



## SAFETY INVESTIGATION REPORT

201910/031

REPORT NO.: 19/2020

October 2020

The Merchant Shipping (Accident and Incident Safety Investigation) Regulations, 2011 prescribe that the sole objective of marine safety investigations carried out in accordance with the regulations, including analysis, conclusions, and recommendations, which either result from them or are part of the process thereof, shall be the prevention of future marine accidents and incidents through the ascertainment of causes, contributing factors and circumstances.

Moreover, it is not the purpose of marine safety investigations carried out in accordance with these regulations to apportion blame or determine civil and criminal liabilities.

### NOTE

This report is not written with litigation in mind and pursuant to Regulation 13(7) of the Merchant Shipping (Accident and Incident Safety Investigation) Regulations, 2011, shall be inadmissible in any judicial proceedings whose purpose or one of whose purposes is to attribute or apportion liability or blame, unless, under prescribed conditions, a Court determines otherwise.

The report may therefore be misleading if used for purposes other than the promulgation of safety lessons.

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### **MT RUBY-T** **Serious injury to crew member** **while alongside at the port of Nikolaev, Ukraine** **20 October 2019**

### SUMMARY

Crew members on *Ruby-T* were testing the rescue boat crane's limit switches, in preparation for a vetting inspection.

To reset the system, the bosun used the hand crank to wind down the wire and disengage the limit switch. Once he saw that the wire was lowering manually, he turned around and focused on the crane control box to resume lowering under power.

As soon as he engaged the crane control box, the hand crank,

which was still mounted on the crane, rotated in a fast motion and hit the bosun directly on his back. This resulted in his chest being slammed against the crane control box.

As a result, the bosun had suffered from three fractured ribs.

The MSIU has issued two recommendations to the Company, designed to ensure that the correct procedures for testing of limit switches are adhered to.



## FACTUAL INFORMATION

### The vessel

*Ruby-T* was a Maltese-registered oil/chemical tanker of 12,890 GT. She was built in Tuzla, Turkey, in 2010. The vessel's registered owners were Neriman Associates S.A., managed by Transal Denizcilik Ticaret A.S, and classed by Class NK. The vessel had a length overall of 156.7 m, a breadth of 22.9 m, and a summer deadweight of 21,224 metric tonnes, corresponding to a summer draft of 9.8 m.

*Ruby-T* was powered by a MAN 6L 48/60B, 6-cylinder, four stroke, single acting, diesel engine, which produced 6,300 kW at 500 rpm. This drove a controllable-pitch propeller, which enabled *Ruby-T* to reach an estimated speed of 16 knots.

### Crew

*Ruby-T*'s Minimum Safe Manning Certificate required a crew of 13. At the time of the accident, there were 18 crew members on board. The crew members were mostly Turkish, with two ABs (able seafarers – deck) being Georgian.

The chief officer was from Turkey. He had embarked on *Ruby-T* on 05 July 2019, in Mesaieed, Qatar. He had served 4.1 years at sea and had been working as a chief officer for about seven months with Transal Denizcilik Tic A.S. He had obtained his STCW II/2 Certificate of Competence in 2017.

The chief engineer was a Turkish national. He had signed on the vessel while she was in Trabzon, Turkey, two weeks before occurrence. He had been working with the Company for the past four years, of which he worked for a year as a Chief Engineer. He had obtained his STCW III/2 Certificate of Competence in 2016.

The injured bosun was also a Turkish national and, at the time of the accident, he

was 48 years old. He had been working at sea for 26 years, of which two years were served as a bosun. His STCW II/5 Certificate of Proficiency was issued by the Turkish Administration. He had joined *Ruby-T* from Istanbul, Turkey, on 26 May 2019.

### Environment

At the time of the accident, the weather was reported to be clear with calm winds. The air and sea temperatures were 20 °C and 18 °C, respectively.

### Rescue boat/liferaft/service crane

The crane was installed on the second deck, on the vessel's port quarter (Figure 1). It was designed to hoist and lower the rescue boat and liferaft, and also to transfer stores, provisions, etc.

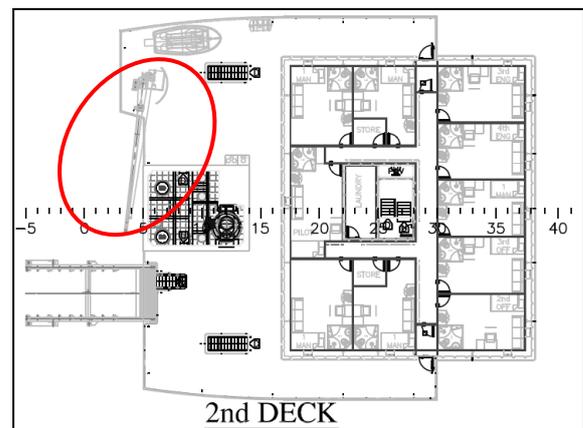
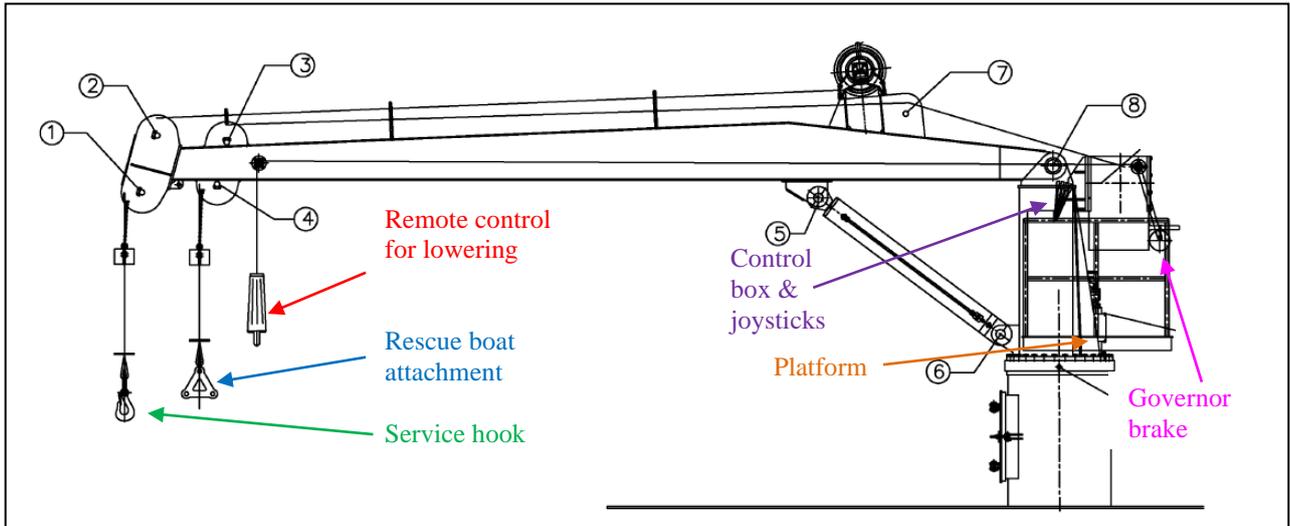


Figure 1: Extract from the General Arrangement Plan, indicating the position of the crane

The crane was fitted with two hooks. The foremost hook was used as a service hook for provisions and stores; while the hook behind it (the rescue boat attachment) was used for handling the davit launched liferafts and the rescue boat (Figure 2).

The service hook was controlled by a winch (stores/provision winch) which consisted of a wire drum that was attached to a hydraulic driven planetary gearbox.

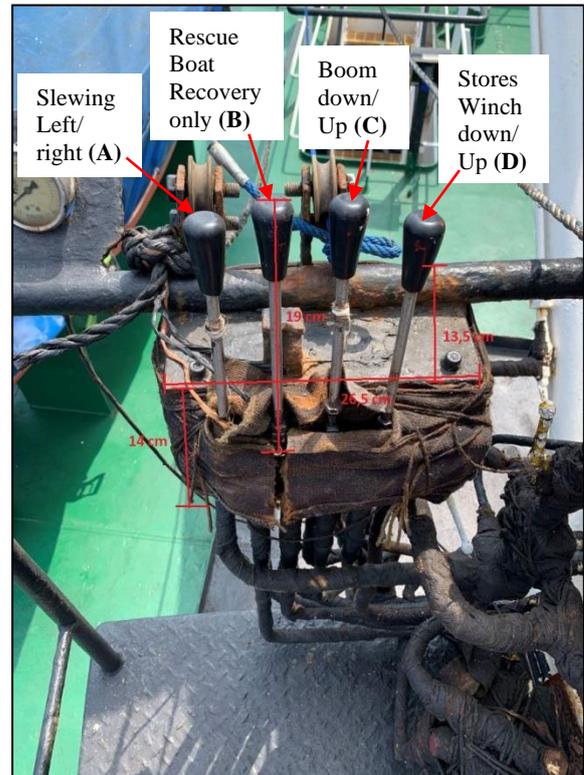


**Figure 2: General arrangement of the crane**

*Adapted from: Crane's Instruction Manual*

The rescue boat attachment was supplied with an electric powered winch (rescue boat winch(R/B winch)) for recovery purposes. Additionally, a manual recovery gear (hand crank) was also fitted to retrieve the rescue boat in the event of an electric power or winch failure. For lowering, the system utilised gravity and was controlled by the installation of a governor brake. The brake could also be released from the rescue boat or liferaft by the use of a remote control wire.

The crane's controls were situated on a platform, which was fitted to the slewing body (Figure 2). There were four joysticks on the control box, each designed to perform a different function (Figure 3). Joystick (A) was for controlling the slewing<sup>1</sup> movement of the crane, the second joystick (B) for rescue boat recovery using the R/B winch (*i.e.*, hoisting of the rescue boat attachment), the third (C) for the movement of the crane's boom in the upward or downward motion and the fourth joystick (D) controlled the stores/provision winch, which hoisted or lowered the service hook.



**Figure 3: The joysticks on the control box mounted on the platform**

The hydraulic circuit of the crane incorporated two separate limit switches (Figure 4), which limited the travel-up movement of the service hook and rescue boat attachment. Once these limit switches

<sup>1</sup> Slewing is the movement of the crane's jib in the horizontal plane.

were activated<sup>2</sup>, the hydraulic circuit becomes isolated, thus stopping all movement before the extreme point of travel could be reached.



Figure 4: Limit switches for hook travel circled in yellow

A mechanical safety device, in the form of a shield, protected the access to the squared spindle where the hand crank for rescue boat manual recovery could be inserted and engaged (Figure 5). If this shield had to be lifted, the (electrical) safety device actuator would turn, resulting in the disconnection of the motor control and power circuits, preventing any movements induced by the R/B winch. In the manufacturer's manual this was also referred to as the limit switch for the R/B winch.

A switch disabling valve was provided to disable the limit switches and to enable the system to be reset. The manufacturer's manual indicated that incorrect use of this

disabling valve may cause structural damage to the crane.

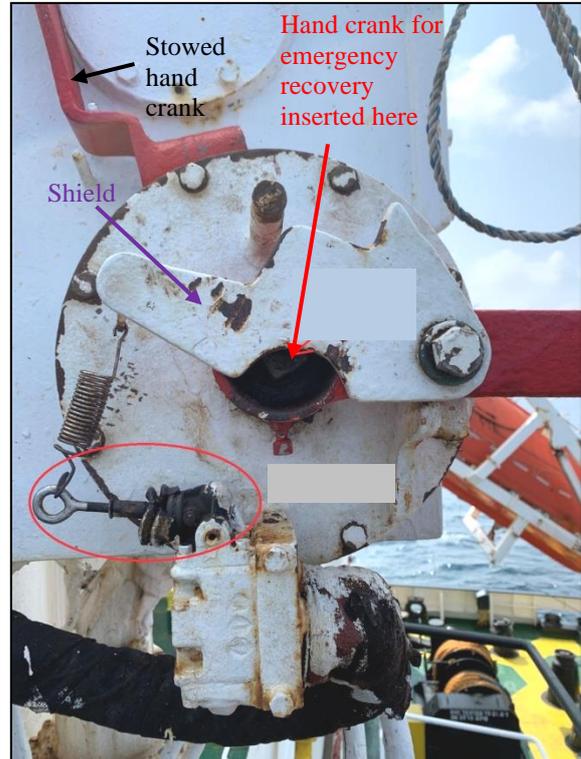


Figure 5: Mechanical safety device – shield for the squared spindle. Once the shield is lifted, the spring deactivates the electrical circuit and the R/B winch is isolated

A functionality check on the condition of the governor brake was required to be carried out on a weekly basis in accordance with the manufacturer's manual. According to the manual, the hand crank would have to be inserted in position for recovery and, thereafter, the handle had to be rotated in the opposite direction, as if to lower the rescue boat attachment, without releasing the governor brake. The manual stated that such movement should not be possible, even if significant effort had to be applied to the hand crank.

<sup>2</sup> The activation occurs when the bottom weight (coloured in yellow) pushes the top weight (also coloured in yellow) upwards.

### Narrative<sup>3</sup>

On 20 October 2019, the vessel was berthed at Pier 3 at the port of Nikolaev, Ukraine. A Company's representative was on board in preparation for a vetting inspection. At 1248, as part of this preparation, it was decided to test the limit switches of the crane on the second deck.

The chief officer was initially handling the joysticks from the control box and, while testing the rescue boat limit switch, joystick (B) was damaged to the extent that it was displaced from the crane control box.

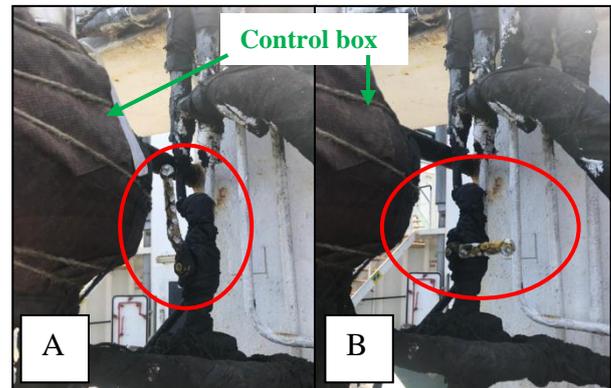
The chief engineer took over the controls to assess the damage which had occurred. The damaged joystick was sent to the engine-room with the third engineer who was also requested to call the bosun to the crane's location for assistance.

The bosun was working elsewhere and, upon being notified, he suspended that job and proceeded to the second deck. In the meantime, the chief engineer used an adjustable wrench in lieu of joystick (B) to hoist the rescue boat attachment and test the limit switch. At 1300, both limit switches for travel up movement activated successfully.

Thereafter, the chief engineer closed the switch disabling valve (Figure 6), to reset the limit switches. The wire of the service hook was successfully lowered and secured using joystick (D).

The chief officer tried to lower the rescue boat attachment wire by releasing the governor brake, however, the crew needed to pull down the wire so as to release the limit switch. Since at that time, the crane's boom was at level with the third deck, the chief engineer thought of slewing the boom, towards the third deck for the crew to be able to grab and pull down the wire and thus release the limit switch. At this stage, the

bosun was on site and intervened in the operation.



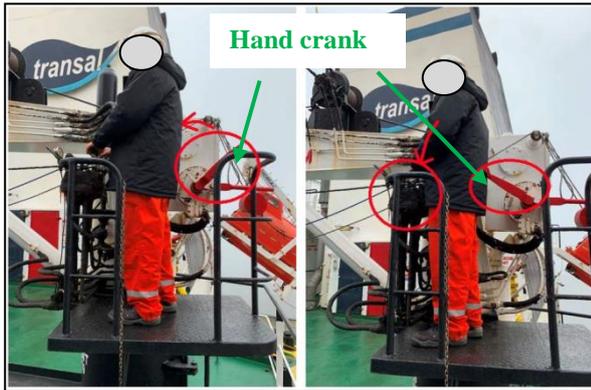
**Figure 6: (A) showing switch disabling valve in the open position and (B) showing switch disabling valve in the closed position**

The bosun was concerned that the operation, as planned by the chief engineer, might cause damage to the wire. Therefore, he opted to use the hand crank to lower the rescue boat attachment. To the crew members present on site, it seemed that the bosun was acting in haste.

At around 1315, the hand crank was turned three to four times and the wire was lowered, which subsequently disengaged the limit switch. Since the rescue boat attachment needed to be lowered further and the hand crank operation was taking some time, the bosun chose to engage the R/B winch.

Several minutes later, he turned towards the control box and as soon as he used the adjustable wrench to engage the R/B winch, the hand crank struck him on his back (Figure 7). This action threw the bosun forward onto the control box from where he fell down. The crew members, who were close by, helped him onto the deck and provided assistance, as he seemed to have been in significant pain.

<sup>3</sup> Unless specified otherwise, all times mentioned in this report are in Local Time (UTC +3).



**Figure 7: A simulation of the bosun's position while handling the control box, with his back to the hand crank**

### **Injuries**

The bosun was transferred to a local hospital via an ambulance, where he was diagnosed with two broken ribs. He was deemed unfit for duty and was discharged from the hospital to enable him to travel with *Ruby-T* towards his home country.

Once the vessel reached Istanbul, he was transferred to the thoracic surgery department of the local hospital there, where it was confirmed that he had suffered three fractured ribs.

### **Extent of damages**

The MSIU could not establish the extent of damage caused to the crane control box's joystick (B). It was understood that joystick (B) was displaced from the control box, possibly during a jerking movement. Following the accident, the crew had fixed the joystick back onto the control box.

### **Planned maintenance system jobs**

The planned maintenance system (PMS) of the vessel listed several job orders for the subject crane. Amongst others, the monthly maintenance included jobs for the crane's limit switch.

This also included test instructions for the limit switch job, which stated that: *Check*

*and test the limit switch that is working in good order [sic].*

The last monthly maintenance/inspection of the crane was recorded to have been executed on 13 October 2019.

### **Familiarization with crane**

The Company's Safety Management System included a form whereby the crane operators and maintenance crew were identified. The form on board *Ruby-T*, at the time of occurrence, indicated that the chief officer and the bosun were exclusively authorized by the chief officer and the chief engineer to operate the crane. Additionally, the chosen crew members were also responsible for technical maintenance training - theoretical and practical.

The form also identified that the chief engineer and the second engineer were responsible for the maintenance programme, lubrication, electrical plant and automation of the crane.

### **Risk assessment**

A risk assessment was not carried out by the crew members for this task.

## **ANALYSIS**

### **Aim**

The purpose of a marine safety investigation is to determine the circumstances and safety factors of the accident as a basis for making recommendations, and to prevent further marine casualties or incidents from occurring in the future.

### **Hours of rest and alcohol**

The bosun had a rest period of 14 hours, accumulated prior to resuming his duty at 0800 on the day of the accident. Although the quality of his rest hours could not be

confirmed, it met the relevant requirements of the STCW Convention and the MLC 2006. In the absence of any cues which would have indicated signs of fatigue, the safety investigation did not consider fatigue as a contributory factor to this accident.

An alcohol test was carried out on the bosun, after the accident. No alcohol in the breath was detected, therefore alcohol was also not considered as a contributory factor to this accident.

### Immediate cause of the accident

At the time of the accident, the bosun was standing in a relatively restricted space of the crane's platform, facing the control box. The switch disabling valve was closed and the hand crank was left mounted in the squared spindle. As soon as the bosun induced the R/B winch, the hand crank rotated and hit the bosun on his back.

The limit switch of the R/B winch was disengaged, allowing the winch to rotate even though the shield was lifted, due to the hand crank being inserted in the squared spindle.

### Accident dynamics

When the bosun arrived on site, the chief engineer was at the crane's controls. A representative from the Company was also in attendance, which reportedly seemed to have induced a sense of urgency into the bosun. At that stage, the chief engineer had already closed the switch disabling valve to be able to reset the system. In fact, the service hook's limit switch had been successfully reset.

Since the boom of the crane was horizontally at level with the third deck, the chief engineer intended to slew the boom towards that deck, so that the crew could pull down on the rescue boat attachment and in the meantime the brake would be released, thus allowing this limit switch to be reset.

At this stage, the bosun was of the opinion that the procedure, as intended by the chief engineer, could damage the wire. It seemed to the safety investigation, that the bosun was, most probably, concerned by the damage that could have been caused to the wire. It is likely that this distracted him from understanding the actual risks of his own actions.

He opted to use the hand crank to lower down the rescue boat attachment to disengage the limit switch. However, he realised that this operation was taking too long.

Joystick (B) was damaged and out of position, and in lieu, a wrench was used. As joystick (B) was barred from moving in the 'lowering' direction on the control box, due to a built-in physical barrier (Figure 8) and thus prevented lowering of the wire under power, the option to lower this wire by using the winch was not available before. However, with the use of an adjustable wrench, this physical barrier could be bypassed.

The MSIU believes that since the bosun perceived this operation as urgent, he opted to improvise by using power to lower the rescue boat attachment, as the other available options were more time consuming.



Figure 8: Built-in physical barrier circled in yellow

In the process, it was reported that the bosun had forgotten about the hand crank mounted

in position. This resulted in the hand crank rotating and striking the bosun.

### Safety barrier systems

The system had several safety barriers designed to prevent damage to the crane and / or protect the user from harm. In this case, the physical barriers present, *i.e.* limit switches and the barrier to prevent joystick (B) from moving in the ‘lowering’ direction, had been by-passed.

Rightly so, the switch disabling valve had to be closed to allow resetting of the limit switches which were tested; therefore, in that moment, all limit switches ceased to function, hence eliminating the protection which they offered. Joystick (B) was damaged and dislodged. By improvising with the use of an adjustable wrench, the obstruction barrier was by-passed, as the wrench was not affected by it. In the opinion of the safety investigation, the use of the wrench was deemed necessary by the crew at that time, as this was the only means of operating the R/B winch until joystick (B) was repaired.

It appeared to the safety investigation that familiarisation with crane operations, which may be considered as an incorporeal barrier, did not cover all the aspects of the crane’s functions. This was concluded from the actions of the bosun, whereby he opted to lower the rescue boat attachment by the use of the hand crank and the R/B winch.

Both the hand crank and the R/B winch were designed for hoisting the rescue boat only, in line with the relevant SOLAS Convention requirements. Lowering of the rescue boat was to be carried out by gravity, either locally from the governor brake (Figure 9) or remotely from the rescue boat by the use of the remote control wire.

A risk assessment was not carried out, which could have served as another incorporeal safety barrier. However, a key factor in risk

assessment is problem detection. Problem detection *per se* is only but one step of the process in the management of risky situations, with scholars going on to distinguish between problem detection and problem identification (problem concern *vs.* problem identification).

The ‘fixing’ of the joystick ‘B’ was a temporary measure, but accepted by the crew members and its use is suggestive that it created no concern and therefore, no problem would have been identified – even because of the absence of negative cues.

The same school of thought applies for the difficulty of the crew members to reset the limit switch. Whilst it may be claimed that the hand crank was overlooked and left in position, it was not excluded that the bosun was unaware of the ‘link’ between the disabling valve and the consequent free operation of the hand crank.

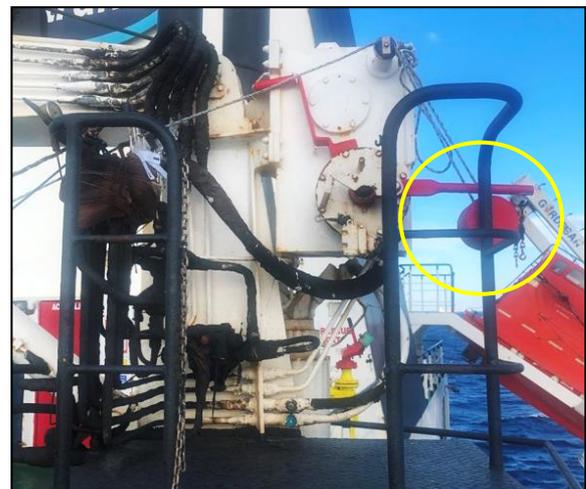


Figure 9: Governor brake circled in yellow

No symbolic barrier systems, in the form of warnings or posters, were posted next to the switch disabling valve to indicate its function. Neither were any warnings posted to inform operators that joystick (B) was only meant for hoisting the rescue boat attachment. Whilst considering that the bosun had forgotten that the hand crank was

still in place, a symbolic barrier could have reminded him to disengage the same.

However, it is understandable that the situation, as it presented itself to the bosun, was not a usual one *i.e.*, the bosun was called in the middle of the operation, where he found a number of crew members engaged to reset the limit switch, as well as joystick (B) was broken. Furthermore, it was reported by the Company that a sense of urgency was induced in the bosun, due to the presence of a Company representative. All of the above could possibly have rendered any symbolic barriers ineffective, in the view of this safety investigation.

#### **Procedures for testing the limit switches**

The manufacturer's manual cautioned that when the switch disabling valve is closed, all the limit switches will be disabled. This would allow the resetting of the limit switches. No specific procedure for testing the limit switches was found in this manual. Furthermore, the SMS of the vessel did not identify the procedures for the testing of these limit switches; it only stated that such switches had to be tested every month.

The chief engineer seemed to be aware of the switch disabling valve's functions, as the limit switch for the service hook was successfully tested and reset by him. However, when trying to reset the limit switch for the rescue boat attachment, the same procedure could not be performed. This is because the rescue boat attachment was designed to be lowered by means of gravity and not power.

Reportedly, no one intervened while the bosun was attempting to reset the rescue boat limit switch. The MSIU believes that the crew members may have relied on him, given that he was one of the crew members authorized to operate the crane. Moreover, since the other authorised person was the chief officer, and considering the chief officer's duties and responsibilities, the

safety investigation believes that the crane would be usually operated by the bosun.

The bosun perceived the chief engineer's intentions as being unsafe to the wire of the rescue boat attachment. In the absence of evidence to support the bosun's perception on this matter, the safety investigation hypothesized that although the bosun was familiar with the operating procedures of the crane, he was not thorough with the same. Moreover, in the view of the safety investigation, complete procedures on the resetting of the limit switches could have provided much needed guidance to the crew.

#### **Other findings**

The manufacturer's manual indicated that in order to check the reliability of the governor brake functions, the hand crank should be engaged onto the squared spindle and turned in the opposite direction, as if to lower the rescue boat attachment. The manual specified that the hand crank should not turn in this direction, even under heavy effort. However, in the case of *Ruby-T*, the bosun was able to turn the hand crank in the opposite direction, and successfully lower the rescue boat attachment wire.

This would normally be an indication that the brake system's inner or outer race was badly indented and that the clutch required immediate replacement. However, after this accident, the Company had carried out an investigation on the brake system and found no wear-down. The Company, therefore, concluded that operation of the hand crank in opposite rotation could only have been possible if the brake was loosened.

Additionally, in accordance with the manufacturer's manual, the correct cranking direction was marked with an arrow. However, upon investigating, no arrow marking could be found. The absence of such an arrow, which in itself would have been a symbolic barrier, may have

contributed to the bosun's actions in using the hand crank to lower the wire in question.

- The investigation report was shared within their fleet to raise awareness.

## CONCLUSIONS

1. The bosun was struck by the hand crank as soon as he engaged the R/B winch;
2. The switch disabling valve was shut, to by-pass the limit switches and to enable resetting of the same;
3. Joystick (B) was damaged and, in lieu, an adjustable wrench was used, which enabled the crew to by-pass the physical barrier present on the control box;
4. It is likely that the bosun was distracted from understanding the actual risks of his own actions, as he was most probably concerned about the damages to the wire;
5. No symbolic barriers were present in the vicinity of the crane;
6. The crew members were most probably unaware of the damage which could have been caused to the braking system of the crane, by cranking it in the opposite direction;
7. No elaborate guidance for testing of limit switches was available on board.

## RECOMMENDATIONS

Transal Denizcilik Ticaret A.S. is recommended to:

**19/2020\_R1** Develop detailed written procedures for the testing of the crane's limit switches.

**19/2020\_R2** Put in place a distinctive arrow marking to indicate the correct direction of rotation of the crank handle.

## SAFETY ACTIONS TAKEN DURING THE COURSE OF THE SAFETY INVESTIGATION<sup>4</sup>

During the course of the safety investigation, the Company had taken the following safety actions:

- A more in-depth familiarization of personnel with the crane, was carried out;

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<sup>4</sup> Safety actions and recommendations shall not create a presumption of blame and / or liability.

## SHIP PARTICULARS

Vessel Name:	<i>Ruby-T</i>
Flag:	Malta
Classification Society:	ClassNK
IMO Number:	9457878
Type:	Oil/Chemical Tanker
Registered Owner:	Neriman Associates S.A.
Managers:	Transal Denizcilik Ticaret A.S.
Construction:	Steel
Length Overall:	156.70 m
Registered Length:	147.36 m
Gross Tonnage:	12,890
Minimum Safe Manning:	13
Authorised Cargo:	Oil / Chemical

## VOYAGE PARTICULARS

Port of Departure:	Nikolaev, Ukraine
Port of Arrival:	Istanbul, Turkey
Type of Voyage:	Short International Voyage
Cargo Information:	20,000 mt of Sunflower seed oil
Manning:	18

## MARINE OCCURRENCE INFORMATION

Date and Time:	20 <sup>th</sup> October 2019 at 13:30 (LT)
Classification of Occurrence:	Serious Marine Casualty
Location of Occurrence:	Port of Nikolaev, Ukraine
Place on Board	2 <sup>nd</sup> deck
Injuries / Fatalities:	Serious injury to crew member
Damage / Environmental Impact:	None reported
Ship Operation:	Moored/Alongside
Voyage Segment:	Alongside
External & Internal Environment:	No wind was reported for that day, the sea state was calm. The air temperature was 20 °C and the sea temperature was 18 °C.
Persons on board:	18