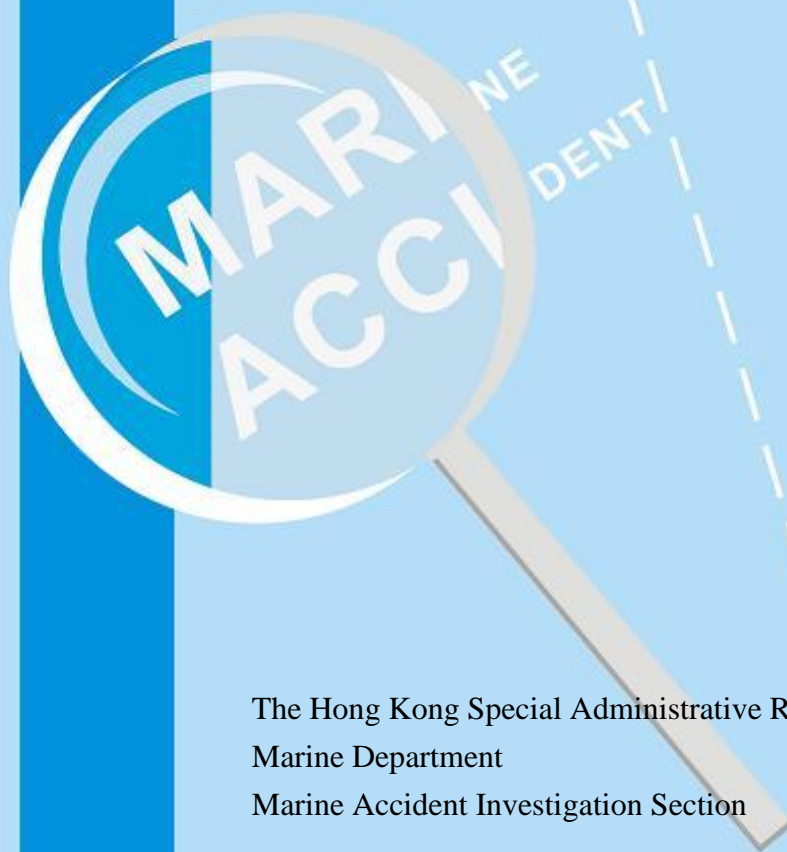




**Report of Investigation into the
Loss of Master of Hong Kong
Registered Log Carrier “*New
Lucky III*” at 35 Nautical Miles
Northwest of Taipei on 15
September 2012**



The Hong Kong Special Administrative Region
Marine Department
Marine Accident Investigation Section

15 September 2014

Purpose of Investigation

This incident is investigated in accordance with the Code of the International Standards and Recommended Practices for a Safety Investigation into a Marine Casualty or Marine Incident (the Casualty Investigation Code) adopted by IMO Resolution MSC 255(84).

The purpose of this investigation conducted by the Marine Accident Investigation and Shipping Security Policy Branch (MAISSPB) of Marine Department, in pursuant to the Merchant Shipping Ordinance Cap. 281, the Shipping and Port Control Ordinance (Cap. 313), or the Merchant Shipping (Local Vessels) Ordinance (Cap. 548), as appropriate, is to determine the circumstances and the causes of the incident with the aim of improving the safety of life at sea and avoiding similar incident in future.

The conclusions drawn in this report aim to identify the different factors contributing to the incident. They are not intended to apportion blame or liability to wards any particular organization or individual except so far as necessary to achieve the said purpose.

The MAISSPB has no involvement in any prosecution or disciplinary action that may be taken by the Marine Department resulting from this incident.

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1. Summary

- 1.1 On 5 September 2012, the Hong Kong registered log carrier *New Lucky III* departed from the port of Vanimo, Papua New Guinea with a full cargo of logs in two cargo holds and on deck. Her discharge port would be at Jingling, China. The fore and aft drafts of the vessel were 7.18 m and 7.87 m respectively. The ship was upright on departure with a total of 17 crewmembers on board.
- 1.2 At 0800 on 14 September 2012, the vessel arrived at position 24° 55.3'N, 120° 29.5'E. Her course and speed were 021° and 4.6 knots respectively. The vessel encountered strong head wind of force 5 to 6 on the Beaufort scale. Very rough seas and swells were up to 3 metres wave height. The company had advised the master about the situation of typhoon Sanba. At about 1300 when vessel was in position 25° 17.0'N, 120° 41.7'E, she listed to port about 3 degrees. Actions were taken to discharge bilge water accumulated inside No.1 cargo hold and add ballast water into No.2 starboard double-bottom ballast tank. The vessel regained her upright position at 1540.
- 1.3 At 0000 on 15 September 2012, the vessel listed to port side about 5 degrees and no action was taken. At about 0500, she listed to port side about 5 to 10 degrees. The master ordered to add ballast water into No.2 starboard double-bottom ballast tank. Then the vessel was diverted towards Taipei, Taiwan to take shelter.
- 1.4 At about 0830, the vessel was gradually becoming upright. A few minutes later, the vessel listed to starboard about 20° and rolled in a range of 10 degrees. Water was pumped out from No.2 starboard double-bottom ballast tank but the vessel could not return upright.
- 1.5 At about 1100, the master asked the chief officer and the bosun to drop anchor. When the starboard list of the vessel worsened to about 30 degrees, the master decided to abandon ship at about 1130 on 15 September 2012. The position of the vessel was about 35 nautical miles northwest of Taipei (35° 33.2'N 120° 54.8'E).
- 1.6 In the course of abandon ship, the liferaft was accidentally dropped into the water and lost without inflating. While the lowering of the lifeboat into the water was not successful. The master eventually fell into the water and lost at sea.
- 1.7 At about 1230, the first rescue helicopter from Taiwan arrived at the scene and started the rescue operation. Then another helicopter and rescue boats joined the rescue operation. All the crew, except the master, of the vessel were rescued without injury.

- 1.8 During the rescue operation, the vessel listed further to starboard for about 40 degrees and rolled heavily. Some lashing wires and uprights were damaged on the starboard side of the vessel in way of the cargo hold area. Under this condition, some of the logs collapsed and fell into the sea. As a result, the starboard list of the vessel reduced.
- 1.9 The vessel was drifting at sea after abandoned. At 0440 on 16 September 2012, she was connected to a salvage tug. *New Lucky III* arrived Taipei, Taiwan under tow by the salvage tug on 18 September 2012.
- 1.10 The investigation revealed that the main contributing factors to the accident were:
- a) the master and chief officer of the vessel did not conduct detailed assessments of ship stability upon sailing and during the voyage. The stability of the vessel could not meet the criteria of applicable IMO Res.A.167(ES.IV) as amended and Res.A.562(14) on sea passage;
 - b) the tarpaulins for the hatch covers on No.1 cargo hold were damaged. Seawater entered the cargo hold while vessel was sailing under heavy seas. Free surface effect of accumulated water in No.1 Cargo hold adversely affected ship stability and caused the ship to list;
 - c) the master and the chief officer took a series of remedial actions to upright the vessel without prior assessment to determine their effects on ship stability; and
 - d) crew members on board were not well trained and prepared for emergency situation (abandoning ship under heavy list of ship in rough seas condition). The life-saving appliances were not maintained in readily operational conditions.

2. Description of the Vessels

2.1 *New Lucky III* (Fig.1 & 2)

.1 Ship Information

Nationality	:	Hong Kong, China
Port of Registry	:	Hong Kong
Official Number	:	HK-2832
IMO No.	:	9228277
Call Sign	:	VRHG9
Ship Type	:	Other Cargo Ship (Log Carrier)
Year of Built (Delivery)	:	21 November 2000
Gross Tonnage	:	4724
Net Tonnage	:	2812
Length (Overall)	:	99.92 m
Breadth	:	19.20 m
Main Engine	:	Makita Corp. B&W 5L35MC
Engine Power	:	3236 kW @210rpm
Service speed	:	13.3 knots
Classification Society	:	NK
Shipbuilder	:	Shin Kurushima Dockyard Co.,ltd
Owner	:	Franbo Loyalty Line Limited
Management Company	:	Franbo Lines Corporation
Operator	:	Franbo Lines Corporation
Persons onboard	:	17

- .2 *New Lucky III* is a Hong Kong registered log carrier. The minimum safe manning requirement is 15.
- .3 The vessel was manned by a master, 3 deck officers, a chief engineer, 3 engineers, 6 deck ratings and 3 engine ratings. The nationalities of the master and the crew were Philippines, Indonesian, and Chinese.
- .4 The shipboard navigation and communication equipment included 2 radars, 1 Global Positioning System (GPS) receiver, 1 Gyro Compass, 1 Magnetic Compass, 1 Automatic Identification System (AIS), 2 Very High Frequency (VHF) radios and an intercom system.



Fig.1 – *New Lucky III*



Fig.2 – *New Lucky III* fully laden with timber deck cargo

3. Sources of Evidence

- 3.1 The statements provided by the master and crew of *New Lucky III*;
- 3.2 The voyage information provided by the ship management company;
- 3.3 The search and rescue information provided by the Hong Kong MRCC;
- 3.4 The weather information provided by the Management Company.

4. Outline of Events

All times are local (UTC+8) unless expressly specified otherwise. The voyage date was not recorded properly by the VDR of the vessel. The outline of event was based on information provided by the ship management company (Company) and statements of crew.

- 4.1 At about 1830 local time (UTC + 9, PNG time) on 5 September 2012, the Hong Kong registered log carrier *New Lucky III* departed from the loading port in Vanimo, Papua New Guinea. Her discharge port would be at Jingling, China. The vessel carried 6918 metric tons of logs (2692.801 mt on deck, 4225.975 mt in holds). No.3 port and starboard ballast tanks were full. No.2 port and starboard ballast tanks were partially filled-up. Upon sailing, the fore and aft drafts of the vessel were 7.18 m and 7.87 m respectively. The Metacentric height of the ship (GoM) was 0.64 m (Ship's crew calculated figure), she was in upright position on departure and was sailing with a total of 17 crew members on board.
- 4.2 The vessel proceeded in accordance with the planned route without anomalies until 14 September 2012. The master sent morning report daily to the company. The daily report contained information of ship loading, stability and tanks sounding.
- 4.3 At 0800 on 14 September 2012, the vessel was at position 24° 55.3' N, 120° 29.5' E. Her course and speed were 021° and 4.6 knots (kts) respectively. The wind was northerly and increased to Beaufort Scale (BS) 7 from BS 3 comparing with the previous days. Since 0600 on 14 September 2012, the speed of the vessel had been slowed down to less than 5 kts due to strong winds and heavy seas, comparing with that of 11 kts in the previous days. At about 0824, the master sent the morning report to the company. He reported that his vessel encountered strong gale head wind (i.e. northerly wind of BS 5 to 6), very rough seas and swells up to 3 m high. The vessel could not make a good speed. The GoM was determined to be 0.69 m.
- 4.4 In the afternoon of 14 September 2012, information about typhoon Sanba was exchanged between the Company and the master. The Company reminded the master to pay attention on its movement. No advice was given to the master on whether the vessel should take shelter or change course to avoid the typhoon.
- 4.5 At about 1300 on 14 September 2012, the vessel was making a speed of 6.0 kts and a course of 024° in position 25° 17.0' N 120° 41.7' E. The second

officer, who was on watch on the bridge, found the vessel listed to port about 3 degrees. He called the chief officer to have a discussion with the master on the bridge. The master ordered to put ballast into the No.2 starboard ballast tank. The chief officer first discharged the bilge water in port side of No.1 cargo hold from 1400 to 1430. The final sounding of bilge was about 20 cm. Then he pumped seawater into the No.2 starboard ballast water tank (No.2S WBT) until the vessel was upright at about 1540. The discharge of bilge water from the port side of the No.1 cargo hold was carried out from time to time thereafter.

- 4.6 From 1600 to 2000 on 14 September 2012, the vessel was making a course of 024° and an average speed of about 3.8 kts. The wind was northerly at gale force. The sea was rough with long swells and the visibility was poor. Ship was rolling and pitching heavily. The typhoon was about 500 nautical mile (nm) east of Taiwan Strait and moving northeasterly. The chief officer suggested the master to divert ship's course towards Taipei for sheltering from the typhoon. The suggestion was not acceded to by the master.
- 4.7 At midnight prior to the second officer taking over the watch from the third officer, he found the vessel listed to port side about 5 degrees. The third officer handed over the watch to the second officer without any remarks. The second officer just maintained the course on 024°. The speed was at about 3 to 4 kts throughout his watch. Meanwhile, the second officer ordered the duty engineer officer to pump out bilge water from No.1 cargo hold. The second officer recalled that during his watch, the seas and swells became heavier, and the wind force was getting stronger. In the log book, it was recorded that the wind was northerly at force BS 7.
- 4.8 At about 0500 on 15 September 2012, vessel was in position 26° 18.3'N 121° 10.1'E. Her speed and course were about 3.5 kts and 023° respectively. The vessel listed to port side about 5 to 10 degrees. The master was called to discuss the situation. The pumping of bilge water from No.1 cargo hold bilge well was then stopped as it was not effective.
- 4.9 When the master came on the bridge, he ordered to alter the heading of the vessel to a course of 170° towards Taipei, Taiwan to take shelter over there. He then ordered to put ballast water into No.2S WBT.



Fig.3 – The track of *New Lucky III* in the Taiwan Strait (AIS track from internet)

- 4.10 At about 0640 on 15 September 2012, announcement was broadcasted requesting all crew to stand by for emergency situation. The second officer and the third officer assisted the master on bridge. The vessels in the vicinity were contacted. The chief officer together with deck hands checked the bilge water soundings of cargo holds. Water was found accumulated in No.1 cargo hold. They found a portable pump and used it to discharge the water from No.1 cargo hold. However, the pump was not working properly, as the electrical supply was 110V while the motor of the portable pump rated 220V. After some arrangement made by the third engineer, the portable pump started running. About 20 minutes later, the pump failed. According to the second office, the last sounding of bilge water inside No.1 cargo hold starboard side was taken at about 1000. The records indicated that the depths of water in the fore and aft of No.1 cargo hold were 0.80 m and 2.0 m respectively.
- 4.11 At about 0830, as the vessel was gradually becoming upright, the ballasting into the No.2S WBT was stopped. However, a few minutes later, the vessel listed to starboard about 20 degrees. The rolling was in a range of 10 degrees. The master asked the engineer to pump out water from No.2S WBT. However, condition of the vessel's list to starboard remain unchanged. At about 1100, the master ordered the chief officer and the bosun to drop anchor. The port anchor was then lowered into the water for about six shackles.

- 4.12 The vessel had developed a list of about 30 degrees to starboard. The situation was reported to the company. The abandon ship was announced by the master at about 1130 on 15 September 2012. The position was about 35 nm northwest of Taipei (35° 33.2' N 120° 54.8' E). The chief officer and the bosun at the forward of the vessel returned to the aft without further lowering of the anchor. The chief engineer stopped the main engine. He brought the engine logbook with him and evacuated from the engine room. The generators were kept running. The oil supply valves to the engines were left opened. The crew member could not remember whether the pump for discharging ballast water from the No.2S WBT had been stopped or not.
- 4.13 Since the emergency situation invoked, the second officer kept contacting other vessels in the vicinity. One container vessel and one tanker responded to him that they would keep monitoring *New Lucky III*. Upon abandon ship, the second officer used MF/HF radio to activate the distress alert signals, and the master reported to the Company by Inmarsat telephone of the abandon ship.
- 4.14 Preparation work for abandon ship was carrying out by the crew. The chief officer was reported by the second Officer that the lifeboat could not be lowered. The chief officer tried to lower down the lifeboat by himself. But he could not open the brake of the lifeboat winch. Then he received an order from the master to launch the starboard liferaft. He removed the lashing of the liferaft and handed the painter to an ordinary seaman (OS). The liferaft was then kicked over the ship side for launching. However, the OS could not hold fast to the painter while the liferaft was falling into the water. The liferaft drifted away from the vessel in the rough seas without being inflated.
- 4.15 The master then ordered the chief officer to re-try lowering of the lifeboat. The chief officer checked the lifeboat lashing carefully. At last he succeeded to lower down the starboard lifeboat into the water. However, the aft lifeboat lifting hook was disengaged accidentally while the forward one remained engaged. The painters of the lifeboat were secured to the ship side. As a result, the lifeboat bumped repeatedly against the ship side due to waves at sea.
- 4.16 The master asked the chief officer to disengage the forward boat hook. The chief officer embarked the lifeboat and tried to enter the lifeboat from the aft entrance door. But the door of lifeboat was locked from the inside. He finally reached to the forward of the boat along the outboard gunwale. A crewmember handed down a hammer for him to release the lifeboat hook. But he could not release the hook with the hammer. .

- 4.17 Seeing the chief officer could not enter the lifeboat, the master also embarked the lifeboat to render him assistance. Unfortunately, he could not hold firmly to the handrail on top of the canopy of lifeboat. As a result the master fell into the water. The master wore a lifejacket and he held on to the lifeline on the side of the lifeboat. A lifebuoy was thrown to the master by the crew. He caught the lifebuoy and then released his grip on the lifeline of the lifeboat. He was then carried away from the vessel by waves very soon. The crew could not render him any assistance in the rough sea. The master finally went missing.
- 4.18 At about 1220, the chief officer returned to the vessel from lifeboat. He was reported that the master went overboard and missing at sea. He used the two-way VHF radio telephone to call for help. A tanker in the vicinity informed him that a rescue helicopter was on the way and would arrive within 10 minutes. Meanwhile the tanker and the container vessel were approaching the scene to provide assistance and for rescue.
- 4.19 The chief officer asked all crewmembers to standby on the poop deck port side to wait for the rescue. He also asked the second officer to throw the satellite EPIRB into the water to activate the emergency distress signals. At about 1230, a helicopter from Taiwan arrived on scene and started rescuing the crew.
- 4.20 After the helicopter had winched up four of the crewmembers, the vessel listed further to starboard. The list was about 40 degree and the ship rolled heavily. Some lashing wires and uprights on deck on the starboard side were damaged and collapsed. Some logs on deck on the starboard side fell overboard and drifted away. A cargo survey carried out later on revealed that 456 pieces of log, equivalent cargo volume of about 1770 m³ was lost. Consequently, the starboard list of the vessel reduced. Soon afterwards, the Taiwanese Coast Guard rescue boats arrived on scene.
- 4.21 At the end, total 16 crew member were rescued. When the rescue boat left the New Lucky III, the starboard lifeboat was still tied alongside the vessel.
- 4.22 The chief officer reported that the master was missing at sea. The coastguard started to search for the missing person. The searching was suspended after two hours operation without finding. The rescue boats then brought the crew to Keelung, Taiwan. The search and rescue operation for the master continued for another three days. It was finally stopped without finding.



Fig.4 – Bended uprights & collapsed derrick on port side (left), starboard uprights removed (right)

- 4.23 *New Lucky III* remained afloat in boisterous sea and heavy weather after being abandoned on 15 September 2012. A salvage tug *Sky 501* was dispatched at 0440 on 16 September 2012. *Sky 501* met *New Lucky III* on the same day. The starboard lifeboat of *New Lucky III* and port anchor had already gone.
- 4.24 *New Lucky III* was towed by *Sky 501* and arrived at Taipei on 18 September 2012. The remaining deck timber cargo was off-loaded from the vessel and then stowed back on board at the port. The damage survey of the vessel found the tarpaulin tapes on the pontoon hatch covers of No.1 cargo hold were damaged. A total of 456 pieces of logs (equivalent volume of 1770 m³) were found lost at sea. The port anchor, starboard lifeboat and a liferaft were lost.

5. Analysis

5.1 Certification of the vessel

- 5.1.1 The annual classification survey of the vessel was carried out on 26 February 2012. All relevant safety certificates for the vessel were valid until 20 November 2015.
- 5.1.2 There were no defects of the vessel reported prior to the accident. The failure of uprights and cargo lashing wires was considered to be the cause of excessive rolling / heeling of the vessel in heavy weather.

5.2 Manning, Qualification and Experience of Personnel

- 5.2.1 At the time of the accident, the vessel was manned by a total of 17 crew (i.e. the master, the chief officer, the second officer, the third officer, the chief engineer, the second engineer, the third engineer, the fourth engineer, the bosun, four able-bodied seamen, the fitter, two motormen, and the cook). The manning level of the vessel met the requirement stipulated in the minimum safe manning certificate.
- 5.2.2 The master and his three navigation officers all held valid certificate of competency applicable for the respective ranks. The master had long experience working on board log carrier vessel. He joined *New Lucky III* in May 2012. At the time of the accident, the chief officer had worked on board *New Lucky III* for about 10 months. He had about 15 years working experience as a chief officer on board general cargo ships and log carrier vessels. Apart from other duties, he was responsible to verify ship stability.
- 5.2.3 The chief engineer and his three engineer officers all held valid certificates of competency. The chief engineer had about 34 years of sea going experience.

5.3 Loading condition and stability assessment of *New Lucky III*

- 5.3.1 Before departed Vanimu, PNG, the Master and the chief officer made an assessment of ship stability and reported to the company. In the report, the GoM was 0.64 m, weight of cargo was 6918.776 mt (2692.801 mt on deck, 4225.975 mt in holds), ship draft at forward and aft were 7.18 m and 7.87 m respectively. Other elements relating to ship stability such as the righting arm and righting area were not calculated in the assessment. The daily morning report was sent to the company. It included the ship loading conditions, stability (only GoM figures) and tanks soundings during the passage from PNG to China.

- 5.3.2 On 14 September 2012, the assessment of stability of *New Lucky III* was prepared by the chief officer. The GoM was 0.69 m and ship's displacement was 10340.028 mt.
- 5.3.3 The stability calculation prepared by the chief officer was incomplete and there were a lot of elements missing. Its accuracy and correctness were doubtful. For examples, the heights of cargo on deck, the heights of the centre of gravity for miscellaneous loads such as fresh water, diesel oil, etc. were inconsistent with the relevant data given in the "Loading and Stability Information Booklet" of the vessel. Also, the transverse metacentric height (TKM) value of 8.20 m, instead of 8.10 m (*Appendix 9.2 TKM data*), was incorrectly selected for a displacement of about 10440 mt. Furthermore, as required by the IMO Res. A. 206(7), assumption for weight increase on deck cargo was not taken into account in the stability assessment.
- 5.3.4 In view of this, the ship stability was re-assessed with details of the calculations shown in the appendix (Assessment of stability). The results of the assessment was briefly described in the following paragraphs.
- a) When the vessel departed from the loading port on 5 September 2012, the displacement was 10440 mt. The GoM was found to be 0.252 m. The righting moment area (RMA), maximum righting level (GZ) and GoM met the criteria of IMO Res.A.206 (VII) and Res.A.562 (14) for severe weather. The stability condition of the vessel was on the margin line of the *Acceptable Zone* (See page 36: "Curve of Minimum Permissible GoM (at Log Loading)).
 - b) On the voyage at sea, following adverse effects should be considered:
 - i. According to IMO Res.A.206 (VII), the assumption of 10% (269 mt) increase at weight on deck cargo. It would cause the rising of gravity centre (KG).
 - ii. On 15 Sep. 2012, water was accumulated up to 2 metres in No.1 Cargo hold. The free surface effect of the water in the cargo hold would be enormous.
 - iii. The consumption of fuel oil in double bottom tank would reduce the GoM also.

The above adverse effects would further worsen the stability of the ship during the passage. Her stability was considered outside the *Acceptable*

Zone during sea passage.

- c) On 15 September 2012, sea water was added into the No.2S WBT. After 2 to 3 hours of pumping, it was assumed about 100 tons of water ballast was added into the tank. Considering the 10% increase in weight (about 269 mt) on deck cargo, water penetration in No.1 cargo hold, and the deduction of fuel oil consumption of less than 100mt. The displacement of the vessel might exceed the summer displacement in the summer zone.

5.3.5 The uprights on the starboard side in way of the cargo deck area were damaged and collapsed. The logs lashing wires parted and a total of 456 pieces of logs on deck (total volume 1770.307 m³ in 1775 tons) fell overboard. It was apparent that the starboard list of the vessel was reduced. The collapse / loss of deck cargo was considered as an unintentional jettison of cargo to improve the stability. The stability would be improved.

5.3.6 As mentioned above, the vessel could only marginally meet the relevant requirements upon departure on 5 September 2012. On 15 September 2012, water ballast was added into No.2S WBT to counter the port list of the vessel. Such action increased the displacement of the vessel and the free surface effect. The stability condition fell outside the Acceptable Zone. The vessel did not capsize and remained afloat after some of the deck cargo fell overboard. It was considered that the master and chief officer of the vessel did not make detailed assessment of ship stability. The stability of the vessel was not maintained within the Acceptable Zone during the voyage.

5.4 Voyage plan

5.4.1 In view of the typhoon season, *New Lucky III* selected to navigate a near coastal route from PNG to Changjiang Kou, China. That was passing through east coast of Papua New Guinea, Java Sea, west coast of the Philippine in the South China Sea, and Taiwan Strait. A shorter trans-ocean route directly passing Guam and Okinawa was not adopted. There were numerous islands along the route forming shelter areas. It was convenient for the vessel to take typhoon shelter if required.

5.4.2 Despite the Master and officers had received weather forecast that the typhoon would cross Taiwan in front of own ship's route, the voyage plan did not mention any contingency measures, for example, measures in case of typhoon. The vessel encountered heavy weather and boisterous seas. The master still maintained the voyage as planned. At last the vessel had developed a port

list of about 5° to 10° . He decided to divert the ship course towards Taiwan at about 0500 on 15 September 2012

5.5 Weather Conditions

- 5.5.1 Typhoon Sanba firstly formed as a tropical depression over the western North Pacific about 660 km east-southeast of Manila on 11 September 2012. Moving northwestward, Sanba intensified into a tropical storm that afternoon. It became a severe tropical storm on 12 September 2012. Sanba further intensified into a typhoon over the western North Pacific to the east of Manila in the morning on 13 September 2012. It turned to move northwards. Sanba continued to strengthen and became a super typhoon that evening. It reached its peak wind speed of 220 km/h near its centre on 14 September. It passed close to Okinawa in the morning on 16 September 2012 and subsequently moved across the East China Sea and weakened into a severe typhoon. Sanba made landfall over the Republic of Korea on 17 September 2012.
- 5.5.2 According to the morning report of *New Lucky III* on 14 September 2012, and the statements of crew, at the time of accident, a northerly strong gale force winds of BS 5 to 7 was blowing, with very rough seas condition and swells of about 3 m high. The vessel was rolling and pitching heavily while she was laboring in the northern part Taiwan Strait. The company sent emails attached with a projected track of the super typhoon Sanba (Fig.5), and reminded the master to take typhoon precautionary measures.
- 5.5.3 In Taiwan Strait, gale warning had been broadcasted continuously from 13 to 15 September 2012. At 2210 on 14 September 2012, the Fujian MSA of China broadcasted a navigational warning (FJ0165). The warning stated that, due to the influence of super typhoon Sanba, winds force BS 9 to 10 were expected in the Taiwan Strait and the coast of Fujian, China. Vessels were advised to pay more attention to Sanba and adjust their sailing plan to keep away from her. This message was received by the Ship's Navtex receiver.
- 5.5.4 The Surface Analysis Report at 0200 Local time (1800 UTC on 14 September 2012) on 15 September 2012 (Fig.6) was received by the chief officer and similar navigation warning via Navtex receiver was also received. All these messages gave navigation warnings of adverse weather caused by super typhoon. At about 0200 local time on 15 September 2012, the typhoon centre was in position 21.4° N, 129.5° E (about 530 nm away from *New Lucky III*). It was moving northwesterly at a speed of about 11 kts. The maximum wind speed was 110 kts near the typhoon centre and gusty wind was about 155 kts.

The wind speed was over 50 kts within 120 nm from the centre of the typhoon, and over 30 kts within 300 nm from east-semicircle and 270 nm elsewhere.

5.5.5 According to the GPS record of the vessel, at about 0800 on 14 September 2012, *New Lucky III* slowed down from a speed of over 10 kts to less than 5 kts. It was caused by the strong wind and rough seas. At 0701 on 15 September 2012, the master reported to the company that the vessel listed 20° to portside and was rolling heavily. He diverted the course to north of Taiwan for taking shelter.

5.5.6 The heavy weather, i.e. strong gale force wind and boisterous seas conditions with high swells, was considered a factor to cause the vessel laboring, rolling and shipping sea water on deck. It was also the cause of water entering into the No.1 cargo hold through the damaged tarpaulin covers.

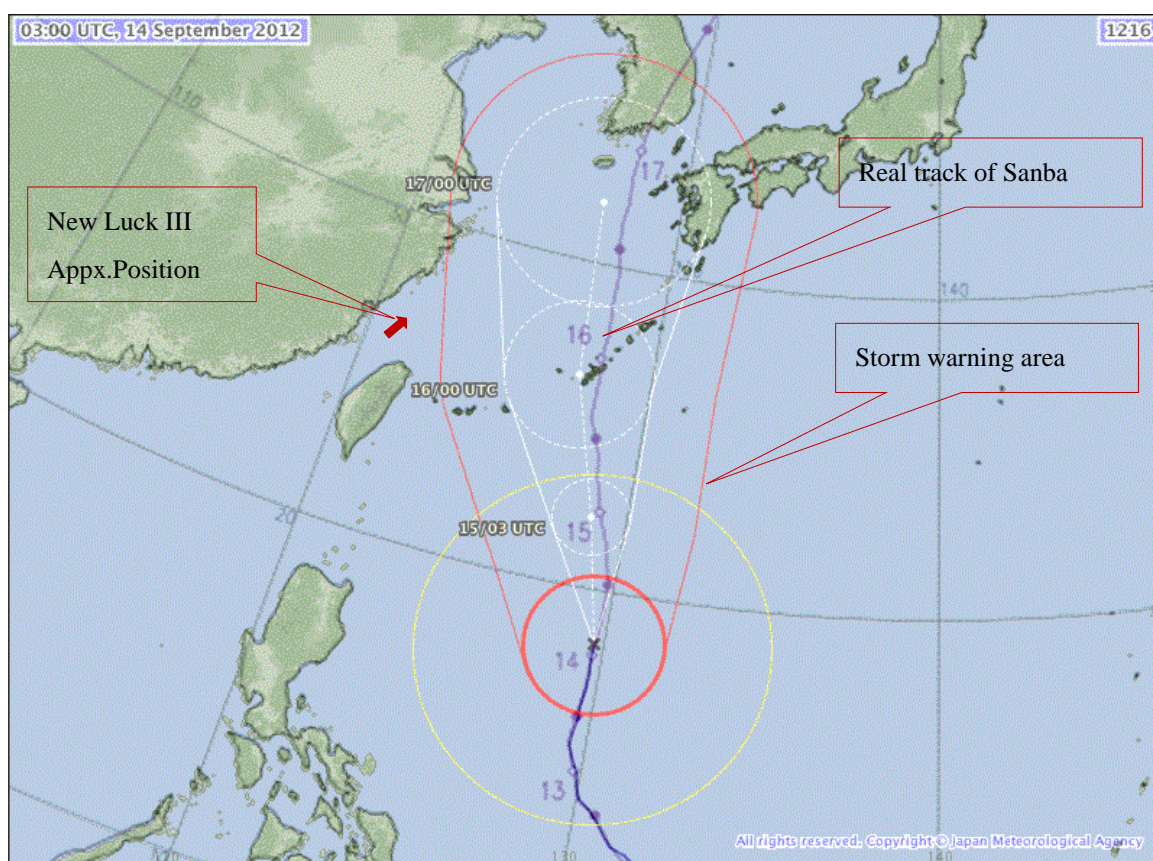


Fig. 5 - The predicted track of Super Typhoon Sanba on 14th September. The real track is shown in purple color.

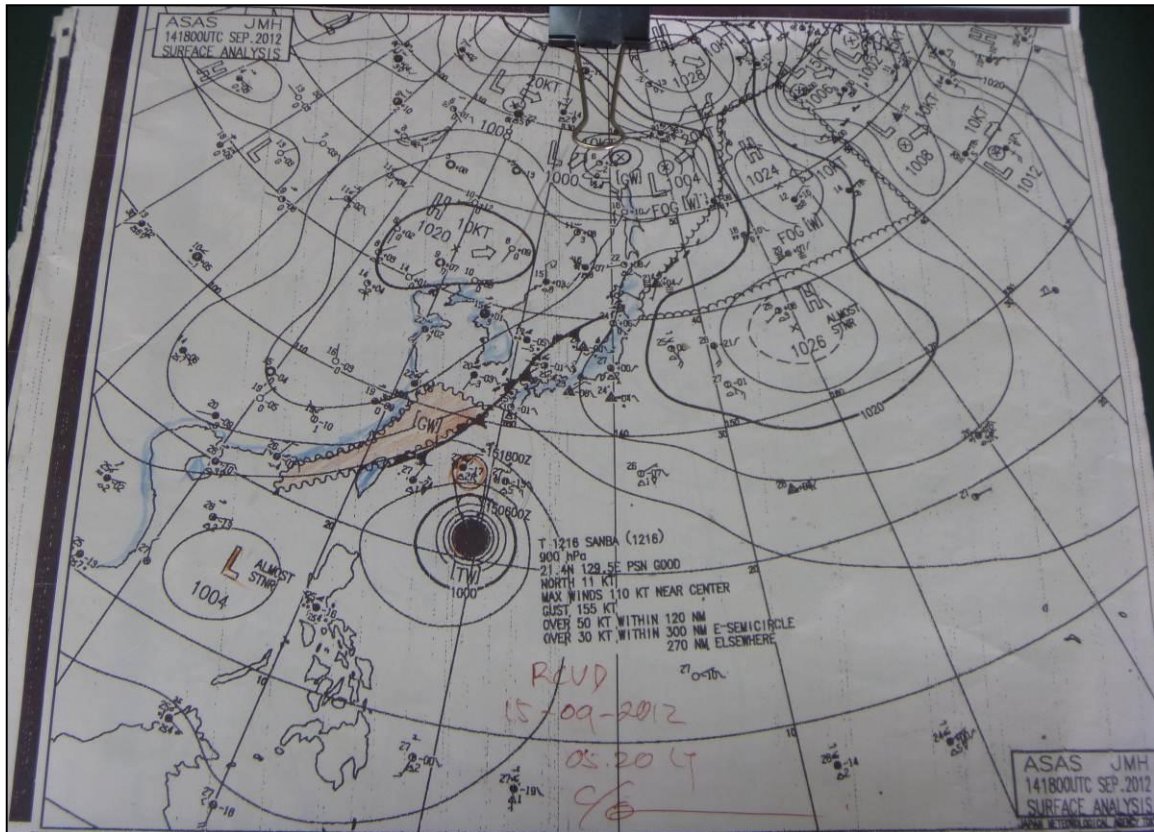


Fig.6 - The Weather Facsimile of Surface analysis at 141800UTC 14 Sept. 2012

5.6 Abandon ship

5.6.1 The vessel developed a starboard list of about 30 degrees. The master announced abandon ship at about 1130 on 15 September 2012. All crew mustered at starboard lifeboat station. The chief officer was reported that the lifeboat could not be lowered. He tried by himself but in vain. The master then ordered to launch the liferaft. The chief officer let an ordinary seaman (OS) to hold the painter. It should have been tied to ship structure before launching of the liferaft. As a result, the OS could not hold fast to the painter while the liferaft was falling into the water. The liferaft drifted away from the vessel in the rough seas without inflated. Painter of liferaft should have always been fastened to ship structure so that it would inflate automatically upon sinking of vessel.

5.6.2 After checking carefully of lifeboat lashing, the chief officer finally succeeded to lower down the lifeboat into the water. However, the aft lifeboat lifting hook was disengaged automatically while the forward one remained engaged. Under normal situation, the lifeboat hooks could only be released from inside the lifeboat. It was therefore deduced that the aft hook was incorrectly set and it released accidentally when the lifeboat waterborne (Fig.7). The chief

officer embarked the lifeboat and tried to enter it through the aft entrance door. The door was locked from the inside. He finally reached to the forward of the boat along the outboard gunwale. He tried to release the lifeboat hook outside with a hammer but in vain.

- 5.6.3 The master embarked the lifeboat to render assistance. Unfortunately, he could not hold the handrail firmly on top of the canopy of the lifeboat and fell into the water. The master wore a lifejacket and held on to the lifeline on the side of the lifeboat. A lifebuoy was thrown to the master by a crew. However, it is not known whether that lifebuoy was attached with a buoyant life line or not. The master caught the lifebuoy and released his grip on the lifeline of the lifeboat. The master was finally went missing. It was not known why the master released his grip on the lifeline of the lifeboat.



Fig. - 7 the port side lifeboat, and the lifeboat hook.

- 5.6.4 The chief officer returned to the vessel and was reported by crew that the master went overboard and missing at sea. He used the two-way VHF radio telephone to call for help. The chief officer asked the second officer to throw the satellite EPIRB into the water to activate the emergency distress signals.
- 5.6.5 It was considered that the crew was not well trained. They were not well prepared to handle emergency situations such as abandon ship. Besides, the

life-saving appliances (lifeboat and liferaft) on board were found not properly maintained. Such as the aft lifeboat hook was not set correctly and the painter of liferaft was not fastened to the ship structure.

5.7 The Safety Management System

5.7.1 The company and the vessel held valid Document of Compliance (DOC) and Safety Management Certificate (SMC) at the time of the accident. However, in view of the analysis above, it was considered that the implementation of the safety management system was not effective. The weak points are highlighted below:

- a) The master and chief officer were not familiar with ship stability assessment. The ship stability reports were not completed with all the necessary data i.e. RMA, GZ calculation, etc. A full assessment of compliance with the statutory requirements of stability was not done during the whole voyage. On the other hand, the company had not checked the completeness of such reports and they had not requested and/or instructed the master of the vessel to do a full assessment of stability;
- b) The tarpaulins on the pontoon hatch covers of No.1 cargo hold was damaged. Seawater entered the No.1 cargo hold through the damaged tarpaulins. The master and chief officer tried to upright the vessel from a port list. They discharged the bilge water inside No.1 cargo hold and added water into No.2 starboard double-bottom ballast tank. The master and chief officer did not conduct a ship stability calculation before the ballasting operation as such they had (or they might have) overloaded the ship;
- c) The vessel was trading in the area during typhoon season. The voyage plan did not include contingency measures to avoid heavy weather; and
- d) The crew on board was not well trained and prepared for handling abandon ship operation. The life-saving appliances on board (lifeboat and liferaft) were not properly maintained to ensure their readiness at all times.

6. Conclusion

- 6.1 On 5 September 2012, the Hong Kong registered log carrier *New Lucky III* departed from the port of Vanimo, Papua New Guinea with a full cargo of logs in two cargo holds and on deck. Her discharge port would be at Jingling, China. The fore and aft drafts of the vessel were 7.18 m and 7.87 m respectively. The ship was upright on departure with a total of 17 crewmembers on board.
- 6.2 At 0800 on 14 September 2012, the vessel arrived at position 24° 55.3' N, 120° 29.5' E. Her course and speed were 021° and 4.6 knots respectively. The vessel encountered strong head wind force of 5 to 6 on the Beaufort scale. Very rough seas and swells were up to 3 metres wave height. The company had advised the master about the situation of typhoon Sanba. At about 1300 when vessel was in position 25° 17.0' N 120° 41.7' E, she listed to port about 3 degrees. Actions were taken to discharge bilge water accumulated inside No.1 cargo hold and add ballast water into No.2 starboard double-bottom ballast tank. The vessel regained her upright position at 1540.
- 6.3 At 0000 on 15 September 2012, the vessel listed to port side about 5 degrees and no action was taken. At about 0500, she listed to port side about 5 to 10 degrees. The master ordered to add ballast water into No.2 starboard double-bottom ballast tank. Then the vessel was diverted towards Taipei, Taiwan to take shelter.
- 6.4 At about 0830, the vessel was gradually becoming upright. A few minutes later, the vessel listed to starboard about 20° and rolled in a range of 10 degrees. Water was pumped out from No.2 starboard double-bottom ballast tank but the vessel could not return upright.
- 6.5 At about 1100, the master asked the chief officer and the bosun to drop anchor. When the starboard list of the vessel worsened to about 30 degrees, the master decided to abandon ship at about 1130 on 15 September 2012. The position of the vessel was about 35 nautical miles northwest of Taipei (35° 33.2' N 120° 54.8' E).
- 6.6 In the course of abandon ship, the liferaft was accidentally dropped into the water and lost without inflating. While the lowering of the lifeboat into the water was not successful. The master eventually fell into the water and lost at sea.
- 6.7 At about 1230, the first rescue helicopter from Taiwan arrived at the scene and started the rescue operation. Then another helicopter and rescue boats joined the rescue operation. All the crew, except the master, of the vessel were

rescued without injury.

- 6.8 During the rescue operation, the vessel listed further to starboard for about 40 degrees and rolled heavily. Some lashing wires and uprights were damaged on the starboard side of the vessel in way of the cargo hold area. Under this condition, some of the logs collapsed and fell into the sea. As a result, the starboard list of the vessel reduced.
- 6.9 The vessel was drifting at sea after abandoned. At 0440 on 16 September 2012, she was connected to a salvage tug. *New Lucky III* arrived Taipei, Taiwan under tow by the salvage tug on 18 September 2012.
- 6.10 The investigation revealed that the main contributing factors to the accident were:
- a) the master and chief officer of the vessel did not conduct detailed assessments of ship stability upon sailing and during the voyage. The stability of the vessel could not meet the criteria of applicable IMO Res.A.167(ES.IV) as amended and Res.A.562(14) on sea passage;
 - b) the tarpaulins for the hatch covers on No.1 cargo hold were damaged. Seawater entered the cargo hold while vessel was sailing under heavy seas. Free surface effect of accumulated water in No.1 Cargo hold adversely affected ship stability and caused the ship to list;
 - c) the master and the chief officer took a series of remedial actions to upright the vessel without prior assessment to determine their effects on ship stability; and
 - d) crew members on board were not well trained and prepared for emergency situation (abandoning ship under heavy list of ship in rough seas condition). The life-saving appliances were not maintained in readily operational conditions.
- 6.11 The safety factors revealed by the investigation are:
- a) the voyage plan approved by the master of the vessel did not include contingency measures such as alternative routes for adverse weather;
 - b) the ship management company failed to detect the incorrect stability information provided by the master of the vessel before and during the voyage. In fact, the stability information of the vessel provided by the master of the vessel was incorrect; and
 - c) implementation of the safety management system of the company ashore and on board ship was not effective.

7. Recommendations

- 7.1 The owner/management company of the vessel should be advised to issue safety circular to draw the attention of their masters, officers and crew to the findings of the investigation into the accident in order to ensure that:
- a) Hull water-tight integrity including load line items should be ensured during cargo operations, before sailing and during the whole voyage;
 - b) Stability of ship should be assessed before the voyage and continuously assessed during the voyage to comply with statutory requirements at all time;
 - c) Voyage plan should include contingency measures that would be encountered during the voyage of the vessel;
 - d) Lifesaving appliances should be properly maintained in a readily operational condition; and
 - e) Crew members should be well trained for all scenario of emergency situations.
- 7.2 The ship management company of the vessel has been changed, a copy of the investigation report is to be provided to both the previous and existing management company for information.
- 7.3 A Hong Kong Merchant Shipping Information Note has been issued to promulgate the lessons learnt from the accident on 7 July 2014.
- 7.4 To ensure the effective implementation of the safety management system (SMS), the Shipping Division of Marine Department should consider to conduct verifications on the SMS to both of the management company and the vessel, i.e. DOC and SMC audits.
- 7.5 A copy of the report should be sent to the COCs (Certificate of Competency) issuing authorities of both the master and chief officer for their action as deemed necessary.

8. Submissions

- 8.1 In the event that the conduct of any person or organization is commented in an accident investigation report, it is the policy of the Marine Department to send a copy of the draft report in its entirety or parts thereof to that person or organization for comments.
- 8.2 The draft report of investigation has been sent to the previous and present owners/management company of *New Lucky III*.
- 8.3 The Shipping Division of Marine Department, being the flag State of the vessel at the time of the accident was invited to provide comment on the draft report.
- 8.4 No submission was received from above parties.

9. Appendices: Assessment of the Stability of *New Lucky III*

9.1. Intact stability requirement

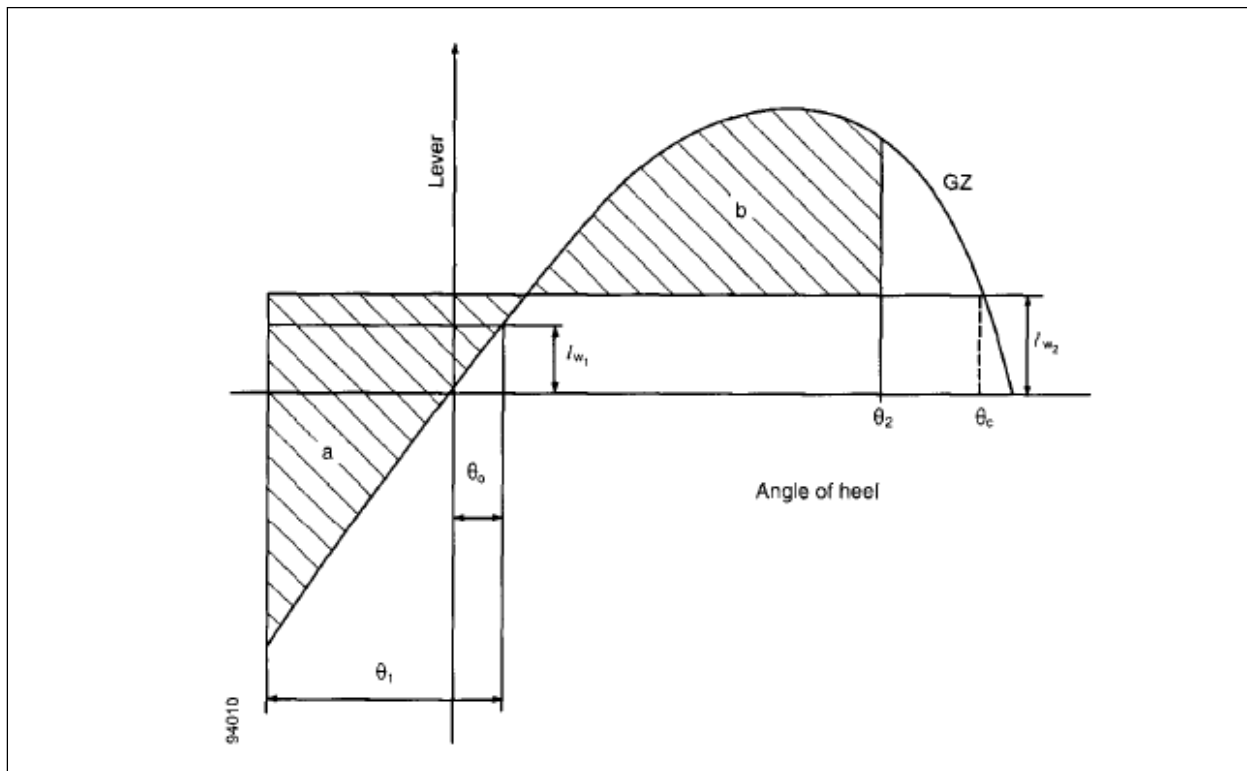
The ship was built and delivered in the year of 2000. With reference to the Loading and Stability Information Booklet which was approved by *Nippon Kaiji Kyokai (NK)* Classification Society in the year of 2000, the stability of the vessel complied with *IMO Res.A.167 (ES.IV) as amended by Res.A.206 (VII) and Res.A.562 (14)*¹.

- .1 The section 5.2 of IMO Res.A.167(ES.IV) as amended by Res.A.206(VII) stipulated the following recommended stability criteria of Intact stability for ships loaded with timber deck cargoes:
 - .a The area under the righting lever curve (GZ curve) should not be less than 0.08 metre-radians (m.rad) up to $\theta = 40^\circ$ or the angle of flooding if this angle is less than 40° .
 - .b The maximum value of the righting lever (GZ) should be at least 0.25 m.
 - .c At all times during a voyage, the metacentric height GoM should be positive after correction for the free surface effects of liquid in tanks and, where appropriate, the absorption of water by the deck cargo and/or ice accretion on the exposed surfaces. Additionally, in the departure condition the metacentric height should be not less than 0.10 m
- .2 Appendix II.2.6 of IMO Res.A.206(VII) stipulated: where timber deck cargo are carried, the amount of cargo and ballast should correspond to the worst service condition in which all the relevant stability criteria mentioned above, it should be assumed that the weight of the deck cargo has increased by 10% due to water absorption.
- .3 Severe wind and rolling criterion (weather criterion). IMO Res.A.562 recommended the following:
 - A. The ability of a ship to withstand the combined effects of beam wind and rolling should be demonstrated for each standard condition of loading as follow:
 - .1 the ship is subjected to a steady wind pressure acting perpendicular to the

¹ *Res.A.167 (ES IV): Recommendation on intact stability for passenger and cargo ship under 100 metres in length*
Res.A.206 (VII) : Amendments to Recommendation on intact stability for passenger and cargo ship under 100 metres in length (resolution A.167 (ES.IV) with respect to ships carrying deck cargoes.

Res.A.562 (14) : Recommendation on a server wind and rolling criterion (Weather criterion) for the intact stability of passenger and cargo ships 24 metres in length and over.

- ship's centerline which results in a steady wind heeling lever (L_{w1});
- .2 from the resultant angle of equilibrium (Θ_0), the ship is assumed to roll owing to wave action to an angle of roll (Θ_1) to windward. Attention should be paid to the effect of steady wind so that excessive resultant angles of heel are avoided²;
 - .3 the ship is then subjected to a gust wind pressure which results in a gust wind heeling (L_{w2});
 - .4 under these circumstances, area b should be equal to or great than area a;
 - .5 free surface effects should be accounted for in the standard conditions of loading, e.g. according to appendix 1 to Res. A.167 (ES.IV).



The angle in above figure are defined as follows:

- Θ_0 = angle of heel under action of steady wind
- Θ_1 = angle of roll to windward due to wave action
- Θ_2 = angle of downflooding (Θ_f) or 50° or Θ_c whichever is less
- Θ_f = angle of heel at which opening in the hull, superstructures or deck houses which cannot be closed weathertight immerse. In applying this criterion. Small openings through which progressive flooding cannot take place need not be considered as open.
- Θ_c = angle of second intercept between wind heeling lever L_{w2} and GZ curves.

² The angle of heel under action of steady wind (Θ_0) should be limited to a certain angle of the satisfaction of the Administration. As a guide, 16° or 80% of the angle of deck edge immersion, whichever is less, is suggested.

B. The wind heeling levers (Lw1) and (Lw2) are constant values at all angles of inclination and should be calculated as follows:

$$Lw1 = PAZ / \Delta \text{ (m)} \quad \text{and} \quad Lw2 = 1.5 \times Lw1 \text{ (m)}$$

P = 0.0514 (t/m²). The value of P used for ships in restricted service may be reduced, subject to the approval of the administration;

A = projected lateral area of the portion of the ship and deck cargo above the waterline(m²);

Z = Vertical distance from the centre of A to the centre of the underwater lateral area or approximately to a point at one half the draft;

Δ = displacement (t)

C. The angle of roll Θ_1 should be calculated as follows:

$$\Theta_1 = 109KX_1X_2 \sqrt{rs} \text{ (degrees)}$$

Where:

X1 = factor as shown in table 1

X2 = factor as shown in table 2

K = factor as follows:

K = 1.0 for a round-bilged ship having no bilge or bar keels

K = 0.7 for a ship having sharp bilges

K = as shown in table 3 for a ship having bilges keels, a bar keel or both

$$r = 0.73 \pm 0.6OG/d$$

With: OG = distance between the centre of gravity and the waterline (m) (+ if the centre of gravity is above the waterline, - if it is below)

d = mean moulded draft of the ship (m)

s = factor as shown in table 4

Table 1
Values of factor X_1

B/d	X_1
≤ 2.4	1.0
2.5	0.98
2.6	0.96
2.7	0.95
2.8	0.93
2.9	0.91
3.0	0.90
3.1	0.88
3.2	0.86
3.3	0.84
3.4	0.82
≥ 3.5	0.80

Table 2
Values of factor X_2

C_B	X_2
≤ 0.45	0.75
0.50	0.82
0.55	0.89
0.60	0.95
0.65	0.97
≥ 0.70	1.0

Table 3
Values of factor k

$\frac{A_k \cdot 100}{L \cdot B}$	k
0	1.0
1.0	0.98
1.5	0.95
2.0	0.88
2.5	0.79
3.0	0.74
3.5	0.72
≥ 4.0	0.70

Table 4
Values of factor s

T	s
≤ 6	0.100
7	0.098
8	0.093
12	0.065
14	0.053
16	0.044
18	0.038
≥ 20	0.035

(Intermediate values in tables 1-4 should be obtained by linear interpolation.)

Rolling period $T = 2\pi C_x B / \sqrt{GM}$ (seconds)

$$C = 0.373 + 0.023(B/d) - 0.043(L/100)$$

The Symbol in the above table and formula for the rolling period are defined as follows:

L = waterline length of the ship (m)

B = moulded breadth of the ship (m)

d = mean moulded draught of the ship (m), in this report, mean draft is referred.

C_B = block coefficient = $\text{Dispt (N)} / (L B d \times 1.025)$

A_k = total overall area of bilge keels, or area of the lateral projection of the bar keel

A_k = total over all area of bilge keels, or area of the lateral project of the bar keel, or sum of these area (m²) = 14.510 m²

GM = Metacentric height corrected for free surface effect (m)

9.2. Principle Particulars of *New Lucky III* and stability data

1. Principle Dimensions:

Length overall	:	99.92	m
Length between P.P. (L.B.P)	:	93.00	m
Breadth (molded)	:	19.20	m
Depth (molded)	:	8.90	m
Draft (Assigned for summer)	:	7.241	m
Draft (Timber Summer)	:	7.589	m
Summer Displacement	:	10565	mt
2. Light ship condition:

Draft	:	2.03	m
Displacement	:	2288	mt
Centre of Gravity from Midship:		5.38	m
Centre of Gravity from B.L.	:	8.01	m
3. Gross Tonnage: : 4,724
4. Net Tonnage : 2,812
5. Cargo capacity:

In hold (Log)			
No.1 Cargo Hold	:	4,378.43	m ³
No.2 Cargo Hold	:	4,815.59	m ³
Total	:	9,194.02	m ³
On Deck (Log) (Height 5.92m):			
No.1 on Deck log	:	2,306.63	m ³
No.2 on Deck Log	:	2,443.03	m ³
Total	:	4,749.56	m ³
Grand Total	:	13,943.68	m ³
6. General tank capacity:

Fuel oil tanks	:	466.24	m ³
Diesel oil tanks	:	173.04	m ³
Lub. Oil tanks	:	41.80	m ³
Fresh water tanks	:	232.36	m ³
Water ballast tanks	:	1,583.07	m ³
7. The data from “Loading and Stability Information booklet”

.1. TKM data from Hydrostatic table:

Draft (M)	Dispt (K.T)	Mid.B (M)	Mid.F (M)	M.T.C (T-M)	T.P.C (T)	KB (M)	T.KM (M)	L.KM (M)
7.40	10259	-1.088	2.820	103.17	16.13	3.893	8.09	97.4
7.50	10420	-1.027	2.903	104.14	16.19	3.947	8.10	96.9
7.51	10437	-1.021	2.911	104.24	16.19	3.953	8.10	96.8
7.52	10453	-1.015	2.918	104.33	16.20	3.958	8.10	96.8

Disp	10°	15°	20°	25°	30°	35°	40°	45°	50°	60°	75°	90°
10450	1.413	2.099	2.786	3.483	4.181	4.884	5.538	6.075	6.492	7.036	7.269	6.931
10500	1.413	2.099	2.785	3.482	4.179	4.882	5.533	6.069	6.485	7.030	7.265	6.930
10550	1.413	2.098	2.785	3.481	4.178	4.879	5.528	6.063	6.478	7.024	7.261	6.929
10600	1.413	2.098	2.784	3.480	4.176	4.876	5.523	6.056	6.472	7.018	7.258	6.928
10650	1.413	2.097	2.784	3.479	4.174	4.873	5.518	6.050	6.465	7.011	7.254	6.927
10700	14.12	2.097	2.783	3.478	4.173	4.871	5.513	6.043	6.458	7.005	7.250	6.926

c) Stability curve

$$\begin{aligned} VCG &= \quad m \\ GGo &= \quad m \\ VCGo &= VCG + GGo = \quad m \\ VCG' &= \text{ASSUMED } VCG = \quad m \\ GoG' &= VCG' - VCGo = \quad m \\ G'Z &= \text{From TABLE OF RIGHTING ARM } (G'Z) \\ GZ &= G'Z + GoG' \sin \theta \end{aligned}$$

Displacement =		t	GoM =		m
			VCGo =		m
VCG' =		m	$GoG' = VCG' - VCGo =$		m
θ	$\sin \theta$	$G'Z$	$GoG' \sin \theta$	GZ $(G'Z + GoG' \sin \theta)$	
5	0.087				
10	0.174				
20	0.342				
30	0.500				
40	0.643				
50	0.766				
60	0.866				
70	0.940				
80	0.985				
90	1.000				

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9.3. Assessment of Stability on various condition

Weight distribution at various stage

Cargo weight distribution

.1 The chief officer and master prepared “daily loading/stability/sounding report” to monitor the condition of the vessel. The report was sent to the management company daily. Base on the daily report, the departure condition at Vanimo PNG on 5 September 2012 was: Forward draft 7.18 m, aft draft 7.87 m, cargo weights distribution in holds and on deck were shown in the following table. (With reference to IMO Res. A.206 (VII), an assumption of 10% weight increase of deck logs should be considered.)

Space	No.1 Hold	No.2 Hold	No.1 Deck	No.2 Deck
Space capacity (M ³)	4378.43	4815.59	2306.63	2443.03
Weight distribution (mt)	2098.806 (2061.344cu.m)	2127.169 (2089.200cu.m)	1256.172 (1233.750cu.m)	1436.629 (1451.237cu.m)
Stowage Factor	47.08%	43.38%	53.49%	59.40%
VCG (m)	5.73	5.49	12.83 (5.92m on deck)	12.47 (5.92m on deck)
Total	4225.975mt in hold		2692.801mt on Deck	

Ballast water and other weight distribution

.2 The weight of ballast water.

WBT	FPT	D. Tk	NO.1	2P	2S	3P	3S	Total
Weight (mt)	7.175	0	0	64.924	77.552	276.443	276.443	702.537
Weight (mt) (15 Sep.)	7.175	0	0	64.924	177.552 (100 mt Added)	276.443	276.443	802.537

.3 Miscellaneous weights such as oil and fresh water.

Item	Drink water	Fresh water	No.1 FOT	No.2 FOT	D.Oil Port	D.Oil Starb.	Total
Weight (mt)	39	151	91	122.375	31.770	30.396	465.541
Weight (mt) (15 Sep.)	39	139	91	32	31.77	21.86	354.63

.4 Additional free water in Cargo hold No.1. On 15 September 2012, the tarpaulin tapes on the pontoon hatch cover were broken. Water accumulated in No.1 cargo holds tanktop. The sounding were about 0.80 m at starboard forward and 2.00 m starboard aft at a list of about 15 to 20 degrees. The free surface effect would be enormous.

.5 In the “Loading and Stability Information Booklet” approved by classification, a chart of “Curve of Minimum Permissible GoM (at Log loading)” was provided. It was prepared to enable the master, rapidly and simply, by insert the GoM and draft only, to obtain accurate guidance as to the stability of the ship under varying conditions of service of carrying timber deck cargo with safe margin. In this appendices, this Chart will be used to verify the conditions.

.6 Referring the master’s report of ships stability calculation, the ship’s GoM was 0.64m on departure. The departure mean draft was 7.525 m under displacement of 10439.852 mt. Some findings were found during checking of the stability calculation prepared by ship’s staff. The deck cargo height of 5 m in the calculation was not consistent with the height of 5.92 m in fully loading of deck cargo. And the KGs of diesel oil tanks, Ballast water and Fresh water tanks and TKM figure were not consistent with the data in the “Loading and Stability Information Booklet”.

.7 On 15 September 2012, the assumption of weight increased by 10% on deck cargo was considered. As report of the master, the fuel oil remain would be about 123 mt. The consumption of fuel oil was about 90 mt from departure.

.8 Considering the pumping water into No.2 Starboard water ballast tank of about 2 to 3 hours, a total water of 100mt added into No.2 WBT(S) was assumed.

.9 At and after the abandon of ship, deck logs on starboard side were collapsed partially and fell into sea. This loss of deck cargo was considered as a kind of jettison of weight to improve the ship’s stability. The weight of deck cargo lost was 465 pieces at volume of 1770.3 m³. It was estimated about 1775.5 tons according to the average density.

Assessment: Stability of departure condition on 5 September 2012

"New Lucky III" Log loading Departure Condition on 5th September 2012							
Item	%	Weight	Mid.G	M.G.M'T	KG	KG M'T	I.SG
No.1 Cargo Hold	100	2098.806	-20.62	-43277.38	5.73	12026.1584	
No.2 Cargo Hold	100	2127.169	11.17	23760.48	5.49	11678.1578	
No.1 on Deck	5.92m	1256.172	-20.95	-26316.80	12.83	16116.6868	
No.2 on Deck	5.92m	1436.629	10.40	14940.94	12.47	17914.7636	
Cargo Grand Total		6918.776	-4.47	-30892.76	8.34	57735.7666	
Fore Peak Tank	2.7%	7.175	-43.59	-312.76	0.10	0.7175	
Deep tank	0.0%	0	0.00	0.00	0.00	0	
No.1 W.B.T.	0.0%	0	0.00	0.00	0.00	0	
No.2 W.B.T.(P)	33.7%	65	-16.08	-1045.20	0.22	14.3	390
No.2 W.B.T.(S)	39.6%	77.6	-16.27	-1262.55	0.22	17.072	413
No.3 W.B.T.(P)	99.8%	276	10.12	2793.12	0.76	209.76	0
No.3 W.B.T.(S)	99.8%	276	10.12	2793.12	0.76	209.76	0
Water Ballast Total		701.775	4.23	2965.73	0.64	451.6095	803
Drink W.T (P)	80.0%	39	42.56	1659.84	7.00	273	68
Fresh W.T. (C)	82.2%	151	45.43	6859.93	7.40	1117.4	1000
Fresh Water Total		190	44.84	8519.77	7.32	1390.4	1068
No.1 F.O.T.(C)	44.8%	91	-17.65	-1606.15	0.63	57.33	490
No.2 F.O.T.(C)	48.2%	122.375	10.04	1228.65	0.63	77.09625	486.8
Fuel Oil Total		213.375	-1.77	-377.51	0.63	134.42625	976.8
Diesel O.T. (P)	42.7%	31.77	39.04	1240.30	7.45	236.6865	32
Diesel O.T. (S)	40.8%	30.396	39.04	1186.66	7.20	218.8512	29
Diesel Oil Total		62.166	39.04	2426.96	7.33	455.5377	61
Constant		66	29.25	1930.50	8.05	531.3	0
Light Ship		2288	5.38	12309.44	8.01	18326.88	0
Displacement		10440.092	-0.30	-3117.87	7.57	79025.92	2908.8

Displacement		T	10440.1		Assumed KG =KGA	0.00	m		
Draft	Equivalent	m	7.513		KGo=KG + GGo=	7.85	m		
	Fore	m	7.12		GoGA=KGo-KGA=	7.85	m		
	Aft	m	7.86						
	Mean	m	7.49		Correcti on of GZ	SIN Θ	GZ from Cross	GoGA x SIN Θ	Corrected GZ (GoZ)
Trim		m	0.74		10	0.174	1.413	1.363	0.050
T.P.C		T	16.18		15	0.259	2.099	2.031	0.068
φ G		m	-0.30		20	0.342	2.786	2.684	0.102
φ B		m	-1.03		25	0.423	3.483	3.317	0.166
H.B.G.		m	0.73		30	0.500	4.181	3.924	0.257
M.T.C		T-m	104.05		35	0.574	4.884	4.501	0.383
φ F		m	2.913		40	0.643	5.538	5.044	0.494
T.KM		m	8.10		45	0.707	6.075	5.549	0.526
KG		m	7.57		50	0.766	6.492	6.012	0.480
GM		m	0.531		60	0.866	7.036	6.796	0.240
GGo		m	0.279		75	0.966	7.269	7.580	-0.311
GoM		m	0.252		90	1.000	6.931	7.848	-0.917
Angle of Down Flooding		Deg.	67						

New Luck III Departure on 5 Sep.2012



IMO A. 206.				IMO A.562					
Area 0 to 40° or Θf		> 0.08	0.113	A (M2)	772	K	0.984	$\Theta 1$	16.97
GoZ (Max) (m)		> 0.25	0.526	Z (m)	8.17	X1	0.970	$\Theta 2$	50.0
GoM (m)		> 0.10	0.252	W (T)	10440.09	X2	1.000	Θc	65.5
Judgement			Yes	LW 1	0.031	S	0.035	ΘF	67.0
Θf : Angle of down flooding or 40 which ever is less				LW2	0.047	R	0.759	Area b	0.165
				OG (m)	0.358	Ang.x 0.	6.7	Area a	0.023
				T	29.864	$\Theta 0$ limit	16°	b/a ≥ 1	7.056
				C	0.390	$\Theta 0=$	3	Judge.	Yes
Angle limit: 16° or ang.x0.8 whichever is less									

Stability of departure condition on 5 September 2012:

1. The deck height of 5.92 m was used in corresponding to the full load capacity on deck. Those correct KG data of fresh water and diesel oil were used corresponding with the volumes in tanks from the stability booklet. The stability elements on departure were as follow:

- .1 General stability criterions of IMO Res.A.206(VII) were all met: GoM =0.252 m, RMA from 0 to 40° = 0.113 m.rad, and GZmax=0.526 m;
- .2 Criterions of IMO Res. A.562(14) (Stability requirement in wind and waves) were all met: The Heeling angle Θ_0 3° and area b is greater than area a. Rolling period 29.9 S;
- .3 But the GoM of 0.252 m was found just on the margin line of Acceptable Zone in the permissible GoM chart.

2. It was found the GoM of 0.252 m was much less than the 0.64 m which was calculated by ship's staff. The incorrect height figures of deck cargo and KG data of Fresh water and Diesel oil were used in the ship's calculation.

Conclusion: The stability on departure condition met all the criteria of stability elements, and also in the Acceptable Zone of Permissible GoM chart. But it was on the margin line of Acceptable Zone.

3. Condition at sea on 15 September 2012, should consider the followings:

- i. According to IMO Res.A.206(VII), the assumption of 10% (269 mt) increase at weight on deck cargo. It would cause the rising of gravity centre (KG).
- ii. On 15 Sep. 2012, water was accumulated up to 2 metres in No.1 Cargo hold. The free surface effect of the water in No. cargo hold would be enormous.
- iii. The consumption of fuel oil (about 90 mt) in double bottom tank would reduce the GoM also.

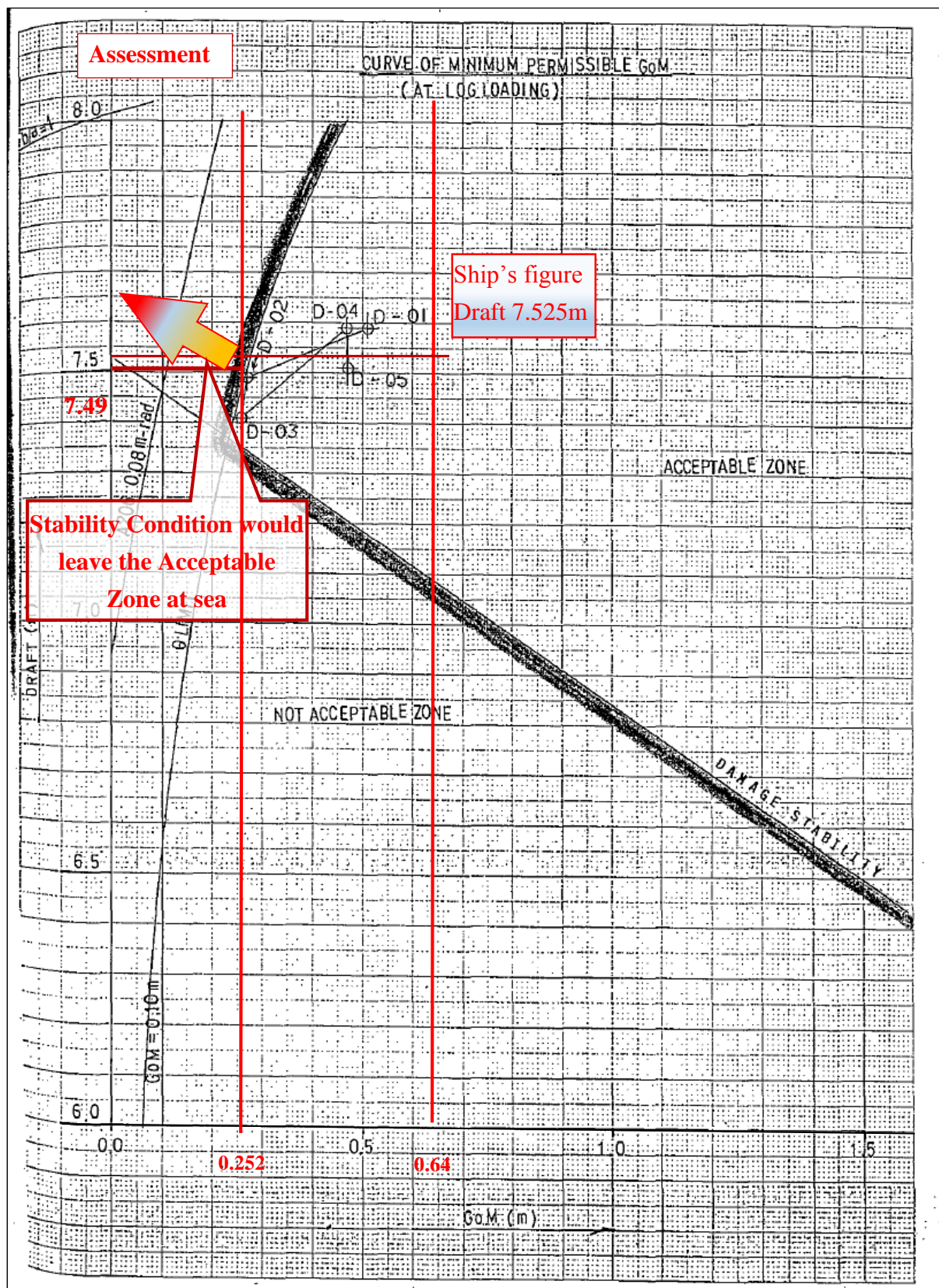
Considering the above adverse effects, the stability would be worsened from the departure condition. It was deduced that the stability condition on 15 Sep.2012 would not be not inside the Acceptable Zone any more.

4. The sea area of Taiwan Strait is summer zone. After the assumption of 10% weight increasing of deck cargo due to water absorption (269 mt), and consumption of about 90 mt of fuel oil, the ship's displacement was 10619 mt

($10440 + 269 - 90 = 10619$ mt). Further considering the water entered into No.1 cargo hold, therefore the displacement was over the summer displacement of 10565 mt. The vessel might be overloaded.

5. In order counter balancing the list of the vessel, more ballast water was put into the No.2 starboard ballast tank, the vessel might be overloaded further.
6. After the loss of some deck logs, the stability would be improved from above condition. The collapse / loss of deck cargo was considered as a jettison of deck cargo to improve the stability of the vessel.

CURVE OF MINIMUM PERMISSIBLE GoM (AT LOG LOADING)



By plotting the GoM of Assessment condition & ship's calculation to the Permissible GoM chart,

1. Assessment (on departure) : GoM 0.252 m was on the margin of Acceptable Zone;
2. Ship's assessment (Departure) : GoM 0.64 m was in the acceptable Zone, but the figure was not reliable due to multiple incorrect figures were used in the calculation.
3. Considering the displacement would be increased on her voyage (draft became more), and GoM would decrease. The stability of the vessel would leave the margin line of *Acceptable Zone* and fall into **Not Acceptable Zone** as the arrow indicating.