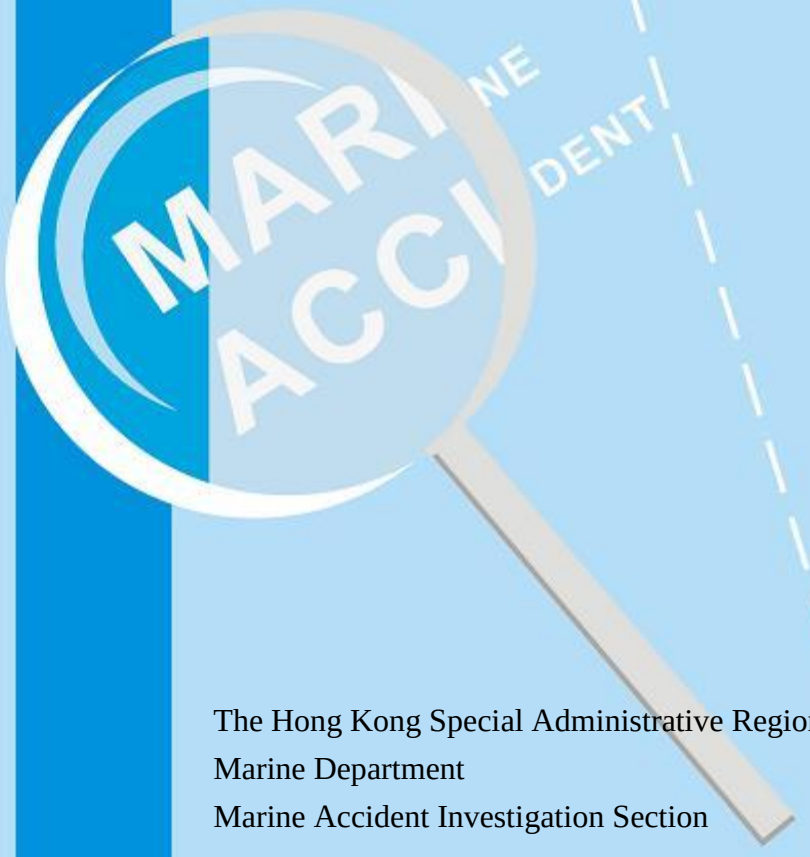
Report of Investigation into the Sinking of Hong Kong Registered General Cargo / Log Carrier *New Lucky VII* at Sea West of Amami Oshima, Japan on 03 April 2012



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

30 May 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 towards 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 A Hong Kong registered general cargo/log carrier *New Lucky VII*, fully laden with logs cargo inside cargo holds and on deck, departed from Rabaul, Papua New Guinea on 24 March 2012 for the discharge port in Jingjiang, Jiangsu Province, China.

1.2 At about 0730 on 3 April 2012, while the vessel was sailing on a course of approximately 310° and a speed of about 10 knots at the sea west of islands of Okinawa and Amami Oshima, she encountered gusty wind of over 60 knots which became wind shear suddenly from port side (southerly) to starboard side (northerly). Together with boisterous seas, it caused the vessel heeled heavily to port side and capsized within 20 minutes. Subsequently, she sank at about 0804 at position 28º15.753'N 128º 06.834'E about 55 nautical miles west of Amami Oshima, Japan.

1.3 All the 17 crewmembers on board fell into the sea from the vessel. Eventually, nine crewmembers, including the master of the vessel, were able to climb on board a liferaft which floated free at sea but was inflated manually by the bosun. Other two crewmembers boarded a lifeboat which was detached from the vessel before sinking. After about 58 hours of drifting at sea, the 11 crewmembers were finally rescued by the Japanese Coast Guard at about 1800 on 5 April 2012. However, the remaining six crewmembers were still missing.

1.4 The investigation into the accident revealed the following main contributing factors:

a) The vessel encountered a gusty wind of over 60 knots in boisterous seas;

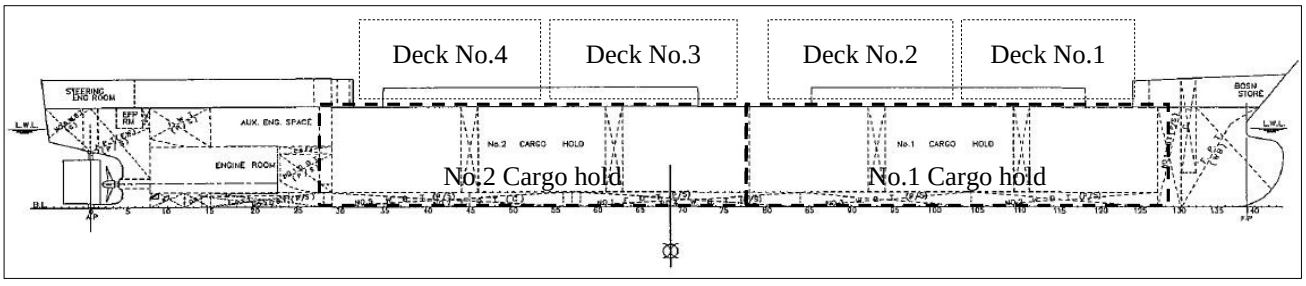
b) The master of the vessel did not ensure his vessel's stability was safe before proceeding to the sea;

c) The master of the vessel did not ensure all lifesaving appliances on board were in working order and/or ready for immediate use before the voyage; and

d) The shore management company could not be contacted by the master in emergency and the safety alertness of the shore management was low (there was no immediate effective actions taken to ensure safety and the whereabouts of the vessel after losing regular contact with her). The search and rescue operation was therefore delayed

2. Description of the Vessels

Flag	:	Hong Kong, China
Port of Registry	:	Hong Kong
Official Number	:	HK-3195
IMO No.	:	9341029
Call Sign	:	VRIV4
Ship Type	:	General Cargo/Log Carrier
Keel Laid	:	27 June 2008
Year of Built (Delivery)	:	20 July 2011
Gross Tonnage	:	4143
Net Tonnage	:	2473
Length (Overall)	:	102.79 m
Breadth	:	17.0 m
Main Engine	:	Hanshin LH41LA
Engine Power	:	2,250 (3060 PS) @ 227 rpm
Service Speed	:	12 knots
Classification Society	:	Nippon Kaiji Kyokai (NK)
Shipbuilder	:	Saigon Shipbuilding Industry Company
Owner	:	Franbo Loyalty Line Limited
Management Company	:	Franbo Lines Corporation
Operator	:	Franbo Lines Corporation
Minimum Safe Manning	:	15
Number of crew on board	:	17
Cargo compartments	:	Cargo hold: No. 1 Cargo hold, No.2 Cargo hold
		On deck: No.1, No.2, No.3, No.4 Deck space.



Cargo compartments distribution of *New Lucky VII*

Fig. 1 – *New Lucky VII* on delivery in shipyard

Fig. 2 – Photo shows *New Lucky VII* fully laden with logs

3. Sources of Information

3.1 The statements provided by the master and the crew of *New Lucky VII;*

3.2 The information provided by ship management company of *New Lucky VII*;

3.3 The search and rescue information provided by Japan Coast Guard via Japan Transport Safety Board (JTSB);

3.4 The weather information provided by the Meteorological Office of Amami, Japan via JTSB.

4. Outline of Events

All times are local time in Japan (UTC+9) unless otherwise specified.

4.1 On 24 March 2012, *New Lucky VII*, a 4143 gross tonnage Hong Kong registered log carrier laden with full cargo of logs of about 5961 tonnes, sailed at 1748 local time (UTC+10) from Rabaul, Papua New Guinea to Jingjiang of Jiangsu Province, China near Chang Jiang Kou. According to the final draft survey report on her departure, the draft was 6.81 m forward, 7.82 m aft, and the displacement was 9313.833 mt[1].

4.2 The vessel was sailing in a northwesterly direction on the planned route via Guam and Okinawa islands smoothly for days until 3 April 2012. In the morning of 3 April 2012 when shifting watch from the second officer to the chief officer at 0400, the wind was blowing at about 20 to 25 knots from port quarter. The vessel was sailing at a speed of about 10.8 knots with course about 314° to 316° (316°was the planned course). The sea condition was slight.

4.3 At about 0400, the vessel passed the Okinawa and Oshima and entered East China Sea. At about 0600, the chief officer, who was on watch in the bridge with an Able-Bodied (AB) seaman, called the master and informed him that he would adjust the course at the next waypoint towards Chang Jiang Kou (a route point to her destination port Jiangjing) in accordance with the planned route. The master came to the bridge later and found ship's heading had been adjusted by the chief officer to the planned course, i.e. 300°. He checked the anemometer and found that the wind blew from about 2 points abaft port beam (i.e. about 180°, southerly) with a varying velocity readings of 15 to 20 knots, and also found that the heights of waves combined with swells at sea were about 3 to 4 m and the swells were from the same direction of wind, i.e. southerly.

4.4 As the vessel was rolling slightly, the master instructed the chief officer to adjust the heading to 310°. After the heading of the vessel was steered to 310°, she proceeded steadily with rolling range reduced. Before the master left the bridge, he ordered the chief officer to maintain that condition.

4.5 At about 0700, the chief engineer came to the bridge. According to the chief engineer, the vessel was rolling slightly about 1° to 2°, wind was blowing with speeds of about 30 to 40 knots from starboard bow as shown in the anemometer (i.e. about 360°, northerly). Then he left the bridge and went to the engine room for a routine check.

[1] mt stand for Metric Tonne

4.6 At about 0730, recalled by the duty AB on the bridge, the wind was blowing very strongly at 50 to 60 knots from starboard side and the sea condition changed rapidly to very rough. The vessel heeled to port side heavily in a very short time without returning back upright. He heard alarm sounded possibly from the main engine tripping alarm. The period was about 20 minutes from the start of gusty wind until the vessel capsized with all the crew fallen into the sea.

4.7 At about 0740, while the chief engineer was taking breakfast in the mess room after he finished his routine rounds in the engine room, the vessel was suddenly heeled to about 15° port without righting back. Almost immediately just one or two seconds later as recalled by the chief engineer, the vessel was further heeled about 30° to 45° to port.

4.8 Having felt the vessel heeled suddenly, the master came up the bridge from his cabin immediately and found the vessel had already heeled to about 45° to port with the deck edge submerged into the sea. The master then switched the steering gear from auto pilot mode to manual mode. He then put the rudder to hard a port in order to righting up the vessel but was in vain. With the vessel's heeling persisted, the master called the management company via satellite telephone (Inmarsat F) but received no answer.

4.9 The second officer was asleep in his cabin after watch and was awakened by the heeling of the vessel. He took his lifejacket and went to the bridge. He fell down and injured his head due to a further heeling of the vessel while he was entering the bridge. The third officer also arrived at the bridge and stayed with the chief officer beside the chart table located at the starboard side of the bridge.

4.10 As the vessel was not righting up and there was no answer of telephone calls from the management company, the master decided to evacuate from the bridge with the chief officer, the second officer, the third officer and the duty AB. The master got a lifejacket from the third officer. He reported to the master that he had pressed the distress button but not mentioned which distress button before leaving the bridge.

4.11 When the vessel was heeled, the chief engineer ran towards the engine room for checking. At the entrance of the engine room, he met the first engineer and the Fitter while they were coming out. The fitter informed the chief engineer that the main engine and generators were all tripped. The chief engineer asked the Fitter to come with him to close the quick closing valves located in the emergency station at the port side of the vessel. However, due to severe heeling of the vessel to port side, they turned back.

4.12 After the chief engineer and the Fitter evacuated from the crew accommodation, they intended to launch the port side liferaft, but found that it had already fallen into the sea and drifted away without inflated. They went to the starboard side of the crew accommodation.

4.13 During mustering for evacuation, all crew members were standing on the starboard external vertical bulkhead of the accommodation with the vessel being heavily heeled. The master ordered to remove the lashings of the starboard liferaft and lifeboat for launching, but they could not be launched due to the heeling of the vessel. When the heeling of the vessel reached about 90°, the liferaft was brought down on the bulkhead of the accommodation, which became almost horizontal. But the crew could not launch it into water.

4.14 The vessel's stern was gradually submerged and seawater started rushing in and flooding the place where the crew mustered. The crew abandoned the launching of the starboard liferaft and lifeboat due to the waves. At that time, the chief engineer, the Fitter and an Oiler were clinging to the aft mast to dodge the waves while all other crew members had been swept into sea.

4.15 Having been swept into sea and seeing a packed liferaft floating nearby, the bosun dived into the water and pulled the painter to inflate the liferaft. After that, he climbed into the liferaft. The chief engineer, the Fitter and the Oiler jumped from the aft mast into the sea and boarded the liferaft. Thereafter, another five crew members, including the master also embarked on that liferaft. Under strong winds and heavy seas, the liferaft drifted quickly away from the sinking vessel with a total of nine crewmembers aboard. The master saw the forecastle of the vessel protruding above the water surface with the stern immersed.

4.16 The second officer clung to a piece of log floating on the sea. He saw an inflated liferaft which probably was the one with the nine crewmembers on board at a distance away from him. Thinking that it was impossible for him to swim to that liferaft, he gave up. Then, he saw No.2 lifeboat which was from the port side of the vessel drifting behind him. The second officer managed to board the lifeboat which had been partially damaged at forward and aft as well as to her canopy. Later, the second officer helped the cook who was holding a lifebuoy floating nearby to board the lifeboat (Fig. 3).

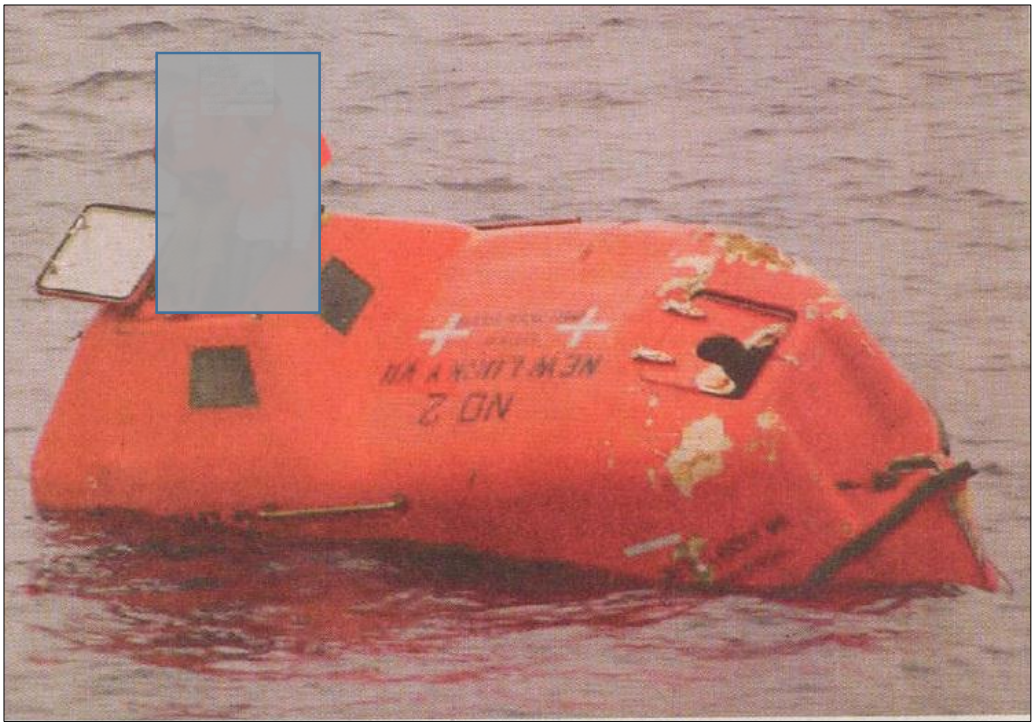


Fig. 3. – *No.2 lifeboat (partly damaged) with two survivors on board drifting at sea*

4.17 The remaining six crewmembers were clinging to pieces of log in the rough sea and were drifting farther away from the lifeboat and liferaft. The crewmembers on the liferaft tried to manoeuvre the liferaft against the wind and current to save them but it was in vain.

4.18 Due to mal-function of the port lifeboat engine (according to the second officer, the engine was under repair before departure of the loading port), the second officer, who was injured and exhausted, was unable to row the lifeboat with the cook to rescue the remaining crewmembers drifting in the rough sea. In the following days, they used their lifejacket lights as a means to attract the attention of others in the sea. There were no food ration on board the lifeboat and they could only sustain their life with fresh water. While drifting at sea, they had seen three vessels in different occasions at about 5 nautical miles away from them. As they had no pyrotechnic signals, radio apparatus or daylight signalling mirror on board (these items had been stowed in ship's store while the vessel was staying in the loading port but were not put back into the lifeboat), they could not attract those vessels' attention. Three days after the accident, they were rescued by the Japanese Coast Guard. Both of them were very weak and in poor health conditions but not life-threatening. They were sent to the hospital in Japan for treatments.

Search and Rescue operation

4.19 Without receiving the morning report from *New Lucky VII*, the ship management company sent emails at 1123 and 1716 on 3 April 2012 to the master of the vessel asking for the report but received no response. The last master's report to the company was received on 2 April 2012.

4.20 The last AIS position of the vessel was at 0704 Beijing time (UTC +8) on 3 April 2012 at position 28°15.753'N 128°06.834'E. On 4 April 2013 at about 1400 Beijing time, the local agent of the vessel in Shanghai, China tried to contact the vessel to confirm the vessel's Estimate Time of Arrival (ETA) Chang Jiang Kou, scheduled to be 1700 on 4 April 2013, but in vain. The agent informed the management company of the loss contact. The ship management company notified the Hong Kong Maritime Rescue Coordination Centre (MRCC) at 2315 Hong Kong time (UTC + 8) on 4 April 2012 (i.e. about 40 hours after the vessel had sunk). The Hong Kong MRCC confirmed that they received no distress alert signal from *New Lucky VII*. The Japanese Coast Guard and China MRCC were requested to assist in the search and rescue (SAR) operation for the vessel in the sea area of her last AIS position.

4.21 At 1330 on 5 April 2012, the Japanese Coast Guard's helicopter and ships launched the SAR operation. At about 1700 on the same day, a lifeboat without crew on board (No.1 lifeboat) and a lifeboat with two crew members on board (No.2 lifeboat) in approximate position 27°41.39'N, 127°43.09'E were located (Fig.4). Also about one hour later, the liferaft with a total of nine crewmember inside was found at position 27°31.9'N 127°57.2'E. Oil sheen was found in position 28°17.6'N, 128°03.8'E. Eventually the 11 crew members were rescued about 58 hours after the accident. The rest of the six crewmembers of the vessel could not be found and the SAR operation stood down on 11 April 2012.

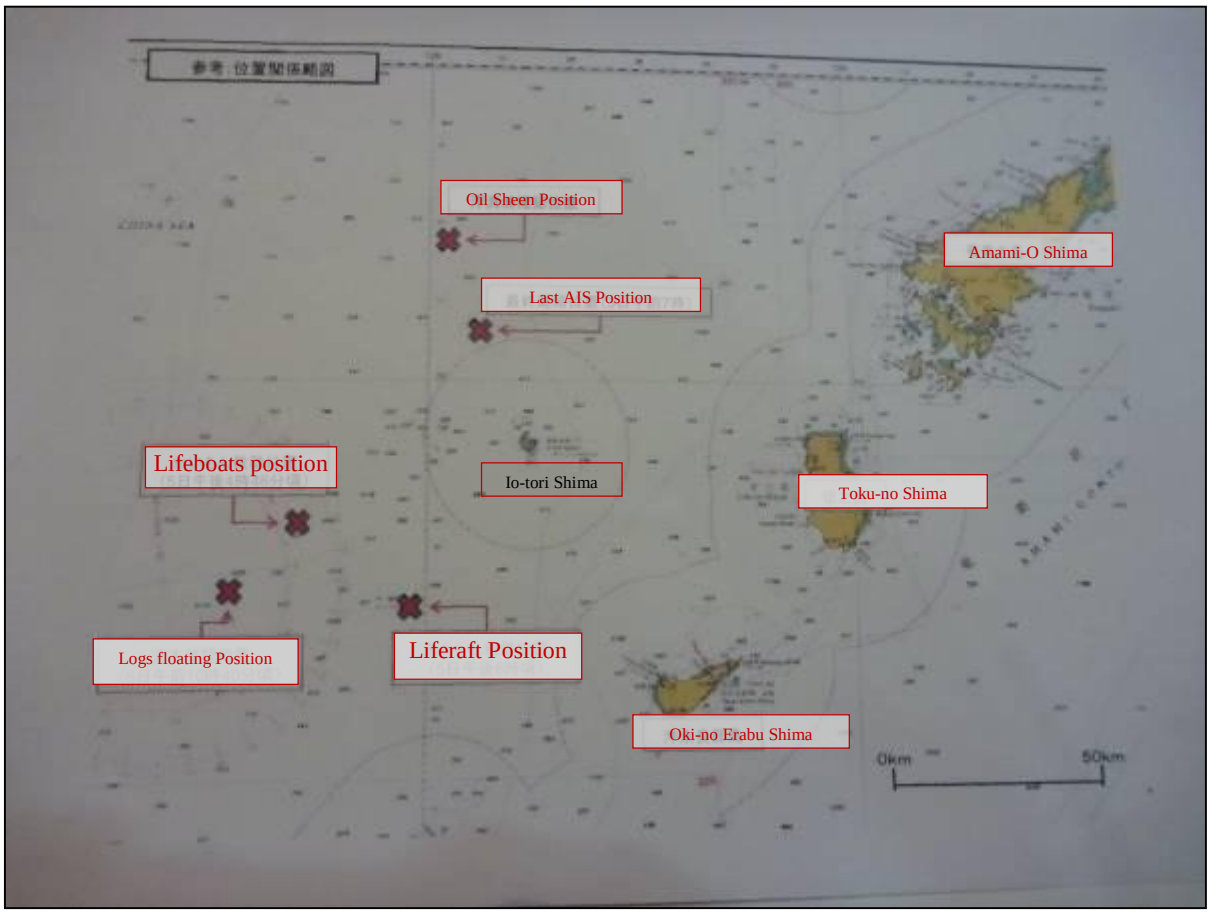


Fig. 4 – The positions of findings in the SAR operation on 5 April 2012

5. Analysis

Certification of the vessel

5.1. The ship certificates were issued by Classification Society of the vessel - Nippon Kaiji Kyokai. The Document of Compliance (DOC) for the ship management company for safe operation of vessel and the ship Safe Management Certificate (SMC) were issued by Bureau Veritas. All statutory certificates for the vessel were valid at the time of the accident.

5.2. There were no reports of structural problems of the vessel received by the ship management company since the vessel delivered. The crew also did not raise any problem with respect to ship's structural or operational condition in their witness statements.

Manning, Qualification and Experience of Personnel

5.3. The vessel was manned by a master, chief officer, second officer, third officer, chief engineer, first engineer, third engineer, fourth engineer, bosun, 4 able-bodied Seamen, 1 fitter, 2 oilers and 1 cook.

5.4. The master and his three navigation officers held valid certificates of competency. The master had long experience working on log carriers. He joined *New Lucky VII* in December 2011. The chief officer joined the vessel in July 2011 upon new delivery of the vessel.

5.5. The chief engineer and his engineer officers held valid certificates of competency. The chief engineer had years of experience working on log carriers.

Ship stability

5.6. At about 0730 on 3 April 2012, the vessel encountered very strong wind of over 60 knots from the starboard side and the sea condition was very rough. She heeled to port side heavily in a very short time without returning back to upright position. At about 0740, the vessel had been heeled to port side about 30° to 45°. At about 0750, the vessel capsized (i.e. 90^{o} to port side). Before the vessel heeled to port side, no crew witnessed the collapse of deck cargo. Therefore, vessel's heeling heavily to port side was not contributed by cargo shifting or collapsing.

5.7. Detailed information on ship's stability before departure from the loading port on 24 March 2012 was not available. The master did not provide details of ship stability upon departure on 24 March 2012 in his daily report to the ship

management company. When enquired by the company, the Master only replied on 26 March 2012 stating that the GoM was 0.20m and ship draught of 7.32 m after filling up No.1 port and starboard ballast tanks on 24 March 2012, and the trim changed from 1.0 m to 0.50 m by stern. The water in No.1 starboard ballast tank was later pumped out to reduce listing of the vessel due to heavy fuel oil consumed in the port side tank. The company's enquiry about the substantial difference in the aft draft readings was not responded by the Master in his email.

5.8. The ship stability booklet of *New Lucky VII* was approved by the Classification Society of the vessel - Nippon Kaiji Kyokai in compliance with the requirements of Resolution A. 749(18) - Code on Intact Stability for All Types of Ships Covered by IMO Instruments as amended (*the Code*). Paragraph 4.1.3 of *the Code* stipulates the recommended stability criteria for cargo ships carrying timber deck cargoes, quoted below:

4.1.3.1. The area under the righting lever curve (GZ curve) should not be less than 0.08 metre-radians up to $\Theta = 40^o$ or the angle of flooding if this angle is less than 40^o ;

4.1.3.2. The maximum value of the righting lever (GZ) should be at least 0.25 m; and

4.1.3.3. 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.

5.9. Paragraph 3.2 of *the Code* stipulates severe wind and rolling criterion (weather criterion). The ability of a ship to withstand the combined effects of beam wind and rolling should be demonstrated for each standard condition of loading. According to *the Code*, when a ship is subjected to a steady wind pressure acting perpendicular to its centre-line, a steady wind heeling lever will result. The angle of heel under action of steady wind should be limited to a certain angle to the satisfaction of the Administration. As a guide, 16° or 80% of the angle of deck edge immersion, whichever is less, is suggested. When the ship is then subjected to a gust wind pressure which results in a gust wind heeling lever, area "b" should be equal to or greater than area "a" under these circumstances (Fig. 5).

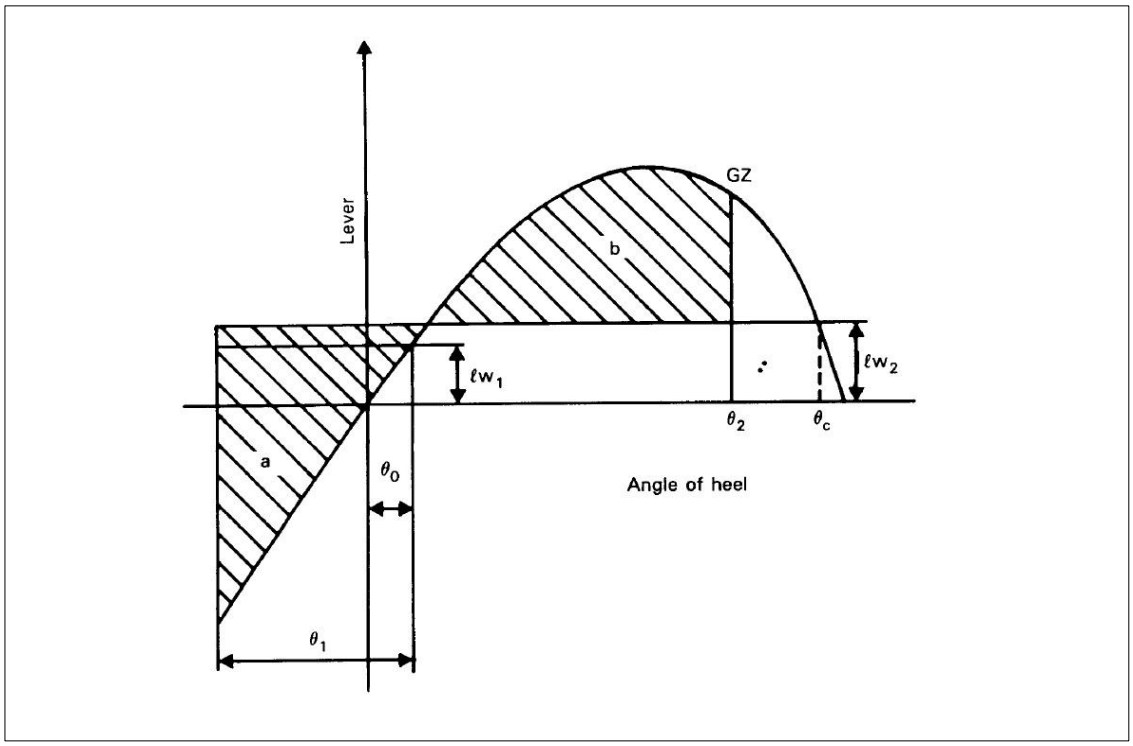


Fig.5 – Sever wind and rolling stability criteria.

5.10. The principle particulars of the vessel are provided in Appendix 1.

5.11. Before vessel departed from the loading port (Tropical Zone) on 24 March 2012, the GoM and mean draft of the vessel reported by the master were respectively 0.20 m and 7.32 m. Based on these information and using it to plot on the GoM Diagram (Timber Deck Cargo) provided in the ship stability booklet, it was apparent that the ship's intact stability was inadequate (i.e. it fell outside the Safety Zone of the GoM Diagram), implying that she was not stable upon departure (refer Appendix 2).

5.12. The ship stability was assessed in accordance with the stability booklet of *New Lucky VII* after the accident. The loading condition of the vessel was provided by the ship management company who received daily reports from the master of the vessel. Upon departure of the vessel on 24 March 2012 with No.1 port ballast tank filled up, the stability curve as shown in Appendix 3 was generated. It revealed that the vessel only met the stability criteria regarding GoM at departure which was 0.15 m (over 0.10 m), but not the criteria of area under curve which was 0.03 m.rad (less than 0.08 m.rad.), and the maximum righting lever (GZ) which was 0.17 m (less than 0.25 m).

5.13. On the day of 3 April 2012 prior to capsizing of the vessel, presuming the fuel oil and fresh water on board were about 108.31 mt and 69.5 mt respectively, the stability curve as shown in Appendix 4 was generated. The calculation was

made without taking into account of the probable increase in weight of deck cargo. It revealed that the GoM was reduced to 0.07 m, and the area under curve and the maximum righting lever (GZ) was 0.02 m.rad and 0.14 m respectively. Moreover, if taking into account of a 10% increase in weight of deck cargo on sea passage (refer to paragraph 4.1.8 of *the Code*), the vessel would have been overloaded (i.e. Summer Zone) and the stability even worse.

5.14. Summarizing above considerations in paragraph 5.11, 5.12 and 5.13, the stability of the vessel was not in conformance with Resolution A.749 (18) "Code on Intact Stability for All Types of Ships Covered by IMO Instruments as amended" which is applicable to the *New Lucky VII*.

Weather Conditions

5.15. According to the prevailing weather and sea condition provided by the crew, at 0400 on 3 April 2012, the wind speed was about 20 to 25 knots from port quarter and the sea condition was slight. At 0600, the wind speed was about 15 to 20 knots about two points from abaft port beam and swell was about 3 m to 4 m high from port quarter. At 0700, the wind speeds were about 30 to 40 knots from starboard bow. At about 0730, the wind was blowing from starboard side and increased abruptly to 50 to 60 knots, and the sea condition became very rough.

5.16. According to the Surface Analysis Charts provided by the Japan Meteorological and Hydrological Services (JMH), at 0300 3 April 2012, a low pressure system of about 986 hp[2] was at a distance about 600 nautical miles north of the position of the accident with the existence of an easterly cold front. The weather warning showed that strong winds in the range from 30 to 60 knots was expected within 900 miles in southeast-semicircle and 500 nautical miles in other area. Also, another gale warning patch was located in the strait of Taiwan. Therefore the rough sea condition, compounded with long swell caused by the strong wind, could be encountered by *New Lucky VII* in the sea area west of Amami Oshima. (Fig.6 & 7).

[2] hp: hectopascal, standard atmosphere = 1,013.25 hPa.

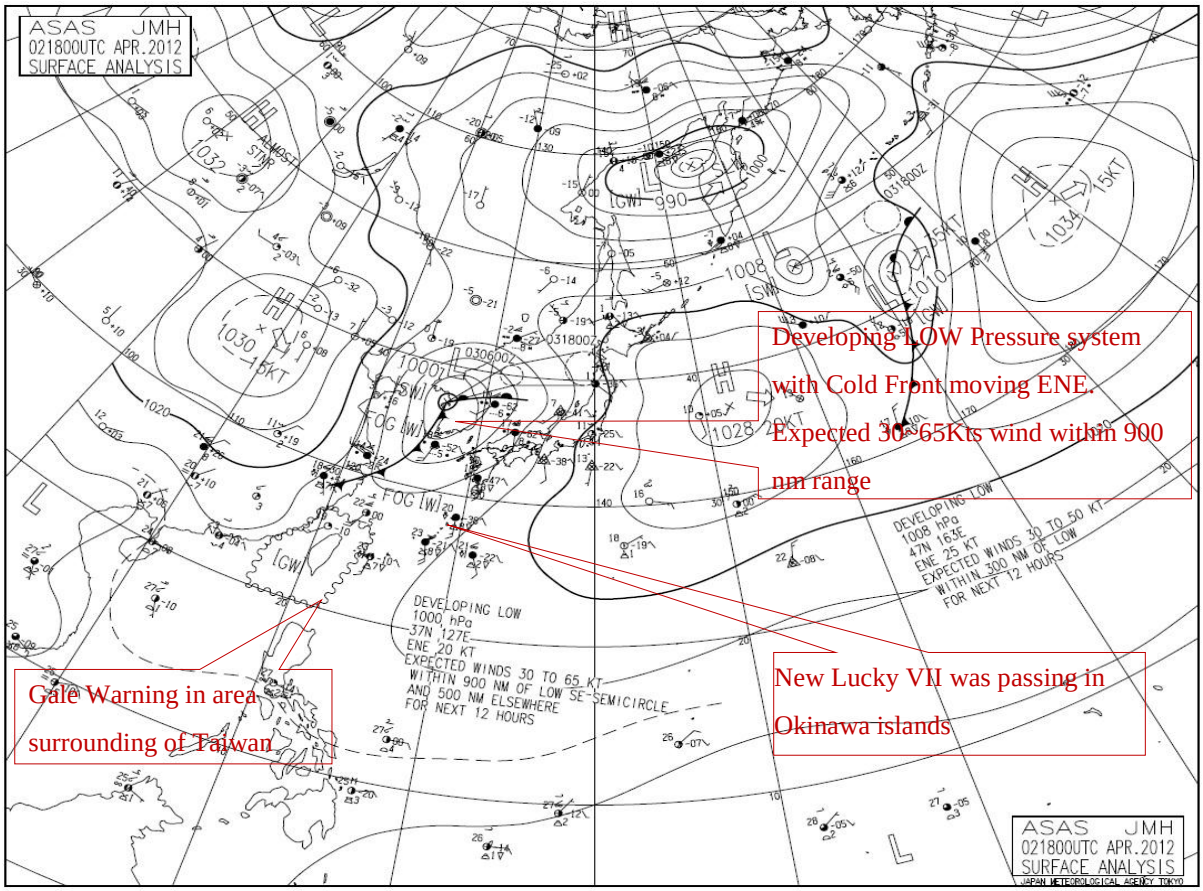


Fig. 6 – Surface analysis at 0300 (UTC+9) of 3 April 2012

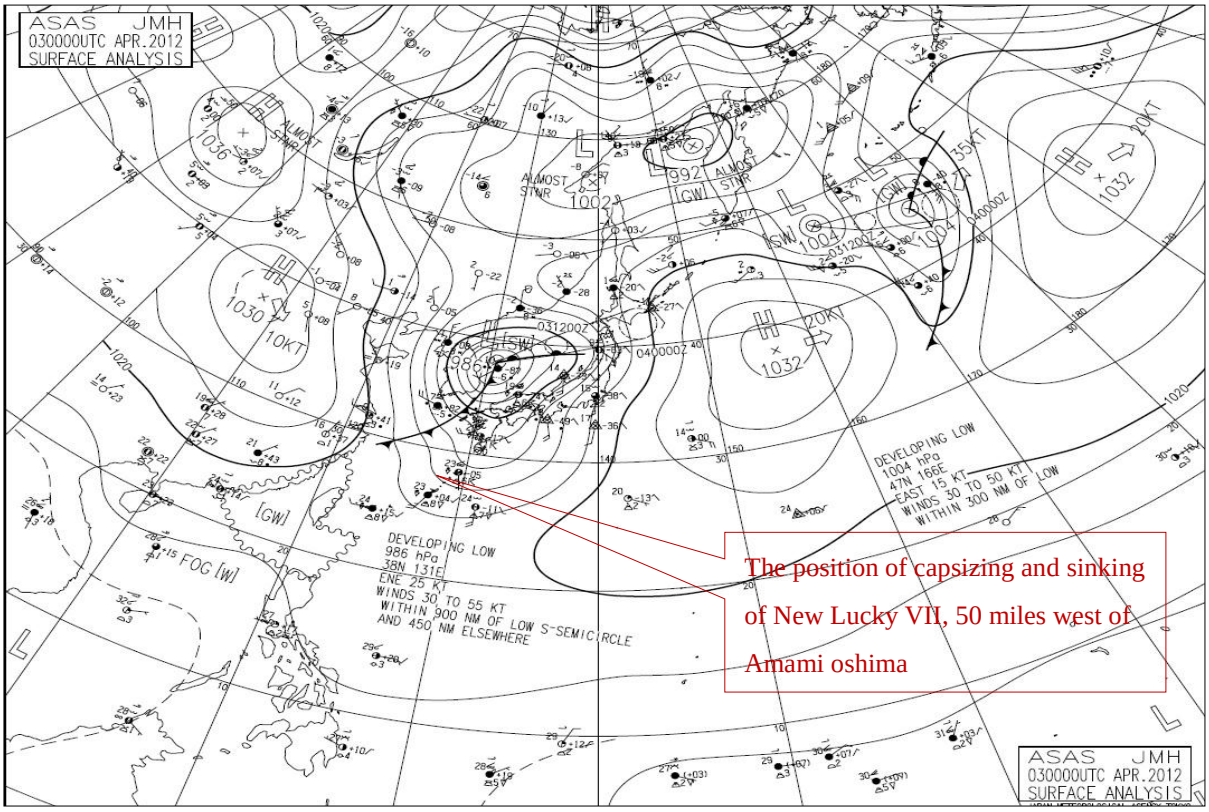


Fig.7 – The Surface Analysis at 0900 (UTC + 9) of 3 April 2012.

5.17. According to the observatory report provided by the Naze meteorological station of Amami Oshima, (Fig.8) at about 0700, the wind was southerly with a speed of 5.4 m/s (10.5 knots), and there was no significant change until 0940. The wind-shear was recorded from southerly to northerly direction with an average speed of about 4.8 m/s (9.3 knots) at 1030, momentary maximum wind speed of 15.4m/s (30 knots).

名瀬 2012年4月3日 （10分ごとの値） 一覧

時	気圧(hPa)		降水量	気温	相対湿度	風向・風速(m/s)				日照時間
	現地	海面	(mm)	(℃)	(%)	平均	風向	最大瞬間	風向	(分)
07:00	1010.1	1011.1	0.5	21.3	88	5.4	南	11.8	南	0
07:10	1010.3	1011.3	0.5	21.3	89	4.7	南	9.5	南南西	0
07:20	1010.5	1011.5	0.5	21.4	88	3.8	南	7.8	南	0
07:30	1010.4	1011.4	0.5	21.5	88	5.9	南	10.5	南東	0
09:30	1010.1	1011.0	0.0	23.3	79	3.9	南	7.5	南南西	0
09:40	1011.9	1012.9	6.0	21.5	84	4.8	西南西	15.4	西北西	0
09:50	1011.9	1012.9	0.5	20.7	84	2.8	北東	7.9	北北西	0
10:00	1011.8	1012.8	0.0	20.8	84	2.4	北	5.3	北西	0
10:10	1012.0	1013.0	0.0	21.0	75	5.5	北	12.5	北北西	0
10:20	1012.1	1013.1	-	20.9	74	4.3	北北西	12.2	西北西	0
10:30	1012.5	1013.5	-	20.3	75	6.1	北北西	12.9	北	0

Fig.8 – The weather recorded at Amami Oshima on 3 April 2012

5.18. The local fishing organization (Setouchi Fisheries Cooperative Association, Amami Oshima) observed that the sea condition, in the area from 2 to 4 April 2012, was extremely boisterous, more than the condition caused by a super typhoon. Accordingly, the waves at sea would be more than 3 m high near the fishery port, and above 5 m high off the coastline. They considered the weather condition was due to the passing of weather front.

5.19. Considered the distance from Amami Oshima to the last AIS position of *New Lucky VII*, it was probable that the vessel encountered the low pressure system at about 0700 to 0800 on 3 April 2012. The vessel experienced gusty wind and abrupt change of wind direction from southerly to northerly (i.e. wind direction changed from port side to starboard side of the vessel). The sea condition became boisterous.

5.20. The wind sheared suddenly from port to starboard, gusting up to about 60 knots or more and the subsequent boisterous seas were considered a main contributing factor to cause the excessive heeling and capsizing of the vessel.

Passage plan

5.21. Before departure, the master instructed the second officer to prepare two voyage plans from Rabaul, Papua New Guinea to Chang Jiang Kou, China for his consideration. The second officer prepared two passage plans listing out the waypoints. One route was to pass through Guam, Islands of Okinawa and Amami Oshima; and the other through north of Papua New Guinea, east of the Philippine and east of Taiwan. The former route was about two days shorter and was adopted by the master.

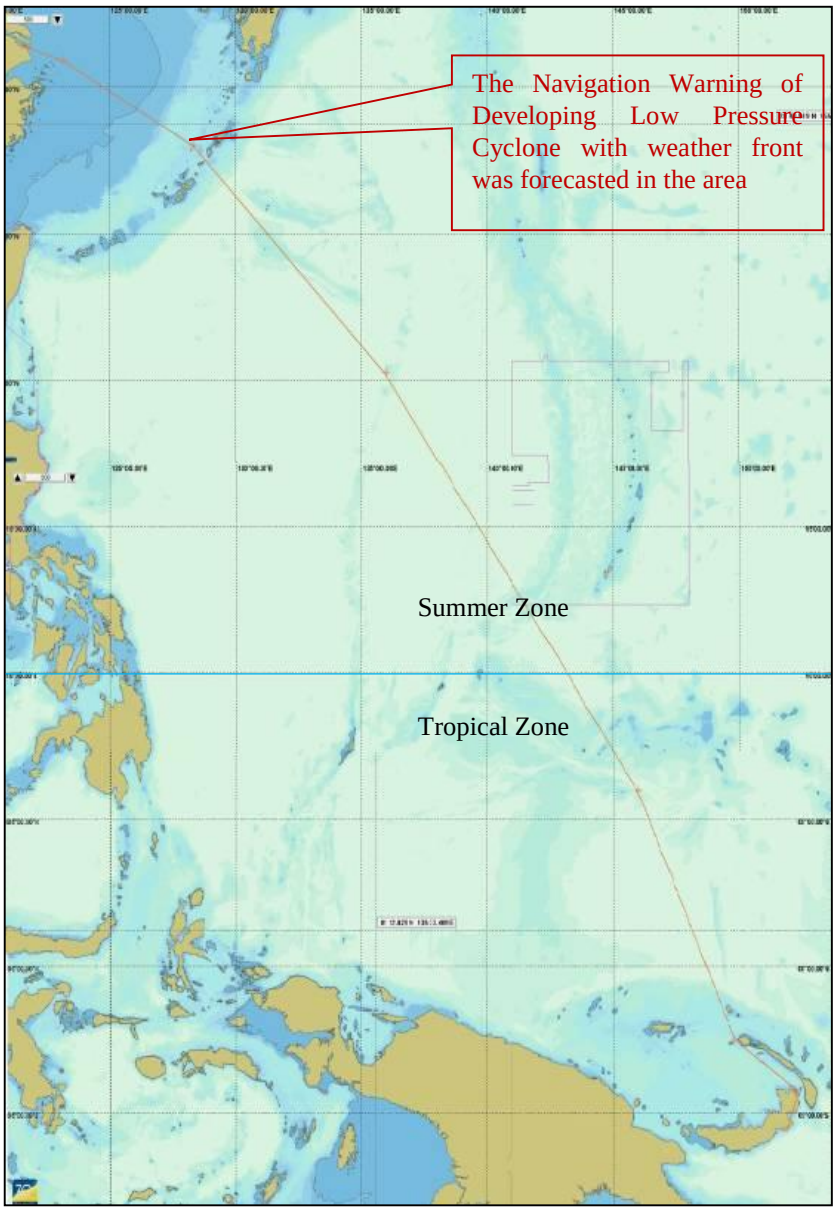


Fig. 9 - The voyage plan via Guam and Amami-Oshima

5.22. However, the master of the vessel did not consider the possibility of adverse weather and sea condition usually occurring in East China Sea during the first half of the year of monsoon wind season. There was no contingency plan

prepared for abortion, deviation or sheltering.

5.23. Before the vessel passing Okinawa and Amami Oshima where adverse weather system should have been foreseen, the master of the vessel did not consider making any deviation of courses and/or seeking shelter for the safety of the crew and vessel.

Emergency preparedness of vessel

5.24. There was no evidence to show that the master had made any announcement for abandoning ship. When the vessel heeled to 45^{o} to port, he left the bridge without making the announcement for abandoning ship, sounding emergency alarm or broadcasting the emergency situation. The crew eventually mustered by themselves at the starboard side of the accommodation with some of them without wearing lifejackets. It might be due to vessel heeled so suddenly and that it was still in the early morning.

5.25. The vessel was equipped with two sets of VHF, one set of MF/HF radio, one set of Inmarsat-C on bridge and one set of Satellite 406MHz EPIRB[3] at the port side bridge wing. All these devices could be used to transmit distress signals in case of emergency. When the vessel sank, the EPIRB, which was fitted with a hydrostatic release device, should be able to float free from its mounting and transmit distress signal automatically. However, there was no distress signal received by Hong Kong MRCC or other ship/shore stations after the accident. As the vessel heeled heavily to port side, it was probable that the EPIRB could have been trapped by hull structure even though it was released. On the other hand, it cannot be verified that the third officer, who was missing in the accident, did have correctly triggered the distress button before leaving the bridge as claimed by the master of the vessel.

5.26. It was evident that the port liferaft, which dropped into the sea when the vessel heeled heavily to the port side, was not properly mounted as it was seen floating at sea without inflated automatically. It was also evident that the port lifeboat, which dropped into the sea and later on embarked by the second officer and the Cook, was found not provided with lifeboat equipment and provisions and that the lifeboat engine had been under repair before the vessel departed from the last loading port.

Emergency preparedness of ship Management Company

5.27. Without any radio equipment, nine crewmembers in the liferaft, and two crew

[3] Emergency Position-indicating Radio Beacon

members on the lifeboat even without pyrotechnic signals were drifting helplessly at sea, while other six crewmembers were floating amid the cargo logs in the boisterous seas since about 0804 on 3 April 2012. On that day when the ship management company did not receive any morning report from the master, it tried two times calling the vessel on that day but failed. It was then assumed that the on board communication equipment of the vessel might have problem. No further attempts were tried out to verify the vessel's position through other means such as using the AIS tracking system on the internet, calling the flag State for assistance to track the vessel through LRIT tracking information, etc.

5.28. While the local agent of the vessel in Shanghai, China could not contact the master of the vessel at about 1400 (GMT+8) on 4 April 2012 to enquire about the estimate time of arrival of the vessel, they reported to the ship management company of the vessel. At 2315 (GMT+8, 9 hours later of the agent's reporting) on the same day, the company reported the situation to the Hong Kong MRCC asking for assistance to trace the vessel. It was confirmed that no distress signal of the vessel was received by Hong Kong MRCC. The last AIS position of the vessel was at 0804 on 3 April 2012 and it was taken as the starting position of the SAR operation.

5.29. The Japanese Coast Guard launched an air search at about 1330 on 5 April 2012. After three and a half hours, two lifeboats and one liferaft were located about 50 miles away from the last AIS position of the vessel. All but six crew members, who were still missing, were rescued.

5.30. If the ship management company had been more prepared and alerted about losing contact of its managed vessel, valuable time for conducting of earlier search and rescue operation for the crew at sea would not have been wasted in this incident and the loss of human lives at sea might have been avoided.

Human factors

5.31. The Master of the vessel did not ensure his ship's stability meeting statutory requirements before proceeding to sea on 24 March 2012. The voyage plan did not have contingency arrangement for abortion, deviation of routes or seeking shelter in case of encountering of severe weather. Before the vessel arrived Okinawa islands and Amami Oshima where adverse weather system should have been received, the master of the vessel did not consider making any deviation of course and/or seeking shelter for the safety of the crew and vessel. The effect on the vessel by gusty winds over 60 knots and boisterous seas, aggravated by inadequate ship stability was the main contributing factor to capsizing the vessel.

5.32. The master did not ensure that life-saving appliances (lifeboats and liferafts) on board were ready for immediate use before sailing. Before evacuation of ship, no distress signal was activated, together with inadequate alertness of ship management company ashore rendered delay in search and rescue operation.

6. Conclusions

6.1 A Hong Kong registered general cargo/log carrier *New Lucky VII*, fully laden with logs cargo inside cargo holds and on deck, departed from Rabaul, Papua New Guinea on 24 March 2012 for the discharge port in Jingjiang, Jiangsu Province, China.

6.2 At about 0730 on 3 April 2012, while the vessel was sailing on a course of approximately 310° and a speed of about 10 knots at the sea west of islands of Okinawa and Amami Oshima, she encountered gusty wind of over 60 knots which became wind shear suddenly from port side (southerly) to starboard side (northerly). Together with boisterous seas, it caused the vessel heeled heavily to port side and capsized within 20 minutes. Subsequently, she sank at about 0804 at position 28º15.753'N 128º 06.834'E about 55 nautical miles west of Amami Oshima, Japan.

6.3 All the 17 crewmembers on board fell into the sea from the vessel. Eventually, nine crewmembers, including the master of the vessel, were able to climb on board a liferaft which floated free at sea but was inflated manually by the bosun. Other two crewmembers boarded a lifeboat which was detached from the vessel before sinking. After about 58 hours of drifting at sea, the 11 crewmembers were finally rescued by the Japanese Coast Guard at about 1800 on 5 April 2012. However, the remaining six crewmembers were still missing.

6.4 The investigation into the accident revealed the following main contributing factors:

a) The vessel encountered a gusty wind of over 60 knots in boisterous seas;

b) The master of the vessel did not ensure his vessel's stability was safe before proceeding to the sea;

c) The master of the vessel did not ensure all lifesaving appliances on board were in working order and/or ready for immediate use before the voyage; and.

d) The shore management company could not be contacted by the master in emergency and the safety alertness of the shore management was low (there was no immediate effective actions taken to ensure safety and the whereabouts of the vessel after losing regular contact with her). The search and rescue operation was therefore delayed.

6.5 The other safety factors revealed by the investigation are :

a) The voyage plan of the vessel from Papua New Guinea to Jingjiang, Jiangsu Province, China sailing on 24 March 2012 did not have contingency arrangement for abortion, deviation of routes or seeking shelter in case of encountering of severe weather;

b) The ship management aboard was not well-prepared for emergency situations such as abandoning ship and transmission of distress signals;

c) The loading of cargo was not well planned. The vessel was overloaded after taking into account of the assumption of a 10% increase in weight of deck cargo on sea passage due to water absorption (refer to paragraph 4.1.8 of *the Code*).

7. Recommendations

7.1 The management company of *New Lucky VII* (i.e. Franbo Lines Corporation) is instructed to review and enhance the safety management system to ensure that procedures for safe operation of ships could be effectively implemented by all responsible persons on board and ashore. Particular attention should be drawn to the following area:

a) stability of vessel meeting the statutory requirements at all times;
b) voyage planning taking into account all relevant requirements stipulated in SOLAS Chapter V Regulation 34 - Safe navigation and avoidance of dangerous situations;
c) operational readiness of all lifesaving appliances on board as stipulated in SOLAS Chapter III Regulation 20.2;
d) emergency preparedness in dealing with emergency situations of all responsible officers on board and management staff ashore meeting the relevant requirements stipulated at Section 8 in Part A of the ISM Code; and
e) the vessel which carries stowed logs on deck should have sufficient additional buoyancy so as to avoid overloading and loss of stability at sea due to the increased weight of the timber deck cargo.

7.2 A Hong Kong Merchant Shipping Information Notice is to be issued to promulgate the lessons learnt from the accident.

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 part or in entirety to that person or organization for their comments.

8.2 The draft report has been sent to the following parties for comments:

1. The owner / management company of the vessel of *New Lucky VII*; and

2. The Shipping Division of Marine Department.

8.3 No submission was received from the parties in 8.2.

Appendix 1 - Principle Particulars, Hydrostatic and Cross Curves Data

1.	Principle Dimensions:	Length over all	:	102.79	m
		Length between P.P. (L.B.P)	:	94.50	m
		Breadth (molded)	:	17.00	m
		Depth (molded)	:	8.80	m
		Draft (Assigned for summer)	:	6.957	m
		Draft (Timber Summer)	:	**7.249**	**m**
		Draft (Timber Tropical)	:	**7.40**	**m**
2.	Gross Tonnage		:	4,143	
3.	Net Tonnage		:	2,473	
4.	Light ship condition:	Draft	:	2.140	m
		Displacement	:	2373.37	mt
		Centre of Gravity from Midship	:	6.60	m
		Centre of Gravity from B.L.	:	7.62	m
5.	Full load condition:	Displacement	:	8761.30	mt
		Deadweight	:	6387.93	mt
		Displacement (Timber summer)	:	**9190.99**	**mt**
		Deadweight	:	6817.62	mt
		Displacement (Timber Tropical)	:	**9415.11**	**mt**
6.	Cargo tank capacity:	Cargo hole (Grain)			
		No.1 Cargo Hold	:	4,015.38	M3
		No.2 Cargo Hold	:	4,485.98	m^3
		Total	:	8,501.36	m^3
		Cargo Hold (Bale)			
		No.1 Cargo Hold	:	3,788.24	m^3
		No.2 Cargo Hold	:	4,252.41	m^3
		Total	:	8,040.65	m^3
		On Deck Log			
		No.1 on Deck log	:	500.69	m^3
		No.2 on Deck log	:	982.67	m^3
		No.3 on Deck log	:	760.90	m^3
		No.4 on Deck Log	:	975.73	m^3
		Total	:	3219.99	m^3
7.	General tank capacity:	Fuel oil tanks	:	364.80	m^3
		Diesel oil tanks	:	80.30	m^3
		Lub. Oil tanks	:	9.95	m^3
		Fresh water tanks	:	209.20	m^3
		Water ballast tanks	:	1,187.67	m^3

8. The data extracted from “Stability Information for the master”

Hydrostatic Data:

Draft Ext (M)	Disp. Full (MT)	TPC (MT)	LCB (M)	LCF (M)	MTC (MT.M)	TKM (M)	VCB (M)	LKM (M)	Corr. Disp. (MT/M)
7.24	9177.668	14.80	-1.01	2.24	98.92	7.23	3.82	106.03	35.02
7.25	9192.47	14.80	-1.00	2.25	99.02	7.23	3.83	105.98	35.13
7.34	9325.90	14.85	-0.96	2.30	99.90	7.25	3.88	105.46	36.07
7.35	9340.76	14.86	-0.95	2.30	100.00	7.25	3.88	105.41	36.17
7.36	9355.62	14.87	-0.95	2.31	100.10	7.25	3.89	105.35	36.27

GZ data from Table of Cross curve (with log):

TABLE OF CROSS CURVE												
Height of Assumed KG Above Base Line			=	0.001	m							
Trim			=	0.000	m							
		Heel Angle (Deg.)										
Draft		5.00	10.00	12.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	85.00
Extreme (m)	Disp. Full (MT)	GZ VALUES (M)										
7.25	9192.47	0.631	1.260	1.511	2.443	3.598	4.730	5.715	6.315	6.614	6.660	6.599
7.30	9266.54	0.632	1.260	1.511	2.442	3.595	4.725	5.706	6.307	6.608	6.656	6.596
7.35	9340.76	0.633	1.261	1.510	2.439	3.592	4.719	5.698	6.298	6.601	6.652	6.593

Freeboard and Deadweight (Timber)

Load line	Freeboard (m)	Draft (m)	Displacement (mt)	Deadweight (mt)
Timber Tropical	1.432	7.40	9415.11	7041.74
Timber Summer	1.583	7.249	9190.99	6817.62

Free board draft : 8832 mm

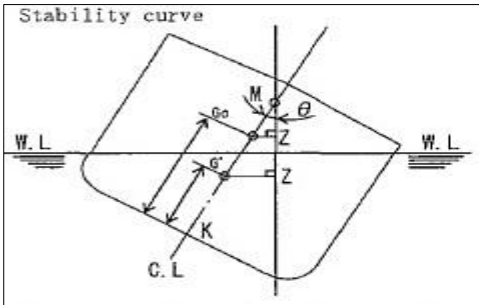
Depth (Moulded) : 8800 mm Deck plate : 18.0 mm Keel Plate : 14.0 mm

AK (Area of Bilge Keel): 14.51 m^2 (estimated)

9. Method for Calculating Stability curve (Assumed VCG'=0.00m method) – extracted from the "Stability Information for the master" :

Stability Curve for timber deck cargo (IMO A. 749(18) 4.1)

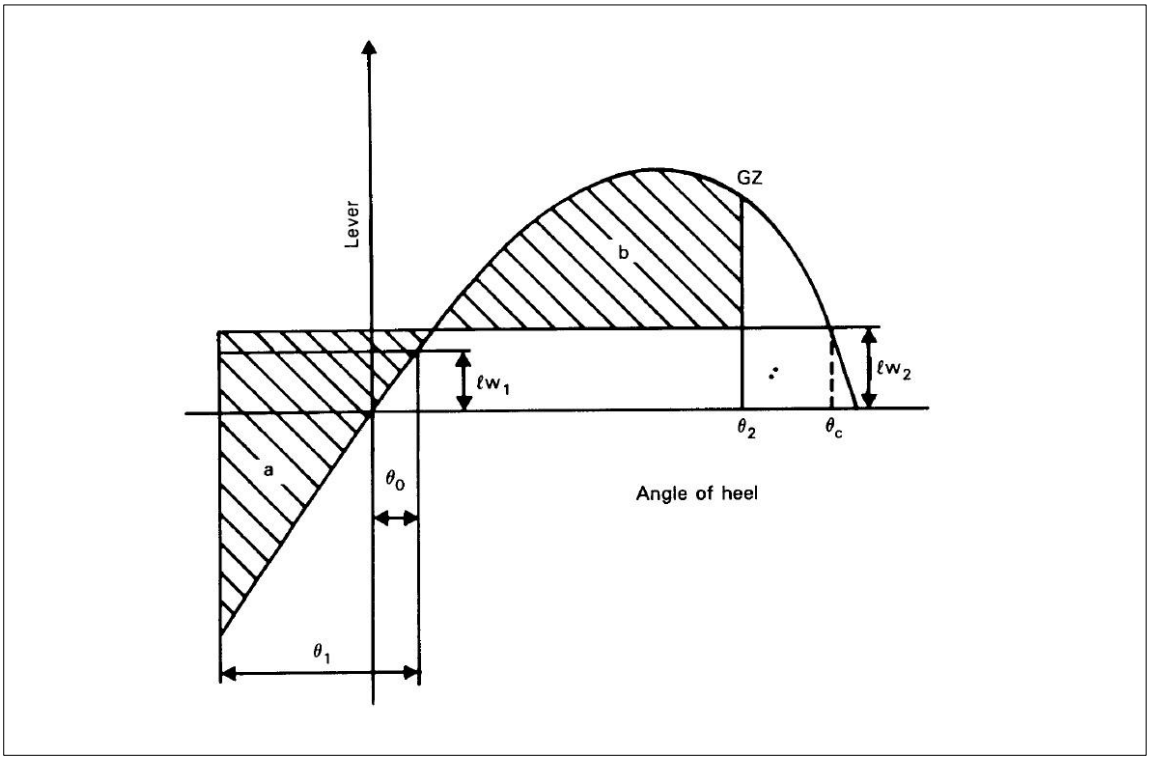
Stability curve



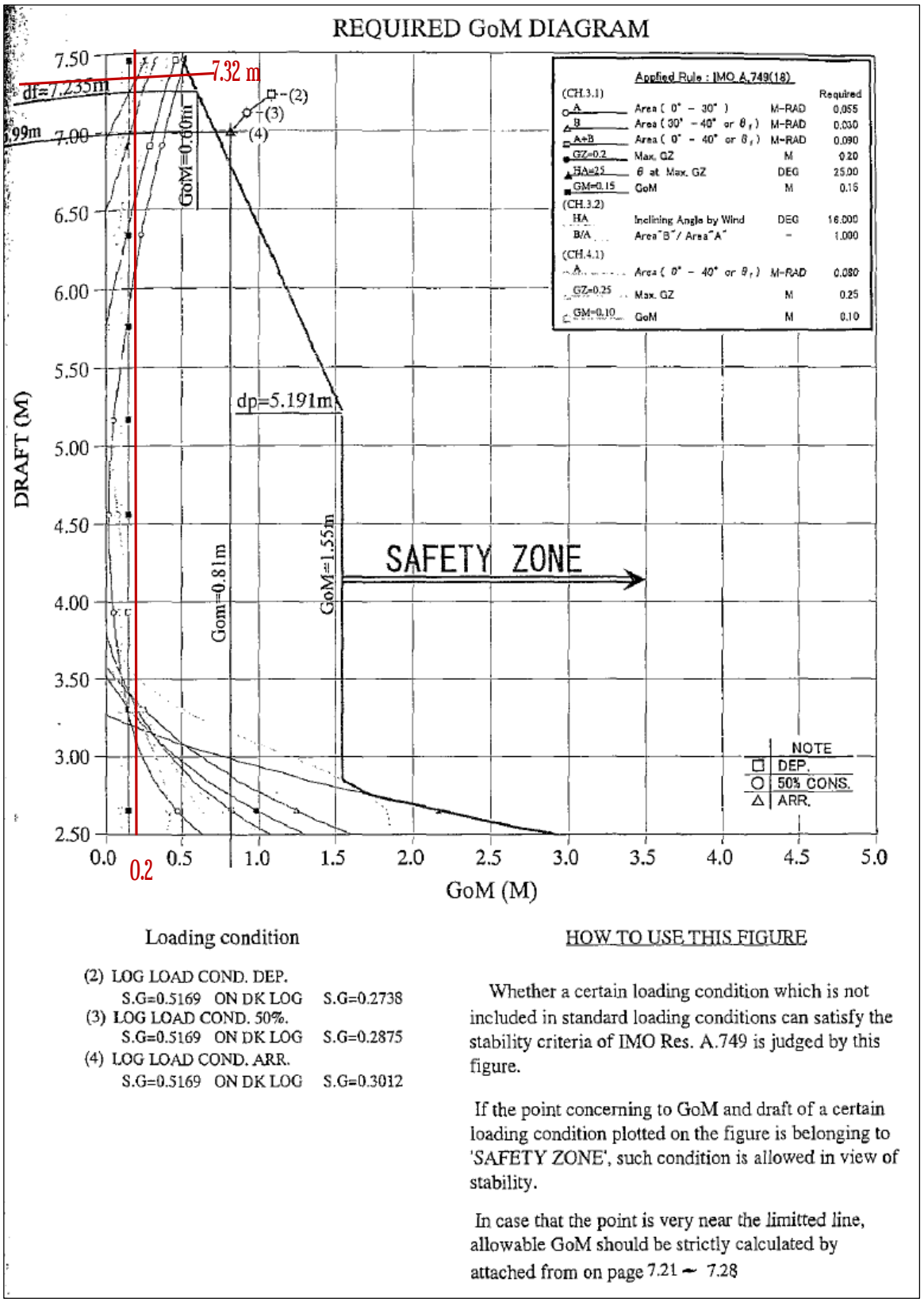
VCG = m
GGo = m
VCGo = VCG + GGo = m
VCG' = ASSUMED VCG = m
GoG' = VCG' − VCGo = m
G'Z = From TABLE OF RIGHTING ARM (G'Z)
GZ = G'Z + GoG' sin θ

Displacement = t		GoM = m	
		VCGo = m	
VCG' = m		GoG' = VCG' − VCGo = m	
θ	sin θ	G'Z	GoG' sin θ	GZ (G'Z + GoG' sin θ)
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			

Stability requirements in wind and waves (IMO A. 749(18) 3.2)



Appendix 2 - Plotting the GoM 0.20 m & Draft 7.325 m into the Required GoM Diagram



Conclusion: By plotting GoM of 0.20 m (provided by the master) and mean draft of 7.32 m (departure draft) on the Required GoM Diagram (Timber Deck Cargo), it indicated that the intact stability was outside of the Safety Zone.

Appendix 3 - Ship stability assessment on 24 March 2012

.1 The vessel arrived at the port of Rabaul in Papua New Guinea on 14 March 2012 and berthed at 0830 local time (GMT +10) on 15 March 2012. The loading of logs was commenced at 1100 on the same day. The master attached the progress report of loading and draft survey report with his daily morning report to the company through email. The morning report on 21 March 2012 showed loading in cargo holds had been completed at 2030 (GMT +10) on 20 March 2012. The drafts of vessel and quantity of cargo loaded are shown in Table 1.

	Fwd	Midship	Aft
Draft (port) (m)	5.55	6.55	7.55
Draft (Starboard) (m)	5.53	6.10	6.55
List (P or S)	0.02 (P)	0.45 (P)	1.00 (P)
Ballast water (mt)	1049		
Bunkers & misc with constant (mt)	418		
Cargo loaded (mt)	4009.943mt (4053.614m^3) total 1415 pieces and S.G 0.989		
Displacement (mt)	7850.313		

Table.1 – Condition of completion of loading into cargo holds on 20 Mar. 2012

.2 Cargo distributed in No.1 and No.2 cargo holds were 2005.978 m^3 (702pcs) in and 2047.636 m^3 (713pcs) respectively.

Total volume of cargo holds = 4053.614 m^3

Total weight of cargo in cargo holds = 4009.943 mt

Hence the Specific Gravity (SG) of cargo = 0.989 g/cm^3

The weight of cargo in No.1 and No.2 cargo hold was respectively 1983.91 mt and 2025.11 mt.

.3 Logs loading on deck commenced at 2120 (GMT+10) on 20 March 2012 and completed at 0406 (GMT +10) on 23 March 2012. The drafts of vessel and the quantity of cargo loaded are shown in Table 2 below.

.4 The final stowage plan prepared by the master on 23 March 2102 showed that the cargo volumes in No.1 and No.2 cargo holds were 1957,185 m^3 and 1973.655 m^3 respectively. Those figures were not consisted with the figures in above paragraphs .1 & .2; and the volumes on deck forward (i.e.No.1 & No.2) and deck aft (i.e.No.3 & No.4)

were 986.902 m^3 and 1013.326 m^3 respectively. The details of cargo weight distribution on deck in positions No.1, 2, 3 and 4 were not available as the layout description of "Stability Information for the master". In this assessment of ship stability, the cargo weight in cargo holds given in master's report on 21 March 2012 was used (i.e. the figures in Table 1).

	Fwd	Midship	Aft
Draft (port) (m)	6.82	7.55	8.24
Draft (Starboard) (m)	6.80	7.10	7.39
List (P or S)	0.02 (P)	0.45 (P)	0.85 (P)
Ballast water (mt)	574	----	----
Bunkers & misc with constant (mt)	405	----	----
Cargo loaded (mt)	5961.513mt (5931.068 m^3) Total 2340 pieces and S.G. 1.005		
Displacement (mt)	9313.883mt		

Table.2 – Final condition upon completion of loading on 23 March 2012

.5 At departure, the total amount of cargo = 5931.068 m^3 (5961.513 mt)

Total volume of cargo inside cargo holds = 4053.614 m^3

Total of volume of cargo on deck = 5931.068 m^3 – 4053.614 m^3 = 1877.454 m^3

.6 According to the master, the stowage of logs on deck was evenly distributed and about 200 millimeter (mm) below the top of uprights in way of No.2 cargo hold, and about 250 mm to 300 mm below the top of uprights in way of No.1 cargo hold. The uprights were about 5 m high above deck. Based on capacity ratio, the estimated cargo weight distribution on deck (i.e. section No.1 to No.4 on top of two cargo holds) and their vertical centres of gravity (VCG) are derived and shown in Table 3.

Section of cargo on deck	No.1	No.2	No.3	No.4
Space capacity (m^3)	500.69	982.67	760.90	975.73
Weight distribution (mt)	303.46	595.58	461.17	591.37
VCG (m)	12.05	11.94	11.93	11.97
Total weight on deck (mt)	1951.58 mt at 1877.454 m^3			

Table 3 – Distribution of deck cargo

.7 According to the master, ballast tanks No.3 port and starboard, No.5 port and starboard, No.6 centre tank were filled-up upon departure on 23 March 2012. Later, he filled No.1 port and starboard ballast tank on 24 March 2012, and then emptied No.1 starboard in order to balance out fuel oil consumed in a port side fuel oil tank. Therefore,

the total amount of ballast water on board is estimated to be 608 mt (see Table 4).

Water ballast tank	1 P	1 S	3 P	3 S	5 P	5 S	6C
Weight(mt)	58.7	-----	143	143	99	103	62

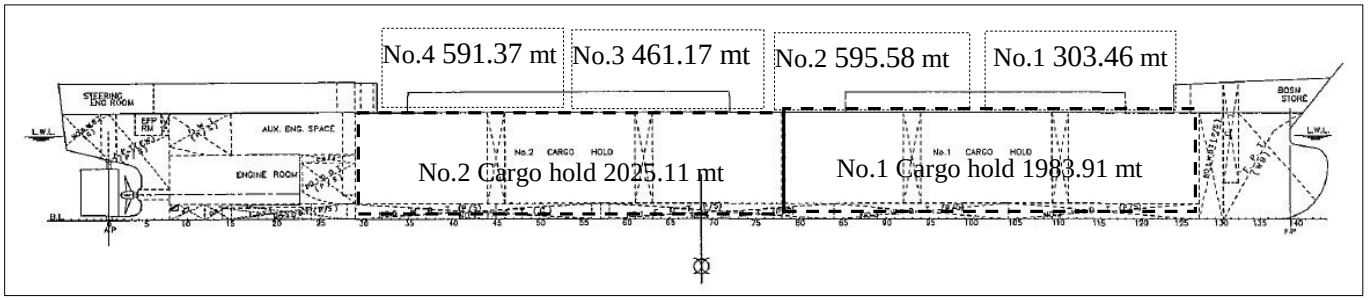
Table 4 – Distribution of water ballast

.8 Other weight information due to oils and fresh water were retrieved from the final draft survey report carried out on 23 March 2102 and oil sounding report on 22 March 2012 prepared by chief engineer.

.9 Assume all tanks were topped up so that the free surface effect of slack tank is neglected in the assessment.

.10 The stability curve under the above conditions was generated. It revealed that the vessel only met the stability criteria regarding GoM (0.15 m cf 0.1 m), not the criteria of area under curve (0.03 m.rad. cf 0.08 m.rad.) and the maximum righting lever (GZ) were respectively (0.17 m cf 0.25 m).

Cargo weight distribution on departure as following table:



Log Loaded Departure Condition: Rabaul, PNG on 24 March 2012 ballasted with No. 1(P) BWT								
item	(%)	Weight (MT)	LCG (M)	L.Moment (Mt-M)	VCG (M)	V.Moment (MT-M)	Free Surface Moment (MT-M)	i
Lightship weight		2373.37	6.60	15664.24	7.62	18085.08		
D.W.Constant *		46.06	23.42	1078.73	7.07	325.64		
Prov. & Consum.		5.00	44.50	222.50	9.80	49.00		
Fresh Water	(S.G. = 1.0000 MT/m^3)							
F.W.T.(P)	0.98	30.00	39.71	1191.30	7.62	228.60	13.10	13.10
F.W.T.(S)	0.98	30.00	39.71	1191.30	7.62	228.60	13.10	13.10
A.P.T.(F.W.)(P)	0.38	30.00	44.37	1331.10	6.00	180.00	39.70	39.70
A.P.T.(F.W.)(S)	0.44	30.00	44.40	1332.00	5.93	177.90	37.40	37.40
Sub Total		120.00		5045.70		815.10	103.30	
Fuel Oil	(S.G. = 0.9780 MT/m^3	*Figures estimated from the "Oil Sounding Record" dated 22 March 2012*						
NO.1 F.O.T.(P)	0.95	90.00	-1.00	-90.00	0.59	53.10	169.59	173.40
NO.1 F.O.T.(S)	0.00	0.00	-1.00	0.00	0.00	0.00	0.00	
NO.2 F.O.T.(C)	0.75	105.00	16.42	1724.10	0.45	47.25	594.92	608.30
Sub Total		195.00		1634.10		100.35	764.50	
Diesel Oil	(S.G. = 0.8470 MT/m^3	*Figures estimated from the "Oil Sounding Record" dated 22 March 2012*						
NO.1 D.O.T.(P)	0.75	10.29	29.38	302.32	3.11	32.00	2.46	2.90
NO.1 D.O.T.(S)	0.48	6.52	29.26	190.78	2.66	17.34	1.44	1.70
NO.2 D.O.T.(P)	0.52	10.20	31.56	321.91	0.47	4.79	18.72	22.10
NO.2 D.O.T.(S)	0.00	0.00	31.70	0.00	0.73	15.00	0.00	
Sub Total		27.01		815.01		69.14	22.61	
Lub Oil	(S.G. = 0.9200 MT/m^3)							
L.O.S.T.(C)	0.90	8.24	34.74	286.26	0.45	3.71	2.00	
Sub Total		8.24		286.26		3.71	2.00	
Cargo	(S.G. = 1.0050 MT/m^3) (from Draft Survey Reports dated 21 March and 23 March 2013)							
No.1 Cargo Hold	1.00	1894.00	-21.99	-41649.06	5.40	10227.60	0.00	
No.2 Cargo Hold	1.00	2116.00	10.42	22048.72	5.36	11341.76	0.00	
No.1 On Deck*	1.00	303.00	-29.42	-8914.26	12.05	3651.15	0.00	
No.2 On Deck	1.00	596.00	-16.86	-10048.56	11.94	7116.24	0.00	
No.3 On Deck	1.00	461.00	1.98	912.78	11.93	5499.73	0.00	
No.4 On Deck	1.00	591.00	15.85	9367.35	11.97	7074.27	0.00	
Sub Total		5961.00		-28283.03		44910.75	0.00	
Ballast Water	(S.G. = 1.0250 MT/m^3)							
F.P. T. (C)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
No.1 W.B.T (P)	1.00	58.00	-40.88	-2371.04	5.15	298.70	0.00	
No.1 W.B.T (S)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
No.2 W.B.T (P)	0.00	0.00	-30.94	0.00	0.69	0.00	0.00	
No.2 W.B.T (S)	0.00	0.00	-30.94	0.00	0.69	0.00	0.00	
No.3 W.B.T (P)	1.00	144.04	-17.65	-2542.31	0.68	97.95	0.00	
No.3 W.B.T (S)	1.00	144.04	-17.65	-2542.31	0.68	97.95	0.00	
No.4 W.B.T (P)	1.00	0.00	-1.55	0.00	0.70	0.00	0.00	
No.4 W.B.T (S)	1.00	0.00	-1.55	0.00	0.70	0.00	0.00	
No.5 W.B.T (P)	1.00	100.02	18.24	1824.36	0.72	72.01	0.00	
No.5 W.B.T (S)	1.00	103.74	17.90	1856.95	0.72	74.69	0.00	
No.6 W.B.T (C)	1.00	62.88	48.70	3062.26	7.64	480.40	0.00	
Sub Total		612.72		-712.09		1121.70	0.00	
Grand Total		**9348.40**	**-0.454**	**-4248.58**	**7.00**	**65480.48**	**892.42**	

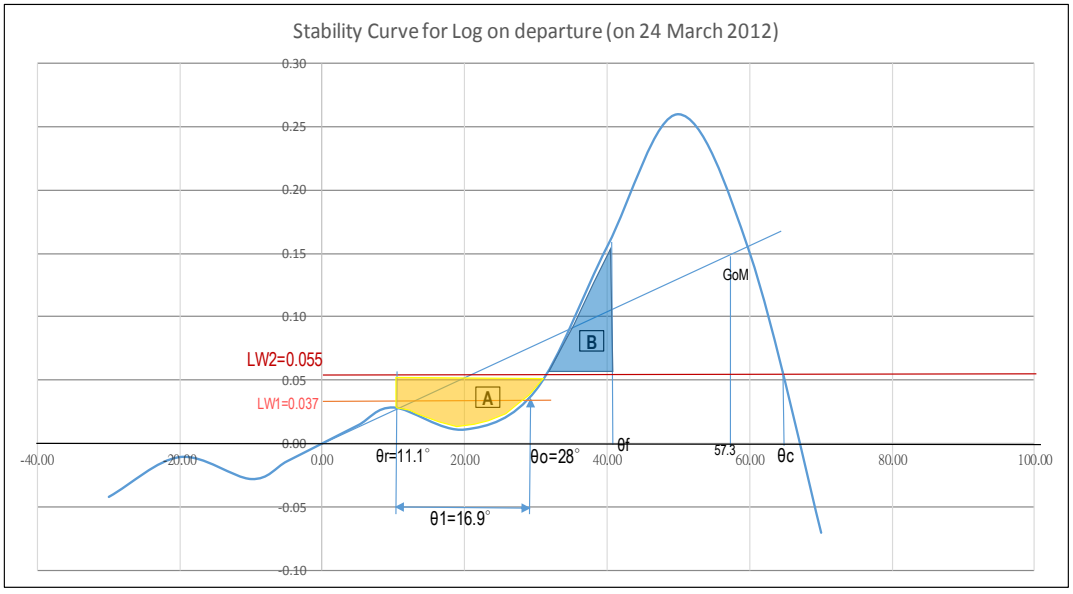
Displacement		MT	9348.40	KM_T		M	7.25	
Draft at C.F.		M	7.36	VCG		M	7.00	
Draft	Fore	M	7.57	GM		M	0.25	
	Aft	M	7.12	GGo		M	0.10	
	Mean	M	7.34	GoM		M	0.15	
Trim		M	0.45					
TPC		MT	14.88					
LCG		M	-0.45					
LCB		M	-0.93					
HBG		M	0.48					
MTC		MT-M	100.03					
LCF		M	2.29					

Stability Verifcation for Timber Deck Cargo

	VCG		7.00	m			
	GGo		0.10	m			
	VCGo		7.10	m			
	VCG'	Assumed V	0.00	m			
	GoG'	VCG'-VCG	-7.10	m			
	G'Z	From table of righting arm for log					
	GZ	G'Z+GoGsinθ					

Dispalcement =	9348.40			GoM =	0.15
				VCGo =	7.10
	VCG'=0.00m		GoG'=VCG'-VCGo=	-7.10	m
θ	sinθ	G'Z for log	GoG'sinθ	GZ (G'Z+GoGsinθ)	
0.00	0.00	0.00	0.00	0.00	
5.00	0.09	0.63	-0.62	0.01	
10.00	0.17	1.26	-1.23	0.03	
20.00	0.34	2.44	-2.43	0.01	
30.00	0.50	3.59	-3.55	0.04	
40.00	0.64	4.72	-4.56	0.16	
50.00	0.77	5.70	-5.44	0.26	
60.00	0.87	6.30	-6.15	0.15	
70.00	0.94	6.60	-6.67	-0.07	
80.00	0.98	6.65	-6.99	-0.34	
85.00	1.00	6.59	-7.07	-0.48	

Flooding Angle = 40.25∘



Applied Rule IMO A.749(18), Chapter 4.1 Stability (log)						
Criteria	Unit	Required		Attained	Judge	
Area (0 to 40∘or θf)	M-rad	0.08	>	0.03	Fail	
Max. GZ	M	0.25	>	0.17	Fail	at 40.25°
GoM	M	0.10	<	0.15	Pass	
θf: Flooding Angle	Deg			40.25°		

Applied IMO A.749(18) Chapter 3.2,Severe wind and rolling criterion					
A (M2)	784.6	K	0.982	Θ1	16.9
Z (m)	8.52	X1	1.000	Θ2	50.0
W (T)	9348.4	X2	1.000	Θc	65°
LW 1	0.037	S	0.035	ΘF	40.25°
LW2	0.055	R	0.710	Area B	0.008
OG (m)	-0.244	Ang.x 0.8	8°	Area A	0.010
T	33.842	Θ0 limit	16°	B/A≥1	0.8
C	0.386	Θ0=	28°	Judge.	Fail

Angle limit: 16∘or ang.x0.8 whichever is less
Lw1: Heeling Moment lever caused by steady wind (m) given by formula: Lw1=(PAZ/100*g*Displacement)(m)
Lw2: Heeling moment lever caused by gust (m) given by formula: Lw2=1.5*Lw1 (m)

Results of ship stability assessment on departure condition of *New Lucky VII* on 24 March 2012:

A. Timber deck cargo, the criteria in Section 4.1.3 of IMO Res. A.749 (18).
   1. The estimation result of area under the righting lever curve (GZ curve) was 0.03 m.rad up to Θ = 40° could not meet the requirement of 0.08 m.rad
   2. The estimation maximum value of the righting lever (GZ) 0.17 m was less than the requirement of 0.25 m.
   3. The estimation result of metacentric height GoM was 0.15 m which met the requirement of GoM 0.10 m on departure.

B. Severe wind and rolling criterion (weather criterion, Section 3.2.2 of IMO Res.A.749(18))
   1. The angle of heel (Θo) under action of steady wind was estimated to be 28° could not meet the criteria of 16° .
   2. subject to a gust wind and waves, estimation of area "B" was less than area "A", it did not meet the requirement of area of "B" should be greater than "A" .

Conclusion: Upon departure of the vessel from loading port on 24 March 2012, the stability of *New Lucky VII* could not meet the requirements of the Code.

Appendix 4 - Ship stability assessment on 3 April 2012

Log Loaded Condition on navigation after consumption of oil and fresh water on 3 April 2012								
item	(%)	Weight (MT)	LCG (M)	L.Moment (Mt-M)	VCG (M)	V.Moment (MT-M)	Free Surface Moment (MT-M)	i
Lightship weight		2373.37	6.60	15664.24	7.62	18085.08		
D.W.Constant *		46.06	23.42	1078.73	7.07	325.64		
Prov. & Consum.		5.00	44.50	222.50	9.80	49.00		
Fresh Water	(S.G. = 1.0000 MT/m^3)							
F.W.T.(P)	100%	30.76	39.71	1221.48	7.62	234.39	0.00	0.00
F.W.T.(S)	100%	30.76	39.71	1221.48	7.62	234.39	0.00	0.00
A.P.T.(F.W.)(P)	10%	7.97	43.97	350.35	5.02	40.00	7.90	7.90
A.P.T.(F.W.)(S)	0%	0.00	44.36	0.00	5.79	0.00	0.00	0.00
Sub Total		69.49		2793.31		508.78	7.90	
Fuel Oil	(S.G. = 0.9780 MT/m		*Figures estimated from the "Oil Sounding Record" dated 22 March 201*					
NO.1 F.O.T.(P)	49%	50.00	-1.03	-51.50	0.34	17.00	165.87	169.60
NO.1 F.O.T.(S)	0%	0.00		0.00		0.00	0.00	
NO.2 F.O.T.(C)	33%	50.00	16.48	824.00	0.23	11.50	582.11	595.20
Sub Total		100.00		772.50		28.50	747.97	
Diesel Oil	(S.G. = 0.8470 MT/m		*Figures estimated from the "Oil Sounding Record" dated 22 March 201*					
NO.1 D.O.T.(P)	22%	3.00	29.05	87.15	2.16	6.48	0.68	0.80
NO.1 D.O.T.(S)	22%	3.00	29.05	87.15	2.16	6.48	0.68	0.80
NO.2 D.O.T.(P)	15%	3.00	31.29	93.87	0.17	0.51	8.22	9.70
NO.2 D.O.T.(S)	0%	0.00	31.70	0.00	0.73	15.00	0.00	
Sub Total		9.00		268.17		28.47	9.57	
Lub Oil	(S.G. = 0.9200 MT/m^3)							
L.O.S.T.(C)	90%	8.24	34.74	286.26	0.45	3.71	2.00	
Sub Total		8.24		286.26		3.71	2.00	
Cargo	(S.G. = 1.0050 MT/m^3) (from Draft Survey Reports dated 21 March and 23 March 2013)							
No.1 Cargo Hold	100%	1894.00	-21.99	-41649.06	5.40	10227.60	0.00	
No.2 Cargo Hold	100%	2116.00	10.42	22048.72	5.36	11341.76	0.00	
No.1 On Deck*	100%	303.00	-29.42	-8914.26	12.05	3651.15	0.00	
No.2 On Deck	100%	596.00	-16.86	-10048.56	11.94	7116.24	0.00	
No.3 On Deck	100%	461.00	1.98	912.78	11.93	5499.73	0.00	
No.4 On Deck	100%	591.00	15.85	9367.35	11.97	7074.27	0.00	
Sub Total		5961.00		-28283.03		44910.75	0.00	
Ballast Water	(S.G. = 1.0250 MT/m^3)							
F.P. T. ©	0%	0.00	0.00	0.00	0.00	0.00	0.00	
No.1 W.B.T (P)	100%	58.00	-40.88	-2371.04	5.15	298.70	0.00	
No.1 W.B.T (S)	0%	0.00	0.00	0.00	0.00	0.00	0.00	
No.2 W.B.T (P)	0%	0.00	-30.94	0.00	0.69	0.00	0.00	
No.2 W.B.T (S)	0%	0.00	-30.94	0.00	0.69	0.00	0.00	
No.3 W.B.T (P)	100%	144.04	-17.65	-2542.31	0.68	97.95	0.00	
No.3 W.B.T (S)	100%	144.04	-17.65	-2542.31	0.68	97.95	0.00	
No.4 W.B.T (P)	100%	0.00	-1.55	0.00	0.70	0.00	0.00	
No.4 W.B.T (S)	100%	0.00	-1.55	0.00	0.70	0.00	0.00	
No.5 W.B.T (P)	100%	100.02	18.24	1824.36	0.72	72.01	0.00	
No.5 W.B.T (S)	100%	103.74	17.90	1856.95	0.72	74.69	0.00	
No.6 W.B.T (C)	100%	62.88	48.70	3062.26	7.64	480.40	0.00	
Sub Total		612.72		-712.09		1121.70	0.00	
Grand Total		**9185**	**-0.86**	**-7909.41**	**7.08**	**65061.64**	**767.45**	

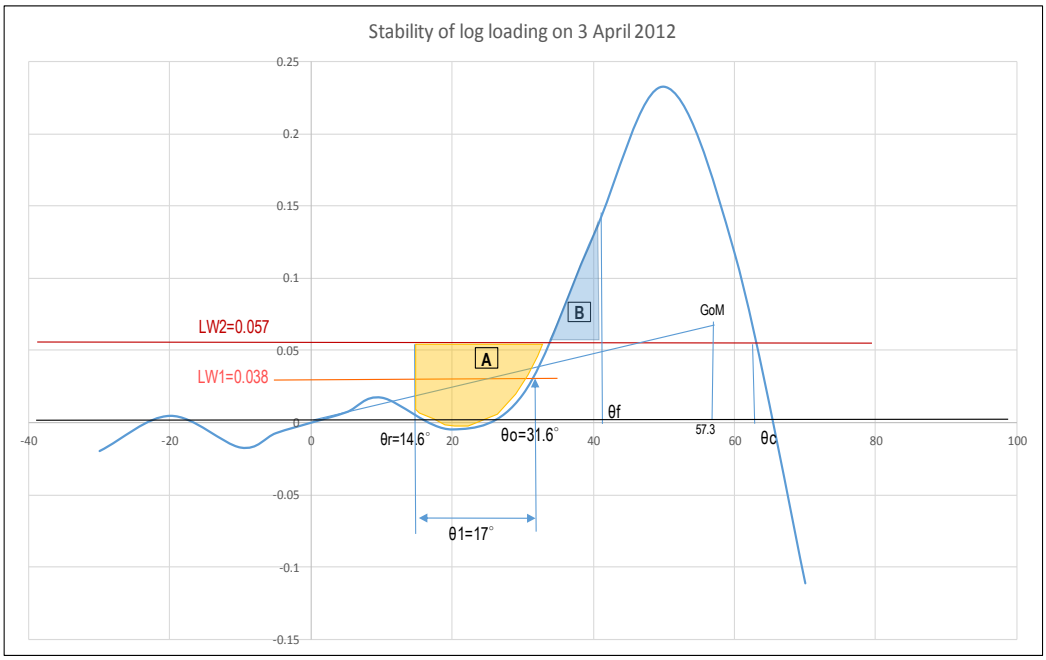
Displacement		MT	9185	KM_T		M	7.23	
Draft at C.F.		M	7.24	VCG		M	7.08	
Draft	Fore	M	7.31	GM		M	0.15	
	Aft	M	7.17	GGo		M	0.08	
	Mean	M	7.24	GoM		M	0.07	
Trim		M	0.13					
TPC		MT	14.80					
LCG		M	-0.86					
LCB		M	-1.01					
HBG		M	0.14					
MTC		MT-M	98.97					
LCF		M	2.24					

Stability Verifcation for Timber Deck Cargo

	VCG		7.08	m			
	GGo		0.08	m			
	VCGo		7.16	m			
	VCG'	Assumed V	0.00	m			
	GoG'	VCG'-VCG	-7.16	m			
	G'Z	From table of righting arm for log					
	GZ	G'Z+GoGsin θ					

Dispalcement =	9185			GoM =	0.07
				VCGo =	7.16
	VCG'=0.00m	GoG'=VCG'-VCGo=		-7.16	m
θ	sin θ	G'Z for log	GoG'sin θ	GZ (G'Z+GoGsin θ)	
0.00	0%	0.000	0.00	0.00	
5.00	9%	0.631	-0.62	0.01	
10.00	17%	1.260	-1.24	0.02	
20.00	34%	2.443	-2.45	0.00	
30.00	50%	3.598	-3.58	0.02	
40.00	64%	4.730	-4.60	0.13	
50.00	77%	5.715	-5.48	0.23	
60.00	87%	6.315	-6.20	0.12	
70.00	94%	6.614	-6.73	-0.11	
80.00	98%	6.660	-7.05	-0.39	
85.00	100%	6.599	-7.13	-0.53	

Flooding Angle = 41.22°



Applied Rule IMO A.749(18), Chapter 4.1 Stability (log)						
Criteria	Unit	Required		Attained	Judge	
Area (0 to 40° or θf)	M-rad	0.08	>	0.02	Fail	
Max. GZ	M	0.25	>	0.14	Fail	at 41.22°
GoM	M	>=0	<	0.07	Pass	
θf: Flooding Angle	Deg	41.22°				

Applied IMO A.749(18) Chapter 3.2,Severe wind and rolling criterion					
A (M2)	792.12	K	0.982	Θ1	17.0
Z (m)	8.51	X1	1.000	Θ2	50°
W (T)	9185	X2	1.000	Θc	62°
LW 1	0.038	S	0.035	ΘF	41.22°
LW2	0.057	R	0.724	Area B	0.006
OG (m)	-0.075	Ang.x 0.8	8°	Area A	0.012
T	51.177	Θ0 limit	16°	B/A≥1	0.5
C	0.386	Θ0=	31.6°	Judge.	Fail

Angle limit: 16° or ang.x0.8 whichever is less

Lw1: Heeling Moment lever caused by steady wind (m) given by formula: Lw1=(PAZ/100*g*Displacement)(m)

Lw2: Heeling moment lever caused by gust (m) given by formula: Lw2=1.5*Lw1 (m)

On 3 April 2012, presuming that the fuel oil remained on board was about 108.31mt and fresh water 69.5mt. The stability of *New Lucky VII* was as follow:

A. Timber deck cargo, the criteria in Section 4.1.3 of IMO Res. A.749 (18).
   1. The estimation result of area under the righting lever curve (GZ curve) was 0.02 m.rad up to Θ = 40° could not meet the requirement of 0.08 m.
   2. The estimation maximum value of the righting lever (GZ) 0.14 m was less than the requirement of 0.25 m.
   3. The estimation result of metacentric height GoM was 0.07 m, which met the requirement of GoM to be positive at all times during a voyage.

B. Severe wind and rolling criterion
   1. The angle of heel (Θo) under action of steady wind was estimated to be 31.6° could not meet the criteria of 16° .
   2. subject to a gust wind and waves, estimation of area "B" was less than area "A", it did not meet the requirement of that area of "B" should be greater than "A".

Conclusion: On the passage to China on 3 April 2012, the stability of *New Lucky VII* could not meet the stability requirements of IMO Res.A.749 (18). Furthermore, according to statements provided by the crew, the gusting wind force at the time of the accident was more than 60 knots (wind load about 880N/m^2), the wind load on windage area was more than 504N/ m^2 (the assumed wind load in the calculation), and the waves were boisterous. The weather condition was severer. The assessment did not consider

the weight increase on deck cargo due to water absorption. If taking into account the assumption of weight increase on deck cargo, the stability would be worse, and the vessel would be overloaded[4] after entering the summer loading zone in East China Sea.

[4] 10% increase on deck cargo weight: 1951*10%=195tonnes.
Displacement : 9185+195=9380 mt,
Draft = 7.38 m @ displacement 9380 mt, the timber summer draft = 7.249 m.
7.38 m > 7.249 m. The vessel was overloaded.