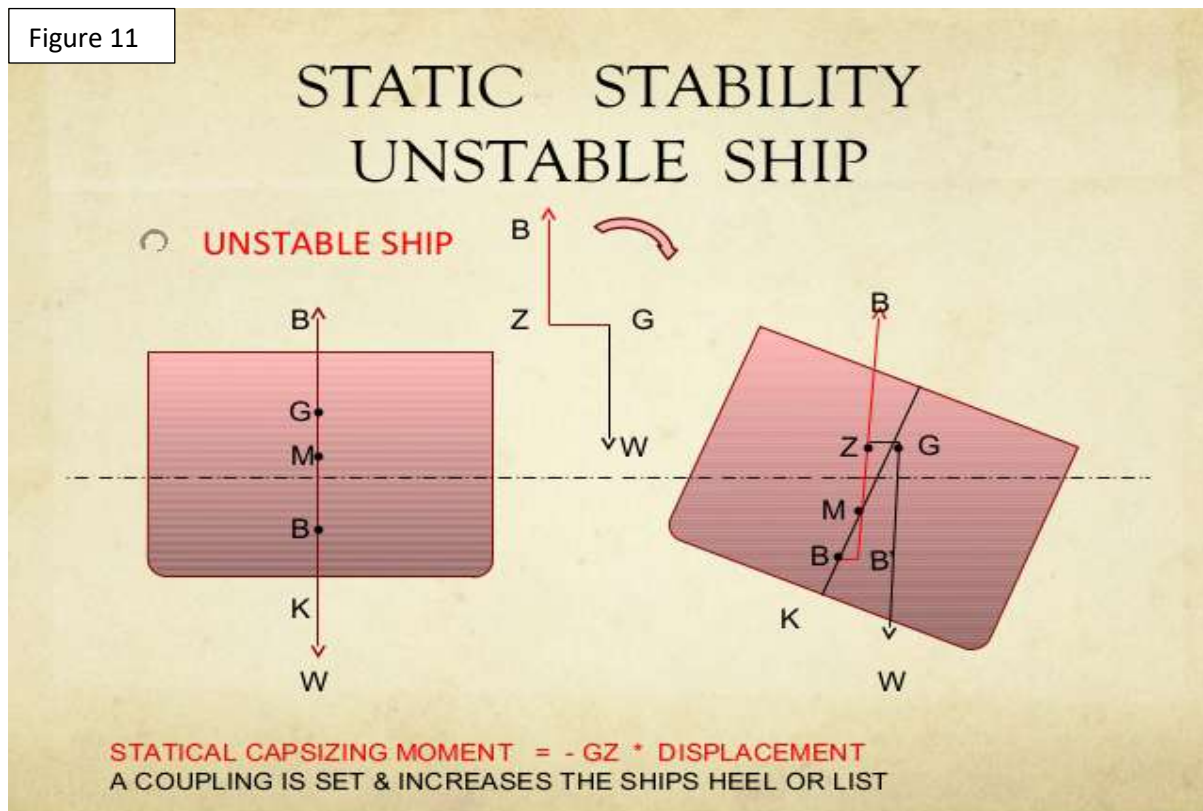
lower decks). Its condition will be assessed after the wreck will be in a safe upright condition.

- 10) It is assumed, as per Master & Ch Mate statements ,that between 90-100 metric tons have been loaded on the sun deck (upmost deck) and between 20-30 metric tons on the bridge fore deck. Neither of these decks/locations are considered by the builder/stability booklet/class to be used as loading areas.
- 11) Crew failed to indicate the status of water ballast tanks 7 port and starboard which are provided with water pump in/out facilities
- 12) Crew failed to indicate procedures for prevention and control of water ingress through watertight doors, as per SOLAS Regulation 24. It is assumed as per `Ch Engineer Statement that the aft watertight door, leading to engine room was open/not secured to allow the emergency exit of engine room personnel, fact that allowed water ingress in the engine room compartment while the vessel severely listed to starboard. room compartment, accelerating the loose of floatability. (SOLAS B4
- 13) Pilot/Master Exchange of information not conducted as required by SOLAS/ISM/Safety Management System and industry practices for Bridge Team Management. Pilot failed to provide Pilotage Company's signed Master/Pilot Exchange form. (Bridge Procedures – Guide 5th Edition 2017 – Ch. 5 – 5.2.1/5.2.2/5.2.3/5.4)
- 14) Master/Ch Off did not consider the check of the available water depth around the vessel, as long as neither the Master, nor Ch. Mate and/or the vessel have conducted cargo operations, in this berth, before and there was not sufficient information about maximum draft allowed at berth.
- 15) Pilot failed to check personally, the real drafts of the vessel and relied solely on the information provided by Master. (Bridge Procedures – Guide 5th Edition 2017 – Ch. 5 – 5.5.1)
- 16) Pilot failed to question the master about ship's seaworthiness and/or readiness for departure with emphasize on stability/draft/trim, eventually refusing the pilotage services. (Bridge Procedures – Guide 5th Edition 2017 – Ch. 5 – 5.4 & IMO Resolution A.960/23 Ch 8)
- 17) As the aft section seemed grounded while under tugs action, Pilot/Mater failed to advise authorities and/or cease maneuver and further investigate. (IMO Resolution A.960/23 Ch 6/7)
- 18) Pilot continued unberthing/departure maneuver even after it become obvious that the aft section was in contact with the bottom.
- 19) Pilot/Master failed to cease maneuver, secure back alongside after vessel heeled between 5-10 degrees to port, under the tugs pulling effect. (IMO Resolution A.960/23 Ch 6/7)
- 20) Master/Pilot did not assess the stability condition after vessel heeling to portside and continued outbound maneuver. (IMO Resolution A.960/23 Ch 6/7)



- 21) Master/Pilot failed to cease outbound maneuver and secure back alongside after the vessel heeled (loll) to starboard side, upon completion of swinging maneuver to port side.
- 22) Master/Pilot failed to understand the stability condition of the vessel by its behavior (signs) occurred during unberthing, turning and proceeding outbound maneuver in the meaning of instability of the vessel with consequent heeling to port and to starboard. (ISM Code Ch. 6.2)
- 23) Even when the list/heeling (lolling) to starboard became obvious and continuously increase, both Master and Pilot failed to understand the critical (negative) stability situation and take urgent actions of either push the vessel along the ship in shipyard, drydocks or voluntary ground the vessel in a safe (sand) bottom area. (IMO Resolution A.960/23 Ch 7)
- 24) Master and/or Ch Mate failed to prove their understanding in respect with neutral versus negative stability. (ISM Code Ch. 6.2)
- 25) Master/Pilot increased the speed to 4.0 to 4.2 Kts after passing Drydocks area and in spite of moderate to severe list/heeling/lolling to starboard side, Pilot commenced turning maneuver at MG9 Starboard Green Buoy using the pulling effect to port of fore tug, hard over rudder to portside and high speed, facts that probably developed the negative stability uprighting moment which combined with heeling induced by the centrifugal force/rudder hard over and accentuated by the speed, increased the list/heeling triggering severe listing and shifting of cargo/weights on board to starboard side area and total loss of stability. Vessel was listed in this moment at an angle more than 40 degrees and continued to list.

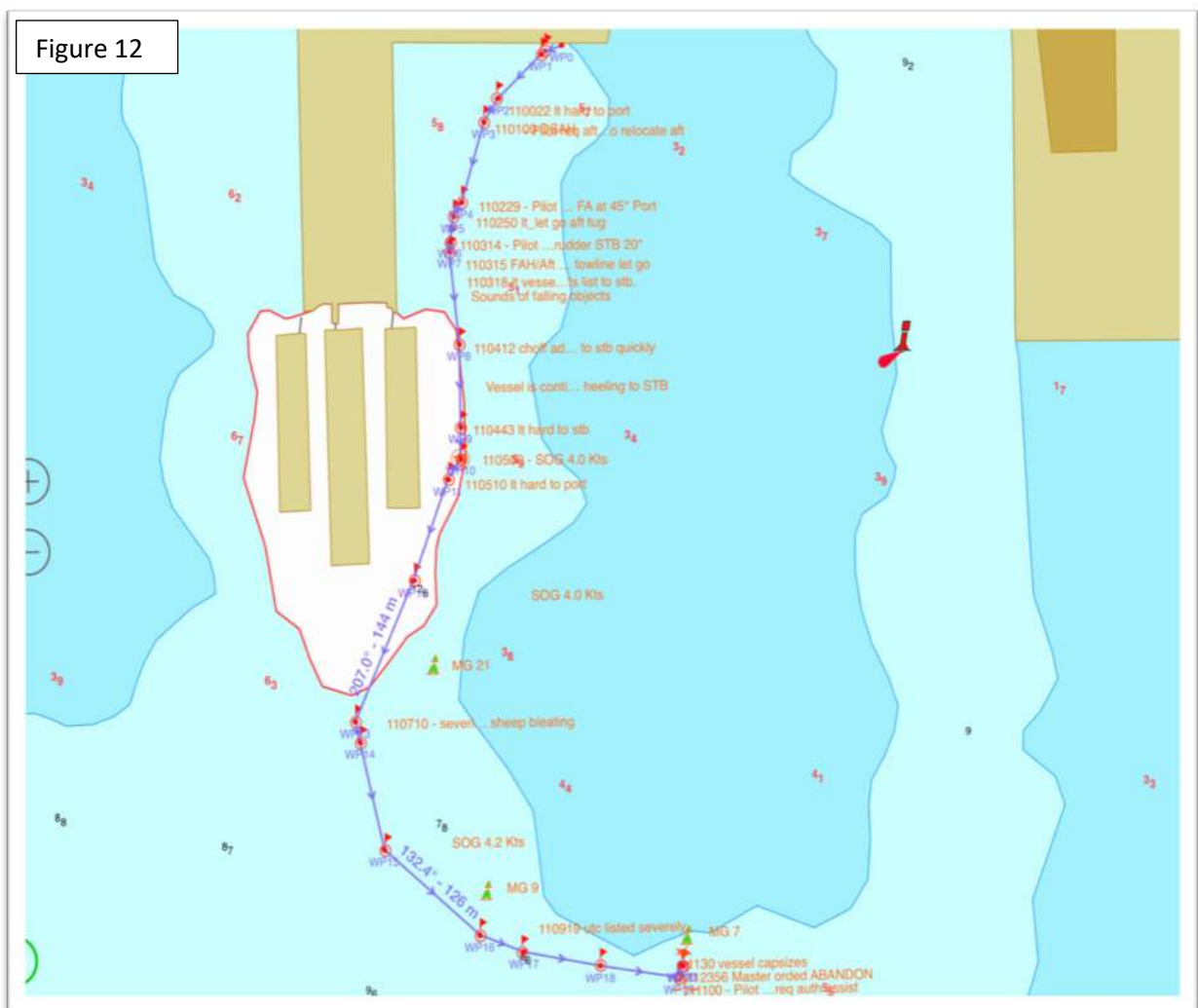
Figure 11





- 26) Master/Pilot realized too late that they have a loss of stability and decided to return to the berth when it was too late to conduct such maneuver due to severe list and continuing listing, under total loss of stability condition.
- 27) Master/Pilot lost situational awareness and Pilot gave and Master accepted many contradictory commands to main engines and/or rudder and/or tugs.
- 28) Master/Pilot failed to act properly in an emergency situation posed by severe listing condition, as per contingency plans. (ISM Code Ch. 8.1/8.2/8.3 & IMO Resolution A.960/23 Ch 6/7)
- 29) Failure of Bridge Team Management – Pilot was giving orders in Arabic and English to Helmsman, communicate with Master in English, and communicate with tugboats captains in Romanian language. Creating confusion and affecting situational awareness of bridge team. (SOLAS Regulation 14/4 & Bridge Procedures – Guide 5th Edition 2017 – Ch. 1.2.12/5.5.2 & IMO Resolution A.960/23 Ch 6/7)

Figure 6 – Reconstructed path based upon VDR Data





5.2 Root Cause & Causal Factors

The Why's technique:

i. Why did the vessel capsize?

Vessel capsized because of poor distribution/loading of cargo on livestock decks (doubled decks 4 & 6) and weights (big bags of animal feed) on upmost decks, combined with failure to assess the initial stability, before commencing the voyage. Leaving the berth in an unstable equilibrium, due to heel produced by tug action, centrifugal forces developed at turns at various rudder angle, up to hard over, shift of livestock and weights on board, (probably the free surface effects of partly filled compartments) combined with negative uprighting stability momentum, occurred as a consequence of unstable equilibrium, led to a total loss of stability and capsizing.

ii. Why did the Master leave the berth after vessel heeled under transverse towing?



Master left the berth in such condition due to lack of knowledge about stability and consequences of sailing in unstable equilibrium. He misjudged vessel's stability condition assessing that the vessel in neutral stability while the vessel was in unstable condition.

iii. Why did the Master load a large amount of animal feed in bog bags on the upmost weather deck without assessing the stability impact/consequences?

Master/Ch. Mate failed to assess the effect on stability of loading heavy weight on upper decks (sun deck/bridge fore deck), elevating center of gravity. He has also failed to comply with Stability booklet which does not allow loading any cargo/animal feed in big bags or ballots on such upper decks.

iv. Why did the Master continue the outbound passage after several listing to each side?

Failed to understand the intact stability principles, failure to understand the behavior of an unstable equilibrium condition (negative stability), probable commercial pressure.

v. Why Master/Pilot did not cease the passage and secure the vessel alongside berth or shipyard or voluntary run aground if doubted about the stability loss?

Lack of knowledge about stability, failure to understand the behavior of an unstable equilibrium condition. Rush to proceed outbound Port of Midia. Probable commercial pressure

vii. Why did the Pilot did not advised authorities about the listing, heeling and overall stability issues in due time?

Lack of compliance with laws & procedures. Possible lack of procedures for such situations, probable lack of knowledge about his duties, failure to understand the criticality of the unstable equilibrium situation.

viii. Why did the Pilot requested and Master accepted vessel to run with more than 4 Kts while vessel was listed to starboard?

Rush. Possible commercial pressure. Failure to understand the criticality of an unstable equilibrium situation

ix. Why did the Pilot and Master accepted to commence a sharp turn to port side, at MG 9 buoy with a large rudder angle, under fore tug action to port and with high speed, vessel being already severely listed/heeling to starboard?

Failure to understand the effect of yawing (centrifugal force) at a moderate speed under tug's and rudder action on stability of a vessel, already listed to starboard due to improper stability.

So far it could be ascertained based upon information obtained at this moment (without inspection of the vessels internal structures, installations, equipment, maintenance records, ISM/Safety Management System records):



A. Root cause of the accident was:

Human error – Poor distribution of cargo (livestock) and weights on board and failure to calculate/assess the initial stability. Failure to understand stability principles, behavior of an unstable equilibrium vessel(vs neutral equilibrium) and continuation of the outbound passage with a vessel in a negative stability condition vessel led to a total stability loss.

B. Causal Factors - Contributory causes:

I. Human Element

- Poor distribution of weights and failure to understand the principles of Initial and Dynamic Stability with emphasize on behavior of an unstable equilibrium condition.
- Disregard for the provision regarding loading/unloading as provided by Safety Management System
- Failure to understand the effect on stability caused by loading heavy weights on upmost decks.
- As the vessel was loaded grounded, the control of trim, drafts and stability could not be accomplished. Thus, more bags have been loaded in starboard side which created the listing momentum and combined with the negative uprighting momentum, cargo, bags, ballots shifting caused the lolling, heeling to starboard and consequent tot loss of stability.
- Failure to comply with Stability Booklet, SOLAS, Intact Stability Code 2008.
- Lack of compliance with SOLAS and Load Line Convention in respect with watertight doors
- Poor Bridge Team Management, failure to comply with Bridge Procedure Guide 5th Edition 2017
- Poor Master to Pilot information exchange, failure to comply with IMO Resolution A 960/23.
- Pilot conduct not in compliance with industry standards and requirements – he accepted to continue unberthing/outbound passage with a grounded vessel, in unstable equilibrium, so considered unseaworthy and failed to refuse maneuvering and advise authorities.
- Pilot failed to abort immediately the outbound passage and secure the vessel at nearest convenient berth or voluntary run aground when clear signs of unstable condition - loss of stability –have been observed, underway.
- Lack of compliance with procedures - Both Master and Pilot failed to comply with Emergency Procedures for “Severe listing” as mentioned in SMS – Emergency &



Contingency Procedures, IMO Resolution 960/23, Bridge Procedures Guides 5th Edition.

- Complacency
- Lack of proactivity
- Poor safety culture

II. Management systems/Procedures/Rules/regulations

- Lack of ISM Implementation, effectiveness and compliance/assurance
- Failure to use Risk Assessment and Risk management procedures/tools and consequent control measures.
- Lack of compliance with Company Safety Management System
- Safety Management System found to be general and not specific for the type of livestock regular carried.
- Improper familiarization and hand-over for Masters (ISM Ch. 6.3)
- There are statements mentioning that Owners and/or Managers added extra decks by inserting double decks in cargo decks with height greater than the others (deck 4 & 6) without Classification Society approval (NKK). The impact of extra livestock on such added decks on stability was not officially assessed. Extra cargo in question may have elevate the center of gravity G and consequently reduce the GM until critical level. (Further investigations requested after vessel refloat)

III. Design/Engineering/construction/Installation/Equipment

- There are suspiciousness that animal feed loading system (conveyor) broke down and no reaction came up from ship's crew and/or Mangers and/or Owners (feed loading conveyor system will be inspected/evaluated after vessel will be refloated) Under commercial pressure to sail, this situation created the premises of loading probably abt 90 - 100 mt on upmost deck (sun deck) and abt 20 - 30 mt on bridge deck, although these areas were not designed to accommodate such weights, as per Stability Booklet. `The influence of such weights distribution on stability was not considered/assessed and it is assumed that these weights furtherly elevated the center of gravity and consequently reduced the GM until critical/negative levels.
- No evidences of planned maintenance – reporting of defects and corrective actions
- It is presumed that judging by the position of pen gates, all in open position (pen gates securing pins are not in secure position) pen gates securing devices not designed to withstand the pressure caused by livestock under listing condition.

6. CONCLUSIONS:

Marine Serious casualty investigated herein occurred because of **human error** in the way of failure to prove the ability to perform the required procedures the and lack of compliance



with International Conventions, local and national regulations, industry practices, standards and guidelines, for the Master and Ch. Mate, at first and secondly, the Pilot.

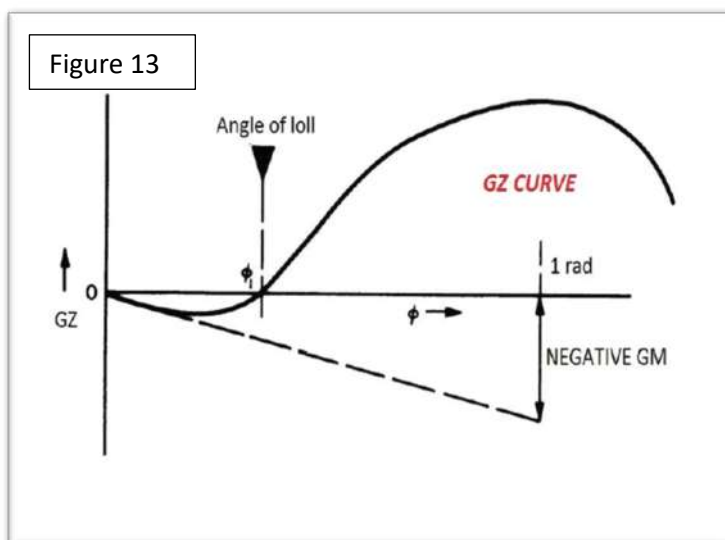
Final conclusions are that such accident could be easily avoided if:

- ISM and Safety Management System should have been implemented, referred to and complied with,
- Human element should have met the required level of competency and show proper proactivity and safety culture.
- Livestock carriers specific hazards identified, and Safeguards developed and implemented by local authorities.

There has to be emphasized the failure to ensure that, for such particular case of vessel, (where cargo (livestock) is concentrated on lower and also upper levels of ship's structures (usually sail with a reduced metacentric height) appropriate initial stability calculation and assesment is performed and positive stability, as per IMO SOLAS/Intact Stability Code and Stability Booklet is maintained throughout the voyage.

Vessel was loaded in a grounded condition fact that may have given wrong draft and list information to the Master and/or Officers. However, this shall not be constructed as an excuse and/or exonerate Master and/or his crew for his responsibility to take any preventive actions meant to ensure safe operations, safety for crew, vessel and environment protection.

Furthermore, neither Master nor the Pilot managed to understand the behavior of a vessel with a negative stability, in an unstable equilibrium. Several heelings, first to Port (under the action of towing lines) and then to Starboard side, under the combined effect of rudder, tow and consequent centrifugal force, amplified by a speed of more than 4.0 Kts, were inside the LOLL angle fact that developed a negative righting moment which combined with heeling, animal and big bags shifting to starboard, leded to a total loss of stability and capsizing.



Nonetheless, local authorities should have been more proactive in ensuring that such particular type of vessels with their intrinsically hazards, and such particular crews are able to operate and maintain such vessels and moreover, conduct comprehensive assesment of safety management and safe



operation of the vessel and environment protection, before they are accepted for operations in Romanian ports and of course prior departure.

There is no doubt that it is time for a concentrated campaign within entire maritime industry regulators, insurers, managers, operators, etc. to come down with clear and firm actions to prevent such occurrence on board livestock carriers.

7. RECOMMENDATIONS:

a. For Master and/or ISM Operators and/or Managers and/or Owners:

- Internal ISM Audit to be carried out in order to assess if ISM/SMS are properly implemented and complied with on a permanent basis
- Managers DOC (Document of Compliance) to be suspended until Managing company is Internally and externally audited and corrective actions for the identified non-conformities are defined and implemented.
- Ensure that Master, officers and crew are properly qualified, certified and experienced to perform the required procedures to operate the vessel.
- Familiarization and hand over procedures to be reviewed and complied with
- All concerned crew to read and acknowledge by signature the understanding of SMS
- SMS section 8.2.2 to be amended and include the obligative of Master and Ch. Mate to issue and submit initial stability calculations to managers/owners and local authorities.
- Such stability calculation to be reviewed and eventually amended/approved by a qualified and competent harbor master authority and managers,
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b. For Pilot(s):

- Pilots reserves the right only as of an advisor for the Master, with no direct responsibility, sharing his sound knowledge about the port and associated hazards/particularities with the Master, well, Pilot it is and important element in port operations management, the last line of control/defense and reaction of a Port state in preventing marine incidents and/or accidents.
- Pilots should ensure that vessels they will pilot outbound or inbound are in a proper seaworthiness condition, with all equipment and installations in a safe and efficient operable status and with a proper intact stability. Such seaworthiness and proper status of crew, machineries and equipment should be inserted within the Pilotage Slip and conformed/acknowledged by the Master before commencing any maneuver.
- If deviations are observed from such requirements, Pilot shall advise the local port and/or harbor master authorities and maneuvering aborted until vessel fulfills the safe maneuvering and environment protection criterions.



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- Pilot shall advise the local port and/or harbor master authorities if the vessel is in a grounded condition and no maneuver/movement carried out until vessel hull integrity and stability is assessed.
 - Pilot shall advise the local port and/or harbor master authorities and immediately maneuver the vessel in a safe berth/location if unstable on neutral stability condition are observed.
 - Pilots shall be properly trained and evaluated in handling emergency situation, as fire, severe listing, capsizing, failures of propulsion/steering situations. Pilot shall be thoroughly familiar with all related contingency plans, communications, entities involved, procedures, etc.
 - Pilots shall be periodically assessed (not exceeding six months) using the navigation mission simulator with various types of vessels, dealing with various emergency situations, as per legal requirements.

c. For Flag State (PISR):

- Palau International Ship Register (PISR) shall ensure that vessels registered under its flag fulfills the requirements as drawn by International, National and Local laws, rules, regulations, guidelines, industry practices and all consequent and that they are at all time in a legal seaworthiness sound condition, properly manned and supplied.
- PISR shall assess the above requirements by a more frequent unannounced safety inspections, tailored and focused on safety campaigns, as dictated by recent industry findings, incidents, accidents, lessons learned, etc.
- For PISR registered vessels failure of two consecutive safety inspections or with poor Port State Control records, there shall have serious consequences aimed to trigger Owners/Managers attentions that substandard vessel will not be tolerated under PISR flag.
- A thorough Safety & Environment Protection Self-Assessment Check List shall be designed/complied and disseminated/implemented on board PISR registered vessels. Any miss compliance shall be addressed immediately and PISR advised accordingly.
- Internal and External ISM Audits shall be as comprehensive, thorough and tough as possible, before SMC and/or DOC Certificates are being issued, ensuring that ISM requirements are fulfilled both, by vessel and managers.
- All PISR registered livestock carriers to be assessed and evaluated for ISM effectiveness and for compliance with SOLAS and Intact Stability Code requirements.

d. For IMO – Maritime Safety Committee

- A “Livestock Carriers Code”, as part of SOLAS Convention is highly required and demanded by the industry due to the high stability risks posed by those vessels and to ensure minimum safe conditions for livestock transported. Lost/dead animals are posing a very high biological and pollution risk.



The fundament for such code is on hand already as the Australian Maritime Safety Agency (AMSA) adopted their own regulations which are consistent, sound and clear ensuring safety of such vessels and/or cargoes, called **Marine Order 43 (Cargo and cargo handling – livestock) 2006, as part of Navigation Act 2012.**

- e. **For Local /National Authorities:** Recommendations have been drafted and forwarded to Port State Marine Casualty Investigator, to be embedded within Port State Marine Casualty Investigation Report.



1. Further relevant photos.

