REPUBLIC OF BULGARIA
NATIONAL AIR, MARITIME AND RAIL ACCIDENT INVESTIGATION BOARD

FINAL REPORT

THE INVESTIGATION OF A SERIOUS MARITIME ACCIDENT —

Grounding of the motor vessel “Vera Su” on the Bulgarian coast on 20.09.2021.

2022

Sofia 1000, 9 Dyacon Ignatii Str.
Tel.: + 359 2 9409 864, Fax: + 359 2 9409 828
https://www.mtitc.government.bg/page.php?category=438

1. Table of content

1.1. Abbreviations

NAMRAIB - National Air, Maritime and Rail Accident Investigation Board;
BNWAS - Bridge navigational watch alarm system;
SMS – Safety Management System;
TSS - Traffic Separation Scheme;
MSW – Maritime Single Window;
ETA – Estimated time of arrival;
EAMA – Executive Agency "Maritime Administration", Republic of Bulgaria;
AIS – Automatic Identification System;
DG — Directorate-General;
LCC — Local Coordination Centre;
m/v — motor vessel;
MRCC — Maritime Rescue Co-ordination Centre;

COLREG — Convention on the International Regulations for Preventing Collisions at Sea, 1972;
SOLAS'74 - International Convention for the Safety of Life at Sea, 1974;
STCW Convention - International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended;
STCW Code - Seafarers' Training, Certification and Watchkeeping (STCW) Code;
IMSBC Code - International Maritime Solid Bulk Cargoes (IMSBC) Code;
DSC — Digital Selective Calling;
GT - Gross Tonnage
LT — Local Time, local time (UTC+ 3)
MT – Metric tons
nm — nautical mile (mile)
VHF — Very High Frequency
VTS — Vessel Traffic Service
OOW – Officer of the watch

1.2 Preface

The National Air, Maritime and Rail Accident Investigation Board (NAMRAIB) is an independent specialised govenmental body within the Council of Ministers of the Republic of Bulgaria, which investigates maritime casualties and marine incidents occurring in the internal sea waters and in the territorial sea of the Republic of Bulgaria, which occurred on or with a ship flying the Bulgarian flag, regardless of the place of accident, which affected other important interests of the Republic of Bulgaria, which affected river ships navigating in the internal sea waters and in the territorial sea of the Republic of Bulgaria, or sea ships navigating in inland waterways.

The investigations carried out by the NAMRAIB aim to improve maritime transport safety and prevent marine casualties by establishing the causes and circumstances of a particular casuaty, without seeking to approtion blame or determine liability.

The investigation shall be carried out in accordance with Article 79 of the Merchant Shipping Code and Ordinance No 23 of 24 October 2011 on the reporting and investigation of marine casualties and incidents in application of the International Maritime Organisation (IMO) Code of the International Standards and Reccomended Practices for a Safety Investigation into a Marine Casualty of Marine Incident (Casualty Investigation Code) as well as the EU secondary law.

The analyses and the safety recommendations made in this report do not give rise to any presumption of liability or guilt. In terms of content and style, the report has not been prepared for use in legal proceedings.

The report is published on the Internet, in the public domain, on the official website of the Ministry of Transport and Communications:* https://www.mtitc.government.bg/.

The events in this report are reflected in local time (UTC + 3).

Fig. 1 — Grounded m/v "Vera Su"

1.3. Summary

At 04:13:43 on 20.09.2021, the motor vessel "Vera Su", navigating from the port of Yuzhniy, Ukraine to Varna, loaded with 2 837,201 mt Urea, missed a way point for joining in the Traffic Separation Scheme due to the falling asleep of the second officer and ran aground on the Bulgarian coast in the area of Yailata Protected Area.

The steep coast and the underwater rocks around the place of grounding, as well as the degraded weather situation, make it very difficult to access the ship and conduct a lightening and an operation of refloating the vessel.

As a result of the holes in the hull, the vessel began to sink, which required evacuation of the crew ashore. There has been some pollution into the sea.

After several attempts, part of the cargo was discharged, the ship was lightered, pulled back from the shallow water and towed to the port of Varna.

As a result of the grounding, the influence of hydrometeorological conditions and the attempts to refloat the vessel, significant damages has been received to the hull, damage to the cargo, flooding of the engine room and underdeck spaces.

The investigation of the accident found that the second officer, who was the only watchkeeping person on the bridge at the time of the accident, without a lookout diring the night time, fell asleep, probably fatigued, as a result of which the vessel missed a turning way point and ran aground. The Bridge navigational watch alarm system (BNWAS), which could wake him up or alarm the crew respectively, has been set with the alrm turned off.

Contributing factors to the accident event are the lack of control by the master of the ship, non-compliance/non-application of the requirements of the International Conventions STCW and SOLAS'74, failure to comply with the safety procedures of the company's SMS, the lack of good practices of the management of the vessel, and the lack of good practices of control by the ship operator regarding safety management in general.

The Investigating commission issued 6 safety recommendations to the shipowner, 2 to the Executive Agency Maritime Administration of Republic of Bulgaria and 1 to the Bulgarian Ports Infrastructure Company.

2. Factual Information

2.1 Data about the ship	
Vessel's name	"Vera Su"
Flag	Panama
IMO No.	8611219
Call Sign	H9YA
MMSI	351299000
Shipowner	VES SHIP MANAGEMENT LTD
Port of registration	Panama City
Ship operator (company operator)	KAMER MARINE DENIZCILIK IC
ISM Manager	MIMOSA MANAGEMENT LTD
Classification society	INDIAN REGISTER OF SHIPPING
Type	General cargo ship
Year of build	1989
Gross tonnage	1984 mt
Length overall	89.21 m
Beam	12.5 m
Summer draught	6.36 m
Deadweight (max.)	3 217 t
Main engine	Deutz SBV 6M 628 600 kW

2.2 Voyage particulars	
Last port of calls	Yuzhniy (Ukraine) 16.09. —18.09.2021 Midia (Romania) 12.09.- 15.09.2021 Poti (Georgia) 25.08. — 11.09.2021 Constanta (Romania) 20.08. — 23.08.2021.
Port of departure	Yuzhniy UA
Port of arrival	Varna, Bulgaria
Type of voyage	International
Cargo information	2 837,201 mt Urea (UREA PRILLED IN BULK)
Manning	9 crew — 6 citizens of the Republic of Türkiye and 3 of Azerbaijan
Working language	The Turkish

2.3. Marine casualty information	
Date and time	20.09.2021, 04:13:43 local time
Type of marine casualty or incident	Serious Marine Casualty — grounding and severe structural damage
Location of incident	43° 25′ 34′ N; 028° 32′ 46′ E — Black Sea
Hydro-meteorological conditions	Visibility: very good, dark part of the day, wind: NE — 5, sea: 2-3, time — clear, sunrise 06:51, sunset moon (98 %) 05:52 hours, sea temperature 22 °C
Injures/fatalities	No
Consequences for the vessel	Yes
Consequences for the cargo	Yes
Effects on the environment	No

2.4. General information about the vessel

"Vera Su" was a self-propelled motor vessel for the carriage of general and bulk cargo, with steel structure, double hulled, with classic wavy and stern, single screw. The superstructure, bridge and machinery space are located in the stern part of the hull, the cargo space is one, with vertical sides.

The vessel was also equipped for the transportation of containers. Its navigation area was limited to 200 nautical miles from the coast, the North Sea, the Mediterranean Sea, the Black Sea and waters with similar maritime conditions.

The main engine of the ship, model DEUTZ SBV 6M 628 600 kW, is a six-cylinder, medium-turned, internal combustion diesel with remote control from the bridge. The vessel is equipped with a 200 kW bow thruster, with a right-step screw.

2.5. Crew

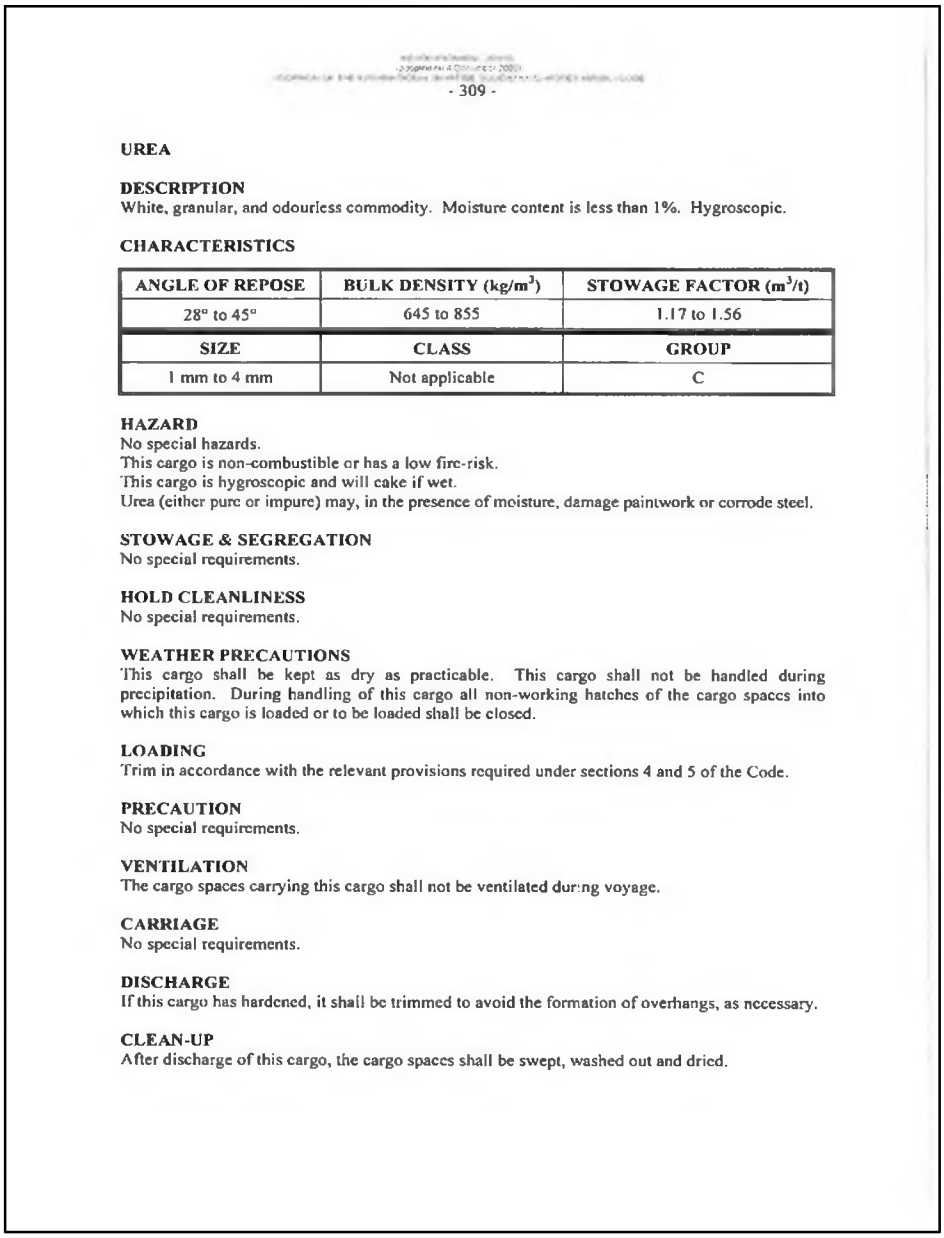
According to the Minimum Safe Manning Certificate issued by the Panama Maritime Authority, the minimum number of crew is 7.

During the passage from South to Varna, the ship was served by 9 crew members, 6 of them Turkish citizens and 3 citizens of Azerbaijan. The working language is Turkish.

All crew members have regular documents — certificates of competency, certificates of proficiency, certificates of proficiency for special and additional training, medical fitness certificates, etc.

- **The master**, 59, a Turkish national with experience at sea for 35 years. He had worked as master for 30 years. He had been on board of the vessel for 3.5 months. Holds a certificate of competency "Master of a ship up to 3 000 GT, without restriction of the navigation area", issued by the Administration of the Republic of Türkiye, valid until 02.08.2022.
- **The chief officer** is 34 years old, a Turkish national with experience at sea for 15 years. He had worked as chief officer for 4 years. He had been on board of the vessel for 10 months. Holds a certificate of competency "Chief mate on a ship up to 3 000 GT, without limitation of the navigation area" issued by the Administration of the Republic of Türkiye, valid until 11.11.2024.
- **The second officer** is 26 years old, a Turkish national with experience at sea for 5 years. He had worked as second officer for 2 years old. He had been on board of the vessel for 6 months, 3 of them on dry dock. Holds a certificate of competency "Officer in charge of a navigational watch on ships up to 3 000 GT, without restrictions of the navigation area", issued by the Administration of the Republic of Türkiye, valid until 18.11.2024.

2.6. Cargo



- 309 -

UREA

DESCRIPTION
White, granular, and odourless commodity. Moisture content is less than 1%. Hygroscopic.

CHARACTERISTICS

ANGLE OF REPOSE	BULK DENSITY (kg/m³)	STOWAGE FACTOR (m³/t)
28° to 45°	645 to 855	1.17 to 1.56
SIZE	**CLASS**	**GROUP**
1 mm to 4 mm	Not applicable	C

HAZARD
No special hazards.
This cargo is non-combustible or has a low fire-risk.
This cargo is hygroscopic and will cake if wet.
Urea (either pure or impure) may, in the presence of moisture, damage paintwork or corrode steel.

STOWAGE & SEGREGATION
No special requirements.

HOLD CLEANLINESS
No special requirements.

WEATHER PRECAUTIONS
This cargo shall be kept as dry as practicable. This cargo shall not be handled during precipitation. During handling of this cargo all non-working hatches of the cargo spaces into which this cargo is loaded or to be loaded shall be closed.

LOADING
Trim in accordance with the relevant provisions required under sections 4 and 5 of the Code.

PRECAUTION
No special requirements.

VENTILATION
The cargo spaces carrying this cargo shall not be ventilated during voyage.

CARRIAGE
No special requirements.

DISCHARGE
If this cargo has hardened, it shall be trimmed to avoid the formation of overhangs, as necessary.

CLEAN-UP
After discharge of this cargo, the cargo spaces shall be swept, washed out and dried.

During the passage to the port of Varna, the ship was loaded with 2 837,201 mt of Urea (carbamide fertiliser) in bulk. The cargo is not listed as hazardous in the IMSBC Code (Figure 2). This type of fertiliser is significantly cheap and widely used worldwide. Urea is highly soluble in water and quickly breaks down to ammonia and bicarbonate by the enzyme urease. In essence, urea in small quantities is not toxic to marine species, but its mineralisation products (ammonia, nitrates, nitrites) are toxic.

The eventual introduction of large quantities of urea into seawater (or the entire load due to hull refraction) would lead to negative changes in the ecosystem in the area — degradation and loss of bottom ecosystems and living invertebrates and fish.

Figure 2 - Information about Urea from Annex 1 of IMSBC Code

2.7. Navigational equipment of the vessel

2.7.1. Provision by technical means, systems and equipment

The vessel was provided navigationally by technical means, systems and equipment complying with the requirements laid down in the international and national legal and regulatory acts to which the flag administration is a party.

- **Communication equipment:**
  - Ultra High Frequency (VHF) radio with built-in digital selective call (DSC) broadcast and reception functions: Brand — Thrane & Thrane; Model SAILOR RT5022. (Thrane & Thrane, SAILOR RT5022 VHF DSC);
  - Ultra short wave radio station: Brand — SAILOR; Model — RT2048. (SAILOR COMPACT VHF RT2048);

- Ultra-short wave receiver on digital selective call: Brand — SAILOR; Model — RM2042. (SAILOR COMPACT VHF DSC RM2042);
- Short and long wave radio with integrated digital selective call function: Brand — Thrane & Thrane; Model — SAILOR HC4500B. (Thrane & Thrane, SAILOR HC4500B MF/HF);
- NAVTEX receiver: Brand — Furuno; Model — NX700;
- Automatic Identification System (AIS): Brand — Furuno; Model — FA-100;
- Inmarsat-C Transceiver: Brand — SAILOR; Model — H2095B;
- Inmarsat-C Transceiver: Brand — SAILOR; Model — H2095C;
- Ship Security Alarm System (SSAS): Brand — Thrane & Thrane; The model: SAILOR IRIDIUM ST4120;
- Antenna for receiving TV signal — SAT Tech, AS-60.
- EPIRB: Brand — JOTRON; Model — TRON 40S;
- SART — SOLAS 9;
- Ultra-short wave transmission stations — 3 pcs: Brand — SAILOR; Model — DEBEG 6701;

- **Navigation equipment**
  - Magnetic compass;
  - Gyrocompas: Brand — TSS SG BROWN; Model — MERIDIAN STANDARD GYROCOMPASS;
  - Global Positioning System Data Receiver — GPS: Brand — Furuno; Model — GPS NAVIGATOR GP-150;
  - GNSS Global Navigation Satellite System Data Receiver: Brand — NSR; Model — NGR3000;
  - Radar — 2 pcs: Brand — Furuno; Model — FR1510 MARK-3;
- **Other means of management and control**
  - Echosounder: Brand — Furuno; Model — FE-700;
  - Log: Brand — SAL; Model — Jungner Marine;
  - Bridge navigational watch alarm system (BNWAS): Brand — NSR; Model — NBW-1000;
  - A control system for smoke from cargo spaces;
  - Fire alarm system;
  - Water Ingress System etc.

2.7.2. Voyage Planning and Navigational Charts.

On the basis of the fullest possible assessment of the scheduled voyage, a detailed plan for the passage from berth to berth, including for areas where pilot services are used, must be drawn up on board the ship. The passage plan was prepared in form according to the Safety Management System (SMS) (Form SS-05-I-74). The way, the sequence of preparation and its content are detailed in the procedure of the SMS, Chapter 4, Section 4: Voyage Planning. The main points set out in the procedure are:

1. The plan is prepared by the navigation officer, who for the company operator of m/v "Vera Su" is the second officer and covers with maximum accuracy the first 48 hours of the passage;

2. The plan shall be approved by the master of the vessel;

3. Before the start of the voyage, the master shall explain to the officers in charge the plan which he has approved;

4. No changes to the voyage plan shall be permitted unless approved by the master of the vessel.

5. Once the voyage plan has been drawn up, the navigation officer (the second officer) shall draw all courses on appropriate scale navigational charts.

The vessel's passage plan was plotted graphically on maps BAC 2232 and 2230.

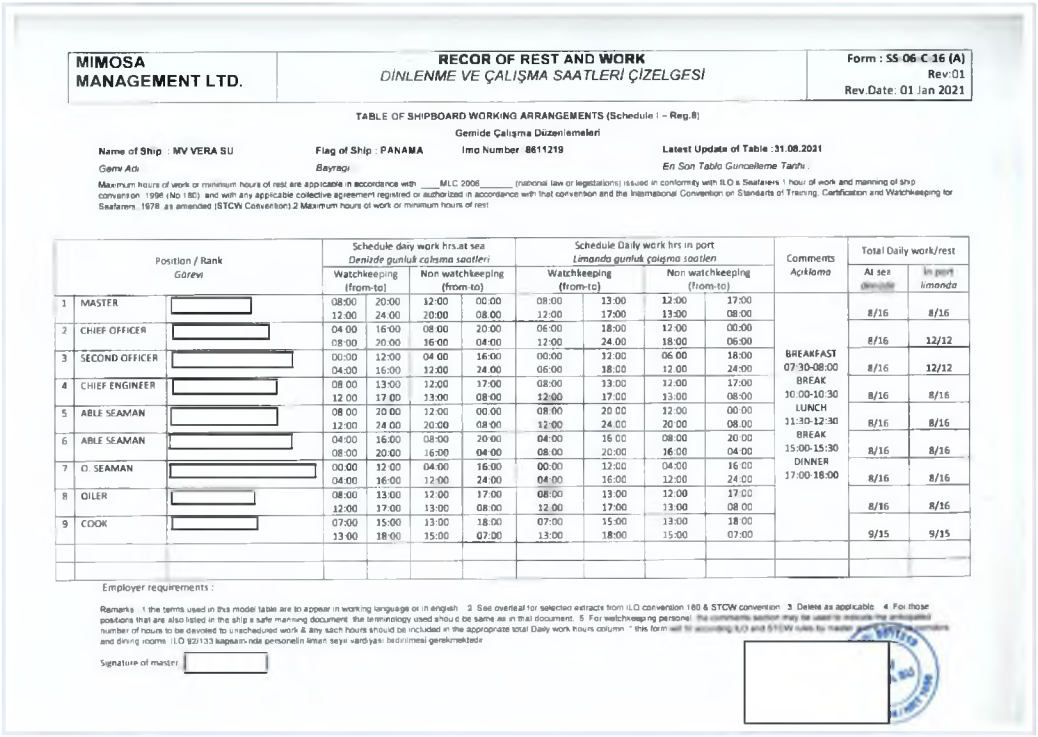
2.7.3. Organisation of the navigational watch.

The organisation of the navigational watch includes the division of the 24th day into six watches of 4 hours each. Watches are generally watches on the bridge (navigational watch) and watch in the

engine room. For the organisation and proper carrying of the watchkeeping service on the bridge during the passage and at anchor, the master of the vessel shall be responsible. When carrying a watch on the bridge, the watchkeeping officer is directly responsible for ensuring the safety of the crew, ship and cargo and for fulfilling the requirements of both the normative documents and the master's orders.

The crew of the bridge's watch includes a navigational officer and a lookout. The qualified officers of the crew of the ship entitled to carry a navigational watch and whose duties are assigned the carrying of watch while underway and at anchor shall be the master, the chief officer and the second officer.

The hours and sequence of overlapping of watches shall be determined by the master, in accordance with the rules regulated by the Safety Management System of the vessel's operator company and documented by a record of working hours and rest periods, including all crew members, signed and stamped by the master.



MIMOSA MANAGEMENT LTD.

RECOR OF REST AND WORK
DİNLENME VE ÇALIŞMA SAATLERİ ÇİZELGESİ

Form : SS-06-C-16 (A)
Rev:01
Rev.Date: 01 Jan 2021

TABLE OF SHIPBOARD WORKING ARRANGEMENTS (Schedule I – Reg.8)
Gemide Çalışma Düzenlemeleri

Name of Ship : MV VERA SU | Flag of Ship : PANAMA | Imo Number :8611219 | Latest Update of Table :31.08.2021
Gemi Adı | Bayrağı | En Son Tablo Güncelleme Tarihi :

Maximum hours of work or minimum hours of rest are applicable in accordance with ____MLC 2006_____ (national law or legislations) issued in conformity with ILO s Seafarers 1 hour of work and manning of ship convention 1996 (No 180) and with any applicable collective agreement registred or authorized in accordance with that convention and the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended (STCW Convention).2 Maximum hours of work or minimum hours of rest

	Position / Rank Görevi	Schedule daily work hrs.at sea Denizde günlük çalışma saatleri				Schedule Daily work hrs in port Limanda günlük çalışma saatleri				Comments Açıklama	Total Daily work/rest	
		Watchkeeping (from-to)		Non watchkeeping (from-to)		Watchkeeping (from-to)		Non watchkeeping (from-to)			At sea denizde	In port limanda
1	MASTER	08:00 12:00	12:00 20:00	00:00 08:00		08:00 12:00	13:00 17:00	17:00 08:00			8/16	8/16
2	CHIEF OFFICER	04:00 08:00	16:00 20:00	08:00 16:00	20:00 04:00	06:00 12:00	18:00 24:00	12:00 18:00	00:00 06:00		8/16	12/12
3	SECOND OFFICER	00:00 04:00	12:00 16:00	04:00 12:00	16:00 24:00	00:00 06:00	12:00 18:00	06:00 12:00	18:00 24:00	BREAKFAST 07:30-08:00	8/16	12/12
4	CHIEF ENGINEER	08:00 12:00	13:00 17:00	12:00 13:00	17:00 08:00	08:00 12:00	13:00 17:00	12:00 13:00	17:00 08:00	BREAK 10:00-10:30	8/16	8/16
5	ABLE SEAMAN	08:00 12:00	20:00 24:00	12:00 20:00	00:00 08:00	08:00 12:00	20:00 24:00	12:00 20:00	00:00 08:00	LUNCH 11:30-12:30	8/16	8/16
6	ABLE SEAMAN	04:00 08:00	16:00 20:00	08:00 16:00	20:00 04:00	04:00 08:00	16:00 20:00	08:00 16:00	20:00 04:00	BREAK 15:00-15:30	8/16	8/16
7	O. SEAMAN	00:00 04:00	12:00 16:00	04:00 12:00	16:00 24:00	00:00 04:00	12:00 16:00	04:00 12:00	16:00 24:00	DINNER 17:00-18:00	8/16	8/16
8	OILER	08:00 12:00	13:00 17:00	12:00 13:00	17:00 08:00	08:00 12:00	13:00 17:00	12:00 13:00	17:00 08:00		8/16	8/16
9	COOK	07:00 13:00	15:00 18:00	13:00 15:00	18:00 07:00	07:00 13:00	15:00 18:00	13:00 15:00	18:00 07:00		9/15	9/15

Employer requirements :

Remarks : 1 the terms used in this model table are to appear in working language or in english 2 See overleaf for selected extracts from ILO convention 180 & STCW convention 3 Delete as applicable 4 For those positions that are also listed in the ship s safe manning document the terminology used should be same as in that document. 5 For watchkeeping personel the comments section may be used to indicate the anticipated number of hours to be devoted to unscheduled work & any such hours should be included in the appropriate total Daily work hours column * this form will to according ILO and STCW rules for master and watchkeepers and dining rooms : ILO 92/133 kapsam-nda personelin iman seye vardiyasi bedirmesi gerekmektedir

Signature of master

Fig. 3 — Schedule of watches on the bridge of Vera Su

At the time of the ship's grounding — 04:13:43 on 20.09.2021, in the logbook, according to the schedule of working hours and rest periods of crew members, form SS-06-C-16(A) of the SMS (Figure 3), the navigational watch should have been composed of a chief officer, reinforced with a lookout for the time of the dark part of the watch — AB.

According to the crew's testimony, the master released the two AB and the seaman from the obligation to carry a watch as lookout on the bridge, in exchange for performing deck work from 08:00 to 17:00 during the day.

For this reason, the composition of the navigation watch from 00:00 on 20.09.2021, until the time of grounding of the vessel on 04:13:43 on the same day, included only the second officer.

2.7.4. Ship's logbook

According to the International Convention for the Safety of Life at Sea (SOLAS'74), as amended, Chapter V, Rule 28, paragraph 1, ships of international navigation are required to keep on board records relating to all activities relevant to navigational safety, in such a way as to allow at a later stage a complete picture of the events occurring on board the ship. One option to comply with the requirements of this SOLAS'74 Regulation is by keeping a logbook. Resolution A.916 (22) of 29.11.2001 gave the IMO guidance on what events should be reflected when keeping logbook entries.

According to STCW (as amended), Chapter VIII, Section A-VIII/2, Part 4-1, para 13, the watchkeeping officer during the watch is a master's representative and is responsible for the safety of the vessel at all times on his watch. Upon completion of the watch, its release and acceptance shall be documented by a record in the ship's logbook. The handing over officer in charge of the watch shall transmit and the relieving officer shall take over the watch on the bridge in accordance with the conditions and procedures laid down in the Safety Management System No.: 55-05-I-77, which shall

in no way contradict and, as a minimum, meet the requirements of the International Convention STCW, Chapter VIII, Section A-VIII/2, Part 4-1, para 19 to 23 inclusive.

The last record in the logbook for the handing over of the watch on the bridge was at 24:00h local time on 19.09.2021. According to this record, the watch from 20:00 to 24:00 on 19.09.2021 the master of the vessel handed over the watchkeeping from 00:00 to 04:00 on 20.09.2021 to the second officer— without this being certified by the signatures of either of the two watchkeepers.

On the day of the casualty, there is no record for handing over and taking over the watch on the bridge from 00:00 to 04:00 on 20.09.2021.

2.7.5. Master's standing orders

Under the general authority of the master of the vessel, watchkeeping officers on the bridge shall be responsible for the safe navigation of the vessel during their watches. For this purpose, the watchkeepers are obliged to pay primary attention to preventing the ship from colliding and stranding. The general direction of the master is expressed by standing orders, which are written in a document called Master's standing orders. These orders shall contain basic rules for the safe carrying of navigation watch and shall comply with the Safety Management System, applicable international and national regulations, good maritime practice and the specific requirements of the master of the vessel.

The Master's standing orders shall be placed in a prominent position on the navigating bridge of the vessel. Upon taking over the first watch or on the first duty of the particular vessel, the watchkeeping officers shall certify by their signature that they are aware of the orders in question.

2.7.6. The Night Order Book

In the case of the operation of the ship during the night, on a voyage or in a port at the discretion of the master, when the particular circumstances so require, in addition to the standing orders, the master of the ship shall record his instructions for safe keeping of the watch on the bridge in a Night Order Book. The book is kept on the bridge and every officer in charge of the watch is obliged before taking over the watch, to be acquainted with his signature, to certify that he is aware of the relevant additional orders related to the particular circumstances.

Only seven empty, unrecorded books of the Master's Night Order Book were found during the vessel's inspection, although point 2 of the Master's standing orders contains a reference to the book in question.

It should be pointed out that, in the lower right corner of the logbook, there was a column entitled Master's Night Orders, the entry of a specific content in which, by presumption, it should be regarded as analogous to the above considerations relating to the Night Order Book.

In the column orders of the master for the night of 19.09.2021 against 20.09.2021, the evening before the accident, there was only a record: "*all time listening ch 16*". The record was made on page 263 of the ship's logbook.

Fig. 4 — the master's order for the night watches on 19-20.09.2021

2.7.7. Bridge Navigational Watch Alarm System (BNWAS)

Fig. 5 — Control unit of BNWAS on the bridge

The ship was equipped with a Bridge Navigational Watch Alarm System, brand — NSR, Model — NBW-1000. The purpose of such a system is to monitor bridge activity and detect operator diability which could lead to to marine accidents. The system monitors the awareness of the Officer of the Watch (OOW) and automatically alerts the Master or another qualified OOW if for any reason the OOW becomes incapable of performing the OOW's duties. This purpose is achieved by a series of indications and alarms to alert first the OOW and, if he is not responding, then to alert the Master or another qualified OOW. The signalling levels of the system are three in number. The first stage involves triggering, after the time set in the system timer (dominant period), a visual and audio alarm on the ship's bridge. The second level of alarm includes simultaneous activation of alarm unit 1 (in the master's cabin), alarm unit 2 (in the cabin of the chief officer) and alarm block 3 (in the cabin of the second officer).

The system makes it possible to select an alarm block or alarm units to act as a second-degree alarm. The third level of alarm is to trigger an alarm (alarm block 4) in the ship's common dining room.

Changing the operational mode of BNWAS (MASTER SETTING), dominant period (Td), password change and the sequence in which alarm block will be activated is only possible after entering a password, which should only be known to the master of the vessel.

Selected dominant period allows to be set from 3 to a maximum of 12 minutes.

Once switched on, the BNWAS becomes operational after a selection of operational mode (OPERATION MODE). At the end of selected dominat period, a visual signal appears on the bridge. If the system timer is not reset within 15 seconds of the start of the visual signal, an audible signal is sounded on the bridge. If the BNWAS timer is not reset within 15 seconds of the start of sounding of the audible signal on the bridge, it shall activate the second stage of signalling, which, depending on the setting variants, shall reproduce an audio signal in the cabins of the master and the officers. If the BNWAS timer is not restarted within a further 90 seconds from the start of activation of the second signaling phase, then the third signaling phase shall be activated.

The investigation found that the BNWAS dominant period was set for 3 min. At the time of the accident, the system operated in MANUAL OFF mode, in which the alarms were not activated.

2.8 Traffic Separation Scheme (TSS) in the territorial sea of the Republic of Bulgaria

Fig. 6 — TSS in the territorial sea of the Republic of Bulgaria.

In order to increase the safety of life at sea, ensure the safety of navigation, better environment protection from pollution from ships and reduce the risk of accidents, a Separate Traffic Separation System regulating navigatrion has been established in the maritime areas of the Republic of Bulgaria. The control and compliance with the rules of the Traffic Separation System is carried out by the Ececutive Agency "Maritime Administration", Republic of Bulgaria. Part of the Traffic Separation System is the Traffic Separation Scheme (TSS) (Figure 6). The scheme consists of 13 parts and is intended for navigating between ports along the coast and joining/leaving to/from all foreign and Bulgarian vessels with a displacement of more than 300 GT. The Scheme implements the principles for the use of TSSs as defined in Rule 10 of the COLREG. Ships shall only navigate in the designated traffic lane, subject to the rule that the separation zone is always on their port side.

The current TSS does not take into account the increase in traffic on the Bulgarian Black Sea coast in recent years. A major disadvantage is its immediate proximity to the coast (about 3 cables at the nearest points to the shore), which creates the prerequisites for vessels under 20 metres, sport and

pleasure vessels and fishing vessels to fall into lanes and circular traffic areas, which increases the risk of an accident.

Fig. 7 — Part I, western lane of the Traffic Separation Scheme. The nearest points from the border to the coast are indicated (Line2 and Line 3).

For vessels heading generally north-south, the points for joining in the Traffic Separation Scheme are in the western lanes, too close to the coast (especially in Part I, western lane), resulting in a small sea area for manoeuvring in close quarter situations with other ships and a small response time of OOW, whether it is a collision avoidance situation or a risk of stranding due to misdetermination of the way point and turning time for joining the traffic lane.

In practice, the VTS operators do not have time to react alerting OOW of the vessels dangerously approaching the shore when leaving the western boundary of the lane when navigating generally north-south.

The investigation carried out by the investigation commission found that a draft of a new Traffic Separation Scheme has been developed, which is located in an easterly direction relative to the existing TSS and significant distance from the coast has been ensured, but the investigation has not been able to establish at what stage the implementation process is.

3. NARRATIVE

3.1. Passage of the vessel from the loading port to the stranding

At 20:05 on 18.09.2021, the vessel left the Ukrainian port of Yuzhniy bound for Varna, loaded with 2 837,201 tons of Urea in bulk (UREA PRILLED IN BULK). At departure, the vessel (according to data from the vessel's loading software and final cargo plan) was in seagoing condition, draught: Fore 4.40 m, Mid 4.60 m, Aft 4.80 m. The trim was 0.40 m to the stern. Metacentric height (1.12 m)

and other stability parameters were normal. The displacement of the vessel was 4078.32 tonnes. The fuel of the ship was 28.69 t, residual ballast 26.64 t. According to the notification sent to the Bulgarian MSW, the ETA at Varna port was 07:00 on 20.09.2021. The passage plan was drawn up by the second officer and signed by him. The master's signature of the passage plan was missing, and the signature of the other navigation officer (chief officer) was also missing. The vessel's courses were drawn by the second officer on navigation charts BAC 2232 and BAC 2230.

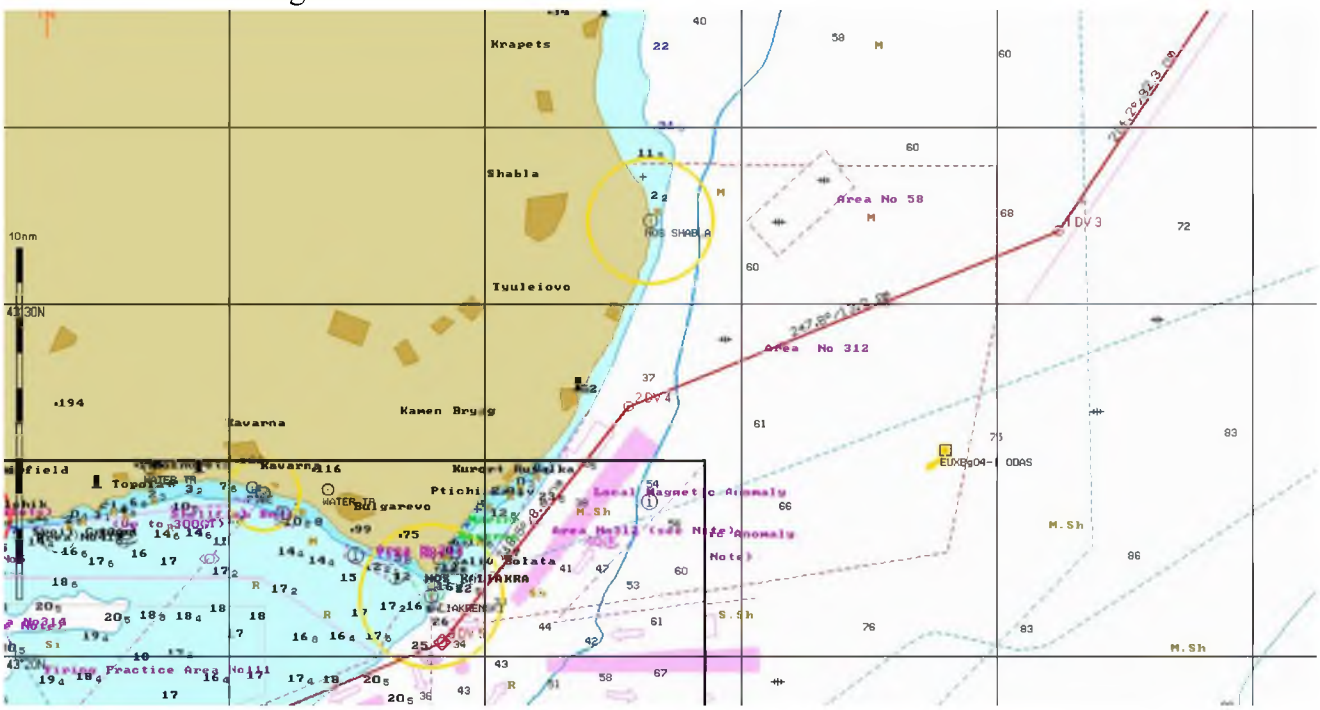


Fig. 8 — Final phase of the deviation of passage plan in the vessel's area of joining the Traffic Separation Scheme and cape Kaliakra

During the passage, at the direction of the master, the courses of the vessel were adjusted so that the navigation to be made closer to the shore (Figure 8, compare with figure 9). The additional passage plan for deviation from the original route (deviation plan) has not been signed by anyone.

Fig. 9 — Comparison between the original passage plan and the deviation plane - final phase by the order of the master.

The reason for the change, according to the master's testimony, was the sharp deterioration of the weather and the need for a better Internet connection in the final stage of the passage, necessary to broadcast messages to the coastal authorities and the shipowner.

According to the change in the schedule for work and rest of the crew made by the master, the navigational watch of the bridge during the passage shall be carried only by an OOW. The two AB and the seaman, who were supposed to carry a watch on the bridge as lookouts, were released for general deck work during the day. All means of navigation and communication on the bridge were in good condition. The alarm of the BNWAS was set off, which is confirmed by the master and the two navigation officers of the vessel. There was no record in the logbook for switching on or off the BNWAS, which is in breach of the SMS established on the vessel. The vessel was on autopilot.

The passage from the port of Yuzhniy until 00:00 on 20.09.2021 was safe and routine for the crew.

3.2. Watch from 00:00 to 04:00 on 20.09.2021

At 00:00 on 20.09.2021, the navigational watch was taken over by the second officer, relieving the master. The watchkeeping officer was not provided with a lookout, although one was listed in the watch schedule. The second officer probably has not been rest enough for the watch. According to his testimony, since the vessel's departure from Yuzhniy (Ukraine), he has not had the opportunity to rest by not sleeping at all. In the watch-free time, he was busy preparing the vessel's documents for the port authorities in Varna, while being summoned by the master whenever he received an email or a need for translation from and into English language, which puts into question the free knowledge of English by the master of the vessel. During the watch, the second officer monitored the radar, the GPS receiver of the vessels's coordinates and other equipment, which provides information about the vessel's movement, her position, traffic and navigational situation around the vessel.

At 02:00, the vessel's position was entered in the logbook. At 00:55, 01:25, 01:55, 02:00, 02:25, 03:00 and at 03:25, the second officer plotted the vessels's positions on a navigation chart. After 03:25 no logbook entries and no position of the vessel was plotted on the navigation chart.

At 01:55 the vessels made the planned turn at 245°, crossed the border of the territorial sea of the Republic of Bulgaria and headed to the way point for joining in the Traffic Separation Scheme.

In the period 03:45-03:55, the OOW briefly sat on the couch of the bridge and fell asleep. At 4:00 a.m. the chief officer, who should take over the watch, did not go on the bridge. He didn't get a wake-up call, relying solely on the call from the bridge.

3.3. Grounding of the vessel

At 03:53, without awake watchkeeper on the bridge, the vessel did not took the intended turn for joining in Part I of the Traffic Separation Scheme, and continued at an unchanged course of 246° and a speed of 7.8 knots towards the shore.

At 04:03 the duty operator of VTS-Varna, and at 04:05, the Border Police duty officer, who had so far monitored the ship's movement, noticing that she was heading towards the shore, began calling the vessel on VHF 14 and 16 channels. The calls were repeated and insistent, but without a result. At the time of the stranding, there was no recorded broadcast of a DSC VHF message that would trigger an audible alarm on the bridge, possibly to wake-up the OOW.

At 04:13:43, with a course of 246° and speed 7.8 knots, the vessel grounded on the rocky coast in the area of Yailata Protected Area (Figure 10). The second officer was awakened by the loud noise and the squeezing of the ship, assessed the situation, gave a stop to the main engine and descended into the living quarters to wake up the master, the chief officer and the seaman.

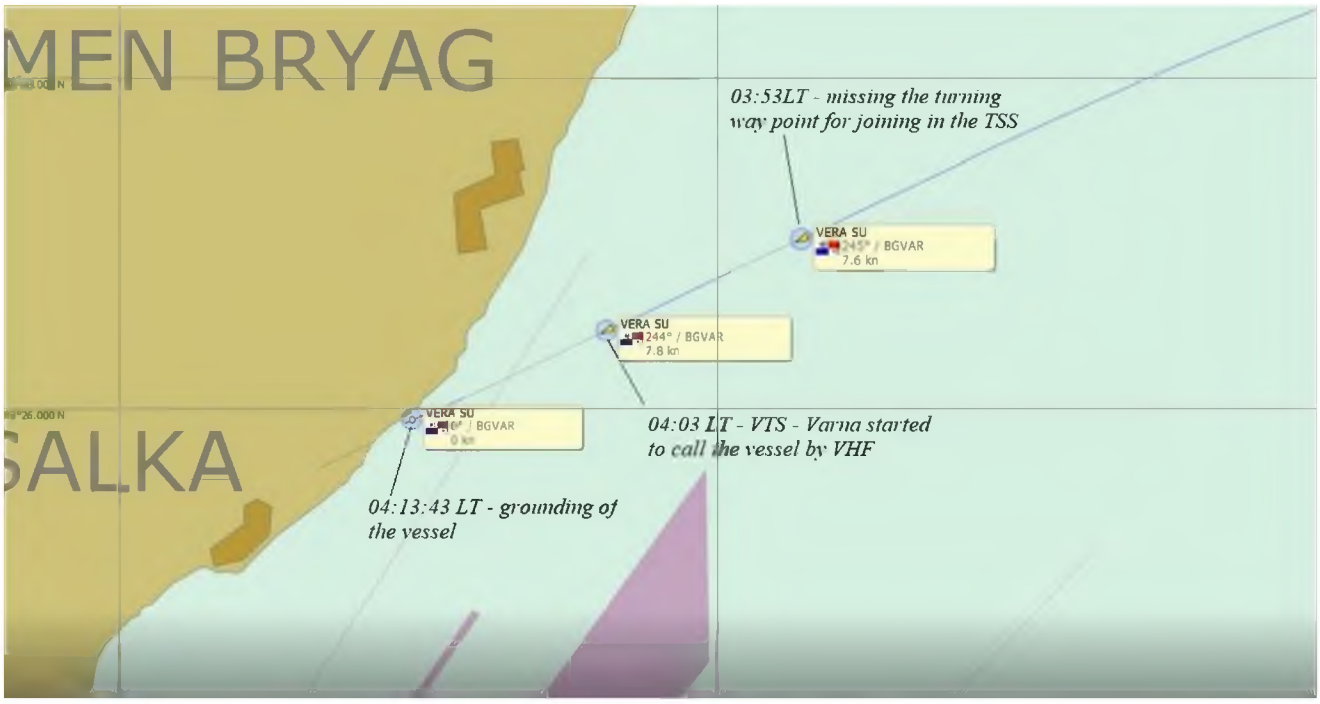


Fig. 10 — Final stages of the ship's passage — missed a planned turning way point, start calls from the shore and the grounding.

3.4. Events after the grounding

The vessel stranded in Yailata, Kamen Bryag, at a point at 43° 25' 34"N and 028° 32' 46" E, as recorded in the logbook.

The shore around the stranded vessel was almost sheer rocks, and the bottom was stony with numerous underwater rocks and relatively small depths, which hindered the vessels's ability to refloat at its own power. The ability to approach tugs in the immediate vicinity of the ship, as well as the possibility of discharging the cargo, were severely restricted due to danger of stranding or cracking when other vessels approach the ship.

Immediately after grounding, the chief officer and a seaman, awakened by the second officer in charge, picked up on the bridge. The master of the ship entered the bridge with some delay. According to information from the chief officer, the master ordered sounding of ballast tanks, and it was found that 5 out of 11 of them were filing with water. It has been established that there was no fuel leakage. The ship's draughts were measured: Fore port side — 3 m; Fore starboard side — 3.4 m (average forward draught on departure the vessel — 4.4 m); Aft port side — 6.7 m; Aft starboard side — 7 m. The depths around the vessel in the area of the stranding were also measured.

After embarking on the bridge (according to the testimonies of a crew member not confirmed by the master), the master ordered not to respond to calls on VHF 11 and 16 channel but subsequently to turn off the VHF radio, as well as the AIS equipment to be swithed off.

Then, the master made several unsuccessful attempts to refloat the vessel off the rocks, putting the main engine full astern, despite warnings from the other officers that this could lead to a violation of the hull.

At 05:12, almost 1 hour after the stranding, the vessel made a VHF contact with the VTS - Varna duty operator. The chief officer reported that the vessel was aground with no heel, no crew casualties and no pollution to maritime environment. The duty operator of VTS - Varna insisted to contact with the master of the vessel. The master confirmed the information given by the chief officer. The ship was stranded at about 16 meters from the shore, there was no heel. Asked if the vessel needed help, the master replied that he would contact after the damage had been inspected.

At 05:16 a.m., the MRCC requested and received radio confirmation from the vessel that no crew members were injured.

3.5. Actions of the coastal authorities

3.5.1. Actions before the stranding of the vessel

Around 00:00 on 20.09.2021 the duty officers of the Local Coordination Centre – Galata (LCC-Galata) of DG Border Police and the duty operators of VTS-Varna discovered the vessel "Vera Su" at about 22 nautical miles east of Durankulak, at a course of 214° and speed 7 knots. Information on the upcoming call of m/v"Vera Su" at the port of Varna was received at the Bulgarian Maritime Single Window by the authorised shipping agent on 17.09.2021. Continuous monitoring of the vessel during its navigation in Bulgarian waters began. In this section of the passage, the vessel had the rights of peaceful passage and radio communication with the coastal centres should not be required, unless exceptional circumstances have arisen. The first radio communication of the vessel to the coast was planned after entering the area for a routine report of the coastal center Varna, whose western border is the meridian of Cape Kaliakra.

At 01:55, about 12 nautical miles from the coast, at the border of the territorial sea, the vessel changed her course and her guidance to the point for joining in the Traffic Separation Scheme was observed. The vessel navigated at constant course and speed, without violating the rules for peaceful passage through the Bulgarian maritime spaces.

At 4:00 a.m., the coastal operators monitoring the vessel's movement found that the vessel passed the entry point in the Traffic Separation Scheme and continued at an unaltered course and speed towards the shore. The ship was repeatedly called at the VHF channels. At 04:03 was the first call from VTS — Varna. A total of 14 calls were made by VTS and 4 from the DG Border Police (first at 04:05). The ship did not answer the calls and at 04:13:43 abruptly stopped its movement in close proximity to the coast in the area between the village of Kamen Bryag and the resort "Rusalka".

A total of 5 calls were made from VTS and 3 calls from the MRCC to which the ship did not respond during the period after the stranding, until 05:12 hours, when the first radio communication with the vessel was made.

M/v "Vera Su" was also called by the coast station "Varna Radio" at 04:33 on DSC VHF ch70 with the message type "URGENCY" to which the vessel also did not respond.

A Border Police Shore Patrol Group from Kavarna was sent to the place of the grounding by land, and the Border Police Vessel "GPK-554" was send to reach the stranded vessel by sea. At 4:40 the Border Police Shore Patrol Group arrived at the site and found that the m/v "Vera Su" was stranded at a distance of no more than 5 meters from the coast. There was a movement of people on the ship's deck. The commanding officer of Border Police Shore Patrol Group reported the situation and stayed in place and monitored the situation from the shore. At the scene of the incident, MRCC sended a boat "Spasitel - 1", which arrived at 06:50.

3.5.2. Actions for refloating the vessel

Only the most important points of the actions taken to refloat the ship are presented below and not all events are set out in chronological order, due to the large number of activities that would unnecessarily aggravate the report. Only those who have a direct or indirect link to the safety casualty investigation are described.

Already on the day of the grounding, at the initiative of the shipowner, an underwater inspection was carried out on the vessel, which found holes only in the ballast tanks of the ship. The bow of the ship was found to be firmly trapped in the rocks, and the middle and stern, including the screw propeller, were free (Figure 11).

The inspection found damage to the hull as a result of contact with the rocky bottom in the area, consisting of undercuts, ruptures and deformations on both sides of the vessel, reaching a distance of about 25 m from the bow to the stern of the vessel.

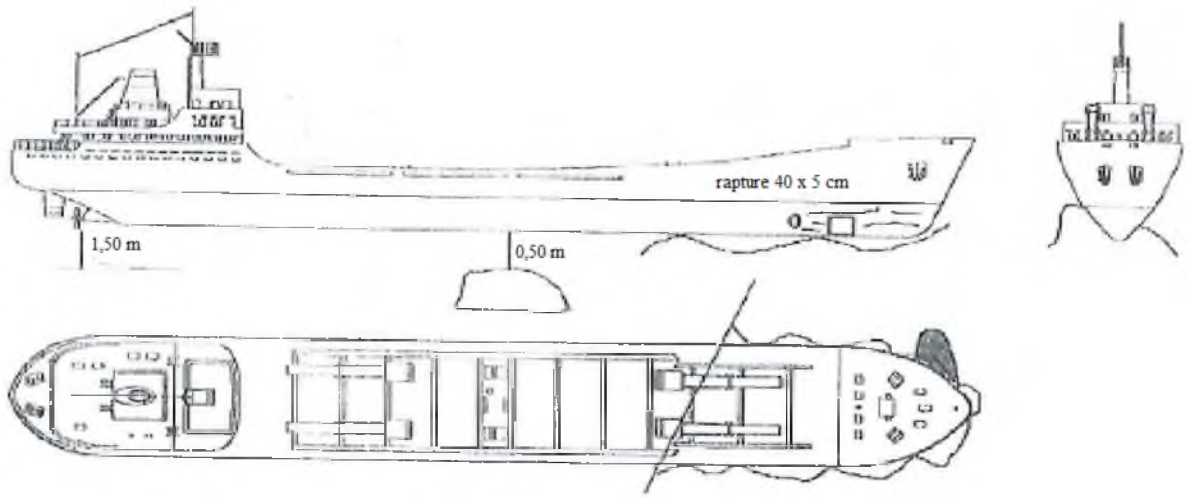


Fig. 11 — Places of contact of the hull with the bottom, at the time the vessel's grounding

More typical damages included:

1. Forsteven — curvature with a length of about 1.2 m from starboard to port side and back to stern;
2. Port side — undercuts, deformations and in places lacerations on the shell plating of the vessel;
3. Starboard side — a hole in the shell plating measuring 40 by 5 cm in the area of the groove of the rudder, combined with significant deformation.

The depths of the ship's grounding area allowed the propeller to remain about 1.50 m above the sea bottom and not be affected when stranded. There were no holes in the engine room of the vessel and the same was not flooded. The vessel's main engine remained operational.

From the moment the ship stranded on 20.09.2021, through the holes on the hull water flowed into the ballast tanks, which gradually led to the vessel's sinking to the point where the hull laid down on a rock located midships. This rock mass at the time of the vessel's grounding was about 0.5 m deep below the bottom of the vessel. After the vessel laid down at the sea bottom, the stern part of the hull remained about one meter above the seabed, leaving the screw unaffected.

A number of activities were carried out on the first day of the stranding and in the subsequent days, such as detailed mapping of the bottom of the sea at the place of grounding, the engagement of a floating crane and other means, active correspondence between state authorities and the shipowner and the vessel's operator, assessed the ship's stability and began considering various options for refloating the vessel.

On 23.09.2021, the shipowner announced a General Average and proposed that a part of the cargo to be thrown into the sea. The proposal was rejected by the Director of the Black Sea Basin Directorate as posing a danger to the marine environment.

The shipowner was granted a deadline of 10:00 on 27.09.2021 to propose technically feasible options for transhipment of the cargo carried and to submit a plan for pumping out the residual fuel of the vessel in order to prevent pollution of the marine environment with petroleum products.

On 24.09.2021, officers of DG Border Police and Executive Agency "Maritime Administration" boarded the vessel for the first time (on the 4th day of the grounding). EAMA staff carried out an inspection of the vessel in order to check her general condition. The ballast and fuel tanks were sounded, the bridge and the engine room were inspected, and the condition of the cargo hold, the bilges and the cargo were also checked. There were no signs of overboard water entering the cargo hold. On the same day depths sounding of the area of stranding was carried out in order to provide the safe lane for approaching of a floating crane and subsequent towing of m/v "Vera Su".

In the days after the stranding of the vessel, the waves and the gradual increase in the amount of water entering the ballast tanks led to an increase in the pressure of the ship's hull on the rocks on the sea bottom, which eventually reflected in holes in the cargo space, leading to the penetration of water into the latter and the wetting the cargo.

All of the above leads to further distortions in the ship's hull and to damages, which were found during the inspection of the ship after its dry docking at the ship repair company Terem-KRZ Flotski Arsenal Varna AD.

In view of the expected deterioration of the weather in the period 27-29.09.2021, including an increase in the wind speed to 8-10 meters per second and the state of the sea to 4, an order of the Minister of Transport, Information Technology and Communications was issued on 26.09.2021, providing for: 1. Pumping out and depositing on the shore of the ship's residual fuel; 2. Transhipment of the cargo present on board the vessel and its unloading at the nearest port; 3. Refloating of m/v "Vera Su" and towing her to the nearest port.

On 27.09.2021, the Harbour master of Varna issued an order for the detention of the vessel. An operation was carried out to pump out the marine fuel, draining about 10 tons and leaving the rest in the ship's fuel tanks to ensure the proper functioning of its machines and mechanisms.

Fig. 12 — Moment of partial unloading

In the evening of the same day, an attempt was made to refloat the vessel by initial lightening by discharging part of the cargo with a floating crane and its subsequent loading on a barge. The partial unloading operation was discontinued due to a noticeable significant leakage of part of the cargo from the grab (Figure 12). The unloaded operation lasts 2 hours and a minimum quantity of cargo was unloaded.

After the minimum lighten the vessel, two powerful tugs were engaged in an attempt to refloat the vessel. The refloating attempt was planned with two tugs combined with the operation of the ship's main engine put at full astern. As a result of the exerted efforts, one towing line was broken and the refloating operation was terminated.

As hydrometeorological conditions deteriorated over the next few days, the vessel's sinking process accelerated.

On 28 September 21, an Order of the Minister of the Environment and Waters was issued, ordering the suspension of the transhipment activities of the cargo on board of m/v "Vera Su" until the provision and implementation of environmentally safe transhipment technology, which did not carry out spillage of the cargo and did not create a risk of seawater pollution.

On 02.10.2021, under the influence of the sea waves, the vessel changed her position, sinking deeper.

By order of the Prime Minister of the Republic of Bulgaria a special coordination group was established with the heads of the Minister of Environment and Waters and the Minister of Transport, Information Technology and Communications and members of the Deputy Minister of Defence, Deputy Minister of Foreign Affairs, Deputy Minister of Justice and Deputy Minister of Interior. The task of the coordination group was to organise, coordinate and monitor the activities of the competent authorities in relation to the situation of the m/v "Vera Su", as well as to collect and analyse all the information on its development.

The EAMA requested assistance from the European Maritime Safety Agency (EMSA) and received specialised inflating barges used to tranship part of the ship's cargo and transport it to shore.

On 02.10.2021, it was established that water entered into the cargo hold through ballast tank No.7. The Harbour master of Varna ordered constant pumping out of the invading water, which was carried out until the moment the crew abandoned the vessel.

On 04.10.2021, in view of the expected deterioration of the weather, a further reinforcement of the vessel with 3 anchors and 4 ropes was carried out.

On 06.10.2021, the master of the vessel announced her abandonment by the crew in view of the impending deterioration of the weather. The Harbor master of Varna ordered the master of the vessel to close all doors, cranes, valves, emergency exits, etc. and to stop the vessel's diesel generators. The crew was successfully evacuated ashore (Figure 13).

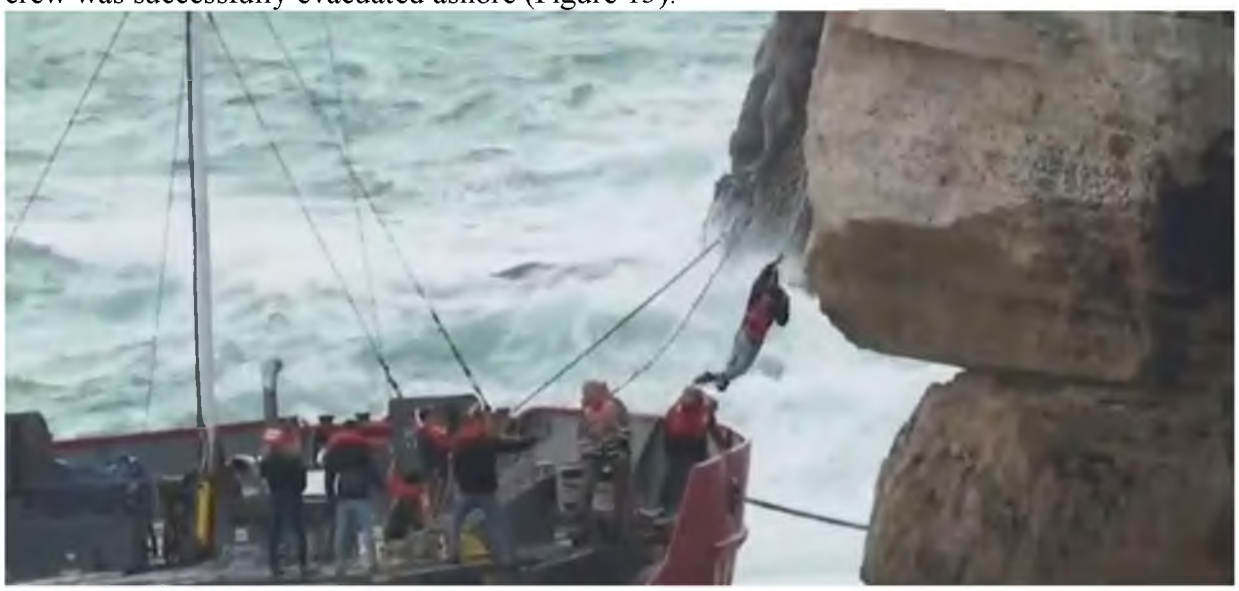


Fig. 13 - Crew evacuation on 06.10.2021

On 11 October 2021, a diving inspection was carried out, which found that the vessel's engine room had been flooded and that the vessel had "leaked" entirely at the bottom.

In the period 12.10-18.10.2021, an exchange of electronic correspondence between the shipowner and state authorities was held in order to clarify the status of the ship, the shipowner's intentions, an action plan on the refloating of the vessel, etc.

An Opinion of the Institute of Oceanology at the Bulgarian Academy of Sciences was prepared in a final version on 18.10.2021, which contained an assessment of the environmental risk of marine environmental pollution associated with the cargo of the stranded vessel "Vera Su" in the coastal waters between Kamen Bryag and the resort "Rusalka". The opinion was drafted at the request of the Black Sea Basin Directorate and was sent to it with a copy to the Ministry of Environment and Waters and the EAMA. The assessment concluded that nitrogenous fertilisers pollute water bodies and alter the ecological balance, and that all previously proposed variants of discharge/leakage of the cargo of m/v "Vera Su" will have a negative effect on organisms and populations, and therefore on the eco-system as a whole, the severity would depend on pollutant concentrations, individual sensitivity of each species and duration of effects. The most favourable option for the marine environment was the option where urea was safely transhipped and brought to shore for disposal. It was recommended to remove urea cargo from the vessel to land storage sites and avoid discharge/unloading in the marine environment.

Options for the release of the cargo in small quantities in the area of the casualty, leakage of cargo due to open hatch openings under the influence of the hydro-meteorological conditions in the Yailata Reserve area, as well as controlled discharges in the shelf and open sea waters have been declared inadmissible in the pelagic ecosystem, especially given the similar poor ecological status of the coastal, shelf and deep-sea assessment area near the accident area or within the range of its likely spread during controlled or uncontrolled discharges.

On 26.10.2021, after several days of successful operation to unload the vessel's cargo, "Vera Su" was refloated from the rocks and shallow waters and towed to the port of Varna.

On 29.10.2021, a letter was sent to the shipowner informing him that the ship is already in the port of Varna, Odessos KRZ and that he should inform the EAMA of its intentions to receive the property after payment of the costs incurred or to abandon the ship.

On 29.10.2021, a reply was received from the shipowner directing the Maritime Administration "Executive Agency" to direct contact with insurers.

On 04.11.2021, the ship was moved from Odessos KRZ to Terem-KRZ Flotski Arsenal Varna AD in order to carry out possible repair works and dry dock the vessel.

3.6. Consequences for the vessel

As a result of the grounding of the vessel and her prolonged stay in rocky area, in which the hull was subjected to the influence of the sea waves and weather conditions, a number of damages were obtained, which were found during the inspection at the Odessos KRZ in Terem-KRZ Flotski Arsenal Varna AD, as follows:

1. On the port side: significant bendings, dents and entanglements of different sizes from bow to stern, pressure tube and suction channel are deformed.
2. On the starboard side: the presence of numerous significant dents, especially in the cheek part bends and undercuts of different sizes from bow to stern, especially in the middle, crushed board stabiliser, severely deformed outlet of the cooling system of the bow truster and emergency diesel generator.
3. The engine room was fooded, with all the mechanisms and devices found out of order.
4. The steering gear room room was flooded, with all mechanisms and devices out of order;
5. The emergency diesel generator room and the emergency switchboard were found in flooded conditionte, with all mechanisms and devices out of work etc.

Fig. 14 Damages of the ship in the bow (port and starboard)

Fig. 15 Significant bends around the midship starboard side

3.7. Investigation of the accident

The investigation of the marine casualty began after receiving a report from VTS — Varna about the vessel's grounding. An investigation commission was set up, which included an external expert, in addition to permanent maritime investigators of the NAMRAIB. The investigators made several attempts to board the grounded vessel, with boats of DG Border police and Bulgarian Ports Infrastructure Company. The attempts were unsuccessful due to the sharp deterioration of the weather, the ship's instability and the danger of stranding the boats when approaching the area. Attempts to board the ship were stopped at the start of rescue operations. Interviews with crew members were conducted after their evacuation ashore. Inspection of the abandoned vessel, inspection of the ship's documentation and the reliability of the communication and navigation equipment were made after her mooring at the quay in Odessos — Varna. Further information was received from VTS Varna, EAMA, DG Border Police, Prosecutor's Office, eyewitnesses, etc.

3.8. Similar cases

Fig. 16 — Movement of m/f SLAVYANIN. The movement towards "Golden Sands" is visible.

At 22:00 on 28.10.2017, the ferry "Slavyanin", IMO 8300169, flag Zanzibar, departed the Caucasus, Russia bound for Varna. At abeam of Cape Kaliakra the vessel did not change her course for joining in the Traffic Separation Scheme, but continued at unchanged course and speed towards the coast. The VTS operator for 40 minutes attempted to communicate with the vessel on the VHF on channels 16, 14 and 11, but without result. The Border Police, the Navy, the MRCC, the Harbour master of Varna and the ship's agent were notified. Only about 2 nautical miles from the coast, the vessel changed her course and returned to the TSS.

A subsequent inspection by the port authorities found that the OOW had become ill and fainted on the navigation bridge while the duty AB was sent to carry out a ship's tour and to check the cargo shifting. The alarm of the BNWAS was switched off.

4. Analysis

4.1. Essential international regulatory requirements for carrying the navigation watch relevant to the accident event with m/v "Vera Su"

4.1.1. Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREG)

Rule 5 of the COLREG clearly states that every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision.

Practically after 03:25 on 20.09.2021, when the vessel's last position was plotted on the navigational chart or after the period 03:45-03:55, according to the statement of the second officer, as a result the latter's falling sleep, there was no proper look-out both auditory and visually, and no technical means are used, which was a gross violation of the above international regulatory requirement.

4.1.2. The nternational Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended (STCW Convention) and the Seafarers' Training, Certification and Watchkeeping (STCW) Code, as amended.

Part 4-1, para 16, Section A-VIII/2 of the STCW Code states that during the day the officer in charge of navigational watch may be the sole lookout on the bridge, but this is allowed only on condition that, in each case, the assessment of the situation, the sea condition, the visibility, the traffic density and the other requirements listed in the Regulation permit.

The above is clearly reflected in point 4.1.4.5 of Chapter 4 of the Safety Management System (SMS) established on the vessel.

According to the form SS-06-C-16(A) of the SMS, which was signed and stamped by the master, for the watch from 00:00 to 04:00, the second officer with a seaman as a lookout, and from 04:00 to 08:00 — the chief officer and an AB should be on watch on the bridge.

Practically at 00:00 on watch on the bridge was the second officer, without provided a lookout who was released by the master for deck work during the day. At 4:00 a.m. there was no handing over of the watch.

The lack of lookout on the bridge during the night was a gross violation of the above regulatory requirements and the rules established by the SMS and was one of the main contributing factors of the accident event (falling asleep of the OOW). Duplicating the watch with a lookout would contribute to the reaction of one of the two men on the bridge if the other fall asleep.

4.2. Bridge navigational watch alarm system (BNWAS)

The statutory requirement for the equipment of such vessels as m/v "Vera Su" is specified in Reg. 19 para. 2.2.3, Chapter V of the International Convention for the Safety of Life at Sea, 1974, as amended and supplemented (SOLAS'74). It is also clearly stated that during a sea passage, the system must be in operational mode (on status with alarm activated at a certain interval of time).

In the course of the investigation, it was established that from 09:28 UTC on 11.09.2021 to 10:30 UTC on 26.09.2021, the system was operational, but the alarm on the bridge of the vessel was switched off. This is confirmed both by automatic recordings from the system itself and by the crew's testimonies.

Chapter 4, item 1.8 of the SMS also clearly states that the system must be operational whenever the ship is underway, and it's switching on/off should be documented by means of a logbook entry. A record(s) in the logbook documenting such an event was not found, both when the ship leaves the loading port and at a later stage.

All this indicates that either the crew was not aware of the principles and modes of operation of the BNWAS on the bridge, or that the master's control of the other officers of the watch and the both OOW's control of the operational mode of the navigational eqipment on the bridge was lacking on board the vessel. The last two hypotheses are more credible, which was a gross violation of the requirements of Reg. 19, para 2.2.3, Chapter V of SOLAS'74 and Chapter VIII, Part 4-1, para 26 of the STCW Code and of the Company's SMS.

In the present case, this was another major contributing factor of the accident event. A clear audible signal from the BNWAS could awaken OOW within a few minutes after falling asleep or signal the master or the other navigational officer, with sufficient time and sea space to avoid grounding.

4.3. Provision with navigational charts, passage planning and route monitoring

The investigation showed that the ship was not provided with the full set of navigational charts needed to make the passage to the port of Varna. Some of the available charts were old editions. No corrections to the navigational charts and the pilot book (NR24, Admiralty Sailing Direction, Black Sea and Sea of Azov Pilot, edition 2019) were made with the latest Admiralty notice to mariners received on board.

The last Admiralty notice to mariners found on board was 38/2021. According to the passage plan, the navigational charts were corrected up to 30/2021 and the Paper charts maintenance record (NP133A) recorded that the last notifice to mariners was number 34/2021, received on 17 August 2021.

In the course of the investigation, it was established that the courses of the passage plan were drawn only on small-scale charts BAC 2232 and BAC 2230. On the large-scale charts, including navigating near the coast (BAC 2283) in the area of Kamen Bryag, where the ship was stranded, and Cape Kaliakra, as well as on the chart for the approach to Varna (BAC 2285), the courses were not drawn at all. This was a violation of Chapter V, Reg. 34 of SOLAS'74, and reference to IMO Resolution A.893 (21) of 25.11.1999, paragraph 1.3, paragraph 3.1 and paragraph 3.2.1.

The passage plan of m/v "Vera Su" from the port of departure to port of Varna was signed only by the second officer. There was no approval by the master of the vessel, the way points of the passage plan had nothing to do with drawings on the ship's navigational charts. A stapled piece of paper, entitled "Deviation of Passage Plan", was attached to the passage plan. This document was not clear who prepared it and whether it was approved by someone — there were no signatures and other accessories. A document under such title did not appear in the SMS of the vessel's operator company. It contained the exact coordinates of the way points on the navigation chart

During the watches from 08:00-12:00 and 20:00-24:00 on 19.09.2021, no position of the vessel was plotted on the navigational charts — gross violation of STCW, Chapter VIII, Part 4-1, para 25. The OOW on the bridge through these watches was the master of the vessel.

For the night of 19.09.2021 against 20.09.2021 no Master's night orders for the watchkeeping officers were made.

Fig. 17 — Part of the passage plan in the area of the stranding drawn by the second officer of a navigational chart.

All of the above gives grounds to take into account the gross violations and omissions of a number of key international instruments regulating the safe carrying of a navigational watch, as well as the organisation of the operation of the vessel for safety purposes in general.

It should be noted that on the day after the vessel's stand at the Odessos KRZ (26.10.2022), scheduled for 27.10.2022, communication and navigation equipment including VHF, GPS and echosounder disappeared from the vessel.

Since the ship did not had an ECDIS, it was normal that the way points was probably inserted into the GPS device. The memory of the VHF DSC device would have allowed investigators to take information about DSC calls from shore.

The echosounder of the vessel also had a memory. When navigating in a coastal area, the requirements insist this device to be switched on. Its alarm in the first place would signal OOW for the reduce of depths when approaching the shore, respectively wake him up, and second, he would gave information about exactly when the ship was aground.

4.4. Analysis of the human factor

4.4.1. Analysis of the actions of the second officer

Essentially every aspect of human performance can be degraded by sleep loss and sleepiness, including physical, psychomotor, and mental performance; mood can be affected, and attitudes toward risk-taking and safety can change. Alertness is the optimal activated state of the brain, which actively changes over time and has a cyclical character.

Alertness cycles closely follow the body temperature cycle with peak alertness occurring when the body temperature is the highest (near midday) and low alertness occurring when the body temperature is lowest (between 3:00 and 5:00 am).

Irregular work schedules typical of life on board ships have a negative impact on the biological clock and alertness in general. Long stays on board the ships lead to a "chronic" accumulation of fatigue.

The working capacity of a person, which is directly dependent on alertness, is disturbed in a state of fatigue. Scientific studies have shown that after 18 hours of wakefulness, there is a 30 % decline in performance, and after 48 hours — an average of 60 %.

The most extreme form of fatigue is falling asleep against the will of the individual. Such a condition is influenced by a variety of factors.

Falling asleep of the second officer occured precisely during the period of minimum alertness, combined with the lack of rest from the ship's departure from the loading port.

At the same time, the investigation found no violations in the documentary coverage of the actual hours of work/rest of the second officer. This gives grounds for a significant discrepancy between the actual work/rest ratio compared to the documented one, which in turn indicates a lack of control and ineffective organisation on the part of the master of the vessel.

4.4.2. Analysis of the actions of the master of the vessel

At the management level the controlling operation of the vessel by the master were violated. A number of international regulations were violated, including the SMS regarding:

— the organisation of the navigational watch;

— fatigue management and application of crew rest rates;

— violation of navigation watch regulations, including the absence of a lookout on the bridge during the night in support of the OOW at the expense of providing maintenance of the deck during the day;

— the lack of control of watchkeeping officers and equipment on the bridge warrants an admission to neglect of basic obligations with regard to the safe operation and management of the vessel.

For nearly an hour since the ship was stranded, there was no response to repeated VHF calls made by the operator VTS - Varna and the DG Border Police, which was probably made intentionally in order not to inform the coastal authorities about the actual situation of the vessel in an attempt to refloat of its own motion. In essence, this constitutes a flagrant breach of the provision of Article 29(1) of the Ordinance on systems for traffic, reporting and traffic management and information services for navigation in the maritime areas of the Republic of Bulgaria, according to which the master of a ship,

regardless of its tonnage, sailing in the maritime areas of the Republic of Bulgaria, is obliged to report immediately to the EAMA – Varna directorate, acting as a maritime rescue coordination centre of the Republic of Bulgaria, located in Varna about any accident affecting the safety of the ship, navigation or any situation posing a risk of pollution in the maritime areas of the country.

Apparently, practices of professional experience were used on board the ship, which were contrary to the current rules of carrying the navigational watch and the organisation of the operation and management of the vessel.

The Investigation Commission considers that this was not an isolated case valid for the vessels's passage from Yuzhniy to Varna, but an established practice on board. Subject to effective control by the shipowner or the operator company, such practices would not be tolerated and allowed.

At the same time, it should be noted that the policies of a large number of flag administrations with regard to minimising the number of crew members on small gross tonnage ships (as a rule below 3000 GT) engaged in short passages between cargo ports, creates conditions for masters to attempt to "circumvent" established international and national regulations on navigation watchkeeping, rules on working hours and rest periods for crew members, especially watchkeeping, in order to ensure effective maintenance of deck and ship equipment (deck, mechanisms, etc.), which is somewhat common practice in modern shipping.

4.5. Analysis of the actions of the coastal authorities

The review of the activities of the coastal institutions shows the commitment of various state bodies, each participating within their competence in the operation to refloat the vessel from stranding.

After the ship's stranding, in the first days a number of activities were carried out to inspect the vessel and the sea around it — diving inspections, measuring and other rescue coordination activities.

In view of the fact that, as a result of the grounding of the vessel, there was no imminent danger to the environment, the obligation to refloat the vessel rested with the shipowner and, at this stage, the intervention of the authorities of the Republic of Bulgaria was not necessary. Such intervention becomes necessary once the shipowner does not provide an adequate green plan for the refloating of the vessel within the prescribed time limits and the fact that if the scales are left to the vessel it may lead to its destruction and environmental disaster, especially after deterioration of the hull. The plans submitted by the shipowner were not approved due to the huge environmental risk.

Analysing the content of the Law on Maritime Spaces, Inland Waterways and Ports of the Republic of Bulgaria, the Merchant Shipping Code, the Disaster Protection Act, the National Disaster Protection Plan and the National Plan for Combating Oil Spills in the Black Sea, established that the departments and organisations concerned, which together with the Ministry of Transport and Communications (Res. The EAMA) must take action after a vessel is stranded on the Bulgarian coast are:

1. DG Border Police — Ministry of Interior;
2. DG Fire Safety and Protection of the Population — Ministry of Interior;
3. Ministry of Environment and WaterS;
4. Ministry of Defence;
5. Ministry of Education;
6. The regional governors of Varna, Burgas and Dobrich;
7. The mayors of the coastal municipalities.

The duties of the various departments and organisations are set out in the National Plan for Combating Oil Spills in the Black Sea, which focuses on incidents and accidents related primarily to environmental pollution, but not those of such a nature as in the case of a serious accident.

After a careful examination of the relevant national legislation and guidance documents, the Investigating commission considers that there is no guidance document regulating the sequence of action of the various institutions and thus their hierarchical subordination during the different phases of incidents (casualties). In this respect, the National Emergency Plan for Combating Oil Spills in the Black Sea is the closest. It should be stressed that casualties involving the stranding of vessels (which

do not have an oil spill) differ radically from oil spill incidents and accidents, both in terms of materials, means and resources that need to be invested to address the problems that have arisen and to remedy the consequences. The existing National Emergency Plan to combat oil spills does not cover similar accidents involving bulk cargo which in large quantities would be hazardous to the marine environment, i.e. there is no obligation to activate it under such conditions.

In the absence of a legal basis and plans, there is no way to identify the resources available in advance in different scenarios — collision, grounding, fire, spill, etc., and in principle the marine casualty can develop as a combination (e.g. collision leading to fire, etc.). Emergency medical care centres do not operate in maritime spaces, and DG Fire Safety and Population Protection, with a specific text in the Ministry of Interior Act, is exempt from action in the maritime spaces and the Danube.

Within the meaning of the foregoing, in the case of the legislation thus in force at the time of the accident with m/v "Vera Su", the sequence of the actions of the departments and organisations concerned, respectively their hierarchical subordination during the various phases of the accident, are governed by the legislation of the Republic of Bulgaria, the National Emergency Plan for combating oil spills in the Black Sea, and by the establishment of an ad-hoc coordination group by order of the Prime Minister of the Republic of Bulgaria, for the organisation, coordination and control of the activities carried out by the competent state authorities. Such a coordination working group was established on 02.10.2021 to coordinate the competent public authorities in connection with the accident.

Detailed analysis is needed for preliminary planning of forces and means of rapid response and a detailed National Emergency Plan for various types of marine casualties associated with a significant risk of loss of life and/or environmental pollution that does not only include oil spills.

The Investigating commission considers it is necessary to carry out a specialised and accurate analysis by experts in the relevant fields with legal participation by an appointed inter-ministerial committee to examine and analyse the actions of any institution that would be involved in such a situation, including coordination between them in order to avoid unnecessary delays and a more operational and adequate response to such accidents and incidents.

4.6. Analysis of the actions of the duty operator of the VTS-Varna

The Traffic Management and Information Services System, Varna Coast Center, includes the following regions:

a) a routine report area covering an aquatic area locked between the meridian 028° 27,9′ E (Cape Kaliakra), the parallel 43° 00,0′ N and the coastline, including water basins, quays and ports to the port of Varna-West, and

b) the responsible area for the monitoring and management of ship traffic, which covers a sea area locked west of a line connecting the Kavarna lighthouse (43° 24,6′ N; 028° 21,4′ E) and Kamchia light (43° 01,6′ N; 027° 53,5′ E).

It should be noted that the areas served by the VTS - Varna do not fully cover the Traffic Separation Scheme, i.e. the duty operator has no obligation to interfere with the movement of vessels outside the area (Figure 18).

The location of the casualty of m/v"Vera Su" is outside the responsible area of the VTS - Varna, but within the scope (immediate proximity) of the Traffic Separation Scheme (Northern part), which raises reasonable doubts about a failure in the design of the boundaries of the scope of the responsible area.

The operator of the VTS - Varna took action (carrying out a VHF call) after it became clear that the ship passed the central part of the western lane of the TSS, which is intended for north-south traffic, and its course was directed towards the coast.

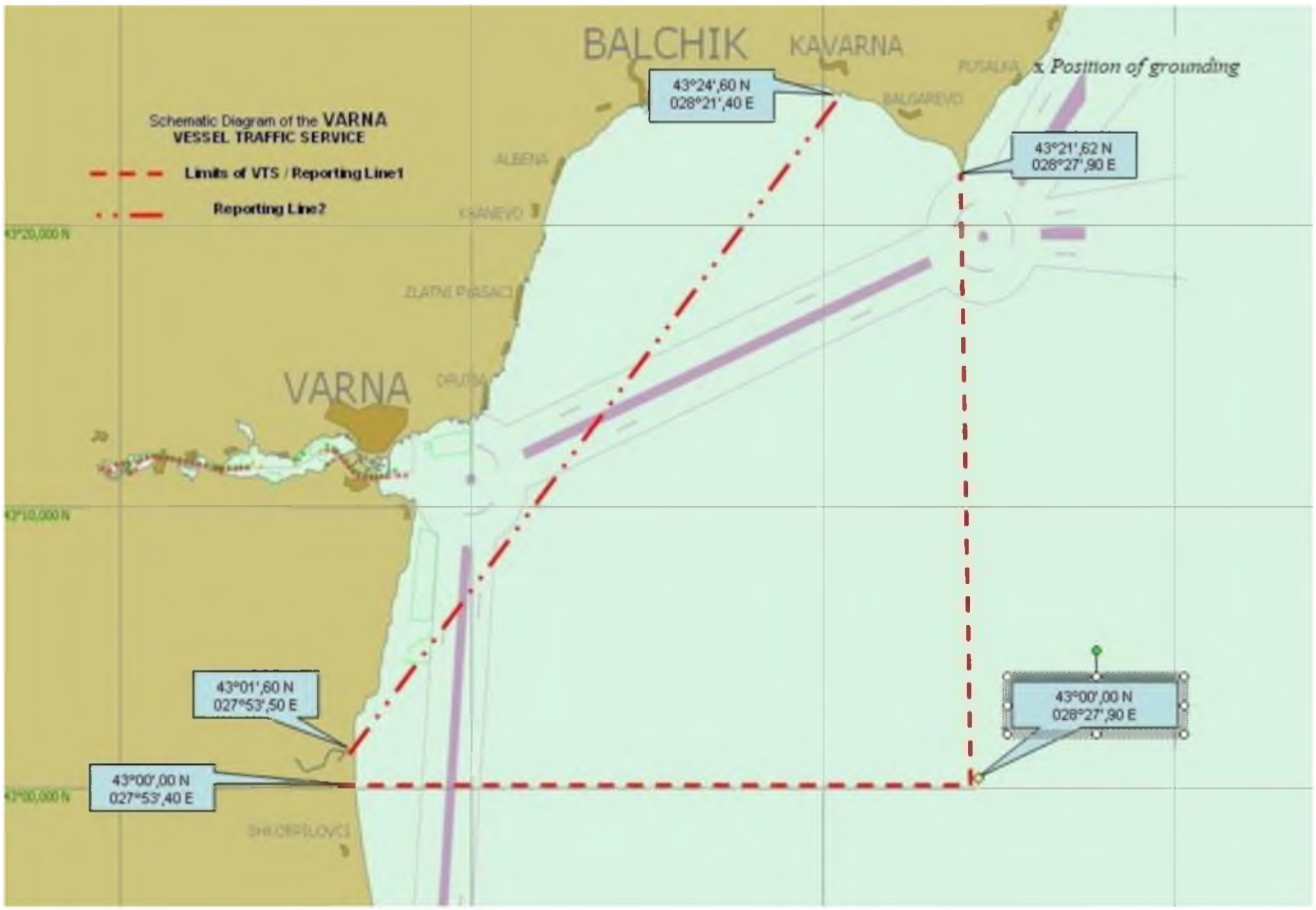


Fig. 18 — Areas served by the VTS - Varna. The part of the TSS which is not covered by the area is visible.

Practically, the calls did not gave a result, on the one hand, due to the lack of awake OOW of the bridge. On the other hand, the proximity of the western boundary of the lane to the shore did not allow intervention by DG Border Police's duty ships or even other vessels in close proximity.

4.6.1. Ability to use the digital selective calling

The Digital Selective Calling (DSC) system is a digital distress alerting, and urgency, safety and routine traffic calling system, utilising the HF, MF and VHF bands, and radio telex type sign.

Receiving a distress, urgency or safety signal on board a ship leads to the visualisation of a text message on the screen of the relevant apparatus on the bridge of the ship together with activation of an audible alarm which has to be confirmed by the ship operator.

The duty operator of the VTS - Varna, could initiate the broadcasting of a DSC shore to ship message to "Vera Su" with high priority, which would trigger an audible alarm on the bridge and possibly woke up the OOW.

This option was not used, in combination with the ship's voice calls by the VTS duty operator, due to the short response time (the ship's immediate proximity to the shore) and the operational instruction of the duty operator did not specifically mention such a possibility.

The broadcasting at 04:33 of DSC VHF ch70 with the message type "URGENCY" from the coast station "Varna Radio" did not essentially changed the factual situation. The transmission of such a message before the grounding would have a possible positive effect with the result of waking up the OOW by activating an alarm on the bridge, but this option was omitted from the shore.

5. Conclusions

1. The Investigating commission found that the second officer, who was the only watchkeeper on the bridge, without a lookout at night, fell asleep, posibly fatiqued, as a result of which a m/v "Vera Su" stranded after a missed turning way point for joining in the Traffic Separation Scheme.

2. The BNWAS, which could wake him up or alarm the crew respectively, was set with the alarm off.

3. The missing lookout on the bridge during the night to assist the OOW has been established practice on board of the vessel.

4. Other contributing factors to the accident event are:

- Lack of master's control, non-compliance/non-application of the requirements of the International Conventions STCW and SOLAS'74;
- Failure to comply with the safety procedures of the SMS of the ship operator company;
- Lack of good practices in managing ship operation and lack of good practices of control by the operator company in terms of overall safety management;
- The proximity of the Traffic Separation Scheme to the shore in the area of grounding;
- Non-use of all technical means for attracting the attention of the OOW, which could have been achieved by broadcasting VHF DSC message shore — ship by the VTS - Varna.

5. On the one hand, the SMS of the operator company gives clear rules that are in line with international legal instruments, but at the same time the omissions, neglect of basic obligations and subsequent events give reason to assume that "other" rules have been established on board the ship, a "parallel" regime of organisation on board, which, instead of more efficient implementation of the objectives set, led only to catastrophic results.

6. The shipowner did not submit an adequate and environmentally sound plan for the refloating the vessel within the prescribed time limits, thereby further delayed the vessel's lightening operation.

7. The main damage to the ship's hull and cargo arised not so much by the accident itself, but by her prolonged stay in the area where she was stranded and exposed to the sea waves. Despite all the efforts made by the coastal authorities to refloat the m/v "Vera Su", the lack of specific actions, responsibilities of the relevant institutions, resources, forces and means led precisely to the long timing of the operation to refloat the vessel.

6. Safety recommendations:

I. KAMER MARINE DENIZCILIK IC is recommended to:

At the time of preparation of the final report of the safety investigation of the serious maritime accident, the Inquiry Committee did not receive any information on actions taken by the ship's operator, regardless of the inquiries made after sending the draft report within the one-month period, and therefore the following reccomendations are addressed to it:

BG/2022_R1 Send a circular letter to all the company's vessels with a description of the casualty and the causes that led to it.

BG/2022_R2 Improve the Safety Management System by:

- Express emphasis on the need for a physical presence of a lookout on the bridge during the night, together with a OOW, and under no circumstances to derogate from this rule;
- Developing guidance on fatigue management and effective use of crew for watchkeeping and general maintenance activities;
- Developing detailed instructions on when and how the BNWAS should be used while the ship is at sea.

BG/2022_R3 To exercise effective control over masters by:

- Instructing Masters to detail their specific requirements regarding passage planning and route monitoring;

- Instructing masters and exercising control to prevent substandard wearing of watches and effective use of all navigational aids on the bridge;

BG/2022_R4 Coordinate an internal audit within the fleet in order to verify that voyage planning is being properly implemented according SMS;

BG/2022_R5 Coordinate an internal audit in order to verify that a proper familiarization with the bridge navigational & communication equipment is being properly implemented between the watchkeeping officers according SMS;

BG/2022_R6 Monitor the implementation and effectiveness of its safety management system policy through an enhanced audit and inspection program.

II. The Executive Agency "Maritime Administration" is recommended to:

At the time of preparation of the final report of the safety investigation of the serious maritime accident, the Inquiry Committee did not receive any information on actions taken by the Executive Agency "Maritime Administration", despite the enquiries made and the inspections carried out, and therefore the following reccomendations are addressed to it:

BG/2022_R7 Consider the possibility of undertaking actions for optimisation of the Traffic Separation Scheme in the maritime areas of the Republic of Bulgaria by deploying it (compared to its current location) in the east direction. This will lead to an optimal increase in the distance between the western boundaries of the extreme lanes and the coast;

BG/2022_R8 To initiate, through the Commission for Safety of Shipping, the appointment of interdepartmental commission/expert board to examine and analyse the actions of each institution that would be involved in such cases, including coordination between them in order to avoid unnecessary delays and a more operational and adequate response to such accidents and incidents, as well as the necessary forces and means. The interdepartmental commission/expert board should also include external experts from the maritime community, including representatives of non-governmental organisations. In this regard, to consider establishing a National Emergency Plan for similar marine casualties (or correcting the existing National Emergency Plan to combat oil spills in the Black Sea) associated with a significant risk of loss of life and/or environmental pollution that does not only include oil spills, but covers all types of dangerous goods carried by sea and presenting a danger to the environment and life.

III. The Bulgarian Ports Infrastructure Company is recommended to:

BG/2022_R9 Technically implement the possibility of direct transmission of VHF DSC message shore to ship without delay by the VTS duty operators in Varna/Burgas in case it is impossible to communicate with a ship whose actions pose a risk of casualty/incident. The sequence of actions shall be clearly stated in the instructions of the duty operator.