



# REPUBLIC OF THE MARSHALL ISLANDS

## Maritime Administrator

### PENELOPE CASUALTY INVESTIGATION REPORT

Provision Crane Maintenance Platform Failure with Fatality

Coral Sea | 26 November 2018

Official Number: 5744

IMO Number: 9317822





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## **AUTHORITY**

An investigation under the authority of Republic of the Marshall Islands laws and regulations, including all international treaties, conventions and instruments to which the Republic of the Marshall Islands is a Party, was conducted to determine the cause of the casualty.



*Maritime Administrator*



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## PART 1: EXECUTIVE SUMMARY

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On 26 November 2018, the Republic of the Marshall Islands-registered bulk carrier PENELOPE was underway in the Coral Sea when the lower stage platform extension for the portside provision crane detached from the main platform and fell. An Able Seafarer Deck (ASD) carrying out routine maintenance on the crane was standing on the platform extension when it detached. His safety line was attached to the railing on the platform extension, which caused the ASD to fall together with the platform about 8-9 meters (m) to the Lifeboat Deck. He died as a result of injuries sustained from the fall.

The Republic of the Marshall Islands Maritime Administrator's (the "Administrator's") marine safety investigation determined that the causal factors that contributed to this very serious marine casualty include:

- (a) the design of the connection of the two parts of the lower stage of the portside provision crane was inherently weak and prone to failure. It was based on three short welded brackets and it did not include mechanical connections joining the railing on the two parts of the lower stage;

- (b) the failure of the welds for the brackets used to connect the two parts of the lower stage; and
- (c) the ASD’s safety line was connected to the railing on the platform extension of the lower stage.

The Administrator’s investigation determined additional causal factors that may have contributed to this very serious marine casualty include:

- (a) corrosion where each bracket landed on the main platform not being detected during the most recent inspections conducted by members of the ship’s crew or most recent surveys conducted by an attending Bureau Veritas (BV) surveyor; and
- (b) the potential consequences of a failure of the bracketed connections used to secure the platform extension to the main platform might not have been recognized; the lack of international and national requirements addressing the design, maintenance, and inspection of means of safe access to lifting devices.

## PART 2: FINDINGS OF FACT

The following Findings of Fact are based upon the information obtained during the Administrator’s marine safety investigation.

1. Ship’s particulars: see chart to right.
2. PENELOPE is a seven-hatch, gearless, bulk carrier built at the IHI Marine United shipyard in Yokohama, Japan in 2006.
3. On 12 June 2014, management of PENELOPE was transferred from Sandigan Ship Services, Incorporated to Oceanbulk Maritime S.A. (the “Company”) and registration was changed from the Republic of Singapore to the Republic of the Marshall Islands. On 15 June 2014, the ship’s Classification Society was changed from ClassNK to BV.
4. PENELOPE was built with port and starboard provision cranes located at the aft end of the accommodation (*see Figure 1*). Both cranes were built by Koei Sangyo Co., Ltd. and were fitted with an upper and lower stage for performing maintenance.

<b>SHIP PARTICULARS</b>		
<b>Ship Name</b> PENELOPE		
<b>Registered Owner</b> Nerites Shiptrade Inc.		
<b>ISM Ship Management</b> Oceanbulk Maritime S.A.		
<b>Flag State</b> Republic of the Marshall Islands		
<b>IMO No.</b> 9317822	<b>Official No.</b> 5744	<b>Call Sign</b> V7GP8
<b>Length x Breadth x Depth</b> 221 x 36.5 x 19.9 meters		
<b>Year of Build</b> 2006	<b>Gross Tonnage</b> 47,051	
<b>Net Tonnage</b> 27,005	<b>Deadweight Tonnage</b> 87,144	
<b>Ship Type</b> Bulk Carrier		
<b>Document of Compliance</b> <b>Recognized Organization</b> Bureau Veritas		
<b>Safety Management Certificate</b> <b>Recognized Organization</b> Bureau Veritas		
<b>Classification Society</b> Bureau Veritas		
<b>Persons on Board</b> 21		

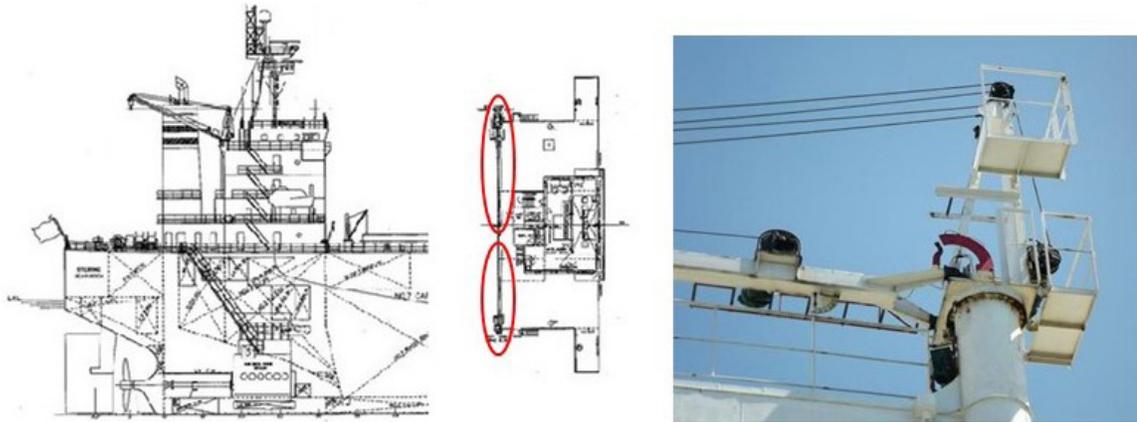


Figure 1: Portion of General Arrangement drawing showing the port and starboard provision crane locations, outlined in red on the plan view.<sup>1</sup> On the right is a picture of the starboard provision crane showing the upper and lower stages. The design of the port and starboard cranes was the same.

- The lower stage has two parts: the main platform (welded to the pedestal) and the platform extension. As built, the extension was attached to the main platform by three bolted connections (see Figures 1 and 2). There was no physical connection at the railing of the two parts.

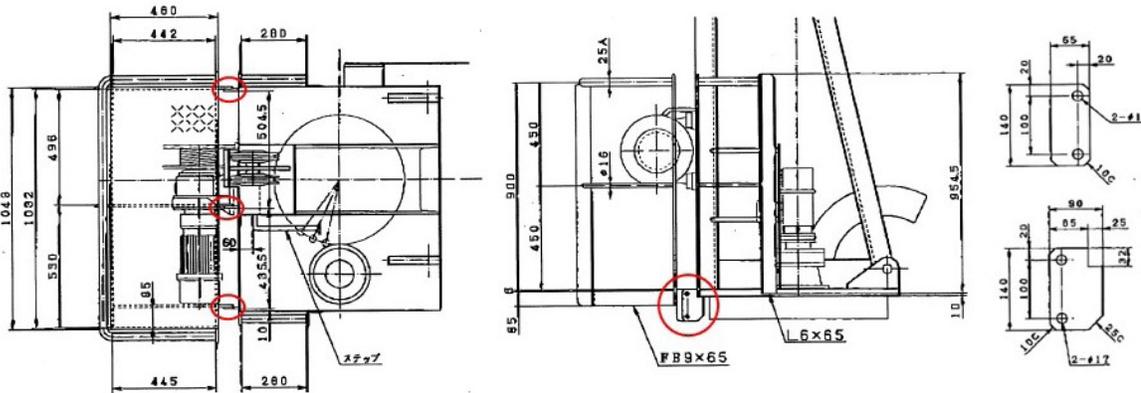


Figure 2: Drawing of the lower stage for the port provision crane. The brackets are circled in red. Note the absence of a physical connection at the railing. On the top right is a drawing of the bracket that is welded to the platform extension and bottom right is a drawing of the bracket that is welded to the main platform.<sup>2</sup>

- Each of the three connections had a bracket welded to the main platform and another to the platform extension. The brackets were notched where they were welded to the main platform. Each bracket set had two bolts installed through the holes connecting the extension and the main platform sections (see Figure 2).
- The arrangement drawing included as part of the operations manual for the port provision crane does not indicate that the lower stage consisted of two parts. Rather, it indicates the lower stage is a single part (see Figure 3).

1 IHI Marine United, SHIRAKUMO S.No.3213, General Arrangement (Drawing No. K2000402), dated 25 June 2006.

2 Koei Sangyo Co., Ltd., 0.9T Provision Handling Crane, Final Drawings & Instruction, Stage (Drawing No. K129-2006-FD-01) with stamped date 29 May 2006.

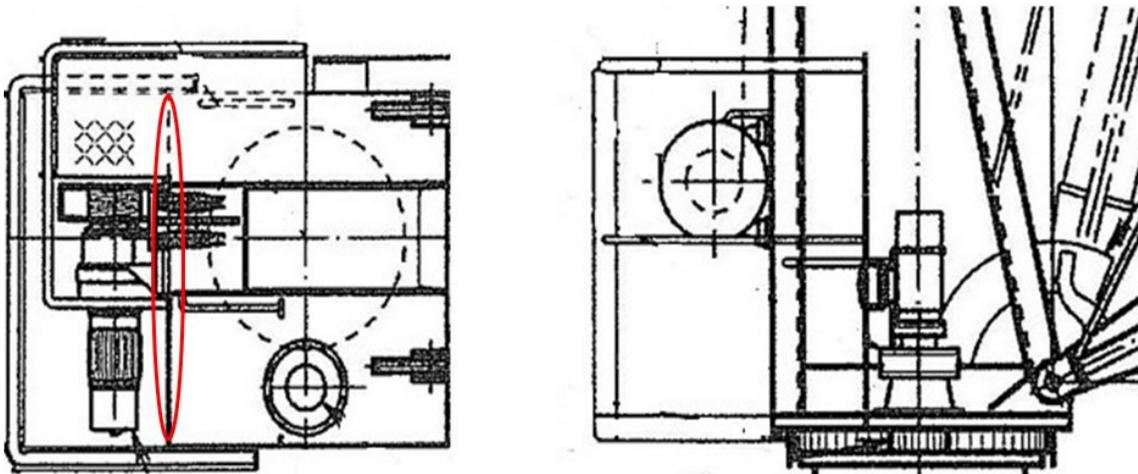


Figure 3: Portion of port provision crane arrangement drawing that is included in the operations manual. The plan view (left), which includes the upper stage, has a line (circled in red) indicating the stage might consist of two parts. However, both the plan view and arrangement view (right) indicate that the two courses of the railing were each a single piece.<sup>3</sup>

### Incident Description

8. On 26 November 2018, PENELOPE was underway in the Coral Sea on a ballast voyage from Yeosu, Republic of Korea to Newcastle, Australia. The weather was reported as good with winds of Beaufort Force 5 from the northwest and seas from the west with a height of about 1-1.5 m.
9. On the afternoon of 26 November 2018, the ship's Chief Officer (C/O) assigned an ASD and an Ordinary Seafarer (OS) to perform routine maintenance on the port side provision crane. A risk assessment and a Working Aloft Permit were completed and signed by the Master, C/O, and the two deck ratings who would be performing the work. The C/O then conducted a Toolbox Talk with the ASD and OS.
10. At about 1600,<sup>4</sup> the ASD and OS began the work. The OS was standing on the Bridge Deck near the port side crane assisting the ASD. The ASD was standing on the platform extension. Both were wearing coveralls, gloves, safety boots, and safety helmets. The ASD was also wearing a safety belt with a line connected to the handrail on the extension (see Figures 3 and 4).

<sup>3</sup> Koei Sangyo Co., Ltd., 0.9T Provision Handling Crane, Provision Handling Crane (Jib Type) with Instruction Book (Drawing No. K129-2006-FD-01, dated 29 May 2006.

<sup>4</sup> Unless otherwise stated, all times are the ship's local time (UTC +11).



Figure 4: Extension platform near where it landed on the Lifeboat Deck.

11. At approximately 1655, the platform extension detached and fell to the port side Lifeboat Deck. The platform extension was approximately 8-9 m above the Lifeboat Deck before falling.
12. When the platform extension and the ASD fell, the OS was getting some extra rags and was looking away from the crane. He did not see what happened but reported hearing a loud noise. The OS stated he immediately turned and saw that the ASD and the extension had fallen to the Lifeboat Deck, and that he then shouted and ran to the Bridge door to alert the Master and C/O. Before the OS reached the Bridge door, the Master and C/O, who reported hearing a loud sound, were proceeding out on deck.
13. The Bosun, who was working near the port side gangway, reported hearing a “big bang” and the OS shouting. The Bosun stated he went up to the Lifeboat Deck, where he saw the platform extension lying on top of the ASD. He removed the extension off the ASD and shouted for assistance. The Master, C/O, Second Officer (2/O), and other crewmembers responded.
14. It was reported that the ASD was unconscious, did not have a pulse, was not breathing, and cardiopulmonary resuscitation (CPR) was started. Within a few minutes he had a pulse and was breathing with some difficulty.
15. The Master informed the ship’s Designated Person Ashore (DPA) of the incident, who instructed him to immediately alter course to the nearest port and to contact the International Radio Medical Centre (C.I.R.M.) for medical advice. The Master was unable to contact C.I.R.M. At 1710, he informed Rescue Coordination Center (RCC) Australia and was put in contact with the Duty Medical Coordinator (DMC), who advised the Master regarding medical treatment for the ASD.
16. At 1720, in response to directions from RCC Australia, the Master ordered the ship’s course changed to proceed to position 16°19’ S, 149° 50’ E, from where the ASD would be evacuated for medical treatment

on shore.<sup>5</sup> While PENELOPE was proceeding to the rendezvous position, the Master was in regular communication with the DMC regarding the ASD's condition. The Master continued, without success, to contact C.I.R.M.

17. At 2140, the ASD's breathing became more irregular. By 2150, he had stopped breathing and the crew started CPR. At 2200, blood was observed coming from the ASD's mouth. The Master contacted the DMC to provide an update and was advised that the ASD had died.
18. At 2259, RCC Australia informed the Master that the medical evacuation had been cancelled and that PENELOPE should resume the planned voyage. Based on this, the Master ordered the ship to proceed to Newcastle.

### *Inspections of the Provision Cranes*

19. Since 15 June 2014, the port and starboard provision cranes were both subject to testing and examinations by BV in accordance with International Labour Organization (ILO) Convention No. 152 Occupational Safety and Health (Dock Work) Convention, 1979 (ILO No. 152), Part III, Articles 21-32.<sup>6</sup>
20. BV's rules for conducting these inspections are found in the Rules for the Certification of Lifting Appliances onboard Ships and Offshore Units (BV Rule Note NR 526).<sup>7</sup> These rules require that during annual examinations the fixed structure of lifting appliances "be checked to ascertain that there is no corrosion, deformation and other damages likely to impede their reliability."<sup>8</sup> They also include a requirement that the ladders, gangway, or other means of accessing a crane "be in satisfactory condition."<sup>9</sup> No distinction is made between permanently-fitted ladders or means of access and those that are temporarily put in place to complete an inspection.
21. The most recent annual examination of the provision cranes by an attending BV surveyor was completed on 23 June 2018. No observations or recommendations related to the condition of these cranes were issued. The scope, including the assessment of the ladders and access means, was based on visual examination. Non-destructive testing (NDT) is not mandatory but can be required if deemed necessary by the attending surveyor.<sup>10</sup>
22. Both cranes were inspected by the ship's crew every three months, as required by the Company's PMS. The last four inspections of the port provision crane were conducted on 29 November 2017, 2 March 2018, 2 June 2018, and 6 September 2018. Based on the inspection checklist completed when these inspections were conducted,<sup>11</sup> the crane was reported to be in good condition.

<sup>5</sup> At 1720, PENELOPE's position was 15° 07.8' S, 152° 51.4' E.

<sup>6</sup> Republic of the Marshall Islands-registered vessels are not required to comply with ILO No. 152. However, the Administrator encourages vessel owners and operators to implement Articles 21-32. See Republic of the Marshall Islands Technical Circular No. 3.

<sup>7</sup> Unless stated otherwise, all references to BV Rule Note NR 526 will be to the September 2017 revision. The platform extension is not considered by BV to be part of the port provision crane's fixed structure.

<sup>8</sup> BV Rule Note NR 526, Chapter 4, Section 2, paragraph 2.2.1.

<sup>9</sup> *Ibid*, Chapter 4, Section 2, paragraph 2.1.3.

<sup>10</sup> *Ibid*, Chapter 4, Section 2, paragraph 1.3.2.

<sup>11</sup> Oceanbulk Maritime S.A., Form D46 – Crane Inspection / Works Checklist. Based on the items that are included on the inspection checklist, it appears it was developed based on inspections of cargo deck cranes rather than provision cranes.

23. The Company's inspection checklist requires inspecting:
- (a) the condition of the crane tower, from the inside and outside;
  - (b) the welding of the crane tower and Main Deck;
  - (c) the condition of the structure; and
  - (d) coating of the crane foundation.

The checklist does not include a requirement to inspect the upper or lower stages.

24. When examined as part of the Administrator's marine safety investigation, it was determined that the welds for all three of the main platform brackets had failed. There was heavy corrosion on the main platform where all three brackets were attached to the main platform (see Figure 5). It also appeared that the welds lacked full penetration. The ship's crew reported that the corrosion was not visible prior to the extension falling.

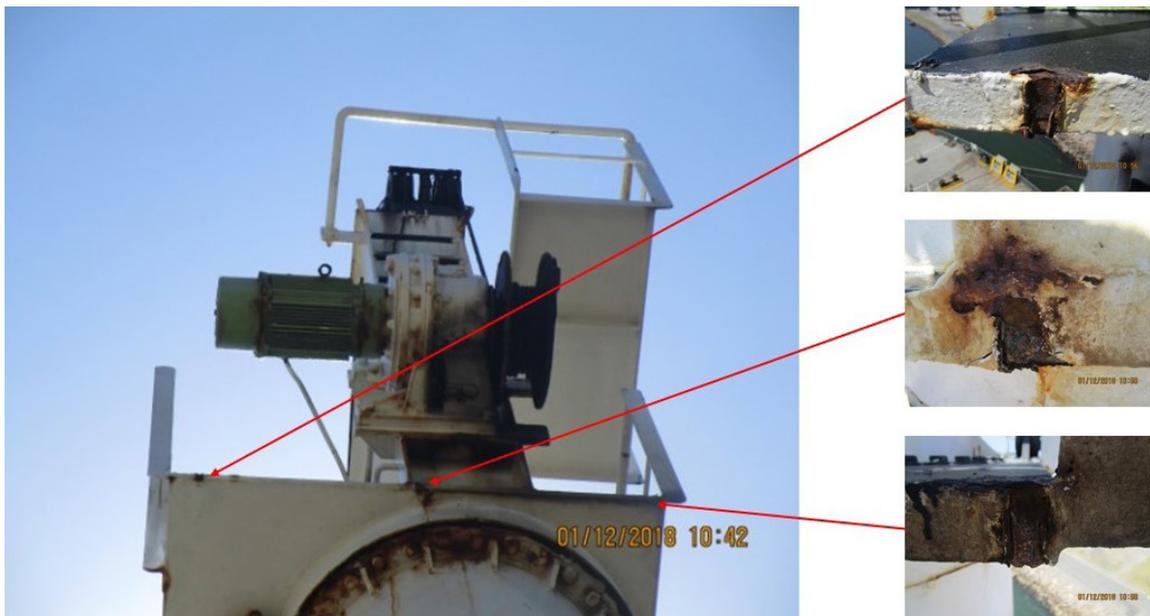


Figure 5: Portside provision crane showing the locations of the failed welds and the corrosion where the brackets were welded to the main platform. The Bridge Deck is to the left of the crane.

25. Two sets of brackets were intact with the bolts in place. The third set, which had been closest to the Bridge Deck at the time of the incident, was broken apart. One bracket of this set was bent but was still connected to the extension. The bracket that had been welded to the main platform was laying on the deck. The lower bolt was sheared off and the upper bolt was missing. There was heavy corrosion on each of the brackets where they attached to the main platform (see Figure 6).

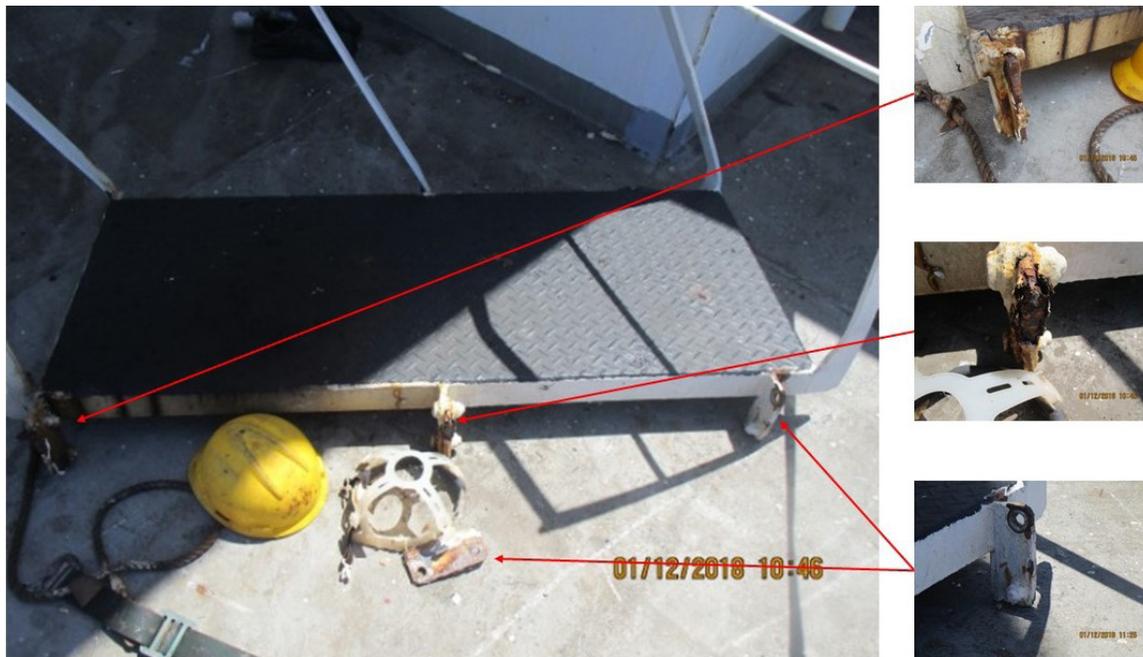


Figure 6: Platform extension showing the brackets. Also shown is the ASD's safety helmet and safety belt and line. Note that the suspension for the safety helmet was dislodged.

26. The railing around the perimeter of the platform extension was bent, but otherwise in good condition.
27. Between 1–3 December 2018, a BV surveyor conducted an ILO 152 Cargo Gear Occasional Survey and issued a recommendation for the port provision crane platform to be restored as per the manufacturer's design and to be verified by BV.<sup>12</sup>
28. Repairs were completed and were verified by the attending BV surveyor during a survey carried out on 25–26 January 2019. Following a visual examination of the repairs, a load test using 150 kilograms on the platform extension was carried out. After completion of the load test, the connection welds were subject to magnetic particle testing.<sup>13</sup>

### **Human Factors**

29. On 26 November 2018, there were 21 officers and ratings on board PENELOPE. All held valid seafarer documents issued by the Administrator, as required for their position on board.
30. The C/O had 18 years at sea and almost one and a half years in rank. He had been with the Company for just over one and a half years and had been on board PENELOPE for almost eight months. Based on the information available to the Administrator, he was familiar with the requirements of the Company's SMS.
31. The ASD had about two and a half years at sea, of which slightly more than two years was as an ASD. He had been with the Company for almost 11 months and signed on PENELOPE on 11 November 2018.

<sup>12</sup> During this period, the BV surveyor also completed an occasional machinery survey. See BV survey report BBN0/2018/J5273.

<sup>13</sup> See BV survey report LCR0/2019/J5004.

After signing on, the ASD received an initial safety familiarization, which included a review of the safe work procedures in the Company's SMS.

32. All involved crewmembers had received the amount of rest mandated by the International Maritime Organization's (IMO's) Seafarers' Training, Certification and Watchkeeping (STCW) Code,<sup>14</sup> Section A-VIII/1, paragraphs 2 and 3 and the ILO's Maritime Labour Convention, 2006 (MLC, 2006), regulation 2.3, prior to the incident.

***Safe Work Practices***

33. The procedures in the Company's SMS for working aloft or over the side apply when working at a height of over 1 m. These procedures require that a "Working Aloft or Over the Side" permit and risk assessment be completed to document the planned work and safety precautions that will be taken.<sup>15</sup> Because a permit is required for working aloft, it is designated by the SMS as a higher risk operation. These procedures also require that a Toolbox Talk be conducted with the crewmembers assigned to the task before work begins.
34. The Company's working aloft procedures mandate the use of a safety harness and having an observer on deck who can call for help if needed. They also include a caution that the safety line should not be fastened to a location that could involve additional hazards.<sup>16</sup> These procedures do not include the use of a safety belt.

***Regulatory Requirements***

35. The International Convention for the Safety of Life at Sea (SOLAS), 1974 currently does not include requirements for lifting gear. The IMO's Subcommittee on Ship Systems and Equipment (SSE) is currently working on the development of amendments to SOLAS for shipboard lifting gear and appliances.
36. Although the Republic of the Marshall Islands Maritime Regulations currently also does not include requirements for such equipment, as previously noted, the Administrator does encourage voluntary compliance with the requirements that are in ILO No. 152, Part III, Articles 21-32.<sup>17</sup>
37. The requirements for lifting gear that are in ILO No. 152 do not include any provisions addressing the design, maintenance and inspection of means for persons to safely access a lifting device when conducting maintenance, inspections or to operate it.

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14 As amended by STCW/CONF.2/34, the Manila Amendments to the STCW Code.

15 Oceanbulk Maritime S.A., Form D38 — Working Aloft or Over the Side Permit.

16 The example that is provided is the funnel.

17 See Republic of the Marshall Islands Technical Circular No. 3.

## PART 3: ANALYSIS

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The following Analysis is based on the above Findings of Fact.

### ***Crane Maintenance Platform Failure***

The ASD's fall from height was directly related to the failure of the brackets connecting the platform extension to the main platform, which was welded to the pedestal. Based on the condition of the three bracket sets when they were examined after the incident, it appears that the set nearest the Bridge Deck might have supported the platform extension and ASD for a short period. This is based on how the bracket welded to the extension was bent and that the remaining bolt was sheared (*see Figure 6*).

Based on the information obtained by the Administrator during the marine safety investigation, it is not known if any of the welds connecting the brackets to the main platform were cracked before the ASD began working on the port provision crane. However, the presence of heavy corrosion where each bracket attached to the main platform indicates water had been able to reach this area over time (*see Figures 4 and 5*). This corrosion would have contributed to the failure of these welds.

Based on how heavy the corrosion was, it is likely that it was present when the crane was last examined by BV on 23 June 2018 and inspected by the ship's crew on 6 September 2018.

If the fillet welds were not wrapped around to close any gaps between the main platform and the brackets, water would have been able to infiltrate these areas causing corrosion. Water could also seep in through a weld crack.

Although the provision cranes had been in service without incident since the ship was delivered from the shipyard in 2006, the way the platform extension was connected to the main platform increased the potential for a catastrophic failure. Because there was not a mechanical connection between the handrail on the main platform and the handrail on the platform extension, the three brackets supported the full weight of the extension and any crewmember standing on it.

### ***Provision Crane Inspections***

The provision cranes were subject to periodic examinations in accordance with ILO No. 152.<sup>18</sup> These examinations were conducted by BV surveyors in accordance with BV Rule Note NR 526. They are supposed to include an assessment of the condition of the ladders and means of access and check to ascertain that there was no corrosion, deformation, or other damage to the fixed structure that would impede its reliability. During the annual examination conducted by a BV surveyor on 23 June 2018, which was the last one conducted before the platform extension detached from the main platform and fell, the condition assessment of the ladders and means of access was based on the attending surveyor's visual examination. No observations or recommendations were issued during this annual examination.

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18 As previously stated in the Findings of Fact, ILO 152 does not include requirements addressing the design, maintenance and inspection of means of access.

The Company's PMS also required that the provision cranes be inspected every three months by the ship's crew. These condition assessments of the crane's structural condition were based on visual examinations. As previously stated, the inspection checklist did not include a requirement to assess the condition of either the upper or lower stages. The implication is that the structural condition of the brackets connecting the platform extension to the main platform may not have been checked when inspections were conducted.

Based on the crew's statements that the corrosion was not visible before the platform extension detached and fell, a visual examination by an attending BV surveyor or visual inspection by a crewmember would not have been an effective means of assessing the condition of the bracketed connections. Defects might have been detected if a closeup, detailed inspection of the brackets had been conducted. Although the brackets could be seen from the Bridge Deck, their location under the lower stage could contribute to them being overlooked during an inspection.

***Onboard Risk Management***

The Company has procedures in place for managing risks associated with working aloft. Based on the information available to the Administrator, these procedures were followed both before and while the ASD and OS were performing routine maintenance on the portside provision crane, except for the use of a safety belt instead of a harness. Because the safety line was connected to the railing around the platform extension of the lower stage, safety harness use would not have resulted in a different outcome in this case.

As previously stated, the Company's SMS procedure for working aloft does include a warning to not fasten a safety line to locations that might pose additional hazards. However, compliance with this warning may be challenging as additional hazards associated with some locations are not always immediately obvious. The potential hazard of connecting the safety line to the handrail on the platform extension was not apparent and, prior to this incident, it would have been reasonable for the seafarers working on board PENELOPE to not have expected the brackets supporting the extension to fail.

***Regulatory Requirements***

Neither SOLAS nor the Republic of the Marshall Islands Maritime Regulations currently include requirements addressing lifting devices. Although the Administrator does encourage voluntary requirements with ILO No. 152, those requirements do not address the design, maintenance and inspection of safe means for persons needing to access a lifting device when conducting maintenance, inspections or to operate it. A result is that the design, maintenance and inspection of the upper and lower stages was outside of regulatory oversight.

## PART 4: CONCLUSIONS

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The following Conclusions are based on the above Findings of Fact and Analysis and shall in no way create a presumption of blame or apportion liability:

1. Causal factors that contributed to this very serious marine casualty include:
  - (a) the design of the connection of the two parts of the lower stage of the portside provision crane was inherently weak and prone to failure. It was based on three short welded brackets and it did not include mechanical connections joining the railing on the two parts of the lower stage;
  - (b) the failure of the welds for the brackets used to connect the two parts of the lower stage; and
  - (c) the ASD's safety line was connected to the railing on the platform extension of the lower stage.
2. Causal factors that may have additionally contributed to this very serious marine casualty include:
  - (a) corrosion where each bracket landed on the main platform not being detected during the most recent inspections conducted by members of the ship's crew or the most recent surveys conducted by an attending BV surveyor;
  - (b) the potential consequences of a failure of the bracketed connections used to secure the platform extension to the main platform might not have been recognized;
  - (c) the inspection checklist in the Company's PMS may not have been as effective as it could have been because it did not include a requirement to inspect the upper and lower stages; and
  - (d) the lack of international and national requirements addressing the design, maintenance, and inspection of means of safe access to lifting devices.

## PART 5: PREVENTIVE ACTIONS

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The Company has taken the following Preventive actions:

1. modified the design of the connection between the main platform and the platform extension to include mechanical connections at the railings on the ship's port and starboard provision cranes;<sup>19</sup>
2. amended the crane inspection checklist<sup>20</sup> in the Company's PMS to include inspection of the condition of the upper and lower maintenance platforms;
3. amended the Company's permit and risk assessment for working aloft or over the side<sup>21</sup> to include guidance for assessing locations where a safety line might be attached to avoid additional hazards;
4. provided all ships in the Company's fleet with five full body safety harnesses and fall arrest systems; and

<sup>19</sup> The Company also modified these connections on the port and starboard provision cranes fitted on board the Republic of the Marshall Islands-registered NOZOMI (IMO No. 9323871). NOZOMI is another ship in their managed fleet that was also built at the IHI Marine United shipyard in Yokohama in 2006 and fitted with provision cranes manufactured by Koei Sangyo Co., Ltd.

<sup>20</sup> Oceanbulk Maritime S.A., Form D46 — Crane Inspection / Works Checklist.

<sup>21</sup> Oceanbulk Maritime S.A., Form D38 — Working Aloft or Over the Side Permit and Risk Assessment.

5. amended the SMS to include a “Stop Work” procedure as part of its adoption of a Behavior-Based Safety System.

BV has taken or is taking the following actions:

1. issued an internal circular in July 2019 drawing its surveyors’ attention to this specific risk for their safety when they carry out survey of cranes; and
2. considering an amendment to BV Rule Note NR 526, Chapter 4, Section 2, paragraph 2.1.3 to include a reference to the connections of ladders, gangways or other means of access used for the inspection to lifting appliances.

The Administrator has taken the following action:

1. Issued Marine Safety Advisory 23–19 on 30 July 2019 that included recommended actions for ship managers based on the Administrator’s marine safety investigation of the failure of the connection of the two parts of the lower stage of the port provision crane.

## **PART 6: RECOMMENDATIONS**

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The following recommendations are based on the above Conclusions and in consideration of the Preventive Actions taken:

1. No recommendations are made to the Company or BV.
2. It is recommended that Koei Sangyo Co., Ltd. consider:
  - (a) developing a means of reinforcing the connection on cranes built using the connection details shown on the drawings for the provision cranes fitted onboard PENELOPE and issuing a service bulletin to owners of ships fitted with those cranes; and
  - (b) amending the design details for new cranes that use a similar means of connection of the two sections of the lower stage.
3. It is recommended that the Administrator take the above Conclusions into account when considering proposals at the IMO related to the development of amendments to SOLAS for shipboard lifting gear and appliances.

The Administrator’s marine safety investigation is closed. It will be reopened if additional information is received that would warrant further review.