Marine Safety Investigation Unit

Transport Malta

MARINE SAFETY INVESTIGATION REPORT

Safety investigation into the grounding of the
Maltese registered bulk carrier

FLASH

on the Galitons de l'est
Ile de la Galite, Tunisia
on 25 June 2012

201206/014

MARINE SAFETY INVESTIGATION REPORT NO. 09/2013

FINAL

Investigations into marine casualties are conducted under the provisions of the Merchant Shipping (Accident and Incident Safety Investigation) Regulations, 2011 and therefore in accordance with Regulation XI-I/6 of the International Convention for the Safety of Life at Sea (SOLAS), and Directive 2009/18/EC of the European Parliament and of the Council of 23 April 2009, establishing the fundamental principles governing the investigation of accidents in the maritime transport sector and amending Council Directive 1999/35/EC and Directive 2002/59/EC of the European Parliament and of the Council.

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

The objective of this safety investigation report is precautionary and seeks to avoid a repeat occurrence through an understanding of the events of 25 June 2012. Its sole purpose is confined to the promulgation of safety lessons and therefore may be misleading if used for other purposes.

The findings of the safety investigation are not binding on any party and the conclusions reached and recommendations made shall in no case create a presumption of liability (criminal and/or civil) or blame. It should be therefore noted that the content of this safety investigation report does not constitute legal advice in any way and should not be construed as such.

MARINE SAFETY INVESTIGATION UNIT
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LIST OF REFERENCES AND SOURCES OF INFORMATION

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GLOSSARY OF TERMS AND ABBREVIATIONS

°C	Degrees Celsius
AIS	Automatic Identification System
ARPA	Automatic Radar Plotting Aid
BNWAS	Bridge Navigational Watch Alarm System
COLREG	Convention on the International Regulations for Preventing Collisions at Sea, 1972, as amended
E	East
ENE	East North-East
ECDIS	Electronic Chart Display and Information System
GPS	Global Positioning System
IFO	Intermediate Fuel Oil
ILO	International Labour Organization
IMO	International Maritime Organization
kW	Kilowatts
LT	Local Time
m	metres
MAIB	Marine Accident Investigation Branch
MSC	Maritime Safety Committee
Mt	Metric Tonnes
MGO	Marine Gas Oil
MSIU	Marine Safety Investigation Unit
MT	Metric Tonnes
N	North
NW	North-West
OOW	Officer of the Watch
SMS	Safety Management System
SOLAS	The International Convention for the Safety of Life at Sea, 1974, as amended
STCW	The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended

RADAR	Radio Detection and Ranging
RPM	Revolutions per Minute
SW	South-West
T	True
UK	United Kingdom
USA	United States of America
UTC	Universal Coordinated Time
VDR	Voyage Data Recorder
WNW	West North-West

SUMMARY

Motor vessel *Flash*, a Maltese registered bulk-carrier, ran aground off Ile de la Galite, Tunisia on 25 June 2012. At midnight, the second mate relieved the third mate from the navigational watch. The vessel was on autopilot steering 083°. At 0020, the second mate noticed that the vessel was deviating from the planned course and set the autopilot on a new heading of 086°. Subsequently, he sat down on the bridge chair and shortly afterwards he fell asleep. The navigational officer was alone on the bridge and no look-out was posted.

As *Flash* approached the next way point, North of Ile de la Galite, the current started to set her south in the direction of Galitons de l'est. Just before 0100, the Electronic Chart Display and Information System's alarm sounded. The officer of the watch, however, remained asleep. When he woke up a few minutes before grounding, it was already too late to reduce speed or change course. At 0353, *Flash* ran aground and remained stranded on the rocky shoals of Galitons de l'est in position 37° 33.69'N 008° 57.17'E.

The vessel sustained extensive damage in the fore and bottom part of the hull but there were no resulting injuries and pollution.

The MSIU safety investigation highlighted several safety issues, which contributed to the grounding including:

- The officer of the watch had become increasingly fatigued. He had been working for over eight months without a break and had adopted a sleep pattern where he would normally not sleep before the midnight watch;
- No dedicated look-out was posted. The officer of the watch was alone on the bridge when he fell asleep;
- The master's instructions to post a look-out only when deemed necessary, without regard to the Company's safety management system and relevant international requirements, caused ambiguity and confusion to the officer of the watch.

Taking into consideration the safety actions already taken by the Company, one recommendation has been made with the scope of ensuring that OOWs make best use of the hours of rest in order to ensure that they are fit to take over the watch.

1 FACTUAL INFORMATION

1.1 Vessel, Voyage and Marine Casualty Particulars

Name	*Flash*
Flag	Malta
Classification Society	American Bureau of Shipping
IMO Number	9522879
Type	Bulk Carrier
Registered Owner	Baby Shipping Ltd.
Managers	Genel Denizcilik Nakliyati A.S.
Construction	Steel
Length overall	292 m
Registered Length	283.04 m
Gross Tonnage	91373
Minimum Safe Manning	17
Authorised Cargo	Solid in bulk
Port of Departure	Gibraltar
Port of Arrival	Taranto, Italy
Type of Voyage	International
Cargo Information	126,738.03 mt of coal
Manning	24
Date and Time	25 June 2012 at 0353 (LT)
Type of Marine Casualty or Incident	Serious Marine Casualty
Location of Occurrence	37° 33.69'N 008° 57.17'E
Place on Board	Ship: Ballast tank, Forepeak tank, Engine-room
Injuries/Fatalities	None
Damage/Environmental Impact	Bottom damage in way of forepeak and double bottom tanks. Progressive flooding of engine-room through open duct keel. No pollution was reported.
Ship Operation	In passage
Voyage Segment	Transit
External & Internal Environment	Clear weather, visibility of 10 nautical miles and a West North-Westerly moderate breeze. Swell was from the North-West with a height of 0.5 m. Air temperature was 24°C.
Persons on Board	24

1.2 Description of Vessel

Flash (Figure 1) was a cape size bulk carrier built in 2009 by Waigaogia Shipyard, Shanghai, China. She measured 292 m length over all with a deadweight carrying capacity of 177,996 metric tonnes. The vessel had nine cargo holds and nineteen ballast tanks, fitted in the conventional double bottom, topside, hopper tanks and a duct keel (Figure 2). *Flash* had a bunker capacity of 4,700 metric tonnes, and was managed by Genel Denizcilik Nakliyati A.S. of Turkey.

Figure 1: MV *Flash*

The vessel's general arrangement plan is reproduced as Figure 3. Propulsive power was provided by a 6-cylinder, 6S70MC (Mark VI), slow speed direct drive diesel engine, providing 16,860 kW at 91 rpm. This drove a single fixed pitch propeller, giving a speed of 14 knots.

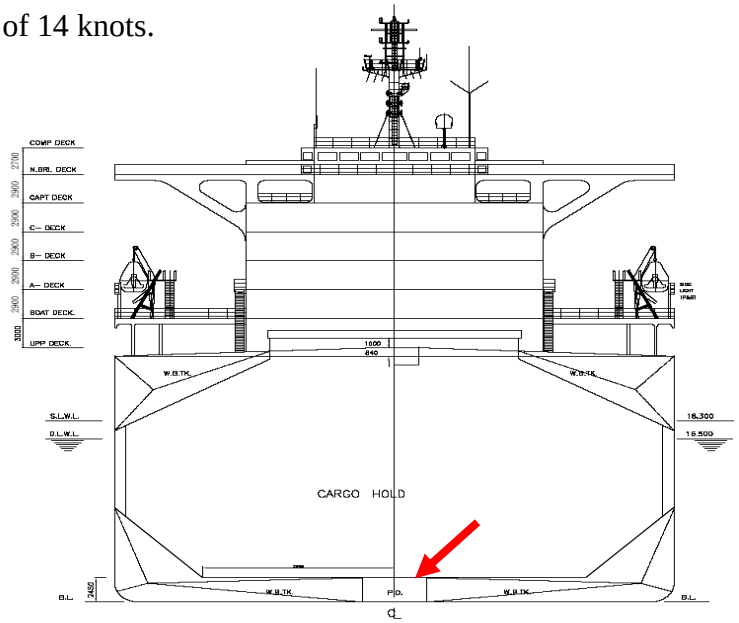

Figure 2: Duct keel running almost the entire length of the vessel, to the engine-room's forward bulkhead

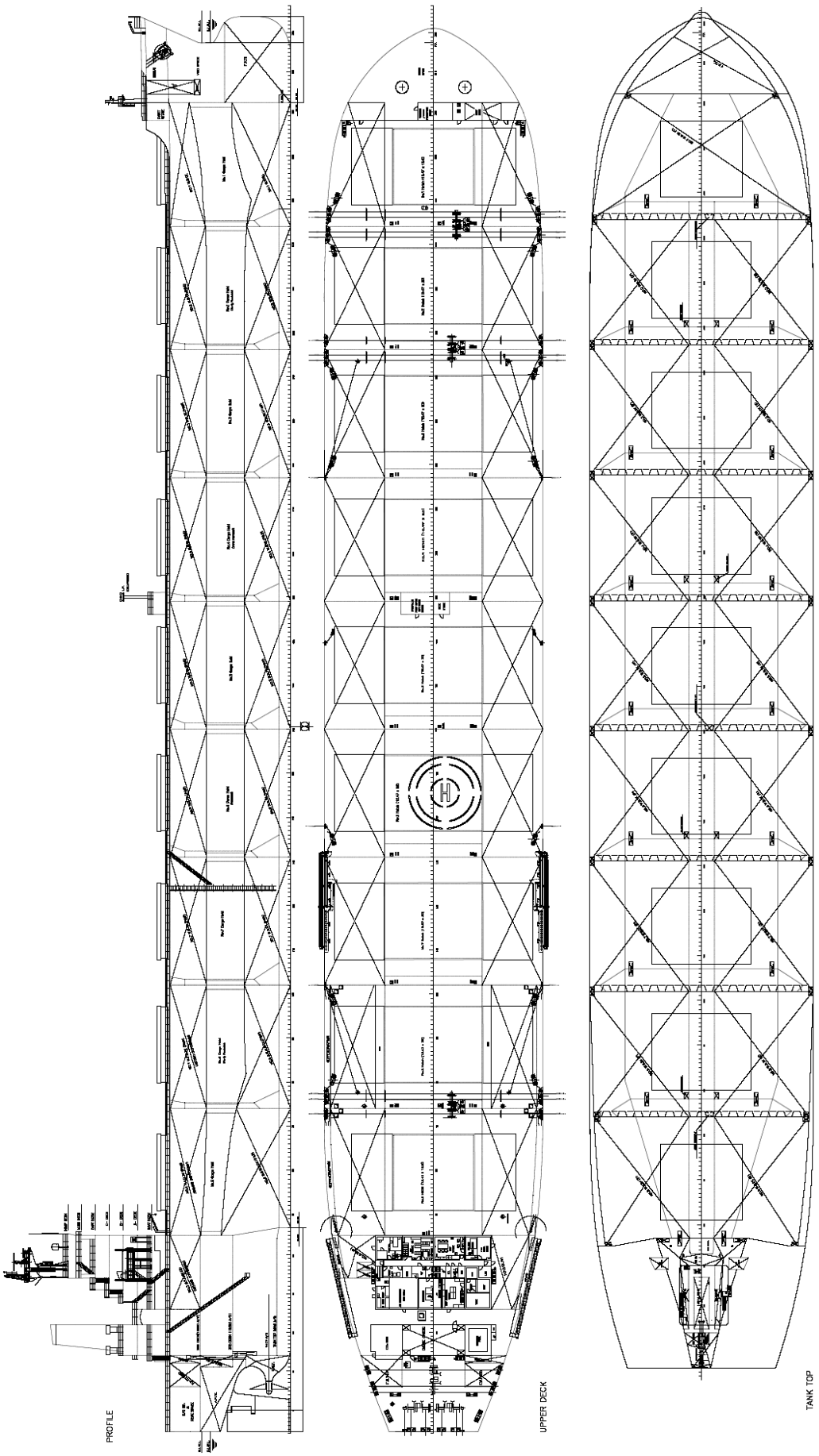

Figure 3: *Flash* General Arrangement Plan

1.3 Navigation Bridge Layout

Flash was fitted with standard navigational equipment (Figure 4) in compliance with the statutory requirements of her Safety Equipment Certificate.

The navigational equipment included X-Band and S-Band radars, an ARPA, one AIS, magnetic and gyro compasses, an echo sounder and a GPS. Although the ECDIS was fitted, it was not considered to be the primary means of navigation. Instead, the bridge team relied on British Admiralty paper charts for navigation and plotting of positions.

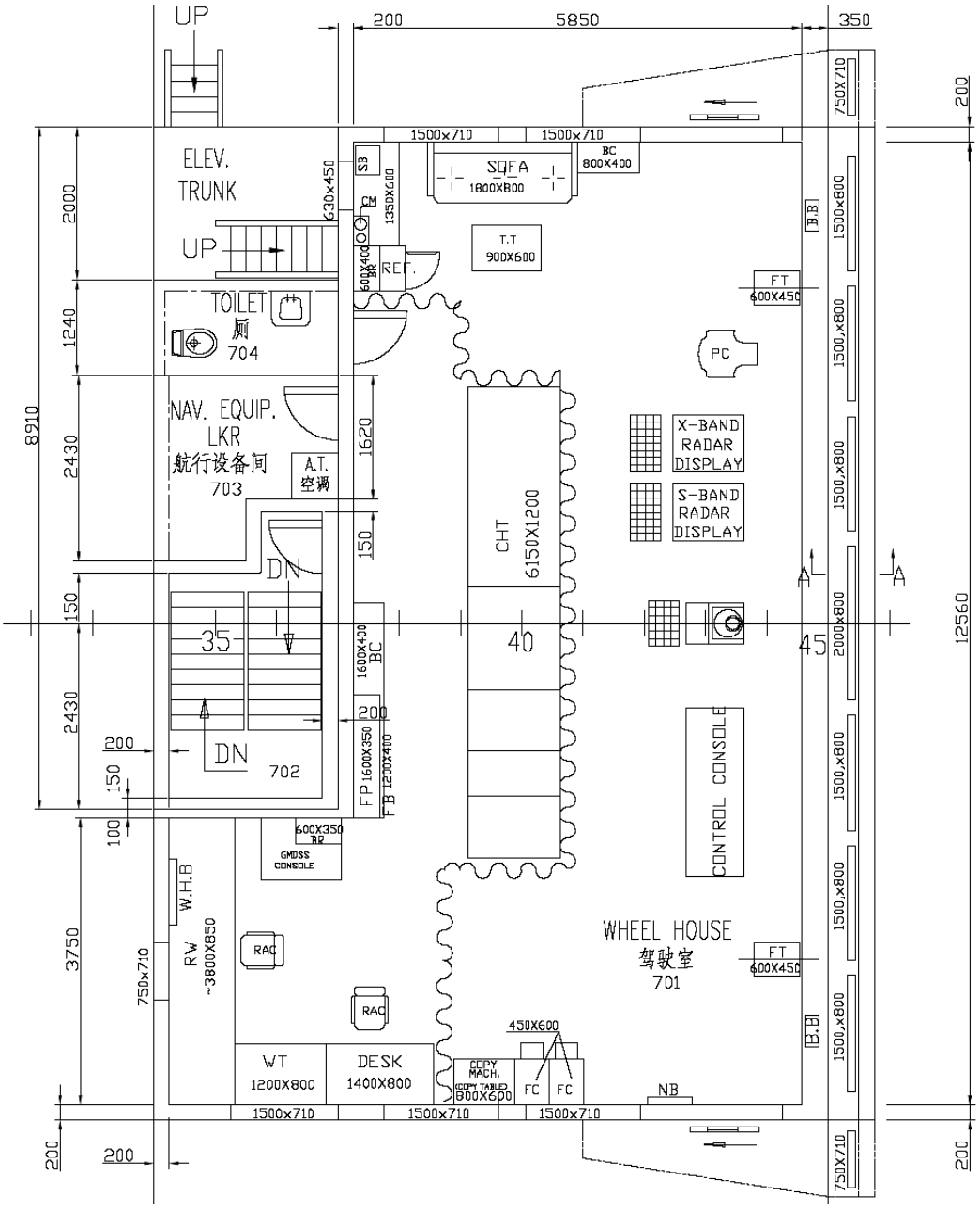

Figure 4: Navigation bridge plan

The bridge was also equipped with a fully functional GMDSS radio station required for a vessel trading world-wide. The chair on the bridge was placed to the port side of the X-Band radar display (Figure 5).

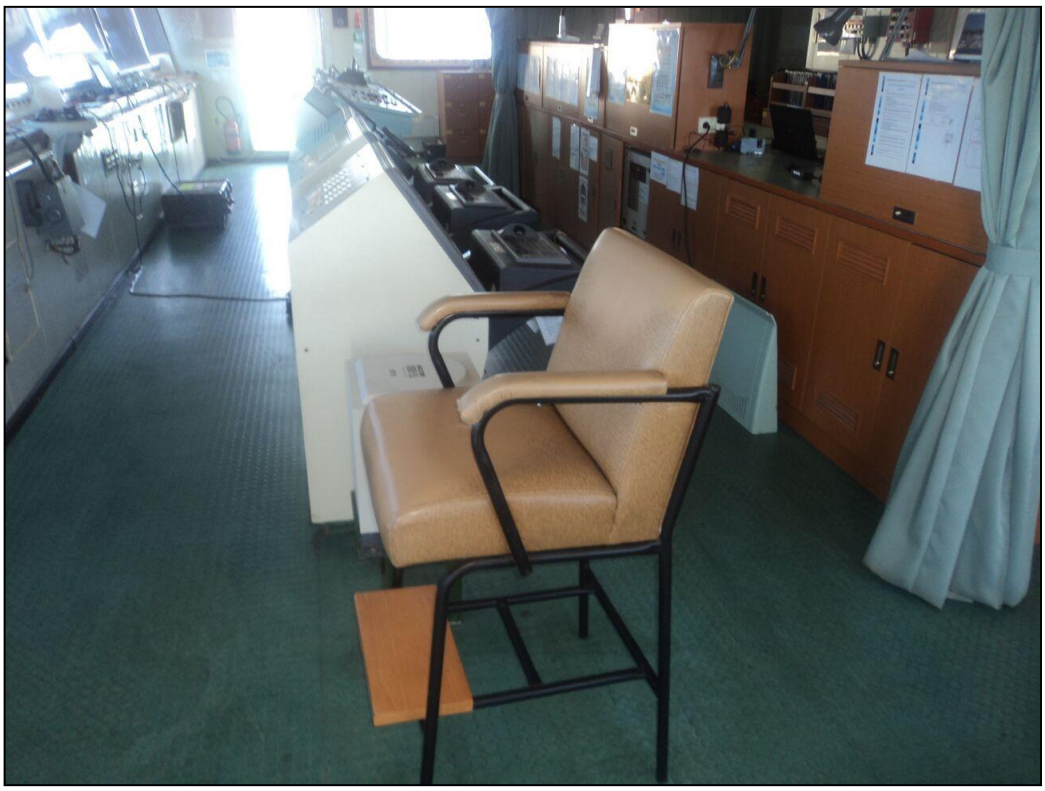

Figure 5: Navigation bridge layout and chair

1.4 Key Crew Members

1.4.1 Master

The master, aged 31, was a Turkish national who had first joined Genel Denizcilik Nakliyati A.S. in 2009 as chief mate, serving on *Flash*. In January 2012, he obtained his unlimited master's Certificate of Competency and in February of the same year, he joined *Flash* as master.

1.4.2 Second mate

The second mate, a 26 years old Turkish national, started his sea carrier in 2005 as a cadet with Genel Denizcilik Nakliyati A.S.. After obtaining his Officer of the Watch (OOW) certificate in October 2010, he served as a third mate for five months on *Amazing*, which is owned and managed by the same Company. He was then promoted to second mate when he joined *Flash* on 02 October 2011. As second mate, he kept the 0000-0400 and the 1200-1600 navigation watches. In addition to his

watch keeping duties, he was also responsible for preparing voyage plans, correcting charts, and plotting courses. He was on *Flash* for well over eight months and due to be relieved in Taranto, Italy.

1.4.3 Third mate

The third mate was 24 years old and also a Turkish national. He commenced his training as a cadet in 2006 on merchant ships. After graduating as a deck officer, he briefly served as a third mate and second mate in 2011. He joined Genel Denizcilik Nakliyati A.S. and signed on *Flash* on 11 May 2012. Prior to joining *Flash*, he was given training on safe work practices and familiarised with his duties and responsibilities as a third mate.

1.5 Look-out Requirements

1.5.1 Company requirements

The requirement to have a look-out posted, in addition, to the OOW, was included as an owner's instruction to the master in the vessel's Safety Management System (SMS).

The importance for an efficient look-out was explained in section 3.3.7 of the SMS:

> The OOW's situation awareness will be improved by both the structured management of the team and his own self discipline ensuring that he keeps a good professional watch. This will include his confirming that a good lookout is kept. A good look out does not mean that he personally keeps a good lookout of the ship's surroundings...

The requirement for a look-out during the hours of darkness was outlined in section 3.3.8 of the SMS:

> The duties of the look-out and helmsperson are separate and the helmsperson shall not be considered to be the look-out while steering, except in small ships where an unobstructed all-round view is provided at the steering position and there is no impairment of night vision or other impediment to the keeping of a proper look-out. The officer in charge of the navigational watch may be the sole look-out in daylight provided that on each occasion:
>
> 1. The situation has been carefully assessed and it has been established without doubt that it is safe to do so.

2. Full account has been taken of all relevant factors including but not limited to:
    - State of weather;
    - Visibility;
    - Traffic density;
    - Proximity of dangers to navigation and the attention necessary when navigating in or near separation schemes.

1.5.2 COLREG requirements

Rule 5 of the COLREG is also very specific on the importance of a navigational look-out:

> Every vessel shall at all times maintain a proper lookout by sight and hearing as well as by 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.

1.5.3 STCW requirements

The STCW also addresses watchkeeping duties, including the keeping of an efficient look-out at sea. The relevant provisions of the STCW were incorporated in the Company's SMS.

1.6 Illes de la Galite

Iles de la Galite consists of a small group of islands, islet and rocks off the coast of Tunisia (22 nautical miles NW of Cap Serrat). It includes Galitons de l'ouest , which is 1.5 nautical miles to the SW, and three rocks of Galitons de l'est off the North end of Ile de la Galite (Figure 6). The islands are surrounded by rocky shoals. The predominant currents in this area are East setting, with an average rate of around 0.25 knots. Both rate and direction are affected by wind.

The waypoint of *Flash* lied just four nautical miles NW of Galitons de l'est and two nautical miles South of Banc des Mazzarilles.

Figure 6 - Ile de la Galite with Galitons de l'est in the background

1.7 Narrative[1]

Flash departed Gibraltar on 22 June 2012 after a brief stop-over for bunkers. Her sailing draft was 14.16 m forward and 15.14 m aft. She was carrying coal in bulk loaded in the ports of Baltimore and Newport News, USA. She was bound for Taranto, Italy and her estimated arrival date was 27 June 2012.

1.7.1 The navigational watch

On 24 June 2012, at 2355, the second mate arrived on the bridge to take over the navigational watch duties from the third mate. At midnight, the third mate plotted a GPS position on the chart. During his 20-24 watch, he had estimated the current's set and drift variable. He informed the second mate that he had found the vessel drifting to starboard and had allowed 2° to port on the gyro heading. The third mate handed over the vessel on autopilot, steering 081°. The charted course was 083°(T). At the time, the vessel was making 12.1 knots. At 0005, the second mate affixed a GPS position on the chart. The position was exactly on the 083°(T) course drawn on the chart.

[1] Unless otherwise stated, all times are ship's time (UTC + 2 hrs).

The GPS, ECDIS, AIS, course recorder and radar were reported to be in good working order. At 0007, the second mate switched off the X-band radar, whilst the echo sounder to measure the depth of water remained switched off. At 0020, he noticed that the vessel was drifting to port and adjusted her heading a few degrees to starboard. By 0030, the vessel settled on a gyro heading of 086°. Shortly afterwards the second mate sat down on the bridge chair and eventually fell asleep.

There was no look-out and therefore he was the sole bridge watchkeeper.

At 0330, *Flash* crossed the 100 m contour line and entered the shallow waters of Iles de la Galite (Figure 7). When the OOW woke up, the time was 0350. He claimed to have heard both the GPS and ECDIS alarms and saw an island ahead, at a distance of less than the ship's length[2]. Using autopilot, he immediately put the helm 15° to port and set about checking the ship's position. The vessel was making good a speed of 12.5 knots but the action taken by the OOW was too late to clear the rocky shoals, which lay dead ahead (Figure 8).

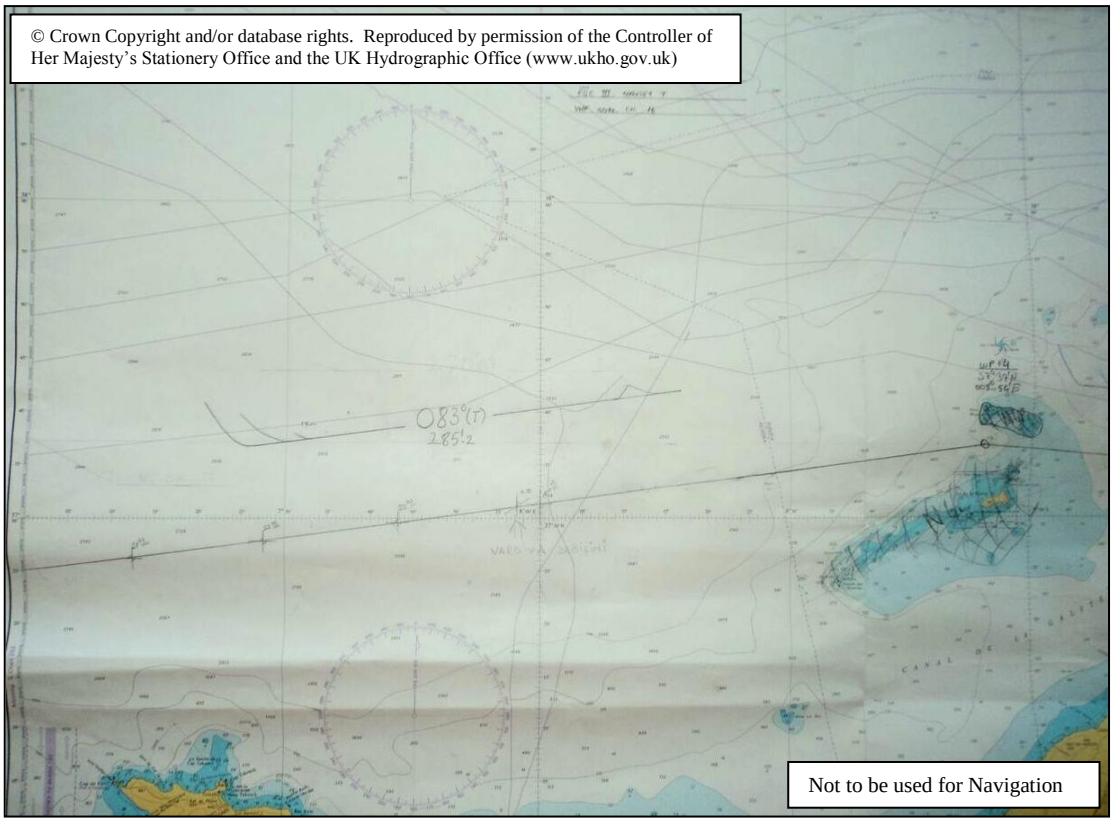

Figure 7: BA Chart 2121 with the actual plotted course

[2] Playback of the VDR data during the course of the investigation indicated ECDIS visual and auditory alarms. The GPS alarm could not be heard.

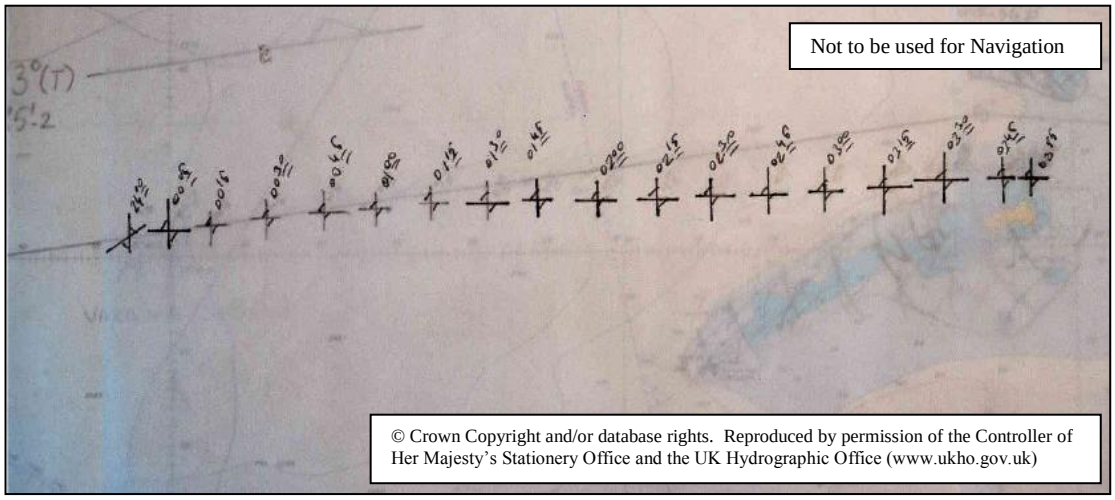

Figure 8: Positions plotted on BA Chart 2121 after the accident

1.7.2 The grounding

On 25 June 2012, at about 0353, *Flash* grounded and remained stranded on the rocks of Galitons de l'est in position 37° 33.69' N 008° 57.17'E (Figure 9).

Figure 9: Flash stranded on the rocks of Galitons de l'est

At the time of grounding, she had on board about 126,738 mt of coal distributed into its nine cargo holds, 2040 mt of IFO and 74 mt of MGO. She was drawing well over 14 m forward and 15 m aft. The vessel suffered severe structural damage to her

bottom hull, the fore peak tank, and several of her double bottom ballast tanks were breached and flooded.

There were no reports of injuries or pollution.

At about 0352, the master, who had been asleep in his cabin, felt excessive noise and vibration. He rushed to the bridge and found that the vessel was already aground. He immediately alerted the chief engineer and stopped the main engine.

The vessel's contingency plan was activated. The seabed around the vessel, hold bilges, ballast tanks and other compartments were sounded. The chief engineer reported that the duct keel high level alarm had activated and that the engine-room was flooding. He started pumping out the water from the bilges using the main cooling sea water pump, general service pumps, and emergency fire pump. At 0406, the Company was informed about the grounding and at 0440 the Tunisian Coast Guard was also notified.

At 1920, the chief engineer reported extensive flooding in the engine-room. By 2010, the water level in the engine-room had reached the level of the pumps. At 2015, the master ordered the evacuation of the engine-room and informed the Company and local authorities. Initial damage assessment by the master confirmed flooding of the fore peak and several double bottom ballast tanks. The vessel listed 1.5° to starboard, however, stability, shear forces and bending moments remained within the maximum allowable.

1.8 Sustained Hull Damages

Subsequent to the grounding, the appointed salvors confirmed that the grounding was on a rock with 14 m of water around the vessel. The salvors survey confirmed flooding of the fore peak tank, the double bottom tanks nos. 1 centre, 2 starboard, 3 port and starboard, 4 starboard and 5 starboard (Figure 10). The engine-room was also flooded.

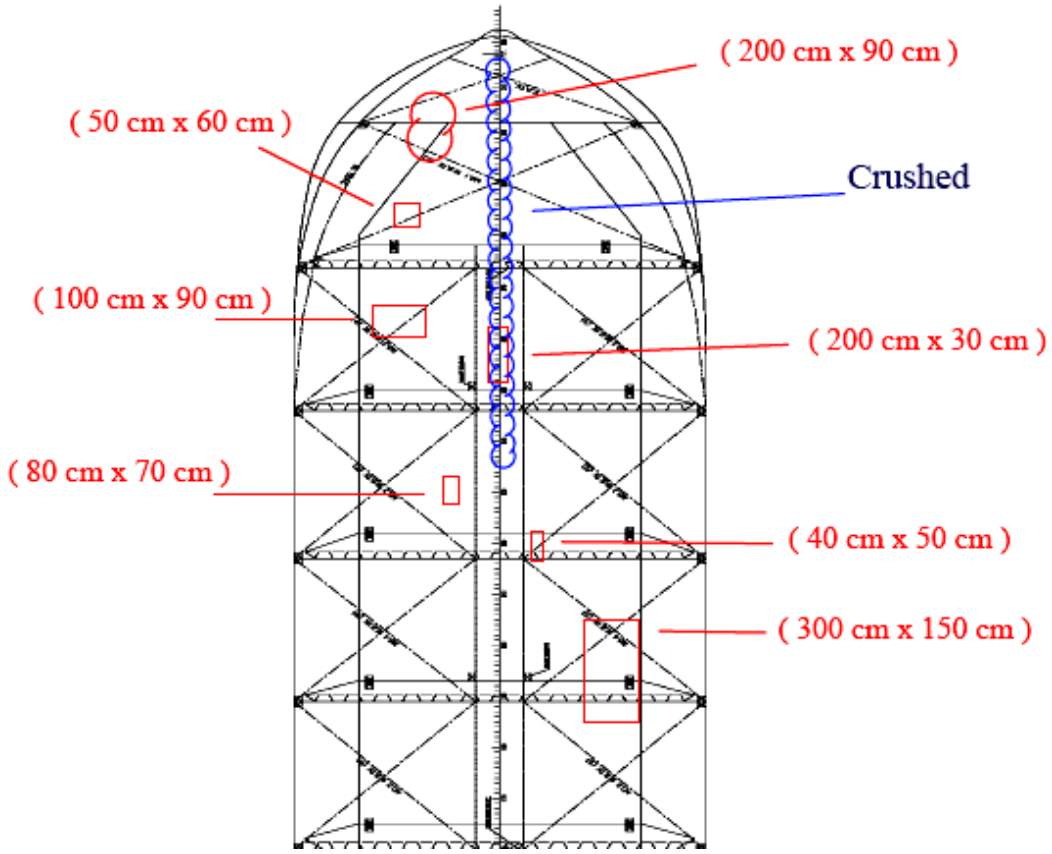

Figure 10: Damaged areas following the grounding

1.9 External Environmental Conditions

At the time of grounding, the sky was clear and the visibility was about 10 nautical miles. The wind was blowing from the WNW at 10 knots. The swell was 0.5 m from the NW and the air temperature was recorded at 24°C.

The currents off the coast of Tunisia set in the ENE direction with an average rate of around 0.25 knots. The currents are, however, heavily influenced by winds. The Westerly winds increase it up to 3 knots, whereas the Easterly winds in summer may temporarily reduce or reverse the East set of the current.

2 ANALYSIS

2.1 Aim

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

2.2 Alcohol and Drug Abuse

The Company recognised the negative effects which alcohol and drug abuse could have on the crew's ability to perform their duties effectively. To this effect, a Company's alcohol and drug policy was in place, which strictly prohibited on-board consumption of alcohol.

There was no evidence to suggest that the second mate was under the influence of alcohol or taking prescriptive / non-prescriptive medicine. The Company's policy directed watchkeeping officers not to hand over the watch to the relieving officer if there were reasons to believe that the latter was not capable of carrying out the navigational duties. The third officer neither found the second mate under the influence of alcohol or drugs nor noticed any unusual behaviour.

The use of alcohol and drugs was not considered to be a contributing factor to this accident.

2.3 Navigational Watch and VDR Data

When interviewed by the MSIU investigators, the third mate stated that he had on previous voyages experienced strong local currents in the vicinity of Ile de la Galite. On one occasion, he claimed that he had encountered strong current which had caused a sudden alteration of course by as much as 5°. However, during his 20-24 watch on 24 June 2012, the current's set and drift had been variable. He cautioned the second mate and advised him of the need to adjust the course accordingly.

At midnight, the third mate plotted a GPS position on the chart. Another position was then plotted at 0005 by the second mate. Both positions indicated that the vessel was

on the charted course. The third mate stated that he had handed over the watch with *Flash* on autopilot on a gyro heading of 081° and course over ground 083°(T). He explained that he had allowed 2° to port as the vessel was setting to starboard. The third mate, however, did not log the effects of current or the alteration of courses, which he had made during his watch. The log of 24 June 2012 showed that the course steered throughout the day was 083° and no error on the gyro compass was recorded. The wind was NE force 3. The noon entries showed an Easterly setting current of 0.1 knots.

The electronic data extracted from the VDR (Table 1), however, sharply contrasted with the observations made by the third mate. The VDR data at 2330 read that the vessel was steering 087.8° and the course over ground was 085.4°(T). At 0000, it was 083.4° and course over ground 081.2°(T). Clearly, the data of the course over the ground between 2330 and 0000 indicated that *Flash was* setting slightly to the North, *i.e.*, to the port of the charted course. Taking the VDR data as true representation of events, the second mate's observation that the vessel was setting to port was therefore correct.

At 0020, the OOW adjusted the autopilot by a few degrees to starboard but could not remember the exact heading. At 0030, the new course settled on 086°. The VDR-read course and speed over ground were 085°(T) and 11.7 knots respectively. Shortly afterwards, the OOW sat down on the bridge chair and fell asleep.

Thirty minutes into the new course, the vessel started to set to starboard. At 0057, the ECDIS channel limit alarm sounded and remained on until 0220. The alarm indicated that the vessel had set to the South of its intended course and outside the preset safety margin. The OOW, however, remained fast asleep. By 0200, *Flash* was making good a course of 089°(T) towards Galitons de l'est. The speed had also picked up.

There was no other means to wake up the OOW other than the Bridge Navigational Watch System (BNWAS) alarm which was, however, not fitted. At 0341, ECDIS way point alarm sounded[3] and remained on until the OOW woke up at about 0350[4]. Alarmed at seeing Galitons de l'est so close, he immediately put the helm to port and

[3] Code 457(2) and Code 457(9) from the ECDIS alarm log.

[4] Extracted from the ECDIS alarm log.

set about checking the vessel's position. At 0352, *Flash* touched the seabed at 12.5 knots. The speed dropped instantaneously. Soon after, at about 0353, *Flash* was hard aground.

Table 1: VDR data extract (ship's time not UTC)

Time hh mm ss	*Latitude N*	*Longitude E*	*Heading Gyro*	*COG True*	*RPM*	*Log Speed Knots*	*SOG Knots*	*Observations*
23 30 00	**37° 30.56'**	**007° 51.15'**	**087.8°**	**085.4°**	**74/75**	**12.3**	**12.1**	Slight alteration of course to starboard to avoid two targets fine on port bow
45 00	30.74'	54.94'	087.9°	085.8°		12.1	12.0	
00 00 00	*37° 31.10'*	*58.70'*	*083.4°*	*081.2°*	*74/75*	*12.5*	*12.1*	*Position plotted by third officer.*
05 00	*31.27'*	*008° 00.05'*	*083.2°*	*082.0°*		*12.5*	*12.1*	*Position plotted by second officer. Vessel on planned course line*
07 00								X-band radar switched to stand-by mode
10 00	31.42'	01.20'	082.4°	080.5°		12.4	12.0	
15 00	31.60'	02.45'	082.2°	080.0°		12.3	12.0	
20 00	31.77'	03.69'	082.4°	080.2°		12.3	12.0	
20 30								*Slight Alteration of course to starboard*
25 00	31.88	04.93'	087.3°	085.3°		12.5	11.9	
30 00	*31.96'*	*06.17'*	*086.5°*	*085.0°*		*12.2*	*11.8*	*Gyro heading settled on 086° COG 085°*
35 00	32.05'	07.40'	085.7°	084.7°		12.3	11.7	
40 00	32.14'	08.63'	086.5°	085.2°		12.2	11.7	
45 00	32.22'	09.85'	085.9°	085.0°		12.4	11.7	
50 00	32.30'	11.07'	086.4°	085.7°		12.1	11.6	
55 00	32.64'	12.29'	086.2°	086.1°		12.2	11.6	COG & heading same 086°
01 00 00	*37° 32.43'*	*008° 13.50'*	*085.5°*	*085.8°*	*74/75*	*12.4*	*11.6*	*Vessel started to drift to starboard*
15 00	32.60'	17.17	085.6°	086.9°		12.7	11.6	
30 00	32.70'	20.84	085.8°	088.2°		12.3	11.7	
45 00	32.75'	24.51	86.1°	89.2°		12.3	11.7	
02 00 00	*37° 32.80'*	*008° 28.18'*	*086.2°*	*089.1°*	*74/5*	*12.3*	*11.7*	*COG 089° on a heading of 086°*
15 00	32.82'	31.87'	086.4°	089.6°		12.3	11.7	
30 00	32.87'	35.57'	085.7°	088.9°		12.4	11.8	
45 00	32.95'	39.35'	085.8°	088.8°		12.4	12.1	
03 00 00	***37° 33.05'***	***008° 43.21'***	***085.8°***	***088.1°***		***12.4***	***12.1***	
15 00	33.16'	47.16'	085.5°	087.5°		12.3	12.6	
30 00	*33.34'*	*51.14'*	*086.7°*	*086.7°*		*12.5*	*12.7*	*Vessel crossed 100m contour*
45 00	33.54'	55.11'	085.0°	085.7°	74	12.6	12.5	
50 00	33.62'	56.42'	085.8°	086.1°	75	12.4	12.5	
50 30	*33.62'*	*56.55'*	*085.9°*	*086.1°*	*75*	*12.5*	*12.5*	*Rudder Angle 6° Port*
50 45	**33.63'**	**56.62'**	**085.5°**	**086.5°**	**75**	**12.6**	**12.5**	
03 51 00	***33.63'***	***56.70'***	***084.6°***	***086.8°***	***76***	***12.6***	***12.5***	
51 30	**33.64'**	**56.82'**	**082.8°**	**085.4°**	**74**	**12.4**	**12.5**	
52 00	*33.65'*	*56.95'*	*081.2°*	*084.0°*		*12.7*	*12.4*	*Vessel started to drop speed*
52 30	*33.66'*	*57.07'*	*079.6°*	*081.8°*		*12.6*	*12.1*	*First contact with sea-bed*
52 45	**33.67'**	**57.12'**	**078.9°**	**080.0°**		**10.2**	**10.5**	
52 48			**080.0°**			**7.7**	**8.2**	**Bridge phone ringing**
52 55			**082.0°**		**75**	**6.0**	**6.5**	**Answering phone**
03 53 00	**33.68'**	**57.15'**	**083.0°**		**74**	**5.4**	**5.7**	**Vibration heard. Rudder angle 0° Rate of turn 18° to starboard**
53 15	**33.69'**	**57 17'**	**088.0°**		**75**	**3.3**	**3.3**	**Alarm. Turning rudder to 14° port**
03 53 30	*37° 33 69'*	*008° 57 17'*	*090.0°*		*75*	*0.3*	*1.0*	*Vessel aground. Phone ringing. RPM 75*
53 45	**33 69'**	**57.17'**	**090.0°**		**75**	**0**	**0.1**	**Rudder angle 35° port. Answering phone. RPM 75. Shutting down engine**
54 00	**33.69'**	**57.17'**	**090.0°**		**51**	**0**	**0**	**RPM 51**
03 54 20	**37° 33.69'**	**008° 57.17'**	**090.0°**		**0**	**0**	**0**	**RPM Zero**

2.4 Look-out During the Navigational Watch

The requirement to have a look-out to assist the OOW, is widely addressed by the IMO[5]. It was also included in the Comapny's instructions to masters in the vessel's SMS. In spite of the importance given to the look-out in maintaining an effective navigational watch, the evidence showed that the master had directed his officers to engage a look-out only when deemed necessary. He neither explained the rationale of his decision (*vis-à-vis* international rules and regulations on look-outs) nor the conditions and circumstances under which a look-out could be dispensed with.

The master was neither questioned nor contested by the officers. It would appear that the OOW interpreted it as a master's order that no look-outs were necessary unless one was requested. To some degree, deck cadets carried out look-out duties as part of their training programme on board.

A monthly schedule of look-outs was also prepared and their names entered in the deck logbook. However, on the morning of 25 June 2012, no look-out was posted during the second mate's 0000-0400 navigational watch.

By failing to appoint a look-out, the safety of the vessel, her crew, and the environment were compromised and placed at risk.

2.5 Fatigue and Loss of Sleep

The effects of fatigue include diminished sense of responsibility and slow reactions to decision-making. The quite environment of the bridge and calm weather conditions could have led to an increased risk of falling asleep.

The fact that the third mate did not notice any symptoms of fatigue during the navigational watch handover, indicated that he had no reason to believe that the second mate was not capable of carrying out his watchkeeping duties. The 'Hours of Work and Rest' documents showed that in the days preceding the grounding, the second mate had rest periods of 14 hours in the 24 hour cycle, in line with the relevant IMO and ILO Conventions.

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[5] *Vide* the STCW and COLREG Conventions.

However, the OOW had stated that after his 12-16 watch on 24 June 2012, he did some light work until 1800 and then watched a movie and listened to music before going on watch again at midnight. He further stated that he did not normally sleep in the evening before the 0000-0400 navigational watch. The second mate said that he had been on board for nearly nine months and the only time he would go to sleep was after the 0000-0400 navigational watch. After reviewing the evidence, the MSIU did not exclude that the OOW was suffering from acute sleep deprivation and this could have possibly been the reason for accumulated fatigue.

Whilst widely quoted as a cause of accidents, considerable body of academic literature suggests that fatigue is actually a hypothetical construct linking past experiences of accidents and sleep deprivation[6]. Acute sleep deprivation *i.e.* reduction in the quantity and / or quality of sleep – or extending the time awake since the last sleep, produces a sleep debt and also a homeostatic drive to sleep. As such, it has been recognised that sufficient good quality sleep (on a daily basis) is the best countermeasure against fatigue and will address homeostatic sleep drive. The problem with sleep loss and fatigue is that the latter will prejudice the availability of resources to perform a task and increases the amount of effort required to perform the task.

Circadian rhythm is a pattern, which varies on a cycle of approximately 24 hours. Research suggests that there is more than one school of thought on circadian rhythms and performance. These different views, although not necessarily antagonistic, arise from the fact that the dimensions of the performance rhythm are affected by a wide range of influences.

For instance, although the OOW fell asleep before the expected circadian dip, the performance rhythm of the OOW was influenced by at least two variables:

1. Type of performance – *i.e.* during the first part of the navigational watch (until he fell asleep), the OOW was a mere observer rather than an active participant;
2. The influence of hours since waking – sleep deprivation (although self-induced), influenced the circadian variation.

[6] It has to be clarified that the analysis of the effects of fatigue on performance has to be somewhat generic, given that the effects of sleep deprivation may vary from one person to another.

This is a very important point, which is being discussed. The effects of sleep deprivation may be reduced by strategic napping. This emphasises the importance of the link between sleep loss and fatigue.

Thus, whilst circadian influences may have contributed to the OOW falling asleep, it is concluded that these influences alone may not necessarily have had effects on the performance of the OOW. Therefore, acute sleep deprivation was a major influencing factor, which contributed to the OOW falling asleep (rather than simply the hour of the night). The lack of sleep and his falling asleep are suggestive that the OOW was not fit to stand a navigational watch and can be considered as one of the contributory factors to this accident.

In addition, it may be implied that even if the OOW did not fall asleep, the lack of sleep would have had an effect on his performance functions and a reduction in his watchkeeping capabilities.

Whilst taking into consideration the points made above on circadian rhythms, the time of the accident was crucial not only for its relevance to the circadian rhythm. A quite watch at night with little or no traffic around the ship may give rise to monotony, boredom and even lack of stimulation. Studies indicate that these conditions, which were very similar to the conditions on *Flash* prior to the grounding, can also contribute to fatigue (physical and mental) and hence increase the safety risk. From another perspective, other scholars remarked that actually, monotony and boredom 'expose' underlying problems of lack of sleep – which will become 'visible' during low stimulus situations.

2.6 Navigational Watch and Equipment

Although mandatory fitting was not applicable to *Flash* at the time of the accident, ECDIS was fitted on board. However, it was not used as an aid to navigation; paper charts were the primary means of navigation. Notwithstanding the above, the planned course was projected onto the ECDIS and an audible alarm for cross-track error was set at 300 m on either side of the planned course. The GPS was also set to give cross-

track error alarm. As indicated by the OOW, both the GPS and ECDIS alarms had activated but only heard just before the grounding[7].

The Bridge Navigational Watch Alarm System (BNWAS) is a system designed to ensure that the OOW remains alert during the navigational watch. This is done by activating an alarm sequence at set intervals. The alarm must be acknowledged by the OOW. In the event that this goes unacknowledged, an audible alarm would sound in selected cabins and, if this is also not unacknowledged, the general alarm would be activated, alerting the entire crew.

The requirement to carry a BNWAS was adopted by the IMO in amendments to SOLAS regulation V/19, which came into force on 01 January 2011. In accordance with Resolution MSC.282(86)[8], *Flash,* had to comply with these new requirements by not later than the first survey on or after 01 July 2012. The unavailability of the BNWAS was considered to be a missing protective barrier.

The Company had an effective SMS, which detailed the responsibilities and duties of the OOW. In addition to the master's standing orders, it listed specific watchkeeping duties, including entries that should have been recorded in the deck logbook. In July 2010, the Company issued a circular 'Navigation Watch Keeping' to all the masters. The circular directed all masters to check and verify that the basic Company procedures on watchkeeping duties were being implemented. Thus, responsibility for the monitoring and effectiveness of the SMS, and other Company directives remained with the master. The master was therefore responsible to ensure that no work-practices were adopted if these contravened Company policy, SMS, international requirements, or the standing orders.

Several publications promote the concept of bridge team management, which contrasted with the situation on the navigational bridge of *Flash,* with one OOW acting as the sole look-out during a period of darkness. In one of its publications, The Nautical Institute emphasised the importance of bridge organisation and correlated it with navigation safety, given that bridge organisation (rather than an OOW acting as a sole look-out) will, *inter alia*:

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7 *Vide* footnote 2.

1. eliminate the escalation of one-person errors;
2. ensure good visual look-outs; and
3. allow continuous monitoring and detection of deviations from the planned track, especially when in coastal waters.

2.7 Ship Inspection and Internal Auditing

The Company's main objective of ship inspection and internal audit was to ensure safety and that the vessel complied with the Company's SMS.

The last ship inspection by a Company official on board *Flash* was done on 05 May 2012. The internal audits by the master spanned over a period of about four months, *i.e.* from January through May 2012. The internal audit reports did not record any instructions given to OOW or non conformities on look-outs. In fact, the navigation audit endorsed by the master on 31 May 2012, stated that "[the] lookout reports lights in good time and correctly." Thus, the safety investigation could not determine with accuracy the date when this practice was established.

2.8 Fatigue and Recurrent Related Safety Issues

During the course of the investigation, it was interesting to note that the findings related to fatigue and sleep deprivation were remarkably similar to several findings published in 2004 by the UK's Marine Accident Investigation Branch (MAIB) on bridge watchkeeping.

The MAIB's research, which, *inter alia,* took into consideration several groundings reported to the Branch had brought to light several safety issues related to standards of lookout and late detection, *i.e.:*

- Fatigue;
- No look-out had been posted;
- Autopilot engaged;

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[8] This amendment introduced the carriage requirements for shipborne navigational systems and equipment , *inter alia,* the BNWAS.

- Watch alarm not fitted (or deactivated);
- Unaccompanied watchkeeper had fallen asleep; and
- Hours of darkness.

The findings of this safety investigation confirm also MAIB's analysis with respect to hours of rest *v.* hours of (good quality) sleep. Although the hours of rest were available, there is no guarantee that these will be utilised by the OOWs to sleep even because of personal matters rather than exigencies related to the operations of the ship.

THE FOLLOWING CONCLUSIONS, SAFETY ACTIONS AND RECOMMENDATIONS SHALL IN NO CASE CREATE A PRESUMPTION OF BLAME OR LIABILITY. NEITHER ARE THEY BINDING OR 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

Flash ran aground after she gradually set to starboard of her planned course and eventually running into shallow waters.

3.2 Latent Conditions and other Safety Factors

1. The OOW fell asleep shortly after he sat down on the chair in the bridge;
2. The OOW did not hear the ECDIS and GPS alarms when the vessel went outside the pre-set safety margins;
3. The OOW was the sole look-out on the bridge;
4. The OOW was suffering from acute sleep deprivation;
5. Although no reduction in performance was observed by the previous OOW, the lack of sleep and his subsequent falling asleep suggest that the OOW was not fit to stand a navigational watch;
6. The vessel was not yet fitted with a BNWAS, which would have served as an additional protective barrier;
7. The bridge watchkeeping practices did not endorse the concept of bridge team management.

3.3 Other Findings

1. There was no evidence which suggested that the OOW was intoxicated or under the influence of prescriptive / non-prescriptive medicine;
2. The hours of rest and sleep records indicated that the OOW was well rested in accordance with the relevant requirements prescribed in IMO and ILO conventions.

4 ACTIONS TAKEN

4.1 Safety Actions Taken During the Course of the Safety Investigation

1. The managers have determined that the BWNAS will be in used at all times except in port;
2. A new ISM Form has been created in order to keep a record of the overall performance of sea passages. The Form will be filled at the end of every voyage;
3. A Navigation Alarm poster has been posted on the bridge of Company managed vessels, as part of the master's Standing Orders. It is a requirement for the officers to sign the poster, which shows all the navigation devices alarms and their pre-determined set values. The aim is to assist the OOWs and avoid similar accidents;
4. It is required that a look-out is posted on the bridge at all times at night without exceptions and irrespective of the trading area. For daylight exemptions, the crew members are requested to refer to the Company's SMS manual;
5. The Company has embarked on an exercise to ensure that navigation standards are practiced at the highest level as per Company's policies and procedures and in accordance with the relevant regulations. Masters are required to strictly monitor the performance of all OOWs;
6. The Company is requiring additional measures that reflect good seamanship practices, *e.g.* the reliever is required to be on the bridge in good time to ensure an effective handover;
7. The use of the master's chair on the bridge has been prohibited;
8. The Company has banned the consumption of alcohol on board its ships;
9. In order to ensure thorough knowledge by the OOW of the Company's established procedures, remote and local auditing of OOWs' performances and navigational skills will be regularly carried out;
10. An internal study will be carried out in order to identify safe passages;

11. Masters have been instructed to ensure that they check all passage plans very closely before departure.

5 RECOMMENDATIONS

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

Genel Denizcilik Nakliyati A.S. is recommended to:

09/2013_R1 Ensure that crew members on board its ships are aware that hours of rest have to be utilised well in order to ensure adequate good quality sleep.