

**The Bahamas**  
Maritime Authority

# Marine Safety Investigation Report

into a mooring fatality onboard Aruba Pearl  
on 26 October 2022



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# 1. Summary

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## What happened

On the morning of 26 October 2022 the Bahamas flagged general cargo vessel Aruba Pearl was manoeuvring into position in preparation for securing its lines to a series of fixed mooring buoys on the Cooper river, Charleston, South Carolina in the United States of America.

During mooring operations, an able bodied seafarer (AB) suffered fatal injuries when a mooring line that was under tension on the mooring winch, sprung free from a bitt that it had been passed around, striking him in the chest.

Despite immediate medical assistance from the crew and ambulance crew ashore a short while later, they were unable to revive him.

## Why it happened

The mooring line that was being guided onto the winch drum had been placed on the wrong side of the bitt in preparation for applying the stopper. Once tension was applied and increased it sprung free and struck the AB who was standing in close proximity to the bitt.

The mooring line when under load would not have given any audible warning that it was about to recoil, nor was the AB aware that his positioning placed them in any immediate danger.

The work party did not assess all potential risks, including safe positioning of crew, prior to commencing the work.

## What can we learn

All personnel working in areas where mooring lines are under tension, should be aware of the associated risks of snap back and recoil when mooring lines either part or come adrift of mooring arrangements on deck, often resulting in serious injury or fatality.

Never tension mooring lines with an upward lead around bitts so that it is retained by the flange - the likelihood of it slipping up and off is incredibly high.

## 2. Factual Information

### Aruba Pearl

<b>Vessel Type</b>	General Cargo vessel	<b>Flag</b>	Bahamas		
<b>Owner</b>	Aruba Pearl Shipping Co. Ltd.	<b>Manager</b>	SMT Shipping Poland		
<b>Classification Society</b>	DNV	<b>Gross/Net Tonnage</b>	28,239 / 12,870		
<b>Built</b>	1986	<b>Propulsion</b>	Burmeister & Wain 6L60MCE 10800 BHP		
<b>IMO No.</b>	<b>Callsign</b>	<b>Length overall</b>	<b>Breadth</b>	<b>Moulded Depth</b>	
8313702	C6CU6	180.51m	29.0m	16.89m	
<b>Last BMA Inspection</b>			<b>Last PSC Inspection</b>		
Point Lisas, Trinidad and Tobago, 02 September 2022. No deficiencies			Mobile, Alabama, USA, 09 September 2022. No deficiencies		



<b>Rank/Role on board</b>	Master	Chief Officer	Third Officer	OS (deceased)	Able seafarer	Cadet
<b>Qualification</b>	Master	Master	Officer of the Watch	Able seafarer	Able seafarer	N/A
<b>Certification Authority</b>	UM Gdynia Poland	Russian Maritime	Philippines Maritime	Philippines Maritime	Philippines Maritime	Trainee
<b>Nationality</b>	Polish	Russian	Filipino	Filipino	Filipino	Trinidadian
<b>Age</b>	59	38	27	35	35	23
<b>Time in rank</b>	20 years	6 years 9 months	7 months	4 years 6 months	7 months	1 year 6 months
<b>Time on board</b>	3 months	4 months	9 months	9 months	5 months	1 month

### Environmental Conditions

Wind Direction	Wind Force	Wave Height	Swell Height	Precipitation / Sky	Visibility Range	Light Conditions
E	3	River	N/A	Clear skies	7NM	Daylight

### Voyage Details

<b>Departure Port</b>	Point Lisa, Trinidad and Tobago	<b>Arrival Port</b>	Charleston, South Carolina, USA
<b>Time of departure</b>	01 October 2022 - 20:10	<b>Estimated time of arrival</b>	06 October 2022
<b>Voyage duration</b>	25 days (18 days at anchor)	<b>Voyage distance</b>	1677 NM
<b>Cargo</b>	Aggregate	<b>POB</b>	25
<b>Stage of passage</b>	Berthing on mooring buoys	<b>Traffic density</b>	Medium – Busy shipping port

## Narrative

All times in this report are UTC - 5

In the early hours of 26 October 2022 the Aruba Pearl anchored outside of Charleston, South Carolina in the United States of America, waiting to unload its cargo of aggregate that had been loaded in Trinidad and Tobago. The vessel had been anchored for eighteen days waiting for an available berth.

At 05:15 the Aruba Pearl received word from Charleston port that following the boarding of the harbour pilot at buoy C the vessel would continue upstream where the berthing pilot would board the vessel at buoy 54A, in the vicinity of the Naval weapons facility. It would then proceed up the Cooper river, to its designated position where it would be moored to multi-buoy mooring buoys (MBM), and unloading would then commence with the use of barges.

The MBM set-up consisted of eight anchored buoys, four set upstream and four set downstream, close to the edge of the main shipping channel and in an area with strong tidal stream. As such the timing of approach and securing was critical. In order to ensure that the vessel remained within the limits of its mooring position and did not drift into the main shipping channel, two tugs would be called to assist with holding the vessel in position whilst lines were sent out.

A berthing window was proposed between 09:00 and 12:00 as the river would be at the top of the tide and with the vessel heavily laden with cargo made for favourable conditions.

At 07:05 the vessel arrived at buoy 54A where the berthing pilot boarded the vessel, met with the master, harbour pilot and reviewed the pilot card, and discussed the proposed mooring arrangement plan. The company agent would normally provide a copy of the mooring arrangement plan in advance to the river and berthing pilot, but on this occasion [he] had not received a copy from the master or the company.

The vessel continued up the river and proceeded to its designated mooring location at the Charleston Midstream Transfer facility, situated between the entrances to Goose Creek and Clouter Creek on the Cooper river (Figure 1).

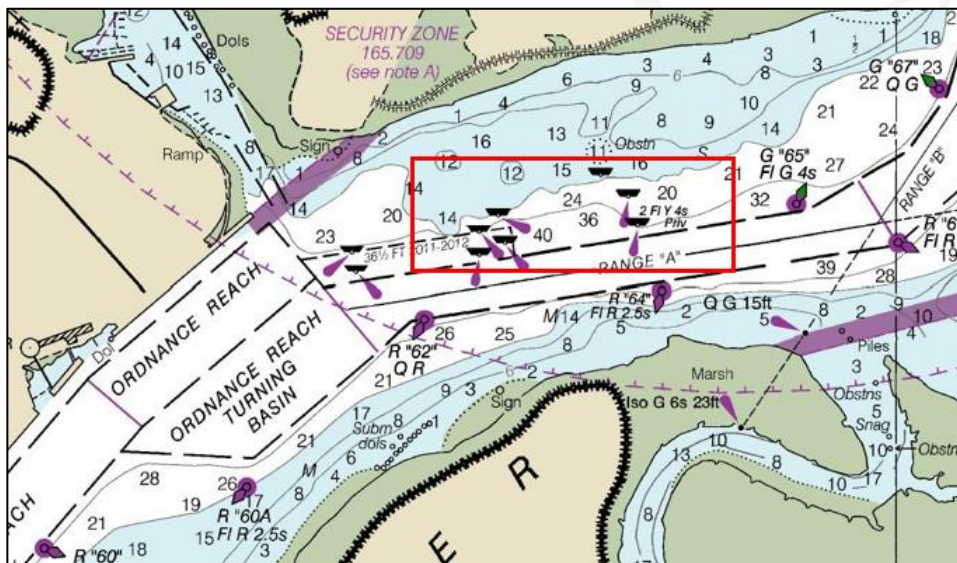


Figure 1. Multi Buoy Mooring location – Clouter Creek – Cooper river (excerpt from NOAA Nautical Chart 11524)

During its approach, the master discussed the proposed mooring plan with both pilots and agreed on a plan, where sixteen lines in total, eight lines apiece forward and aft, would be payed out to both sets of buoys. The plan consisted of four lines being fixed to the double drum winches and four lines secured to the bitts at each mooring station.

To secure to the buoys, two lines would be sent down to a line handling tender who would transfer the lines to the buoy's quick release hooks and signal back to the vessel to take up the strain. Mooring would commence with the first set of lines aft being payed out through their respective chocks down to the #1 starboard outer buoy. One line would then be stoppered off to enable it to be made fast on the bitts

This process would be mirrored at the forward station, followed by the second set of lines being payed out and the process then repeated according to the plan below in figure 2.

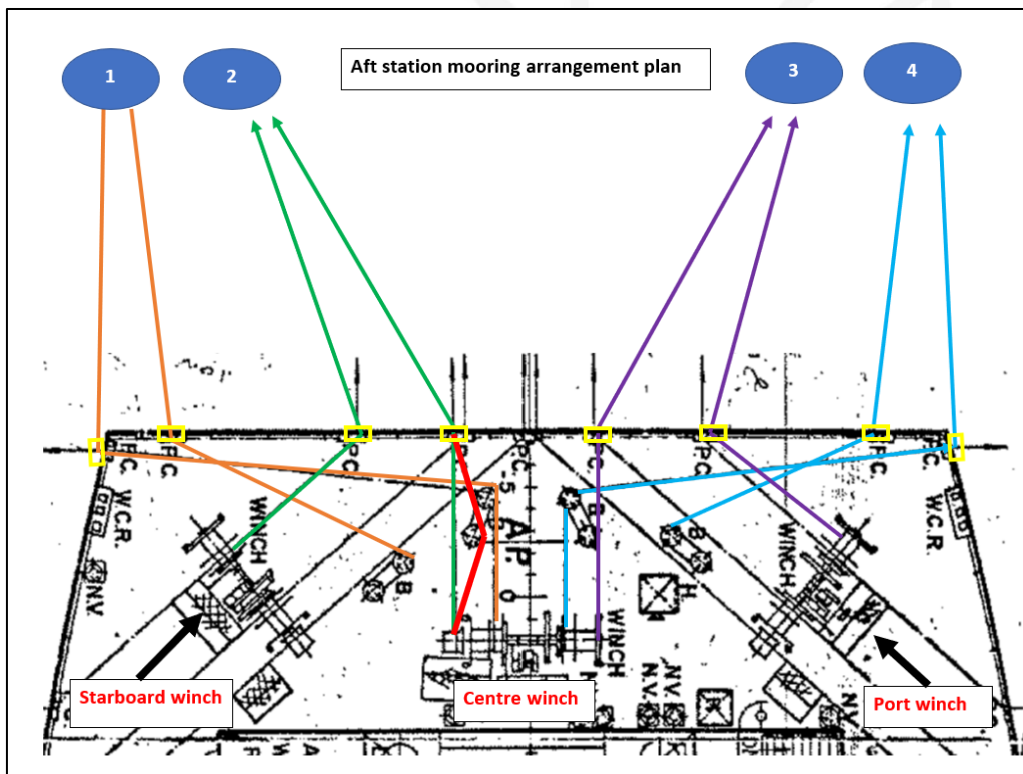


Figure 2. Mooring arrangement plan - aft (depicting incorrect lay of line in red)

Prior to mooring commencing the chief officer held a safety briefing where crew were assigned to teams and roles explained. The newly promoted third officer would assume responsibility for the aft mooring station and would be accompanied by an experienced able bodied seafarer (AB), another AB and ordinary seafarer as well as a deck cadet operating in an observer capacity, who recently joined the vessel during loading in Trinidad and Tobago. The vessel had previously moored at this location and at similar locations where tidal fixed mooring buoys were used and therefore the crew were familiar with this process of securing the vessel.

The crew were advised that as a result of being delayed by eighteen days at anchor, that upon completion of mooring, arrangements had been made for them to depart the vessel and head home, with incoming replacement crew already on their way.

At 09:35 both tugs arrived on scene and in discussion with the bridge positioned themselves and held the vessel steady whilst mooring commenced. At 09:56 the harbour pilot departed the vessel, leaving the master and the berthing pilot to secure the vessel.



At 10:05 the first set of lines forward and aft were sent to the buoys and the process of securing the vessel as per the agreed mooring plan commenced. The tugs would remain in situ until such time that they were no longer needed and sufficient lines were set holding the vessel in position.

Whilst mooring was underway, the master accompanied by the berthing pilot observed that two of the lines aft which were due to be sent out were not in sequence and had become tangled. The master halted operations aft until such time that the lines were corrected. The third officer who was new to the role, but experienced onboard was instructed by the master to correct the setup and untangle the lines prior to hauling up on the winch (Figure 3).



**Figure 3. Mooring deck – crew positions during untangling of line**

Conscious of time and the imminent crew change, the third officer, departed from his role as mooring party leader and set about physically helping the crew untangle, pay out and secure the lines.

Whilst the lines were being untangled, the third officer moved the third line clear from where work was taking place and positioned it over a bitt before continuing to assist the others in correcting the lines.

Once the lines had been corrected, another AB operating the centre winch started taking up the slack on the third line that had been passed around the bitt, and which had already been attached to the mooring buoy. On witnessing this, the AB picked up the stopper and on facing the winch proceeded to attach it.

At 10:25 during the process of the AB attaching the stopper, the third line sprung free from the bitt it was passed around, and struck the AB in the upper chest, propelling him backwards. A loud shout for help could be heard on the very high frequency radio by the master and pilot located on the vessels starboard bridge wing deck. The master ordered the chief officer who at this time was at the main engine telegraph position to investigate what had happened and to report back.

At approximately 10:27 the third officer, with assistance from his team, moved the injured AB to an undercover area ahead of the mooring station and within proximity of the accommodation block.

A short while later the chief officer arrived on scene and reported that an AB had been struck by a mooring line that had sprung free and was seriously injured. On hearing this, the master in agreement with the pilot suspended all mooring manoeuvres in order to attend to the casualty.

A call was made by the berthing pilot requesting emergency medical assistance from shore, while the master notified the company's designated person and requested that the authorities be informed. During the request for medical assistance the CO remained with the injured AB, whilst arranging for a stretcher to be readied on board so that the AB could be transferred ashore.

At 11:00 a line handling tender pulled alongside and the injured AB was transferred to the tender before being transported to shore where it was met by an ambulance. At approximately 11:05 the master received word from the ambulance crew that the AB could not be revived.

A short while later mooring commenced and at 12:00 the vessel was made secure and fast.

Autopsy results declared that the AB suffered fatal injuries caused by blunt force trauma.

### Previous similar casualties

The Bahamas Maritime Authority has recorded three instances of mooring related fatalities in the last ten years. In the same period, there were 25 casualties that resulted in serious injuries. There have been several cases where seafarers have been killed by a mooring line that has not parted:

#### Teal Bay (2021) MAIB

A Chief officer was fatally injured when he was struck on the head by a tensioned mooring line that sprang out of an open roller fairlead. The Teal Bay was loading grain when moored alongside an anchored bulk carrier.

[MAIB Report 9/2022 - Teal Bay - Very Serious Marine Casualty \(publishing.service.gov.uk\)](#)

#### Jawor (2021) BMA

A Bahamas flagged vessel whilst on passage, identified areas of damage to its mooring lines and assigned crew to undertake repairs before load testing. Whilst carrying out the load testing, an ordinary seafarer was fatally injured when the mooring line he was guiding onto the winch drum sprung free from where it had fouled, striking him in the abdomen.

[BMA-MSI-Report-Jawor-Mooring-line-load-testing-fatality.pdf \(bahamasmaritime.com\)](#)



## 3. Analysis

**The purpose of the analysis is to determine the contributory causes and circumstances of the casualty as a basis for making recommendations to prevent similar casualties occurring in the future.**

A crew member suffered fatal injuries when a mooring line that was under tension on the mooring winch, sprung free from a bitt that it had been passed around, striking him in the chest.

### Cause of injury

The cause of injury which resulted in the death of the AB was blunt force trauma to the chest, as a result of extreme force due to the recoil of the mooring line when it sprung free from the bitt.

The properties of man-made fibre ropes such as polypropylene mean that they can extend up to one third their original length when tension is applied. Once the maximum permissible tension is applied the rope will recoil back to its static position once freed from its fouled position with the force equivalent to over 250 Newtons (1 Newton = 1 kg • m/s<sup>2</sup>- /Newtons 2<sup>nd</sup> Law) (figure 5).

At the time the mooring line sprung free, the AB would have been unaware that if freed would reach the position where he was stood, or that it placed him in danger.

Guidance on the recommended procedures during mooring operations are widely available and useful as part of the work planning and review of the generic risk assessment being used. Extracts from the Code of Safe Working Practices 2015 (October 2020 amended) section 26 offer guidance when working with mooring lines and the dangers associated with recoil and snap-back.

- *26.3.12 Personnel should not, in any circumstances, stand in a bight of rope or wire. Operation of winches should be undertaken by competent seafarers to ensure that excessive loads do not arise on moorings... competent personnel must be used and a toolbox talk should precede operations with maintenance of good communications with all participants throughout.*
- *26.3.13 When moorings lines are under strain, all personnel in the vicinity should remain in positions of safety, i.e. avoid the snap-back zones. It is strongly recommended that a bird's eye view of the mooring deck arrangement is produced to identify danger areas. Regardless of designated snap-back zones, seafarers should always be aware of other areas of potential danger – the whole mooring deck may be considered a danger zone.*

### Multi Buoy Mooring

The Multi Buoy Mooring (MBM) also known as conventional buoy mooring includes multiple buoys fixed to the seabed by means of mooring lines and marine anchors. The buoys are permanently installed in a rectangular pattern that allows safe mooring of a vessel which is positioned between the buoys.

MBM are usually located in areas where weather conditions are mild to moderate. This is because the mooring restraint is limited, due to the requirement to pay out the mooring lines on both port and starboard sides, in contrast to mooring at piers and sea islands where mooring lines are paid out on one side only.

Considering that eight lines were required to be fastened at each mooring station, the limitations imposed on the crew due to the configuration and deck design meant that what would normally be a straightforward securing arrangement if berthed alongside a quay, became more complex due to having to bypass and lead the lines through several chocks, crossing of winches and not fully utilising the bitts correctly.

In overlapping, bypassing and running lines out at acute angles to the winch carries a greater risk, including securing of lines to only one end of a double bitt bollard. In order to achieve this, stoppers were required to take the strain whilst the line was transferred to the bitt (Figure 4).

Stopping off a line entails risk. High loads in the lines must be avoided since the stoppers have less strength than the mooring line. Furthermore stoppers need to be applied leading away from the winch in the direction of the buoy. The AB attempted to fasten the stopper in the direction of the winch and not leading away as would be required, distracted from the task at hand.

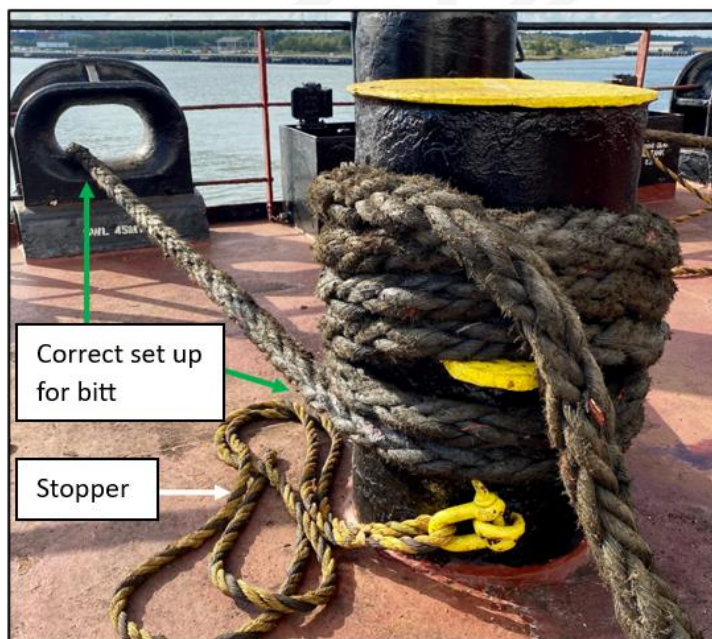


Figure 4. Stoppers -Aft (image courtesy of United States Coast Guard)

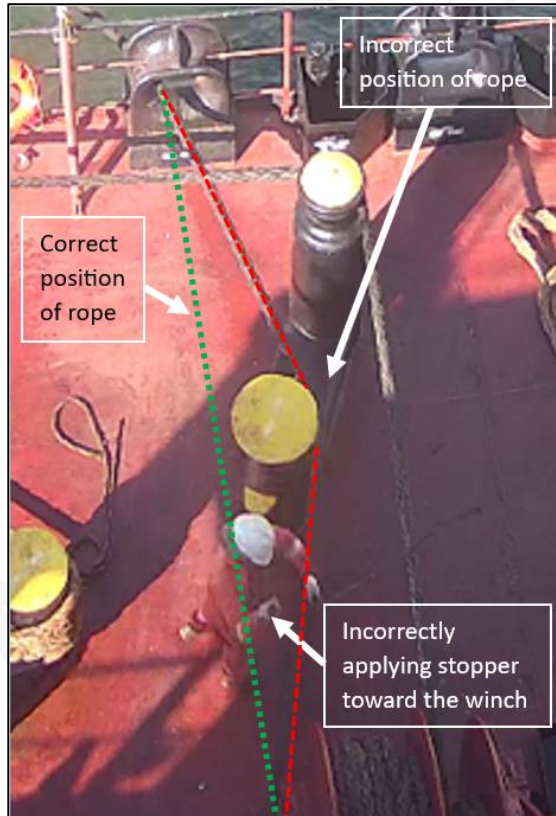
## Human Error

Human error accounts for about 80–85% of all marine accidents<sup>1</sup>. Daily, seafarers are faced with ever changing work patterns and modern working environments, and errors will exist no matter how well trained and motivated they are. However, in high risk areas or activities, the consequences of such human errors or failures can be severe and in this case fatal.

Human error or failure are not random, and understanding why it occurs and what steps can be taken to reduce the likelihood of an unsatisfactory outcome need to be considered.

Although the AB had carried out mooring on MBM arrangements several times before, his decision to place the mooring line on the opposite side of the bitt, and tie off the stopper leading towards the winch and not the chock (Figure 5), was most likely due to distraction.

<sup>1</sup> Baker, C.; McCafferty, D. Accident database review of human element concerns: What do the results mean for classification? In *Proceedings of the International Conference Human Factors in Ship Design and Operation*; RINA: London, UK, 2005



**Figure 5. Stopping off the line**

Details from interviews and witness accounts, validate that due to a lengthy delay at anchor for eighteen days, thoughts and discussions among the aft mooring station crew had turned to when they would be going home rather than maintaining their focus on the task at hand.

Consequently the third officer did not factor this distraction in as part of their planning as it would have identified the risks associated with working with lines under tension, requiring them to review the mooring arrangement, reassess the placement of ropes, their standing positions, and of the potential snap-back zones or areas of danger.

Distraction and deviation from standard mooring operations was most likely a factor as routine tasks that had been done on numerous occasions, were now being halted due to incorrect lines being payed out and securing sequences contrary to those in which they had been trained in.

The AB at the time of the incident would have been distracted and conflicted in his duties when surrounded by other crew correcting the line that had been payed out incorrectly, as well as overseeing the whereabouts of the cadet and other crew members during mooring operations<sup>2</sup>.

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<sup>2</sup> [Distraction conflict theory - Oxford Reference](#)

## 4. Conclusions

- An AB died when he was struck by a mooring line that sprung free from the flange of a bitt.
  - At the time of the casualty, the AB was standing in a dangerous position, attempting to apply a stopper in the wrong direction to a line that was badly lead. He was likely distracted by assisting with untangling the line and not on the task at hand.
  - Although the work planned for that day had been discussed, a comprehensive review of the mooring arrangement plan and crew responsibilities was not considered.
  - The third officer deviated from procedural responsibilities when assisting in line handling, rather than oversee and control the activity of the mooring party.
-

## 5. Actions taken

### SMT Shipping Poland has:

- Carried out a comprehensive review of its shoreside and onboard operations, and implemented changes to its management structure and its safety management system, including an overhaul of procedures in risk management, with the inclusion of compulsory training for all ships' officers in performing risk assessments.
  - Created the SMT Academy which contains a series of online animated training material for all ships' crew in relation to onboard operations including, but not limited to; mooring operations, working at height, enclosed space entry and practical onboard skills.
  - Implemented changes to the duties and responsibilities of safety officers with the inclusion of a mandatory safety officer training course offered by an external provider, and all senior officers joining a vessel are to complete a series of familiarisation prior to joining.
  - Addressed the concerns around fatigue and mental health by reducing the contract periods of crew from nine months to six months.
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## 6. Recommendations

Considering the actions taken (and ongoing work) by SMT Shipping Poland, there are no recommendations.

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## 7. Glossary and Definitions

AB	Able bodied seafarer
Bitts	Vertical steel posts or bollards mounted in pairs around which a line can be secured.
Chock	Chocks are structural reinforcements on ships which guide the mooring lines to and from the shore / other vessels.
m	metre
MBM	Multi Buoy Mooring is a facility where a vessel is usually mooring by either a combination of the ships anchors and mooring buoys fore and aft or on mooring buoys alone fore and aft.
Newtons 2 <sup>nd</sup> Law	Newton's second law states the acceleration of an object is directly proportional to the net external force applied, and it is indirectly proportional to its mass. In other words, more force generates more acceleration for a given mass, but more mass means less acceleration from a given force.
OS	Ordinary seafarer
Payed	Payed is a word that's only used in nautical/maritime contexts. It can be used to refer to the act of coating parts of a boat with waterproof material or to the act of letting out a rope or chain by slackening it.
SMS	Safety Management System
Snap-back	A snap-back is the sudden recoil of a mooring line as a result of its failure under tension. A snap-back zone on a mooring deck is the space where it is anticipated that the failed mooring line could recoil with great velocity, possibly resulting in injury or even death to crew present within this zone
Stopper	A device for securing a mooring line temporarily at the ship while the free end is made fast to a ships bitt.
Telegraph	In modern ships with automation and controls, the bridge telegraph is directly connected with the engine controls and it doesn't require involvement of engine room personnel.
VHF	Very High Frequency