Report of investigation into the death of Bosun on board the Hong Kong registered bulk carrier *Magsenger 3* at sea in position $48^\circ 35.1'\text{N} 014^\circ 08.2'\text{W}$ on 13 March 2012.
**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 At about 1430 on 13 March 2012 at position 48° 35.1’N 014° 08.2’W, while the Hong Kong registered bulk carrier vessel *Magsenger 3* was en route from Dunkrik, France to Newport News, the United States, the Bosun fell into the No.7 cargo hold during cargo hold cleaning operation.

1.2 At the time of the accident, a portable derrick was used to lift a bucket of cargo residues of iron ore from the No.7 cargo hold. The bucket had been lifted to a level above the hatch coaming and was ready to be slewed away from the cargo hatch opening, suddenly the derrick failed and collapsed into the cargo hold. The Bosun immediately used his hand to hold the derrick but lost his balance and dropped into the cargo hold. He was certified dead on board.

1.3 The investigation into the accident revealed the following main contributing factors to the accident:

   a) not only ignoring the misalignment of the derrick’s mountings, the crew still used the derrick without following the manufacturer’s instructions. As a result, it caused the fracture of the derrick; and

   b) the Bosun did not realize the risk of working aloft nor following the relevant company procedures.
2. Description of the Vessel

Vessel Name: *Magsenger 3*

IMO Number: 9497220

Call Sign: VRIK6

Flag: Hong Kong

Port of Registry: Hong Kong

Trade of Vessel: World wide

Ship Type: Bulk Carrier

Gross Tonnage: 64769

Net Tonnage: 36935

Length (LOA): 254.00 m

Breadth (molded): 43.00 m

Depth (molded): 20.80 m

Summer Draft: 14.500 m

Deadweight(DWT) 115,401 M.T

Main Engine: Man B & W – S60MC-C8

Engine Power: S.M.C.R. 12220 Kw / 101.4RPM

Year of Built: 2011

Owners: Winrich Investments Holding Ltd

Managers: Anglo-Eastern Ship Management Hong Kong

Class: Lloyds Registry

Casualties: One

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1 S.M.C.R. – Specified Maximum Continuous Rating Power, and on corresponding revolution per minute.
Fig. 1 - Magsenger 3
3. **Sources of Evidence**

3.1 The ship management company conducted the investigation into the accident and provided the report to Hong Kong Marine Department for reference. The sources of evidence for this accident investigation were based on the report and information provided by the ship management company.
4. Outline of Events

4.1. At 1630 hrs local time on 11 March 2012, the Hong Kong registered bulk carrier *Magsenger 3* departed the port of Dunkirk in France after completed discharging of iron ore cargo. The Chief Officer signed off the vessel at Dunkirk due to medical reason. She sailed without Chief Officer on board and it was agreed by the Hong Kong Marine Department (HKMD) before sailing.

4.2. Cargo holds cleaning was planned to be carried out by the ship’s crew while the vessel en-route to Newport News, the United States. On 11 March 2012 after the dinner time, the Second Officer chaired a meeting with crewmembers briefing about cargo holds cleaning operations.

4.3. The cargo holds cleaning team consisted of the Bosun, who was in charge of the work, the Deck Cadet, two Ordinary Seamen and two Able-bodied seamen. The arrangement was :

- three crewmembers work inside cargo hold to scoop the cargo residues into a bucket;
- the Bosun controlled the derrick to lift up the bucket;
- two crewmembers on main deck to slew the boom of the derrick swinging the bucket away from the cargo hatch opening;
- the Bosun land the bucket on the main deck;
- the two crewmembers transfer the bucket to shipside and dump the cargo residues overboard.

4.4. The team started working in No.1 cargo hold at 0800 hrs on 12 March 2012. By 1800 hrs, they had completed the work in No.1, 2 and 3 cargo holds without encountered any problem with the use of the derrick.

4.5. The team resumed the cleaning work at 0800 hrs on 13 March 2012. After finished the work in No.5 and No.6 cargo holds, they continued in No.7 cargo hold.

4.6. At the time of the accident at about 1430 hrs on 13 March 2012, the approximate position of the vessel was 48º 35.1’N 014º 08.2’W. A bucket of cargo residues had been lifted to a level above the hatch coaming. While a crewmember responsible for taking care of the starboard slewing rope moved to the port side to assist his teammate to slew the derrick boom, he heard the Bosun shouted loudly that the derrick was going to collapse into the cargo hold. He saw the Bosun used his
hands to grasp the derrick but lost his balance and fell down into the cargo hold.

4.7. The port slewing rope could not hold the derrick from falling and was parted. The steel wire connecting to the bucket was parted too under the impulsive force applying on the steel wire due to free falling of the bucket. The derrick was restrained from falling by the rubber air hose and it was hanged in the air without reaching the tank top of the cargo hold.

4.8. The Bosun lied on the tank top and was bleeding from his head. The crewmembers inside the cargo hold called him but received no response. One crewmember on deck ran to the nearby telephone to inform the duty officer in the wheelhouse.

4.9. When the Master was informed of the accident, he ordered the Third Officer to relieve the Second Officer in the wheelhouse. The Second Officer proceeded to the cargo hold with first aid kit and oxygen resuscitator. After checking the vital sign of the Bosun, the Second Officer reported to the Master that the Bosun was out of senses, not responding and had no pulse, breath and heartbeat. As per company instructions, the Master sought medical advice from Falmouth Coastguard. A medical team ashore was convened to provide remote medical advises. However, the Bosun was later confirmed dead.

4.10. At 1500 hrs, the vessel was allowed to proceed the voyage. The body was lifted from the cargo hold on a stretcher and shifted to ship hospital and later preserved in the cold store.

4.11. The body was delivered ashore on arrival at Newport News, USA on 26 March 2012. A death certificate of the Bosun was issued by the port Authority.
5. Analysis

Manning

5.1 The Master of the vessel possessed a Certificate of Competency, in the capacity as Master on ships of 3,000 GT or more, issued by the Shanghai Maritime Safety Administration, the People’s Republic of China on 14 January 2008 and valid until 14 January 2013. He had been serving on board ocean going vessels in the capacity as a Master for more than three years and joined the vessel on 19 September 2011.

5.2 The Second Officer possessed a Certificates of Competency, in the capacity as Second Officer on ships of 3,000 GT or more, issued by the Tianjin Maritime Safety Administration, the People’s Republic of China on 08 October 2011 and valid until 08 October 2016. He had more than 10 years of sea services on ocean going vessels, and had been serving as second officer on bulk carrier vessels for more than three years. He joined the vessel on 3 October 2011.

5.3 The Bosun possessed a Certificate of Competency, in the capacity as A.B forming part of a navigational watch on ships of 500 GT or more, issued by the Guangdong Maritime Safety Administration, the People’s Republic of China on 07 January 2008 and valid until 07 January 2013. According to company record, he had served on board bulk carrier vessels for 14 years and had served on board three company’s bulk carrier vessels in the capacity of a Bosun since January 2007 when he was promoted from A.B to Bosun. Since then, he had accumulated about 40 months of sea services before joining the Magsenger 3 on 13 October 2011. The Bosun was considered experienced.

5.4 The Minimum Safe Manning Certificate issued to Magsenger 3 by HKMD required the vessel to be manned by 14 crewmembers. At the time of the accident, the number of crew on board the vessel was 21. It consisted of the Master, Second and Third Officers, Chief, Second, Third and Fourth Engineers, Electrician, one deck cadet, one fitter, three Able-bodied Seamen, two Ordinary Seamen, three Oilers, chief cook and mess boy, all were of Chinese nationality. The Chief Officer had signed off at Dunkirk, France before vessel departure. The Master had informed HKMD and the vessel was permitted to sail without Chief Officer for a maximum period of 28 days.

Weather and sea conditions

5.5 At the time of the accident, it was overcast with good visibility of 7 nautical miles. The wind was easterly Beaufort Scale force four. The sea was slight with
northwesterly swell approximately two metres long. *The weather and sea conditions were good and it should not have contributed to the accident.*

**The derrick for lifting cargo residues**

5.6 The derrick for lifting cargo residues was portable, designed and constructed by the shipbuilding yard which built and delivered the vessel in 2011. It was for winching a bucket for carrying cargo residues from inside cargo holds. The derrick was transportable by means of a trolley and required to be mounted to special mountings provided in each cargo hold.

5.7 The particulars of the derrick were:

- Rated lifting weight: 2.0KN (200Kg)
- Max. lifting height: 25 metres
- Rated working radius: 1.65 metres
- Hoisting speed: 8 m/min
- Air pressure for the motor: 0.6 ~ 0.7 MPa
- Steel Wire for the drum: 6 x 19-5-155-I x 45m-Plating-right ream GB/T1102-74
- Allowable list / Trim: Heel 5° / Trim 2°
- Weight of derrick: 58 Kg

5.8 The derrick was made of a steel tubular structure forming a straight vertical section (the foundation post) and an inclined section (the boom). A winch with wire drum was mounted on a stand welded to the post. Steel wire, pulley and lifting hook were rigged. An air motor was operated by pressurized air supplied from the engine room through the air filters mounted on the derrick. The air motor turned the winch to hoist or lower a bucket in way of cargo hold (see Figure 2 and 3).

5.9 During lifting, the air motor drove the winch to hoist up the bucket from the cargo hold until the bucket reached a level above the hatch coaming. The derrick was slewed manually to port or starboard side by pulling the port or starboard slewing ropes attached to the tip of the derrick so as to swing the bucket across the hatch coaming before landing it on the deck.
Figure 2 – Drawing of the derrick

Figure 3 – Photo of the derrick
5.10 The size of the bucket was 590mm in diameter and 500mm in height. When it was filled up with cargo residues of iron ore cargo, it weighed approximately 169 kg according to information provided by the company. The lifted load was below the designed safe working load of 200 kg of the derrick.

5.11 According to the manufacturer, the derrick should be mounted to a specialized fittings provided for each cargo hold at the hatch coaming (see Figure 3). The end of the foundation post should be inserted into a steel socket (lower support plate) fabricated and welded on the hatch coaming in way of a stiffener to support the weight of the derrick. It also allows the derrick to slew and twirl at this point during operation. The foundation post is also supported by a bracelet type mounting (upper support plate), which could be open and close to hold the body of the post, connecting to a steel plate welded on the hatch coaming plate (see Figure 4).

Figure – 4 Illustration of the foundation post
After the accident, inspection of the derrick by the ship management company found that the lower and upper supports were not in alignment, i.e. when the foundation post was inserted into the socket, the bracelet type mounting could not be fitted, or vice versa (Figure 5).

<table>
<thead>
<tr>
<th>Upper and lower support of the derrick</th>
<th>Upper bracelet type mounting inserted and aligned with the holes of the anchoring plate</th>
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<td><strong>The foundation post was inserted into the socket without fitting of the bracelet type mounting</strong></td>
<td><strong>The bracelet type mounting was engaged but the foundation post could not be inserted into the socket</strong></td>
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</table>

Figure 5 – Misaligned upper and lower supports
5.13 It was further confirmed by the ship management company after the accident that, due to poor workmanship, none of the cargo holds had a fully aligned setup to rig the derrick as required by the manufacturer. That defect was not discovered by the company upon acceptance of the vessel in October 2011.

5.14 Due to misalignment of the lower and upper supports, the derrick could not be properly mounted with lower and upper support plates, but it could still conveniently be inserted into the steel socket (lower support plate) as a temporary measure to solve the problem. The crew used the equipment for the first time on 12 March 2012 without following manufacturer’s instruction; and the defect was not reported to the ship management.

5.15 Refer to Figure 4, the weight of the derrick and the lifted load was supported by a disc welded at the foot of the foundation post. One end of the disc was welded to the end of the post and the other end of it welded to a short piece with round pivot end. A torque was applied to the derrick due to the lifted load together with the weight of the boom itself.

5.16 According to the calculation as shown in the Appendix 1, with the derrick correctly mounted at the upper and lower support plates, the estimated reaction force at the lower support of the derrick was about 540 Kg when the lifted load was 169 kg. However, when it was not mounted properly at the upper support plate, the estimated reaction force became 2047 kg (i.e. about 3.79 times of the normal).

![The foot of the davit was detached](image1.jpg)

![The poor welding surface of the foundation](image2.jpg)

Figure 6 – failure of the derrick at the foot of the foundation post
The higher than normal forces repeatedly applying on the lower support plate of the derrick could have caused premature failure of the welding seams in way of the disc at the foot of foundation post. Furthermore, poor workmanship on welding of the disc, revealed by inspection carried out by the ship management company of the failed components, aggravated the problem (Figure 6). As a result, the derrick was broken while it was lifting a bucket of cargo residues from No.7 cargo hold at about 1430 hrs on 13 March 2012.

**Risk assessments and Safety awareness**

While without Chief Officer on board, the Second Officer was responsible for cargo cleaning operation. He held a briefing session with crewmembers taking part in the cargo cleaning operation. No records was available to show what issues had been discussed in the briefing session.

During the operation, the Bosun was to operate the air motor to control the up and down movements of the bucket, and at the same time to check and ensure safety and no obstruction during lifting. As there were no monitoring platforms provided near the derrick, so he had to station himself at a convenience position beside the derrick with his body leaning against it and partly over the hatch coaming plate in order to enable him to look into the cargo hold. Presumably, the associated risk of a person working aloft (i.e. on top of the cargo hatch coaming with the hatch covers opened) was not identified in the briefing session. Hence safety precautions were not in place to mitigate or remove the risk before commencement of the work.

Despite of that, the experienced Bosun should have aware of the risk during working at the site since he had to lean against the derrick and with the upper part of his body cranked over the hatch coaming (witnesses even mentioned that he stood on top of the hatch coaming plate) in order for him to look into the cargo hold so as to monitor the safe lifting of the bucket of cargo residues.

The height from the top of the coaming to tank top plate of the cargo hold is about 21 metres. According to the “Code of Safety Working Practice for Merchant Seaman”, all seamen shall wear safety harness (or safety belt with shock absorber lanyard) while working aloft, over the ship side, under the deck or any place with the possibility of falling down. The Bosun did not realize the risk of working aloft and did consider to use personnel protection equipment such as fall arrestor or harness in accordance with company procedures. He might have perceived that the height of the hatch coaming from main deck approx. 1.5m was sufficient to guard him from falling into the cargo hold. He had accustomed to that unsafe practices since he
started the cargo hold cleaning operations on 12 March 2012.

**Corrective and preventive actions taken by the company**

5.22 After the accident, the company staff attended the vessel and conducted crew briefing on safety precautions while carrying out hold cleaning operation on 25 March 2012. The procedure for operation of the derrick on board the vessel was reviewed and revised. Platform for monitoring of holds while operating the derrick were fabricated for all cargo holds and the mounting of the derrick were modified.

5.23 The company had also promulgated message to the fleet to share the lessons learnt. The condition of portable hold cleaning derrick and their mounting arrangements were verified, especially for the derricks built by the same manufacturer.
6. **Conclusions**

6.1 At about 1430 on 13 March 2012 at position 48° 35.1’N 014° 08.2’W, while the Hong Kong registered bulk carrier vessel *Magsenger 3* was en route from Dunkrik, France to Newport News, the United States, the Bosun fell into the No.7 cargo hold during cargo hold cleaning operation.

6.2 At the time of the accident, a portable derrick was used to lift a bucket of cargo residues of iron ore from the No.7 cargo hold. The bucket had been lifted to a level above the hatch coaming and was ready to be slewed away from the cargo hatch opening, suddenly the derrick failed and collapsed into the cargo hold. The Bosun immediately used his hand to hold the derrick but lost his balance and dropped into the cargo hold. He was certified dead on board.

6.3 The investigation into the accident revealed the following main contributing factors to the accident:

   a) not only ignoring the misalignment of the derrick’s mountings, the crew still used the derrick without following the manufacturer’s instructions. As a result, it caused the fracture of the derrick; and
   
   b) the Bosun did not realize the risk of working aloft nor following the relevant company procedures.

6.4 The other safety factors revealed are as follows:

   a) Poor workmanship in the fabrication of the derrick and its mounting;
   
   b) Misalignment of the derrick mountings was not detected upon acceptance of the new vessel;
   
   c) The crew did not report the defect in the mounting of the derrick to the ship management;
   
   d) The assessment before commencement of work did not fully consider all possible steps in the work and the associated risks.
7. **Recommendations**

7.1 The ship management company should:

a) circulate the findings of this accident investigation to the managed vessels for lessons learnt;

b) check the correctness of fittings for derricks having similar designs upon future acceptance of new vessels and during routine maintenance thereafter; and

c) instruct the masters of vessels to ensure crewmembers follow manufacturer’s instructions in the use of derrick of similar designs.

7.2 The Shipping Division of the Marine Department, as flag Administration of the vessel, should monitor the effective implementation by the ship management company of the above safety recommendation.

7.3 Hong Kong Merchant Shipping Information Note should be issued to promulgate lessons learnt from this accident.
8. Submissions

8.1 In the event that the conduct of any person or organization is criticized in an accident investigation report, it is the policy of the Marine Department that a copy of the draft report, either partly or entirety, is given to that person or organization so that they can have an opportunity to rebut the criticism or offer evidence not previously available to the investigating officer.

8.2 Copies of the draft report, in its entirely, are provided to the following for comments:
   a) management company of the Magsenger 3;
   b) Shipping Division of Marine Department; and
   c) Mercantile Marine Office of Marine Department.

8.3 A submission by the management company of Magsenger 3 has been received and the report has been amended as appropriate.
Appendix. 1. Shear force analysis on the derrick post

Comparison of shear forces applying at the end of the derrick foundation post when it is properly mounted in accordance with manufacturer’s instructions or not is given below.

As shown in the above diagram, the external forces acting at the end of the foundation are the weight of the lifted load and the body weight of the derrick boom.

In this calculation, the body weight of the derrick boom is neglected.

The weight of the lifted load is $W$ kg. The horizontal distance between the weight and the centre line of the derrick is $L$ mm.

The torque applying at the end of the foundation equal to $W \times L$ kg.mm.

In the incident, $W = 169$ Kg; $L = 1599$ mm.

The torque applying at the end of the foundation equals to
\[ W \times L = 169 \times 1599 = 270231 \text{ kg.mm} \]

**Condition 1**

When the derrick is properly mounted at its lower and upper supports, the position at the upper support becomes the leverage point.

The reaction torque at the end of the foundation equals to the reaction force \( F_1 \) multiply by the distance \( L_1 \) measured from the end of the foundation to the upper support, such that \( F_1 \times L_1 = 270231 \text{ kg.mm} \).

\( L_1 = 500 \text{ mm} \) as shown in the above diagram, therefore \( F_1 = \frac{270231}{500} = 540 \text{ kg} \).

**Condition 2**

When the derrick is not properly mounted at its upper support, the leverage point changes to the position at edge of the lower support.

The reaction torque at the end of the foundation equals to the reaction force \( F_2 \) multiply by the distance \( L_2 \) measured from the end of the foundation to the upper edge of the lower support, such that \( F_2 \times L_2 = 270231 \text{ kg.mm} \).

\( L_2 = 132 \text{ mm} \) as shown in the above diagram, therefore \( F_2 = \frac{270231}{132} = 2047 \text{ kg} \).

**Conclusion**

When the derrick is not mounted in accordance with the manufacturer’s requirement, the shear force applying at the end of the foundation increases. In this incident, the shear force increased about 3 times.