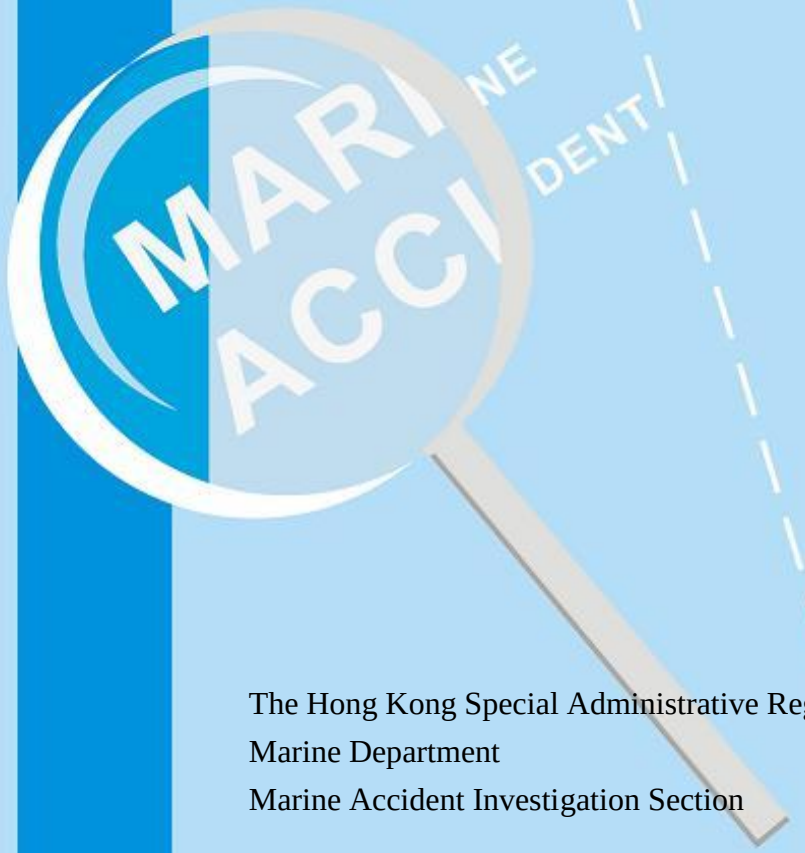
Report of Investigation into the fatal accident on board Hong Kong Registered Ship "*KSL Singapore*" at Beilun New Mineral Anchorage, Ningbo, China on 16 July 2014.



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

26 February 2015

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 On 16 July 2014, the Electrical Officer (E/O) who worked on board the Hong Kong registered bulk carrier "KSL SINGAPORE" (hereinafter referred to as the *Vessel*) was found missing after he did not show up at 1910 during dinner. The search for the E/O was then commenced after the Messman reported to the Second Engineer (2/E).

1.2 The 2/E began to look for the E/O in the Engine Room (E/R). The 2/E noticed that an elevator emergency key and a tool bag was laid on the ER second deck beside the elevator entrance door. When the elevator entrance door on the upper deck was opened, the E/O was found trapped between the elevator cage and the escape ladder inside the elevator trunk with his head and body in downward vertical position. The E/O did not show any vital signs. When a doctor arrived on board at about 0420 on 17 July 2014, the E/O was subsequently declared dead.

1.3 The investigation had identified the following contributory factors leading to this accident:

- The E/O failed to perform the elevator repair/maintenance works according to the procedures stipulated in shipboard Safety Management Manual (SMM) and in the instruction manual of the elevator; and
- The E/O did not work under any supervision that was incompliance with the E/O's duties listed in SMM.

2. Description of the Vessel

2.1 Particulars of "KSL SINGAPORE"

Port of Registry	:	Hong Kong
IMO Number	:	9719903
Official Number	:	HK-4065
Call Sign	:	VRNE8
Classification Society	:	American Bureau of Shipping
Type of Ship	:	Bulk Carrier
Keel Laid	:	27 November 2013
Built At	:	Shanghai Weigaoqiao Shipbuilding Co. Ltd, Shanghai, China.
Ship Owner	:	Front Singapore Inc., Liberia
DOC Company	:	Wilhelmsen Ship Management Sdn. Bhd., Malaysia.
Length	:	292 metres
Breadth	:	45 metres
Depth	:	24.9 metres
Gross Tonnage	:	94,528
Net Tonnage	:	58,889
Deadweight	:	181,062
Main Engine	:	one set of CSSC-MES Engine (China) MAN-B&W 6G70ME-C9.2
Engine Power	:	15,748 Kw
No. of Crew	:	22

Fig 1: M.V. " *KSL SINGAPORE"*

2.2 **"*KSL SINGAPORE*"**, a nine-hold bulk carrier built by Shanghai Weigaoqiao Shipbuilding Co. Ltd, Shanghai, China in 2014. She was powered by a six-cylinder marine diesel engine, CSSC-MES Engine (China) MAN-B&W 6G70ME-C9, capable of developing engine power of 15,748 kW. The *Vessel* was owned by Front Singapore Inc. and managed by Wilhelmsen Ship Management Sdn. Bhd. (hereinafter referred to as the Company).

2.3 **Particulars of the elevator**

Manufacturer	:	Moriya Transportation Engineering & Manufacturing Co., Ltd. Japan
Type	:	Single wrap traction geared type (crew elevator)
Standard	:	American Bureau of Shipping
Capacity	:	5 persons / 430kg
Speed	:	45 m/min
Stage	:	8 stops
Power supply	:	3 phase, AC440V, 60Hz
Cage	:	900mm (W) x 1200mm(D) x 2130mm(H)
Home landing deck	:	Captain Deck

3. Sources of Evidence

a) The statements of the Master, Officers and the crew of "*KSL SINGAPORE";* and

b) Information provided by the Ship Management of "*KSL SINGAPORE"*.

4. Outline of Events

(All times were local time GMT + 8hours)

4.1 On 16 July 2014, the Hong Kong registered bulk carrier "KSL SINGAPORE" (hereinafter referred to as the *Vessel*) was anchored at Beilun New Mineral Anchorage, Ningbo, China (29-44N and 122-34E), waiting for berth to discharge cargo "Iron Ore" (about 174,014 metric tons) in bulk that was loaded in Whyalla, Australia on 22 June 2014. The engine crew were performing various maintenance tasks in Engine Room (ER) at the anchorage on the day.

4.2 The engine department was composed of eight personnel including the Chief Engineer (C/E), the Second Engineer (2/E), the Third Engineer (3/E), the Electrical Officer (E/O), the Fitter, the Cadet and two Oilers. On that day, the E/O had to work alone as all other members were busy with the maintenance works on the main engine and on the No.1 auxiliary engine.

4.3 The Fitter met the E/O in the engine room workshop at about 1510 when the E/O was looking for tools in the workshop. There was no communication between them at that time and they did not know the jobs of each other.

4.4 The missing of the E/O was not noticed until he did not present in the mess room for dinner at 1910. The Messman reported his missing to the 2/E. The 2/E then began to look for the E/O in the ER but in vain. The 2/E noticed that an elevator emergency key and a tool bag had been laid on the engine room second deck (ER 2nd deck) beside the elevator entrance door (Fig.2).

Fig. 2: Elevator Entrance Door at Engine Room Second Deck

4.5 The 2/E opened the elevator door by means of the emergency key and found the elevator cage had gone up and stopped at about half a meter above the ER 2nd deck level. He noticed the blood stain on the door entrance and substantially at the bottom of the elevator trunk. He shouted the name of the E/O but no response.

4.6 Afterward the 2/E reported the case at about 1920 to the Chief Officer (C/O) who was the duty officer on the bridge. The C/O then raised the general alarm and mustered all the crew to the upper deck.

4.7 The 2/E opened the elevator entrance door on the upper deck by the key (Fig.3). The upper deck was a deck immediately above the ER 2nd deck. By looking downward from the door opening, the E/O was found trapped between the elevator cage and the escape ladder inside the trunk with his head and body in downward vertical position (Fig.4 and Fig.5).

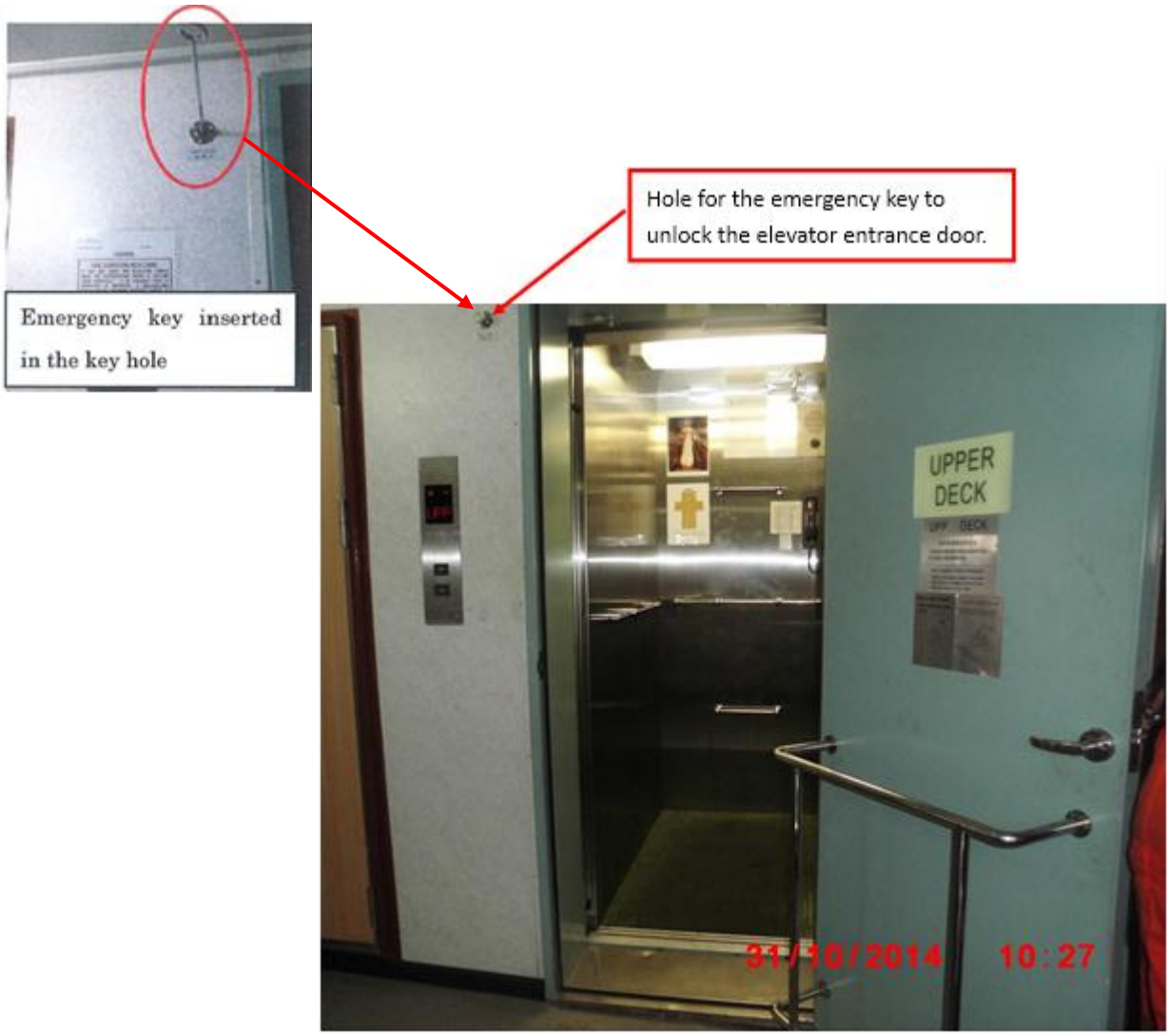

Fig. 3: Elevator Entrance Door at Upper Deck

4.8 At about 1925 when the C/E came to know about the accident, he first went to the elevator machinery room on C deck. Inside the machinery room the C/E noticed that the elevator control panel door was opened with all the power switches switched on.

4.9 At about 1930 the Master informed the company about the accident and sought for advice. He was instructed to seek help from local authority. The Master was able to contact the local agent successfully only at about 2050. The agent promised to arrange emergency assistance from shore.

4.10 From about 2240 to 2305 the C/O and the 3/E went down to the cage top to check for any vital signs of the E/O. They also tried to release the E/O from trapping but failed. It was noticed that the safety line had linked up the E/O to the rung of the escape ladder underneath. It was believed that this life line dragged and trapped the E/O to the space between the trunk members and the cage when the elevator went up with the E/O on the top of the cage.

4.11 On 17 July 2014 at about 0420 the local authority and a doctor arrived on board by a service boat. The doctor certified the death of the E/O and they left the *Vessel* at about 0638.

4.12 On the same day about 0756 the *Vessel* left the anchorage and shifted to the Inner Anchorage. Upon completion of the port formalities, at 2050 the elevator maker representative boarded the *Vessel* to look into the elevator and to assist in taking out the body entirely from the elevator trunk.

4.13 The maker representative inspected the electrical and mechanical controls of the elevator inside the machinery room. He noticed that the hand tool for the emergency rescue was still attached to the motor. The electrical control panel had been reset several times by the crew during their unsuccessful rescue attempts before his attending. Therefore, maker representative was not able to read out the cause of the stoppage of the elevator at the elevator trunk from the programmable logic controller (PLC).

4.14 The maker representative also noticed that the elevator power was on and the operation selections at the operation panel on the cage top were set as follows: the safety switch was set at "Normal", the change-over switch was set at "Auto". The crew claimed that nobody touched the operation panel on the cage top during their rescue attempts.

4.15 The maker representative also noticed that the body was wedged between the forward starboard side of the cage and escape ladder of the trunk. It was believed that this wedge generated a resistance force on the two guide bars and stopped the elevator cage from travelling up or down.

Front View

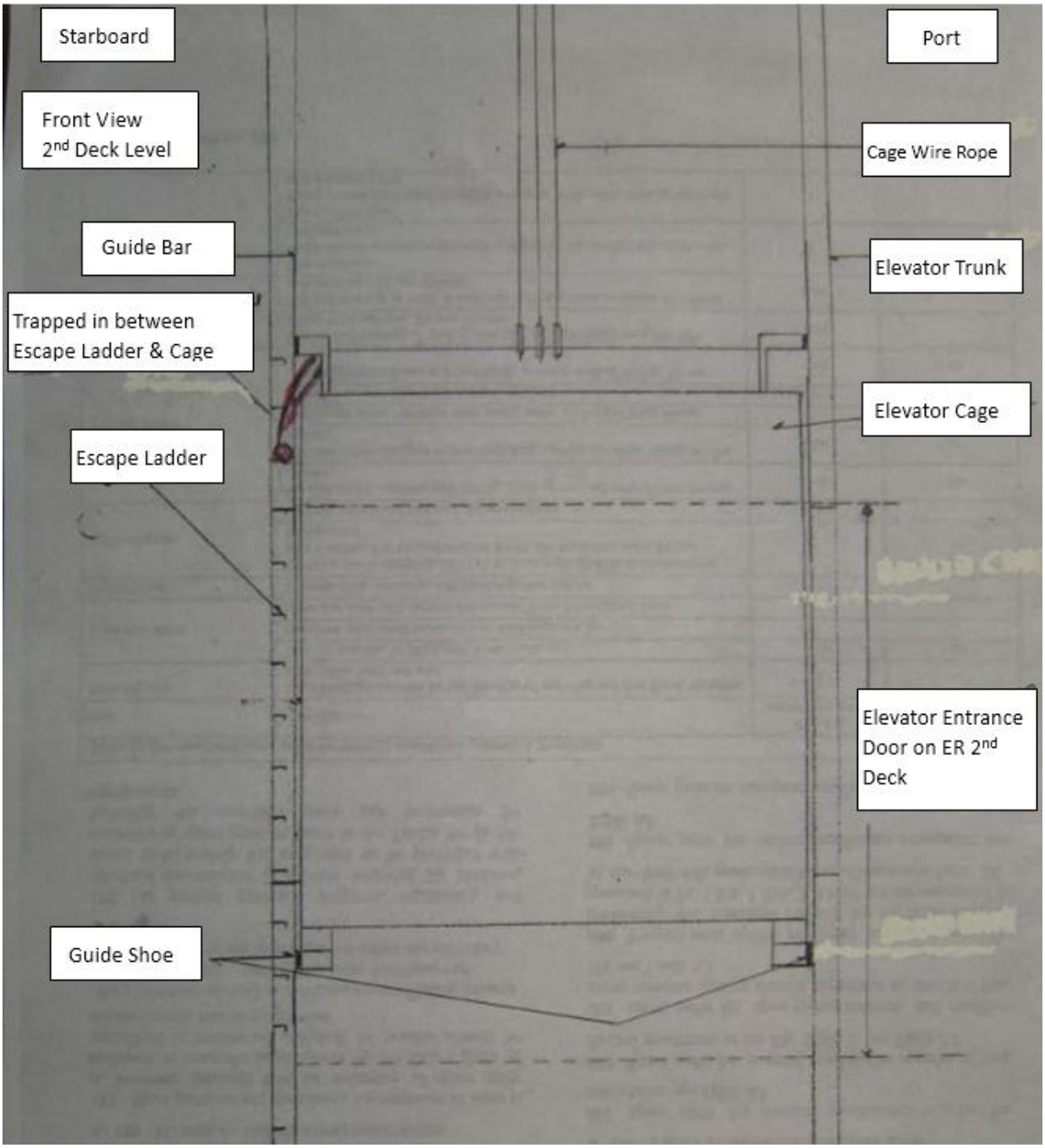

Fig. 4: Front View of the Cage where the E/O was trapped

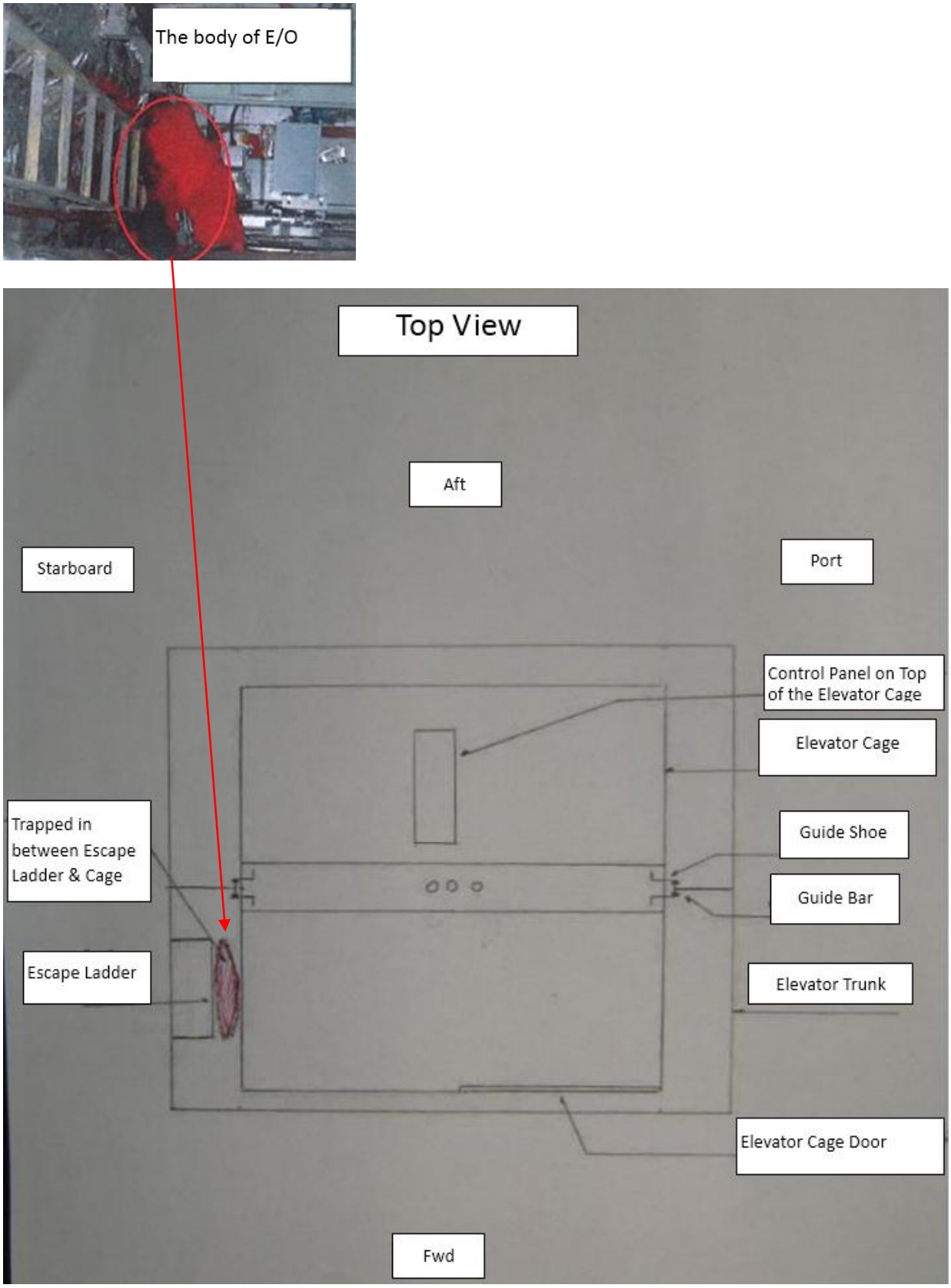

Fig. 5: Top View of the Cage where the E/O was trapped

4.16 After general examination, the maker representative then arranged to remove the port guide shoe on top of the cage away from the guide bar to release the cage thus enabling the elevator to travel up or down with the permission from the Company at about 0215 on 18 July 2014.

4.17 With the port shoe guide removed, the maker representative switched on the electrical power to the elevator. The local elevator control panel on top of the cage was switched to "Manual" mode, all the entrance doors closed, the cage door closed and two additional ropes tied to the leg of the body in order to secure it to the escape ladder and to prevent it from falling down. The maker representative then slowly moved the cage down to the ER 2nd deck by jogging the "DOWN" button.

4.18 Once the deceased was freed from the elevator cage, it was confirmed that the safety harness was worn on the body and it was hooked onto the escape ladder near the ER 2nd deck level. The maker representative stopped the elevator cage by switching the "SAFETY" switch from "NORMAL" to "STOP". The body was then ready to be released. Subsequently, the elevator door on the Upper Deck was opened by the emergency elevator door key by the crew from outside.

4.19 At 0235 hours, the body was pulled out of the elevator trunk and was placed on a stretcher at the cross passageway on the upper deck. The body was checked and photographed by the attending police officer on board.

5. Analysis of Evidence

Working experience & training

5.1 The Master of the *Vessel* had about seventeen years of seagoing experience, and about eleven years of which were in the capacity of a ship master. He took over as the Master of the *Vessel* for about two months before the accident. He held a certificate of competency as Master issued by the Republic of the Philippines on 30 March 2012 valid until 18 May 2016.

5.2 The C/E had about ten years of seagoing experience and about seven months of which was in the capacity of a chief engineer. He took over as the C/E of the *Vessel* for about one month before the accident. He held a certificate of competency as C/E issued by the Republic of the Philippines on 18 February 2009 valid until 11 November 2014.

5.3 The 2/E had been working as a second engineer for more than one year. He took over as the 2/E of the *Vessel* for about two months before the accident. He held a certificate of competency as 2/E issued by the Republic of the Philippines on 11 June 2010 valid until 10 June 2015.

5.4 The E/O joined the *Vessel* on 19 May 2014 i.e. about two months before the accident. He had more than nine years of seagoing experience as an electrical officer. He held a certificate of competency of marine engineering at support level issued by the TESDA on behalf of the Republic of Philippines on 25 April 2006 valid until 4 January 2016. He was registered as a Registered Electrical Engineer of the Board of Electrical Engineering of the Republic of the Philippines on 10 October 1997.

Working hours

5.5 The *Vessel*'s machinery space was certified as an Unmanned Machinery Space. The engine room watch-keeping was not required especially when the *Vessel* was at the anchorage on 16 July 2014 when the accident happened.

5.6 The day work started at 0800 and the accident was only noticed until the time for dinner. The search for the missing E/O was commenced at 1917.

5.7 There was no evidence to show the E/O had insufficient rest period prior to the accident. Fatigue of the crew members was not considered as a factor leading to the accident.

Alcohol Abuse

5.8 There was no evidence of alcohol abuse of the deceased.

Weather and Sea Conditions

5.9 On the day of the accident, it was cloudy with moderate breeze, and slight sea with small wave about 0.5 to 1.25 meters high, according to the report from the Company. The Master of the *Vessel* mentioned that there was no movement of the *Vessel* by the wave motions at the time of the accident. The weather and the sea conditions did not seem to contribute to the accident.

Safety measures during elevator maintenance work

5.10 The shipboard safety procedure in the Safety Management Manual (SMM) for working in elevator trunk had stipulated the requirements. The following procedures stated in the manual had not been complied with by the E/O during the accident:

- The maintenance required in the elevator trunk is to be carefully planned, which includes a risk assessment to identify all potential and actual hazards and arrive at comprehensive and practical controls;
- The power supply should be isolated by following the lock out/ tag out procedure;
- The atmosphere is to be tested prior to entry into the elevator trunk which is considered as an enclosed space;
- Notices are to be placed at each level indicating the elevator is not to be used or the doors forced open; and
- Radio communications, if required are to be tested for effectiveness, especially to monitor the crew from outside of the elevator trunk.
- Although the E/O had secured himself by a safety harness onto the ladder to prevent himself from falling down when working inside the elevator trunk, he failed to ensure that the elevator cage to stop from travelling (e.g. by firmly secured the entrance door from closing). Eventually he could not free himself up in time when the elevator cage travelling up.

Engine Room Organization.

5.11 It was reported that neither the C/E nor the 2/E had been informed what the E/O was working on 16 July 2014. As per the statement from the C/E, there was no planning to work on the elevator in a tool box meeting on the morning of 16 July 2014.

5.12 The shipboard Safety Management Manual (SMM), documented the duties of the E/O. According to this document, the E/O needed to perform all the duties assigned by the C/E. And one of the main duties of the E/O was to assist the engine staffs under the supervision of the 2/E when he was instructed by the C/E. Therefore, the shipboard management had a communication breakdown as nobody knew what the E/O was

working on that day.

5.13 When the day work was finished in the Engine Room, nobody could notice the missing of the E/O before leaving the Engine Room. The E/O failed to follow the SMM to inform the C/E of his working plan and to update the result of his works to the C/E.

Working condition of the elevator

5.14 The *Vessel* had only been delivered two months since 19 May 2014. The elevator was serviced and tested by the maker representative in the presence of a Class Surveyor before the delivery. There was no outstanding or remark in the Class report of the elevator.

5.15 During this two months, some weekly and monthly routine works were recommended by the maker. The C/E claimed that they had followed the maker's recommended maintenance and inspection list to perform the maintenance. However, onboard record showing that only one maintenance work was done by the E/O on 30 May 2014.

5.16 The monthly inspection items would involve the elevator machine room, the internal and the upper part of the cage, and the landing floor. The C/E claimed that on 1 July 2014 those items were inspected but were not recorded.

5.17 When someone pressed the calling button, the elevator would not travel occasionally from the 2nd Deck. The C/E stated that this seemed to be a problem with the 2nd Deck Entrance Door. Perhaps the E/O was attempting to fix this problem on 16 July 2014. After the accident, the C/E believed the E/O had made some adjustments to the interlock device on the ER 2nd deck entrance door, as this interlock device had been shifted upwards by a few millimeters indicated by the paint marks. As nobody knew what had happened to the E/O, this shown that the E/O did not receive sufficient supervision on board.

5.18 According to the maker representative who attended on board on the next day after the accident, there were no damage to the local electrical control panel and all the switches were operational. All the repairs done on board by him were due to the damage by the body of the EO who wedged between the escape ladder and the starboard corner of the cage top.

The elevator moved when the E/O was inside the trunk

5.19 No one witnessed the course of the accident as the E/O was working alone in the elevator trunk. The E/O did not inform anyone about his works and he was last seen by the Fitter at 1510 in the ER workshop for picking up tools.

5.20 The 2/E, who first commenced the search for the E/O, opened the elevator entrance door

on the upper deck and saw the posture of the E/O trapped in between the upper deck and the ER 2nd deck (Fig.4). The elevator emergency key and the tool bag were laid on the floor beside the elevator door on ER 2nd deck (Fig.2).

5.21 The operating panel on top of the cage (Fig.6) was used to control the elevator during the maintenance and inspection. There were four push buttons "UP" and "DOWN"; "DOOR OPEN" and "DOOR CLOSE" and three selector switches "AUTO/MANUAL"; "DOOR - STOP/NORMAL"; "SAFETY - STOP/NORMAL" on the control panel. To stop any calling response and to manoeuvre locally on the cage top, the changeover mode switch had to change to "MANAUL", therefore this switch was also named as the maintenance switch. To stop the travelling of the elevator, the switch "SAFETY" had to be switched to "STOP". To stop the cage door from operating, the "DOOR" switch had to change to "STOP".

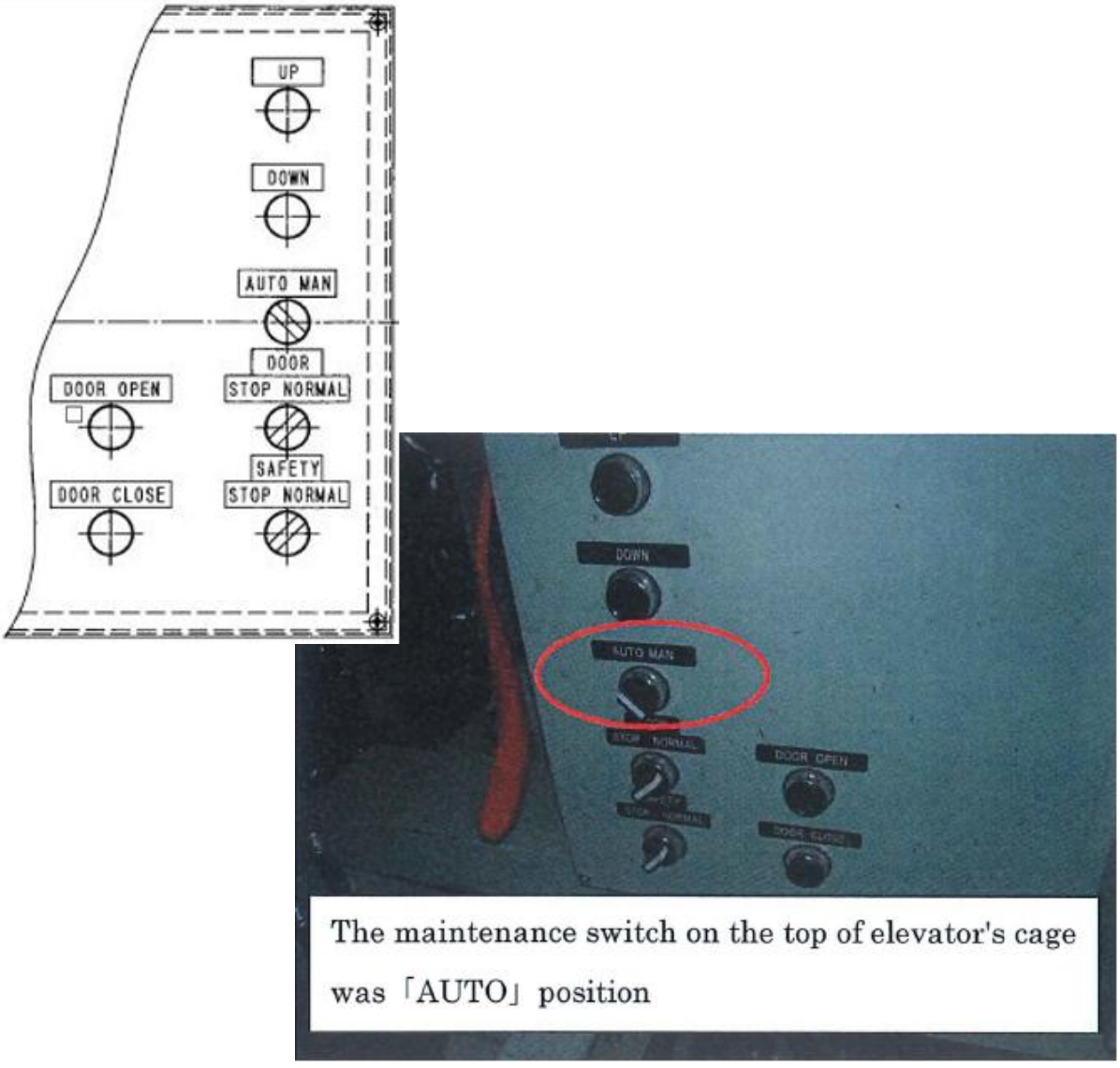

Fig. 6: The Operating Panel on top of the Cage

5.22 With all the doors closed, the cage can be moved by pressing either the "UP" or "DOWN" button on the control panel with manual mode. Such movement of the cage was slow and inching. The movement would stop immediately when the push button was released.

5.23 It was probable that the E/O used the "emergency elevator key" to open the elevator entrance door on the ER 2nd deck and climbed the escape ladder of the trunk to approach the cage top, as the key and the tool box were laid outside the entrance door. Without applying any external stoppers to hold the door, the door would close automatically after his entry. The key dropped off on the floor when the door was banged to close. The E/O failed to follow the Maker instruction to reach the cage top of the elevator. Maker recommended that there should be an assistance crew inside the cage to drive the cage till the cage top could reach the standing floor level of a person. Only under that situation, the person could attempt to open the entrance door and stepped onto the cage top.

5.24 The E/O was found wearing a safety harness. He had anchored this harness to the escape ladder near the entrance on the ER 2nd deck. This would prevent him from falling to the ER 3rd deck about five meters underneath.

5.25 The E/O failed to switch the change-over switch from "AUTO" to "MANUAL" on the control panel on the cage top. As a result, the cage was ready to move upon callings.

5.26 From the position where the E/O was trapped, it was clear that the elevator was at its upward travelling. It was probable that the elevator cage was at a deck below ER 2nd deck which was the ER 3rd deck at the lowest level, when the E/O attempted to enter the trunk space.

5.27 When someone from the above pressed the elevator call button, the elevator would travel upward. The elevator speed was rated at 45 meters per minute or 0.75 meter per second. It would take about 6.7 seconds for the cage to travel up to the 2nd Deck.

5.28 With very little time to think or react, the E/O probably jumped onto the forward center area of the cage top without detaching his safety harness from the escape ladder.

5.29 As the elevator cage continued to travel upward and passed the 2nd Deck level with the bottom of the cage at about 0.5 meters above the ER 2nd deck level, the safety harness dragged him downward, with his head first towards the forward starboard corner of the cage top. The continuing upward force of the elevator crushed the E/O's head, upper body and buttock against the cage and the escape ladder of the trunk as shown in Fig.4 and Fig.5. This eventually punctured the body and caused a major blood loss that contributed to his death.

5.30 With the E/O wedged between the escape ladder above the ER 2nd deck level and the cage, the elevator motor tripped and stopped there.

To prevent unintentional elevator movement at inspection

5.31 The E/O failed to carry out either one of the following ways to stop the elevator:

- The change-over switch (also named as the maintenance switch) at operating panel on the cage top for local control should be switched to "MANAUL"; or
- The exit hatch cover on the ceiling of the cage should be opened, this would achieve the same as the above and should be tested for each month as per maintenance checklist from the maker.

Similar accident on board Hong Kong registered vessel on 13 December 2011

5.32 A similar accident happened on board Hong Kong registered ship on 13 December 2011. Correspondingly, the Hong Kong Marine Department had issued the investigation report and the Merchant Shipping Information Note 18/2013 (MSIN 18/2013) so as to promulgate the lessons learnt on the safety measures for the elevator maintenance.

6. Conclusions

6.1 On 16 July 2014, the Electrical Officer (E/O) who worked on board the Hong Kong registered bulk carrier "KSL SINGAPORE" was found missing after he did not show up at 1910 during dinner. The search for the E/O was then commenced after the Messman reported to the Second Engineer (2/E).

6.2 The 2/E began to look for the E/O in the Engine Room (E/R). The 2/E noticed that an elevator emergency key and a tool bag was laid on the ER second deck beside the elevator entrance door. When the elevator entrance door on the upper deck was opened, the E/O was found trapped between the elevator cage and the escape ladder inside the elevator trunk with his head and body in downward vertical position. The E/O did not show any vital signs. When a doctor arrived on board at about 0420 on 17 July 2014, the E/O was subsequently declared dead.

6.3 The investigation identified the following contributory factors leading to this accident:

- The E/O failed to perform the elevator repair/maintenance works according to the procedures stipulated in shipboard Safety Management Manual (SMM) and in the instruction manual of the elevator; and
- The E/O did not work under any supervision that was incompliance with the E/O's duties listed in SMM.

7. Recommendations

7.1 A copy of this report should be sent to the Master and the Company of the *Vessel*, advising them the findings of this incident. The owners / management company of the *Vessel* should issue circular to inform all masters, officers and crew on board ships the findings of this accident investigation.

7.2 To prevent the reoccurrence of similar accident, the owner should take appropriate measures to:

(a) ensure that all masters, officers and crew on board ships would strictly follow the procedures stipulated in shipboard Safety Management Manual (SMM) and in the machinery instruction manuals, for any kinds of works on board;

(b) ensure that all masters, officers and crew on board ships would be aware of the importance of effective team management; and

(c) ensure that all masters, and the chief engineers on board ships would enhance supervision and monitoring on crew members engaged in shipboard operations. Working alone by crew members should be avoided as far as possible and practicable.

7.3 The Company should inform the Marine Accident Investigation Section of the Hong Kong Marine Department of the above corrective actions taken upon completion.

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 draft report to that person or organization for comments.

8.2 The draft report was sent to the Manager of the *Vessel* of *Wilhelmsen Ship Management, Malaysia* and the Master of the *Vessel* through the Manager for the comments. They accepted the report without comment.