Marine Safety Investigation Unit

Transport Malta

MARINE SAFETY INVESTIGATION REPORT

Safety investigation into the grounding of the

Maltese registered LPG

SEASURFER

in the Port of Praia

Ilha de Santiago, Cabo Verde

on 12 October 2019

201910/016

MARINE SAFETY INVESTIGATION REPORT NO. 18/2020

FINAL

CONTENTS

LIST OF REFERENCES AND SOURCES OF INFORMATION

Crew members, Company, ECDIS and VDR – MV *Seasurfer*

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GLOSSARY OF TERMS AND ABBREVIATIONS

°C	Degrees Celsius
AB	Able Seafarer
AIS	Automatic Identification System
BRM	Bridge Resource Management
BTM	Bridge Team Management
gt	Gross Tonnage
GPS	Global Positioning System
IMO	International Maritime Organization
IPIAAM	Institute for the Prevention and Investigation of Aeronautical and Maritime Accidents
kW	Kilowatt
l	Litre
LOA	Length Overall
LR	Lloyd's Register of Shipping
LPG	Liquified Petroleum Gas
LT	Local Time
m	Metres
mg	Milligram
MGN	Marine Guidance Note
MLC	Maritime Labour Convention
MSIU	Marine Safety Investigation Unit
rpm	Revolutions per Minute
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended
UTC	Coordinated Universal Time
VDR	Voyage Data Recorder
VHF	Very High Frequency

SUMMARY

At about 1700 on 12 October 2019, the Maltese registered LPG tanker *Seasurfer* ran aground in the Port of Praia, Ilha de Santiago, Cabo Verde. Prior to the grounding, *Seasurfer* was manoeuvring in the port's turning basin to berth port side alongside. A local pilot was on board and one harbour tug was assisting the vessel. Soon after dropping anchor off the assigned berth, the vessel took a sudden sheer to starboard. The tug, helm and the ship's main engine were used to check the sheer and align the vessel with the jetty. However, the subsequent action of the tug's thrust, the vessel's propulsion, helm and anchor, caused the stern to swing to port and set lateral movement towards the inner side of the breakwater. The increased speed ahead averted the stern closing-in on the breakwater but the bulbous bow came in contact with the seabed.

Seasurfer was pulled back in the turning basin but the subsequent manoeuvres swung the vessel rapidly to starboard and the port side ran aground on the shoaling depth, just outside the periphery of the turning basin. *Seasurfer* sustained damages to the bulbous bow, tips of the propeller blades and underwater hull port side. There was no hull breach and no oil pollution was reported.

During the course of this safety investigation, the Company took a number of safety actions to prevent recurrence of similar accidents. The MSIU has made two recommendations to the Authority of the Port of Praia to review and develop guidelines on the number and power of tugs for safe handling of ships, and consider providing pilotage / manoeuvring plan to masters of vessels carrying hazardous goods, prior to their arrival or as soon as practicable.

1 FACTUAL INFORMATION

1.1 Vessel, Voyage and Marine Casualty Particulars

Name	*Seasurfer*
Flag	Malta
Classification Society	Lloyd's Register of Shipping
IMO Number	9763033
Type	LPG Tanker
Registered Owner	Indigo Star Inc.
Managers	Thenamaris LNG Inc., Greece
Construction	Steel
Length overall	179.87 m
Registered Length	174.39 m
Gross Tonnage	25079
Minimum Safe Manning	14
Authorised Cargo	LPG
Port of Departure	Chesapeake, USA
Port of Arrival	Port of Praia, Cabo Verde
Type of Voyage	International
Cargo Information	22,638 tonnes of Butane / Propane
Manning	24
Date and Time	12 October 2019 at 16:59 (LT)
Type of Marine Casualty	Serious Marine Casualty
Place on Board	Ship bottom port side, bulbous bow and propeller blades
Injuries/Fatalities	None
Damage/Environmental Impact	None
Ship Operation	Manoeuvring
Voyage Segment	Arrival
External & Internal Environment	Wind North Northeast, Beaufort Force 2 to 3. Visibility 10 miles. The air temperature was 29 °C.
Persons on Board	24

1.2 Description of Vessel

Seasurfer was a 25,079 gt, liquified petroleum gas tanker, owned by Indigo Star Shipping Inc., and managed by Thenamaris LNG Inc., Greece. The vessel was built by Hyundai Mipo Dockyard (HMD), Ulsan, South Korea in 2017. She was classed with Lloyd's Register of Shipping (LR). The vessel had a length overall of 179.87 m, and a deadweight of 28,447 tonnes. The vessel was propelled by a Hyundai MAN 6G50ME-C9.5 six-cylinder, diesel engine, manufactured by Hyundai Heavy Industries, South Korea, producing 7,860 kW and driving a single right-handed fixed pitch propeller. The estimated service speed of the ship was 16 knots. The vessel was fitted with port and starboard stockless anchor with 11 and 12 shackles[1] respectively. *Seasurfer*'s midship section is shown in Figure 1.

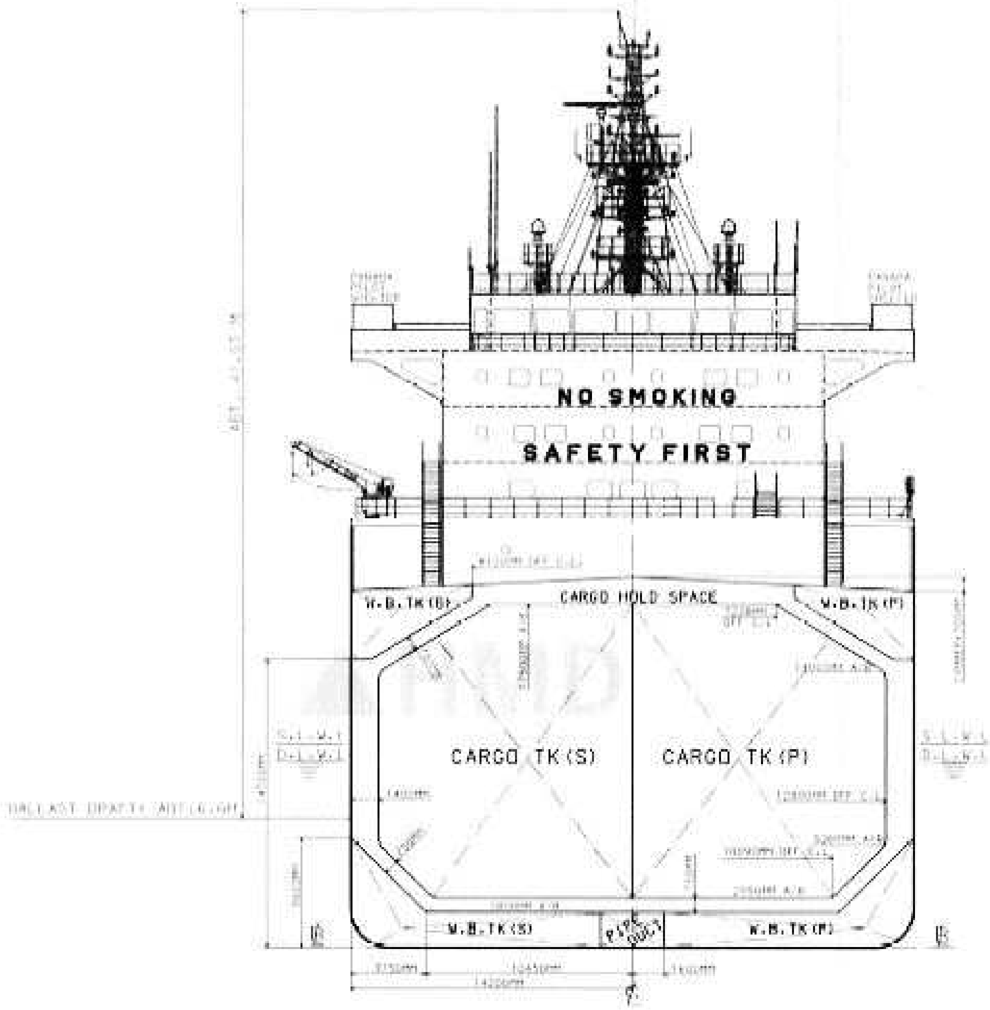

Figure 1: ***Seasurfer*** **midship section**

[1] One shackle is equivalent to 27.5 m of anchor chain.

Seasurfer's bridge was equipped with a Voyage Data Recorder (VDR) and interfaced with a Global Positioning Systems (GPS), gyro compass, S-Band and X-Band radars, Electronic Chart Display and Information System (ECDIS), an Automatic Identification System (AIS), speed log (through the water) and a rudder indicator. Figures 2a and 2b show the general layout of the bridge equipment.

Figure 2a: Navigation equipment. View from the port side

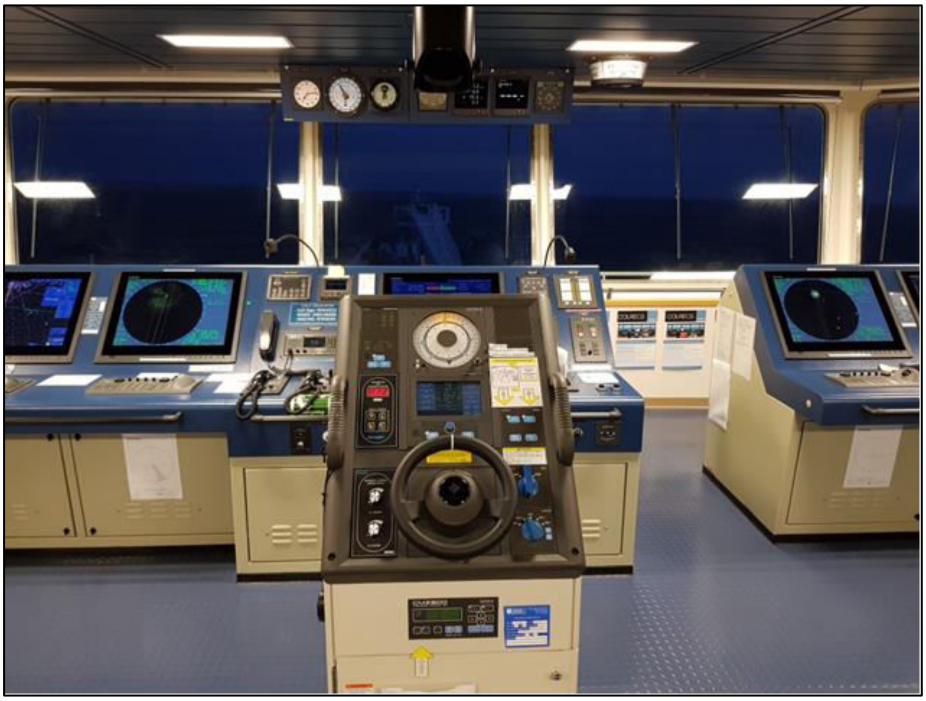

Figure 2b:View of the bridge and navigation equipment from the helm console position

1.3 Bridge Team

Seasurfer was manned in accordance with her Minimum Safe Manning Certificate, issued by the flag State Administration. The crew members were from the Philippines, Greece, Russia, Ukraine and Latvia and the working language was English.

At the time of the accident, the master was on the bridge along with the chief officer, helmsman and the deck cadet. The master was a 45 year old Latvian national and held an unlimited master's Certificate of Competency. He had been a master for seven years and employed by the Company for 18 months. He had joined *Seasurfer* in July 2019. The chief officer was also from Latvia. He was 34 years old and held an unlimited chief mate's Certificate of Competency. He had over four years of sea-going experience on tankers and had been employed with the Company for 24 months. He had joined *Seasurfer* in August 2019. Both the master and the chief officer had attended Bridge Resource Management (BRM), Bridge Team Management (BTM), and ECDIS generic and type specific training programmes.

The helmsman was from the Philippines, whilst the cadet was a 20-year old Greek national.

The personal and professional details of the pilot, who embarked *Seasurfer* were not available to the MSIU. However, the MSIU understood that either a port authority, and / or a pilotage organisation ensures that pilots providing their services, are appropriately qualified, trained and licenced for the tonnage they handle. Therefore, for the purpose of this safety investigation, the MSIU deemed that the pilot was fully certified and licenced to handle *Seasurfer*.

1.4 Port of Praia

The Port of Praia (Figure 3) is one of the main ports of Cabo Verde. Port infrastructure is designed for cargo and passenger ships. In 2014, the existing jetty was extended to 460 m and the port's turning basin was also expanded. The port is equipped with two roll-on / roll-off ramps and a 355 m passenger terminal. The port also has an 80 m fishing pier and a fish processing plant.

Figure 3: Port of Praia, Cabo Verde

The navigable channel leads to the port's turning basin. The sectored leading lights guiding vessels are located to the North of the navigable channel. The harbour entrance is defined by the extremity of the breakwater (bullnose), and port (red) and starboard (green) lateral buoys[2]. The diameter of the turning basin was expanded to 400 m and is bound on the West by Santa Maria Islet and East cardinal buoy, and by Jetty no. 1 and no. 2 on the Eastern side. Dredging works, which were carried out in 2014, increased the depth of the turning basin to 13.5 m (Figure 4).

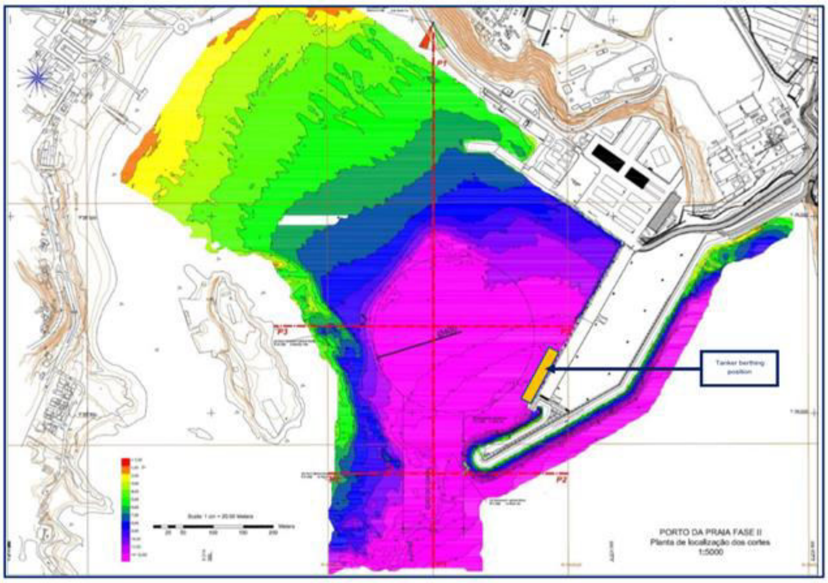

Figure 4: Port of Praia showing depth contours, turning basin and *Seasurfer*'s berth

Source: http://www.enapor.cv/web/image/1047

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2 Lateral buoys mark the sides of navigable channels.

1.5 Environment

The visibility was good. There was light to gentle breeze from the North Northeast. The sea state was slight. The air and sea temperature were 26 °C and 24 °C respectively. According to the tidal tables, low water (0.3 m) was at 1300 and high water (1.20 m) at 1900.

1.6 Narrative[3]

On 02 October 2019, *Seasurfer* sailed from Chesapeake, USA to discharge part cargo at the Port of Praia, Cabo Verde. She sailed on an even keel, drawing a draft of 9.80 m and carrying 22,635 tonnes of butane and propane. Passage planning was carried out prior to the departure by the second officer, in accordance with the procedures and guidance contained in the vessel's SMS. During sea passage, the ship's agent[4] advised the vessel of compulsory employment of tug for entering / departing the port and requested the master to send his requirements in advance of the vessel's arrival.

Seasurfer arrived at the Port of Praia on 11 October and a notice of readiness was tendered at 1200. Slightly trimmed by the head, her arrival draft was 9.697 m forward and 9.571 m aft. The pilotage was arranged for the following day and the master decided to stay drifting outside the port.

At 1530 on 12 October 2019, the master took the con. A pre-arrival checklist was completed and the main engine was tested. A 10-metre contour, delineating the fairway and turning basin, was displayed on the ECDIS. At 1555, a local pilot embarked the vessel and upon arrival on the bridge, he exchanged information with the master. The pilot advised the master that he will be using starboard anchor to turn the vessel before berthing port side alongside on the newly constructed Jetty no. 1 (Figure 4), and one tug (with a bollard pull of 50 tonnes), unsecured to the vessel, would be assisting with the mooring operations[5].

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[3] Unless otherwise stated, all times are ship's time (UTC -1).

[4] A port agent acts as an intermediary between the vessel's master, service providers, port authorities and arrange berth for cargo operations.

[5] In a casual conversation with the master, the pilot stated that the port only had one tug and gas tankers coming to the Port of Praia were generally small in size and had a bow thruster.

Escorted by tug *Praia Maria*[6], the pilot guided *Seasurfer* into the port's navigable channel. The master reported that a 0.5 knot current was flowing Northeast and he repeatedly corrected the pilot's course directions[7]. At 1615 (Figure 5), *Seasurfer* entered the port's turning basin at 2.8 knots. The main engine was stopped and her course was altered to starboard, towards the middle of the turning basin.

Figure 5: ECDIS image at 1615, showing *Seasurfer* off the breakwater bullnose

At 1620 (Figure 6), the pilot ordered half astern on the main engine and the tug was instructed to push on the starboard quarter. The master, however, revised the pilot's order to full astern. As soon as the forward speed dropped, the main engine was stopped and the pilot turned the vessel to starboard. In the meantime, the forward station reported that the bow was passing clear off the jetty.

6 *Praia Maria* was a 365 gt tug, built in 2016 and registered in Sao Vicente. She had a LOA of 25.2 m and was fitted with two main diesel engines.

7 Master reported that the drift was about 10°.

Figure 6: ECDIS image at 1620 showing *Seasurfer* turning to starboard

By 1625, *Seasurfer* had completed the turn and the vessel was aligned with the jetty. The course and speed over the ground was 073° and 1.2 knots and the jetty was roughly 250 m on her port side. The pilot advised the master to drop the starboard anchor (Figure 7).

Figure 7: *Seasurfer* dropped starboard anchor at 1625

As soon as the anchor was dropped, *Seasurfer* started swinging to starboard. The pilot ordered the helm hard to port and the engine dead slow ahead to check the swing. By this time, seven shackles of anchor chain had run out, the vessel was heading West, and ahead at 0.50 knots (Figure 8). The helm was put amidships and the main engine was stopped. The pilot ordered dead slow astern and the tug was shifted to starboard midships. The master directed the pilot to shift the tug to the starboard bow. A few minutes later, the main engine was stopped.

Figure 8: ECDIS image at 1630 showing *Seasurfer* heading West

At 1637, *Seasurfer* was manoeuvred back parallel to the jetty (Figure 9). The anchor chain was on moderate stay, leading abaft the beam. The stern started to swing to port and the pilot requested the chain to be slackened. It appeared that a kick ahead on the main engine, and with the helm hard to port, the bridge team had controlled the swing. The pilot then ordered the tug to start pushing from starboard midship and again requested the master to slacken the chain. The master replied that slackening the chain would restrict the vessel's movement. At that point, seven shackles were out and the master advised the pilot the need to shorten the chain and drag the anchor (along the seabed), since the anchor chain would be insufficient to reach the berth.

Figure 9: ECDIS image showing *Seasurfer*'s position at 1637

The master also advised the pilot that the stern was moving towards the berth faster than the bow and to this effect, he instructed the crew at the forward station to heave up the anchor. He also directed the pilot to shift the tug towards the bow. The manoeuvre accelerated the stern's swing to port. By 1645 (Figure 10), the ECDIS was displaying a course and speed over the ground of 171° and 0.90 knots respectively.

Figure 10: *Seasurfer* at 1645, when the stern was swinging to port

Five minutes later, at 1650 (Figure 11), six shackles of anchor chain had been recovered on deck. At this point in time, the tug was pushing on the vessel's starboard shoulder. The pilot requested dead slow and slow ahead on the main engine and the helm to port, to check the swing. A few minutes later, the main engine was stopped. Almost instantly, the master ordered the main engine on slow ahead.

Figure 11: ECDIS image showing position of *Seasurfer* at 1650

The cumulative effect of weighing of the anchor, tug pushing on the starboard side, main engine running ahead and with the helm to port, set the vessel laterally moving Southwards. By the time *Seasurfer* had picked up five shackles of the anchor chain, she was heading almost West. At this point, the breakwater was reportedly 80 m on her port quarter (Figure 12).

The master ordered the anchor brakes open, with the intention of allowing the bow to move to port and draw the stern away from the breakwater. He ordered the main engine full ahead and told the pilot to instruct the tug to push, in order to swing the bow to port. The master then ordered the forward station to hold the anchor, whilst the pilot advised the master to stop the main engine.

Figure 12: ECDIS image at 1655 showing position of *Seasurfer* relative to the breakwater

At 1658 (Figure 13), nine shackles of anchor chain had run out, leading aft on moderate stay. The vessel was moving ahead at 1.5 knots and the shoaling depth lay close ahead. The bow started to swing slowly to starboard and the pilot advised the master to set the main engine to half astern, with the helm midships.

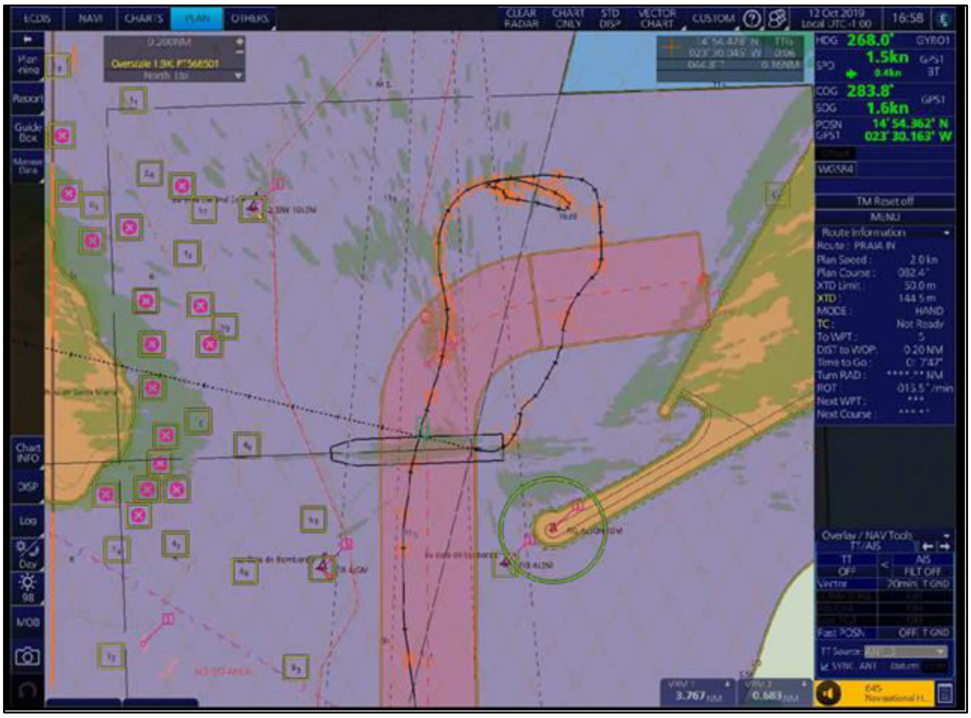

Figure 13: ECDIS image at 1658

At 1659, the master stopped the main engine and almost immediately ordered dead slow ahead. The helm was turned hard over to port. The pilot advised the master to stop the main engine but a few seconds later, the bow crossed the 10 m contour and made contact with the seabed (Figure 14).

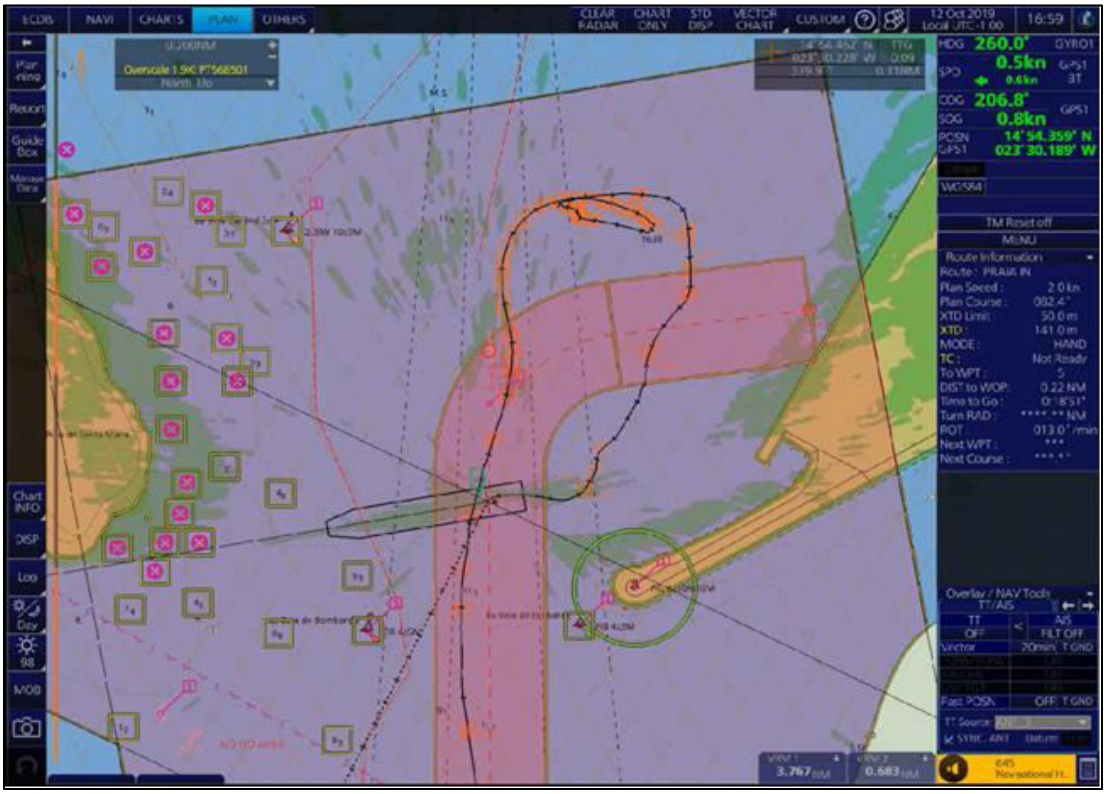

Figure 14: ECDIS image at 1659 showing the bow crossing the 10 m depth contour

The master stopped the main engine and followed it up with a dead slow astern and full astern, with the helm amidships. About five minutes later, although the bow was heaved off the shoal (Figure 15), the stern started to close-in on the breakwater bullnose. The main engine was stopped and the tug was sent aft to make fast on the starboard quarter. The forward station was instructed to heave up the anchor. At this point, the pilot asked the master as to his intentions, the latter replying that he wanted to swing the bow into the turning basin and requested the pilot to instruct the tug to push from the stern.

Figure 15: ECDIS image at 1704, showing *Seasurfer* heaved off the shoal

As the stern drew closer to the breakwater bullnose, the master ordered half ahead and full ahead at 1704. Following the pilot's advice, the helm was set hard over to starboard and the bow started to swing to starboard. The master stopped the main engine and ordered dead slow astern, half astern and the helm midship. The pilot advised the master to cast off the tug. At 1708, the master stopped the main engine and then ordered dead slow ahead, slow ahead and half ahead, whilst the tug was instructed to push from the port quarter. *Seasurfer* rapidly turned around to starboard and the vessel's port side ended up just outside the 10 m contour (Figure 16).

The chief engineer, who was in the engine-room, felt the impact and noticed the vibrations; he also heard the propeller blades touching the seabed. He called the bridge and informed the master of his observations. Straightway, the master stopped the main engine, put the rudder amidships, and informed the pilot that the vessel had ran aground, with her stern resting close to the port lateral buoy, in position 14° 54.32′ N 023° 30.24′ W.

Figure 16: ECDIS image at 1711. ***Seasurfer*** **is aground with her port side lying along the 10 m depth contour**

1.7 Post-grounding Events

The forward station was instructed to weigh the anchor and with the tug pushing on the port side, the vessel was manoeuvred back in the turning basin (Figure 17). With the main engine set to dead slow ahead, the vessel advanced towards her berth. At 1735, the starboard anchor was recovered and the port anchor was prepared for letting go. As soon as the bow came close to the jetty, the port anchor was dropped. The vessel was in position at 1805 and the crew sent out the mooring lines ashore. At 1840, *Seasurfer* was all fast starboard side to on Jetty no. 1.

Shortly after she was secured alongside, soundings of water ballast tanks, cofferdams and pipe duct in way of the engine-room and cargo tanks were taken. The initial damage assessment identified neither hull breach nor was oil pollution reported.

Figure 17: ECDIS image at 1720

1.8 Structural Damages

An occasional survey revealed that the damages to *Seasurfer* were generally confined to the forward part of the hull, on the port side below the waterline, and the tips of the propeller blades. The following damages were reported by the LR surveyor:

- forepeak water ballast tank - bottom plating indented between frame 213 and aft bulkhead. Centre line longitudinal girder and adjacent port and starboard floors buckled in various locations;
- forward port side water ballast tank - floor plating longitudinal girders nos. 3, 4 and 5 in connection with the bottom plating were buckled between frames 196 and 199;
- forward starboard side water ballast tank - floor plating in connection with the bottom plating was buckled in way of frames 199, 200, 201 and 202 and the bottom plating in way was indented;

- hopper and top side no. 1 port water ballast tank - forward bulkhead, frame 196 (port side) buckled in connection with the bottom plating and bottom plating, second strake from keel indented between frames 193-196;
- hopper and top side no. 2 port water ballast tank - bottom plating, fourth and fifth strake from keel indented between in way of frames 130-132, 134-137, 139-142 and 144-147 and aft end of first bilge keel from bow was distorted;
- hopper and top side no. 3 port water ballast tank - web frame 112, plating in connection with bottom plating in way of the turn of the bilge and flat bar at frame 110½, port side, plating in connection with bottom plating in way of the turn of the bilge found distorted. Bottom plating, turn of the bilge, fourth strake from keel indented between frames 100 and 160. Port side, aft end of second bilge keel from bow and forward end of third bilge keel from bow found distorted;
- one propeller blade tip found bent; and
- minor tear at the tip of the remaining propeller blades.

2 ANALYSIS

2.1 Purpose

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

2.2 Fatigue, Drug and Alcohol

The hours of rest of the master, chief officer, cadet and helmsman were found to be in accordance with the MLC and the STCW Convention requirements, although the safety investigation could not determine the amount of quality sleep taken during the hours of rest.

As drug and alcohol abuse directly affects the fitness of crew and the ability to perform their duties, both IMO's guidance on prevention of drug and alcohol abuse and the flag State Administration prescribed a maximum limit of 0.25 mgl^{-1} of breath as a minimum safety standard. Thus, following the accident, and prior to the pilot leaving the vessel, the master carried out an alcohol test on all crew members. All tests returned negative results. In the case of the pilot, the test showed 0.026 mgl^{-1} of breath of alcohol. Since, this amount was significantly less than the prescribed limit, drugs and alcohol were not considered to have influenced the actions of the pilot.

2.3 Passage Plan

A passage plan involves detailed planning of the entire voyage, its execution and monitoring. The passage planning of *Seasurfer* was completed by the second officer prior to the vessel's departure from Chesapeake. In accordance with the vessel's SMS, the master was responsible for a clear and concise passage plan for all sections of the voyage, taking account of any information communicated to him during the sea passage.

The MSIU was provided with a copy of the berth-to-berth passage plan from Chesapeake to the Port of Praia. The plan had been endorsed by the master. The passage plan identified waypoints along the vessel's intended track and provided the bridge team with detailed navigational information for each waypoint. This navigational information included coordinates for each waypoint, distance and course to steer between waypoints, under keel clearance calculations, tidal information, ENC charts and the means for obtaining a position fix. The waypoints and courses to steer, terminating at the Port of Praia, were transferred onto the vessel's ECDIS by the second officer.

However, with respect to the pilotage section of the passage plan, the MSIU noticed no specific directions on manoeuvring with the use of tug/s at the Port of Praia. The MSIU acknowledged the importance of the assistance of tug at the bow and stern in handling of large ships, particularly in the confines of a port. Considering the size, cargo and tonnage of *Seasurfer*, it was very likely that the engagement of tugs at the bow and stern may have been a general practice on board *Seasurfer*. Therefore, it seemed likely that the master intuitively assumed berthing with two tugs since the agent's message indicated that the use of tugs at the Port of Praia was compulsory and hence, no further communication was made by the master.

2.4 Master / Pilot Information Exchange

A pilot card with the vessel's information was prepared and exchanged shortly after the pilot arrived on the bridge. Moreover, verbal exchanges between the pilot and the master were captured on the VDR and reviewed by the safety investigation. The safety investigation observed that key ship-handling issues were largely addressed by the pilot. He advised the master that he will be using one tug (unsecured to the vessel) and the starboard anchor, at a distance of 250 m from the jetty, for berthing. Following the master / pilot exchange, the statement "critical areas of the piloting passage were thoroughly discussed and the safe speed to avoid wave wash effect and consequent damages were agreed" was logged in the pilot card. It has to be noted that at this stage of the discussion, the master queried neither the need nor the availability of a second tug. Moreover, the analysis of the pilot's exchange with the master *i.e.*, the use of one tug, revealed no clues in the speech that the Port only had one tug.

2.5 Monitoring, Control and Grounding

Following the master / pilot exchange, the pilot took the con. Escorted by tug *Praia Maria*, the vessel approached the port. Inside the port's turning basin, the tug was engaged on the starboard quarter. The ship's main engine was set to astern. When almost stationary, the pilot executed a 180° turn, aligned the vessel with the jetty and dropped the starboard anchor. As soon as the anchor hit the sea bed, the pivot shifted to the bow near the hawse pipe. The exceptionally large leverage and inertia of rotation exacerbated the rate of turn and *Seasurfer* swung further to starboard, heading almost West.

With the main engine telegraph now on dead slow ahead, helm to port, and tug assisting on the starboard side, the swing was checked and the vessel was brought back parallel to the jetty. Given the pilot's level of local knowledge and ship handling experience, he did not seem overly concerned. Nonetheless, it appeared that the master was concerned by the unintended turn of events. Watching the stern fast approaching the jetty may have been perceived an unacceptable risk, and which may have also contributed to an increase level of stress.

Although, the master did not verbalise his concerns, it seemed that at this point, he exercised his overriding authority under the Company SMS to secure the safety of the vessel. Meanwhile, the pilot's advice to slacken the anchor chain was countered by the master's suggestion of shortening the chain and dragging the anchor along the seabed. In the absence of any compelling information of the master taking over the con, it is believed that the pilot raised no objection to the master's direct intervention in the subsequent manoeuvring of the vessel.

From the review of the available information, it was apparent that the action to weigh the anchor resulted in the bow to yet again turn to starboard. Subsequent orders on the vessel's main engine, helm position and shifting of the tug to forward (starboard bow) brought about a lateral movement towards the harbour entrance with the stern closing in on the breakwater. Even though the pilot continued to advise the master on helm and the main engine movements, and communicating instructions to the tug, they did not share a common mental model. The master was essentially preoccupied with the stern running on the breakwater (and ordered the main engine full ahead). In doing so, he averted the stern running into danger but consequently, the vessel's bow advanced beyond the limits of the navigational fairway and came in contact with the shoaling depth.

Full astern on the main engine and with the tug fast on the starboard quarter, the vessel was brought back in the turning basin. However, subsequent ahead propulsion, helm hard over to starboard, weighing the anchor and the tug pushing on the starboard quarter concurrently resulted in the vessel rapidly turning around to starboard and the port side ran aground on the shoal just outside the periphery of the turning basin. As illustrated in section 1.6 of this safety investigation report, hydrodynamic interaction of forces of the tug's thrust, vessel's forward and stern motions, effectiveness of the helm in shallow water, environmental conditions, anchor leading aft and frequently under strain, made the situation even more complex.

It would appear that during the manoeuvring operation, there were two main issues:

1. the pilot and the master were focusing on different events; and
2. multiple events were happening simultaneously.

Focusing on different events meant that the master and the pilot had different goals. This is not to say that the safe mooring of the ship was not the ultimate objective of the master and the pilot. However, focussing on different events (clearing the vessel's stern *vs.* the bow making contact with the shoaling depth) – and doing so under pressure of time and minimal clearances, meant that the goals to reach an unequivocal objective were in conflict.

This was an issue which both the master and the pilot had, and reconciliation of these differing goals in the presence of risk and uncertainty, was anything but a straight-forward task. As remarked by one distinguished scholar, whereas little information may lead to inaccuracy, too much information (as it was in this case), can lead to inefficiency. It was therefore clear, that the actions of the master and the pilot were the outcome of the context's complexity, being experienced at the time.

Multiple events happening simultaneously is a typical characteristic of complex situations, eloquently described by academics as event-rich domains. An event-rich domain is data rich, and would necessitate alterations in attention – more so during critical situations, where the time to assimilate, plan, act and react (and assimilate again)[8] is not necessarily abundant. The cognitive effort is therefore significant and this may lead to significant challenges for the operator, who is required to negotiate the situation.

The process described above must have been similar to what the master and the pilot had been experiencing. Not only juggling attention efforts from one event to another is cognitively demanding, but also challenging. Without having the benefit of hindsight, neither the master nor the pilot were in a position to determine which events were critical, and which were less.

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[8] This is also known as the cognitive cycle.

THE FOLLOWING CONCLUSIONS, SAFETY ACTIONS AND RECOMMENDATIONS SHALL IN NO CASE CREATE A PRESUMPTION OF BLAME OR LIABILITY. NEITHER ARE THEY BINDING NOR LISTED IN ANY ORDER OF PRIORITY.

3 CONCLUSIONS

Findings and safety factors are not listed in any order of priority.

3.1 Immediate Safety Factor

.1 The vessel's bow advanced beyond the limits of the navigational fairway and came in contact with the shoaling depth.

3.2 Latent Conditions and other Safety Factors

.1 The pilotage section of the passage plan contained no specific directions on manoeuvring with the use of tug/s at Praia;

.2 No navigational hazards or constraints were anticipated in the approach to the port or in the port's turning basin and the master did not query the need for a second tug;

.3 Watching the stern fast approaching the jetty may have been perceived an unacceptable risk by the master and may have also contributed to an increase level of stress;

.4 The exceptionally large leverage and inertia of rotation when the starboard anchor hit the sea bed, exacerbated the rate of turn and *Seasurfer* swung further to starboard, heading almost West;

.5 As the situation evolved, the master and the pilot did not share a common mental model and their goals to reach an unequivocal objective were in conflict;

.6 Subsequent ahead propulsion, helm hard over to starboard, weighing the anchor and the tug pushing on the starboard quarter concurrently resulted in the vessel rapidly turning around to starboard and the port side ran aground on the shoal just outside the periphery of the turning basin;

.7 Hydrodynamic interaction of forces of the tug's thrust, vessel's forward and stern motions, effectiveness of the helm in shallow water, environmental conditions, anchor leading aft and frequently under strain, made the situation more complex.

3.3 Other Findings

.1 The hours of rest of the master, chief officer, cadet and helmsman were found to be in accordance with the MLC and the STCW Convention requirements;

.2 Drugs and alcohol were not considered to have influenced the dynamics of the accident.

4 ACTIONS TAKEN

4.1 Safety Actions Taken During the Course of the Safety Investigation

The Company issued a Fleet Circular, establishing a new procedure for non-routine ports whereby prior to calling a new port, all masters are required to:

- submit to the Company's superintendent passage plan, UKC calculation, and risk assessment of all sections of the passage including but not limited to, the main engines and approach to the pilot station, pilot boarding, master / pilot exchange of information, tugs for berthing / mooring, mooring layout and manoeuvring in port, for their review;
- contemplate in advance alternative ways to conduct the pilotage operations or abort the operation anytime if not confident;
- monitor the weather and confirm with the local agent 24 hours prior to berthing;
- to review the guide to port entry with the Company's superintendent and collate information on port facilities, including tugs, mooring, pilotage, *etc.*, and confirm with the local agent;
- conduct an extraordinary meeting on board to discuss navigation under pilotage, working with tugs, mooring operation and contingency plans (details of the meeting / discussion to be sent to the Company office); and
- evaluate the port facilities and submit their comments / findings to the Company after calling at a new port.

Moreover, Company's superintendents are required to review and advise senior Company officials whether the designated new port is safe or not.

5 RECOMMENDATIONS

In view of the conclusions reached and taking into consideration the safety actions taken during the course of the safety investigation,

The Port Authority of Praia is recommended to:

18/2020_R1 review and develop guidelines on optimal use of tugs for safe ship movements in the port and its approaches.

18/2020_R2 consider providing a pilotage / manoeuvring plan prior to their arrival or as soon as practicable to masters of vessels carrying dangerous goods.