



**The Bahamas
Maritime Authority**

THE COMMONWEALTH OF THE BAHAMAS

Vision of the Seas

IMO Number: 9116876

Official Number: 8000405



**Report of the marine safety investigation into a
fall from height overboard on 5th September 2019 in
Livorno, Italy**

Vision of the Seas – Marine Safety Investigation Report

The Bahamas conducts marine safety or other investigations on ships flying the flag of the Commonwealth of the Bahamas in accordance with the obligations set forth in International Conventions to which The Bahamas is a Party. In accordance with the IMO Casualty Investigation Code, mandated by the International Convention for the Safety of Life at Sea (SOLAS) Regulation XI-1/6, investigations have the objective of preventing marine casualties and marine incidents in the future and do not seek to apportion blame or determine liability.

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1 GLOSSARY OF ABBREVIATIONS AND ACRONYMS

AB	Able Bodied Seaman
BMA	Bahamas Maritime Authority
°C	Degrees Celsius
CCTV	Closed-Circuit Television
CM	Crew Member
DOC	Document of Compliance
GMT	Greenwich Mean Time
ISM	International Safety Management
JSA	Job Safety Analysis
m	Meters
MLC 2006	Maritime Labour Convention
OOW	Officer Of the Watch
OS	Ordinary Seaman
PMS	Planned Maintenance System
PPE	Personal Protective Equipment
RCCL	Royal Caribbean Cruise Line
SQM	Safety Quality Management System
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers
STCW II/1	Mandatory minimum requirements from certification of officers in charge of a navigational watch on ships of 500 gross tonnage or more
STCW II/2	Mandatory minimum requirements from certification of masters and chief mates on ships of 500 gross tonnage or more
USA	United States of America
VHF	Very High Frequency communications

2 SUMMARY

The Bahamas registered passenger ship was undertaking a 12-day Mediterranean cruise with 2073 passengers and 777 crew, departing Barcelona on the 03rd September and calling at multiple ports before returning to Barcelona on 15th September 2019.

On the 5th September 2019 whilst the ship was alongside in Livorno, Italy. An experienced Ordinary Seaman (OS) was conducting maintenance to exterior windows of the Solarium on deck 9 and fell 30 meters into the water below. The OS survived the fall however despite a swift response, a rescue could not be achieved before the crew member (CM) disappeared beneath the surface of the water.

The maintenance task being conducted by the on board Deck department personnel was not a routine task as described by the standard operating procedures, nor was the location adequately designed to support personnel conducting maintenance on the external superstructure of the vessel.

The Deck department team assigned to the maintenance task conducted the task without adequate fall prevention device whilst utilising improvised securing techniques to achieve the maintenance task. Although the exact cause of the fall could not be categorically determined, it was determined that the crew member was not secured to the structure of the vessel by the two lanyards attached to his harness. On entering the water, the crew member was unable to maintain positive buoyancy as a required flotation device was not being worn.

A rescue attempt was initiated swiftly with the use of on board expertise and the starboard rescue boat. By the time both resources arrived at the known location in vicinity of the starboard quarter of the vessel, the OS was no longer visible on the surface of the water.

The investigation determined that no marine pollution occurred as a result of this very serious marine casualty.

3 DETAILS OF INVOLVED VESSEL(S) AND OTHER MATTERS

Details of vessel

The Vision of the Seas is a cruise passenger ship which has been registered under the flag of The Commonwealth of The Bahamas since 29th August 2002. Principal details as of September 2019 were as follows:

The vessel had the following principal particulars:

Call sign	C6SE8
IMO number	9116876
MMSI number	311321000
Built	St. Nazaire, France 1998
Length overall	245.08m
Breadth	32.2m
Depth moulded	15.85m
Propulsion power	34,000kW
Gross registered tonnage	78717tonnes
Net registered tonnage	46,471tonnes
Class Society	DNV GL
Class Notation	+1A1 Passenger ship EPR

The ship is owned by Vision of the Seas Inc., Monrovia (Liberia) and technical and safety management is performed by RCL Cruises Ltd., Weybridge (United Kingdom) and had been issued a Document of Compliance (DOC) under the International Safety Management (ISM) Code by the Bahamas Recognised Organisation DNV GL, based on the audit carried out in Weybridge on 03rd October 2018. The certificate was valid for five years until 07th November 2023 subject to the necessary audits.

Vessel Certification

Vision of the Seas was first registered with the Bahamas Maritime Authority (BMA) in 29th August 2002 and was classed with DNV GL Classification Society. At the time of the incident, the vessel complied with all statutory and international requirements

and certification. The ship held valid statutory certification required under International Conventions. Of relevance to this investigation are the following certificates:

- Classification Certificate (Full Term) – issued by DNV GL at Houston (USA), on 09th April 2018
- Passenger Ship Safety Certificate (Full Term) – issued by DNV GL at Hamburg (Germany), on 19th June 2019
- Load Line Certificate (Full Term) – issued by DNV GL on 05th March 2018. The certificate was endorsed for Annual Survey at Galveston (USA) on 27th March 2019
- Safety Management Certificate (Full Term) – issued by DNV GL on 31st July 2018, at Barcelona (Spain).

The vessel was subjected to a Bahamas Maritime Authority Annual Inspection at the Port of Barcelona (Spain) on 14th July 2019. No deficiencies or observations were identified.

The vessel had a Port State Control Inspection at the Port of Malaga (Spain) on 05th March 2019 with three deficiencies identified, none of which were relevant to this marine incident.

Weather

The weather on the 5th September 2019 in the port of Livorno, Italy was benign and although consideration was given to the weather, it was not determined to affect the task undertaken by the maintenance team. At 1100 local time the weather recorded was East South East wind at 5kts, gusting 10kts. Outside temperature was 23°C with no precipitation. The sea water temperature was 24°C and depending on a number of variables, the time taken before the crew member would ordinarily expect to display signs of hypothermia¹ would range between 20 – 35 minutes with a predicted survival time of between 2 and 3 hours².

Crew Member Details

The crew member who died as a result of falling from deck 9 was a 26 year-old Philippines national serving on board the Vision of the Seas as an Ordinary Seaman within the Deck department. He joined RCCL in August 2017, initially as a Junior Seaman and was soon promoted to Ordinary Seaman in May 2018. He commenced this contract, his sixth contract on this vessel, on 19th April 2019 and was due to sign off in January 2020. In January 2019 he underwent a medical examination and was issued with a medical certificate for service at sea in accordance with the provisions of the International Convention on Standards of Training, Certification and

¹ Below normal body temperature (may be clinically defined as a deep body temperature of 35 °C)

² Figures derived from: Review of probable survival times for immersion in the North Sea by D H Robertson and M E Simpson, issued January 1996 for Health and Safety Executive.

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Watchkeeping for Seafarers (STCW) 1978, as amended, Regulation I/9 and Maritime Labour Convention 2006 (MLC 2006) Regulation 1.2.

Over the course of his 2-year tenure on board Vision of the Seas he had consistently performed to a high standard and was held in very high regard by his colleagues and superiors alike. His performance was recognised in the Monthly Safety & Injury Prevention Divisional Meeting having been awarded the departments' 'Safest Performer' for the month of July.

The 1st Officer Deck on the 1200 - 1600 watch was a 29 year-old Argentine national who held national certification in accordance with the provisions of STCW II/2 and IV/2. He held an Endorsement issued by the Bahamas Maritime Authority in accordance with STCW Regulation I/10 in 28th November 2018. The Endorsement was valid until October 2023. He had joined the ship on 16th August 2019.

The Master of the ship was a 52 year-old Argentine national who held national certification in accordance with the provisions of STCW II/2 and IV/2. He held an Endorsement issued on 22nd July 2016 by the Bahamas Maritime Authority valid until 14th June 2021 in accordance with STCW Regulation I/10. He had joined the Vision of the Seas as Master on 10th August 2019. The Master did not stand a navigating watch but remained available to support any OOW whenever necessary.

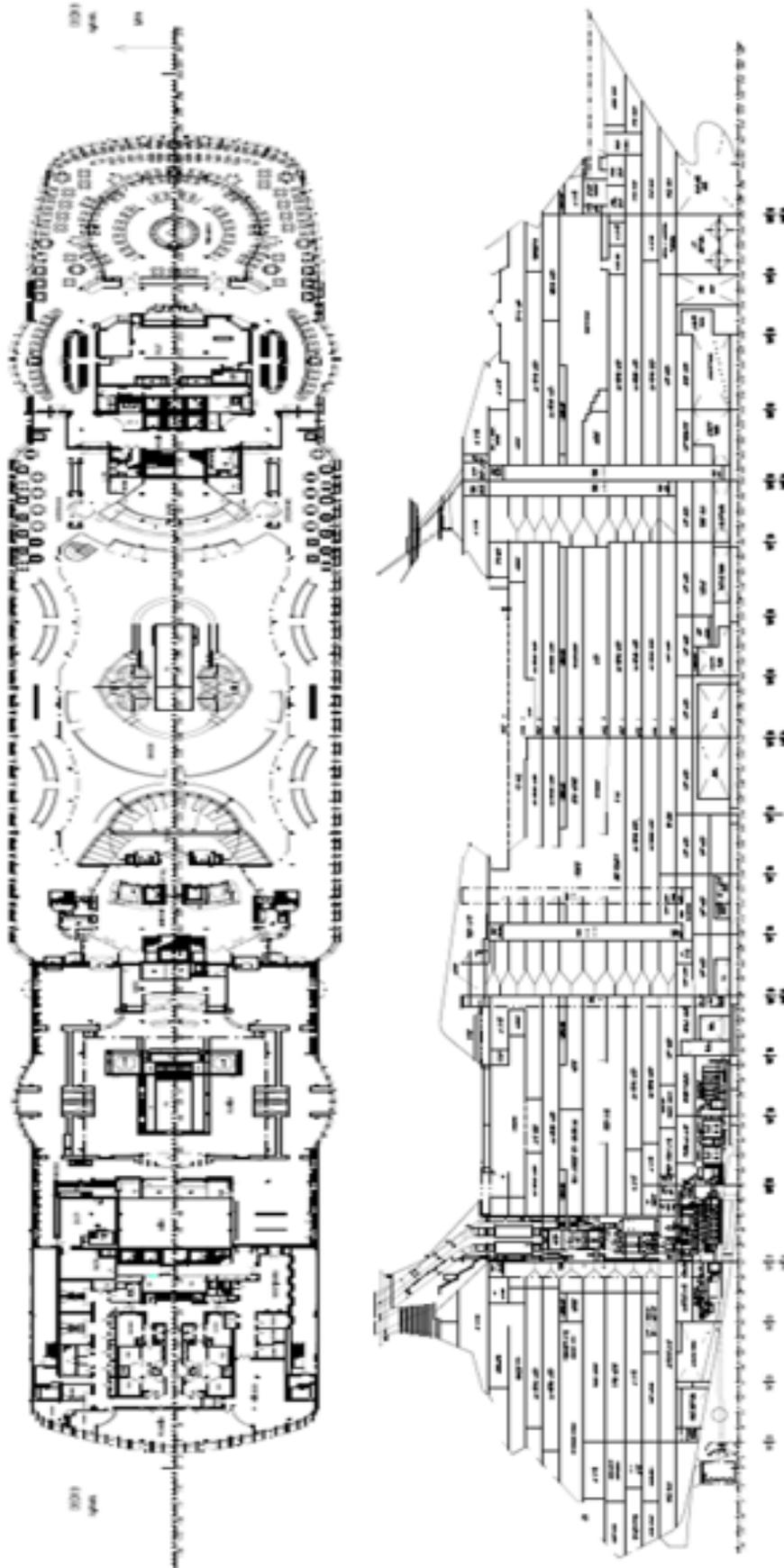


Figure 1: Vision of the Seas general arrangement plan (deck 9 & starboard side of vessel)

4 NARRATIVE OF EVENTS

All times are given in ship time (GMT+2)

The Vision of the Seas was engaged on a 12-day cruise which commenced on 03rd September in Barcelona (Spain). The cruise incorporated port calls in Villefranche-sur-Mer (France), Livorno (Italy), Civitavecchia (Italy), Salerno (Italy), Venice (Italy), Split (Croatia), Kotor (Montenegro) before returning to Barcelona (Spain) on the 15th September where guests disembarked.

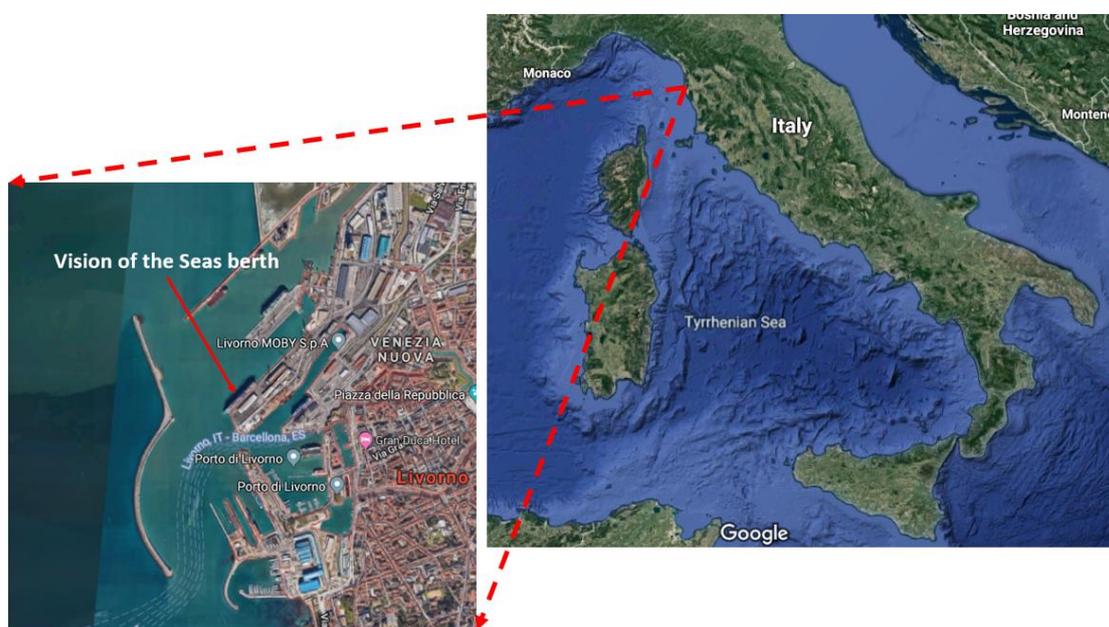


Figure 2: Geographic location of incident, Port of Livorno (Italy)

The ship arrived in Livorno (Italy) on the morning of the 5th September 2019. The Deck department personnel had been assisting with the berthing of the ship alongside the pier from approximately 0500 and released for breakfast at 0700. At 0800 the Bosun held a morning meeting in the Bosun's store assigning jobs to the deck personnel to be accomplished that day.

The Bosun assigned the 2nd Bosun, two Ordinary Seaman and one Able Bodied Seaman to the Solarium on deck 9 to commence maintenance on the internal and external windows located on the starboard side of the ship. Prior to the 5th September the same team of four Deck department personnel had been conducting maintenance on the port side Solarium windows. The planned maintenance system (PMS) required all the windows of the Solarium to undergo maintenance.

On completion of the morning meeting, the Solarium maintenance team which consisted of 2nd Bosun, one OS(2)³ and one AB left the Bosun store and made their way to deck 9, via various locations collecting the required equipment for the task. This included rigging of high-pressure air hoses on deck 10 midships.

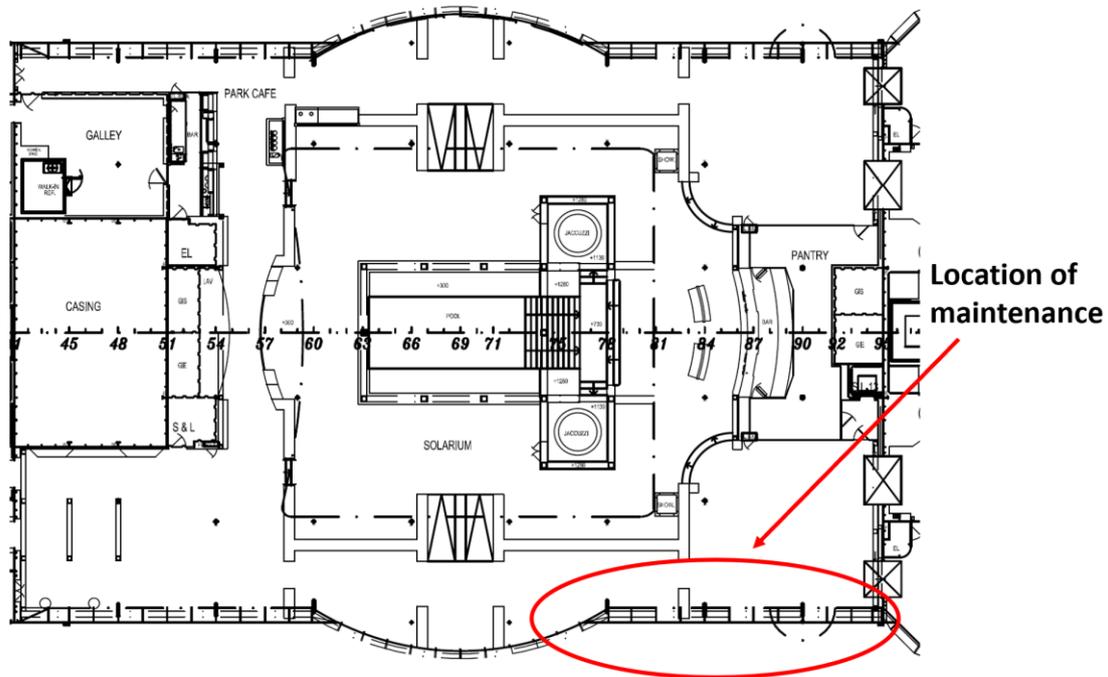


Figure 3: General arrangement plan of Solarium, location of incident circled

At approximately 0815 the second Ordinary Seaman (OS(1)) who had not been present at the Bosun’s morning meeting arrived at deck 9 to commence maintenance work on the windows as an additional member of the Solarium maintenance team. This crew member was late to the task as he was assisting the rigging of freshwater hoses for potable water.

Immediately upon arrival in the Solarium, the team commenced rigging of equipment required for the task whilst the two Ordinary Seamen started to don their respective safety harnesses. At approximately 0830 the first OS(1) connected to the external securing rail and stepped outboard of the ship and onto the catwalk located aft of frame 78. The second OS(2) followed and stood behind the first OS(1) on the catwalk whilst connected to the outboard securing rail.

³ For the purpose of this investigation, the fatality injured crew member will be referred to as OS(2) throughout the report.

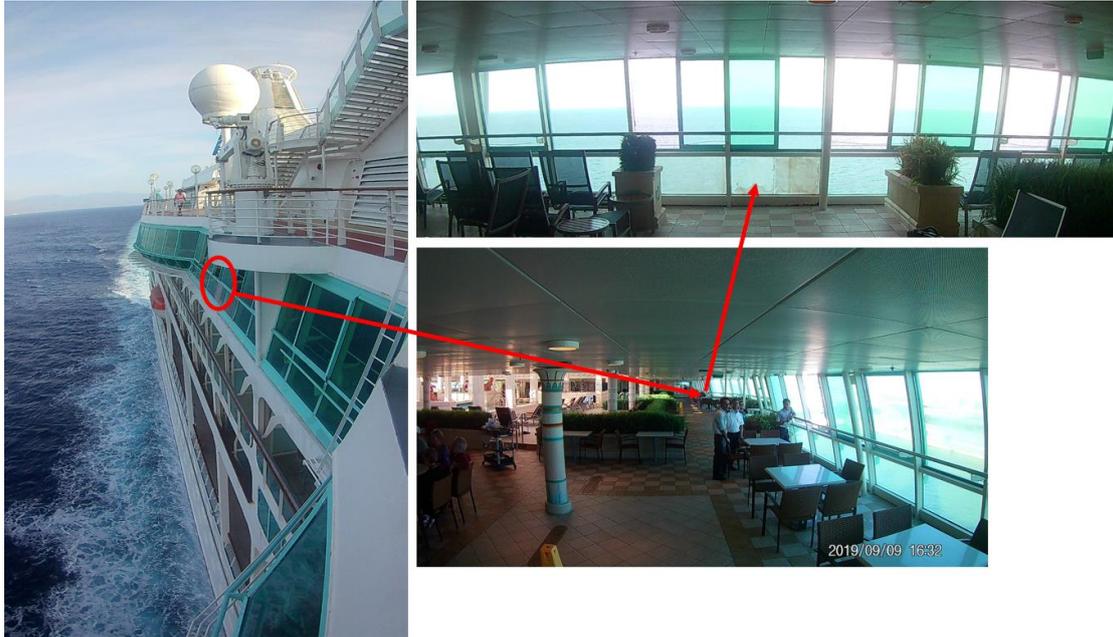


Figure 4: Internal and external view of the Solarium windows in the location of the maintenance work from the perspective of the internal CCTV camera (bottom right picture)

Maintenance began with the support of the 2nd Bosun and AB who were located inboard, cleaning and polishing the internal face of the glass. These two members of the team also assisted with moving, adjusting and connecting of safety lanyards and strops and provided equipment to the two team members working outboard on the catwalk.



Figure 5: External view of Solarium windows (starboard side), picture taken from deck 10 looking down

At 0920 OS(2) made his way inboard and proceeded up to deck 10. Whilst on deck 10 he met with the 1st Officer Deck who was walking around deck 10 inspecting the superstructure for defects. The two individuals talked for approximately 10 minutes

before the OS(2) made his way back down to deck 9 and the 1st Officer Deck continued his inspection walking aft along deck 10.

Shortly thereafter, at 0945 the maintenance team temporarily stopped work and went for a coffee break. The break lasted for 30 minutes before the team returned to deck 9, Solarium to commence the scheduled maintenance.

The two Ordinary Seamen donned their harnesses and stepped outboard of the vessel. In order to undertake the maintenance forward of the catwalk the two Ordinary Seamen, led by OS(1) connected their lanyards to the inboard handrail via a strop. Their feet at this point were positioned on top of the upper basket rail which is designed to support and carry the weight of the basket⁴.



Figure 6: External view of Solarium window (starboard side) looking forward

OS(1) was removing the old silicon sealant and replacing with new silicon sealant located between the frame and the glass. OS(2), who was stood aft of OS(1) who was polishing the external face of the glass with a mechanical polisher.

The two OS's continued with the maintenance in a forward direction, adjusting their lanyards and securing points to the inboard handrail as they went.

At 1121 the OS(2) who was located aft of OS(1) fell backwards whilst clutching his strop and lanyard in one hand. He entered the water face down and immediately started to swim to maintain buoyancy.

⁴ The basket is a piece of apparatus that is located beneath deck 9 and used for housing crew while they traverse the outboard side of the ship cleaning windows and balcony glass securely.

The 2nd Bosun called the bridge via the VHF handheld radio to inform the OOW that a man overboard had occurred on the starboard side. The bridge reacted swiftly and announced over the public address system “*OSCAR⁵ OSCAR OSCAR, starboard side*”.

The Man Overboard checklist was initiated on the bridge at 1122.

At 1122 the first lifebuoy was thrown into the water from deck 10, followed shortly thereafter by two more from deck 4 and deck 5 on the starboard side, at 15 second intervals.

Upon the first lifebuoy entering the water the OS(2) attempted to swim towards it. Before reaching the lifebuoy, a second lifebuoy was thrown overboard and landed closer to him. He then changed direction and attempted to swim towards the second lifebuoy. Before reaching the 2nd lifebuoy the OS(2) was seen struggling with progressively slower strokes and eventually, at 1124 the OS(2) was no longer visible on the surface of the water.

At 1126 the Master informed all shoreside authorities including the vessel’s Director of Marine Operations located in the United Kingdom and Livorno Port Control of the incident.

The starboard side shell gate located on deck 1 was opened at 1126. At 1127 the onboard Lifeguard jumped into the water and proceeded to swim aft, towards the last known position of the OS(2).

At the same time, the starboard rescue boat was launched in order to commence a search of the area.

Immediately after which at 1128 a second crew member jumped from the starboard side shell gate into the water to assist in the search effort.

The bridge issued a VHF “Pan Pan⁶” message requesting assistance from passing vessels and informing all vessels in the vicinity that the ship had a man overboard.

At 1136 propulsion was secured in anticipation of divers who had been requested by the Master via Livorno Port Control.

At 1147 four Italian Coast Guard Officers boarded the vessel from shoreside and commenced conducting an investigation into the circumstances of the incident. This investigation was later supported by three Immigration Officials who boarded the vessel at 1210.

⁵ Oscar is the designated code word for Man Overboard.

⁶ Pan Pan is an internationally recognised signal indicating an urgent situation has occurred from the issuing vessel. The message should be preceded by the nature of the urgency, in this case a Man Overboard.



Figure 7: CCTV imagery of rescue vessels attending the scene searching for the OS(2)

Local divers from Corpo Nazionale dei Vigili del Fuoco⁷ (CNVVF, National Firefighters Corps) were on scene at 1155 and two divers entered the water to search for the missing OS(2). The surface current was minimal which enabled the divers to focus their search in vicinity of where the crew member entered the water. However, visibility in the water was less than 1 meter making it very difficult for the divers to see. The search continued for a further two hours until at 1358 the divers recovered the body of the OS(2).

The vessel sailed later that day having been cleared by the local authorities, having participated in full with the Italian Coast Guard's investigation.

An investigator from the Bahamas Maritime Authority attended the vessel at its next port of call on the 7th September 2019 to commence a marine safety investigation.

⁷ Italy's institutional agency for fire and rescue service.

5 ANALYSIS AND DISCUSSION

Evidence Obtained

The evidence obtained during the course of the investigation was provided by witness testimony and CCTV imagery. There were two cameras located internally within the Solarium. One camera was obscured by a statue located between the camera and the work location. The second camera provided the optimum view of the work location, circled within figure 8.

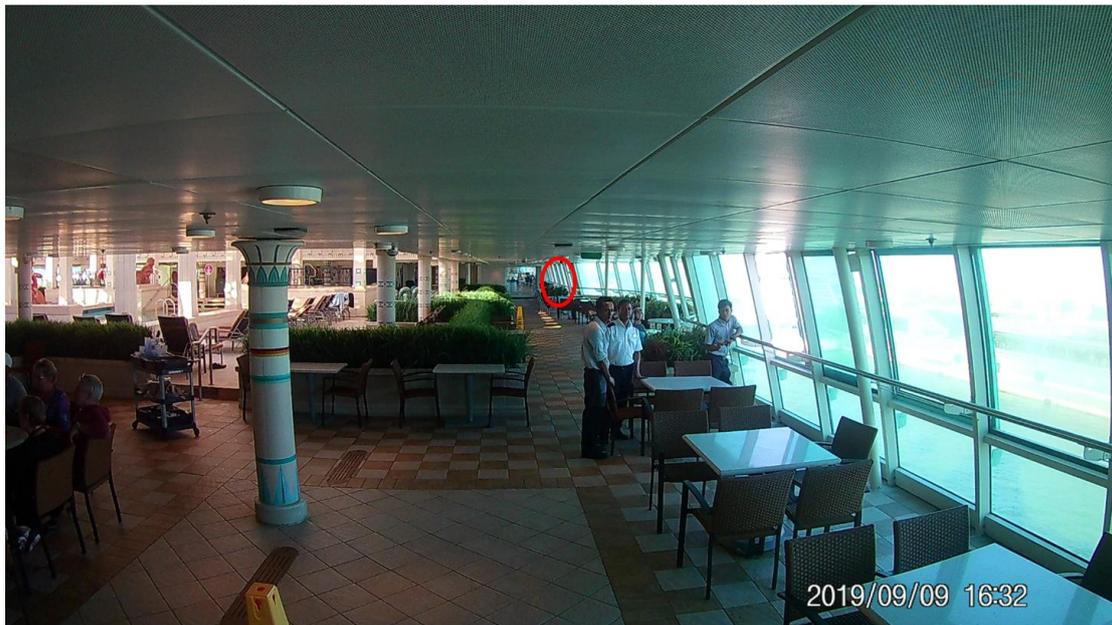


Figure 8: Picture taken from the perspective of the internal CCTV camera located aft of the Solarium (the area circled is the location of the maintenance work)

Externally, there were no cameras capturing imagery of the work being undertaken however there were several cameras with a view of the starboard side of the vessel, capturing the fall and subsequent actions at the waterline⁸ level.

Organisational Procedures

The windows located on deck 9, within the Solarium situated along the port and starboard side required maintenance. Glass maintenance is described within the SQM 4.01.10 as follows: *'After several years exposure to the elements and chemicals, consider window restoration using proper tools and products to remove scale and other contaminants'*. The windows required general maintenance which consisted of polishing the external face of the glass with a mechanical polishing machine, cleaning

⁸ The waterline is the line where the hull of a ship meets the surface of the water.

of the internal face of the glass and replacement of the silicon which secures the glass in the frame.

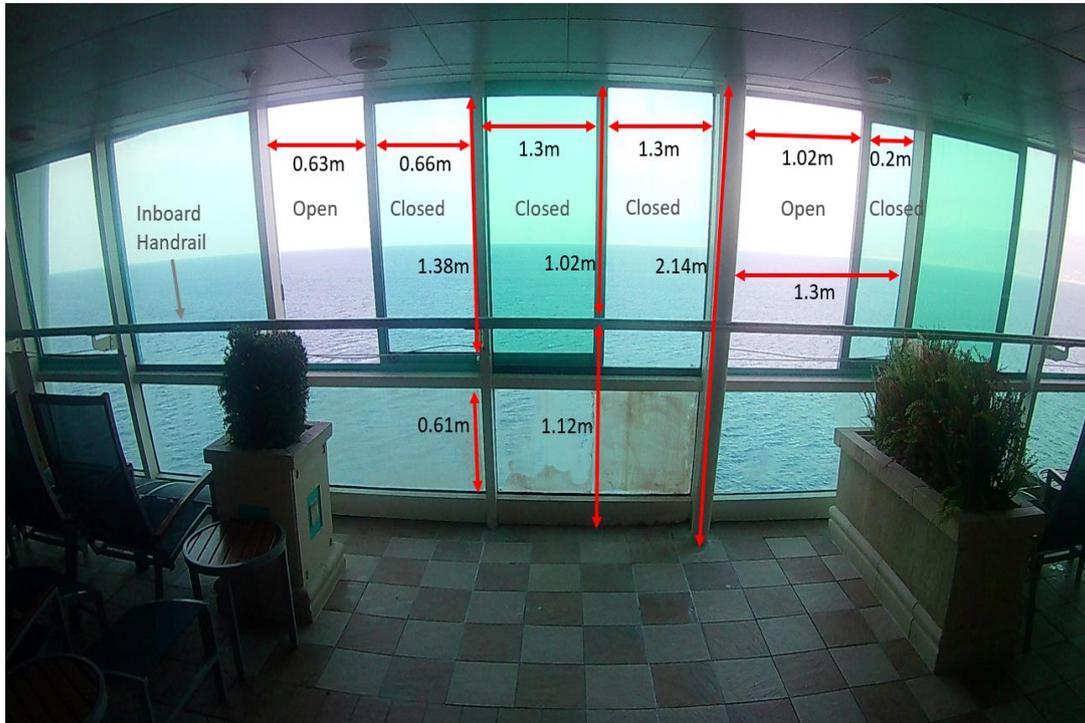


Figure 9: Dimensions of the starboard side windows of the Solarium where the maintenance and fall occurred

The Safety Quality Management System (SQM) procedure (4.01.10) for External Glass Cleaning stipulates who is responsible for the general maintenance, cleaning and rinsing of all external glass attached to the main structure. Under general definitions stated within the procedure, 'glass maintenance' directs users of the SQM policy to ensure that proper tools and products to remove scale and other contaminants is used and requires the users of this policy to strictly adhere to the product manufacturer's safety procedures and restoration instructions. SQM 4.01.10 does not provide instruction, direction or guidance to the maintainer on how to undertake the physical task of maintaining external windows with regard to specific locations, personal protective equipment (PPE) or general safety practices and therefore a Job Safety Analysis (JSA) process is to be followed in accordance with SQM 4.01.

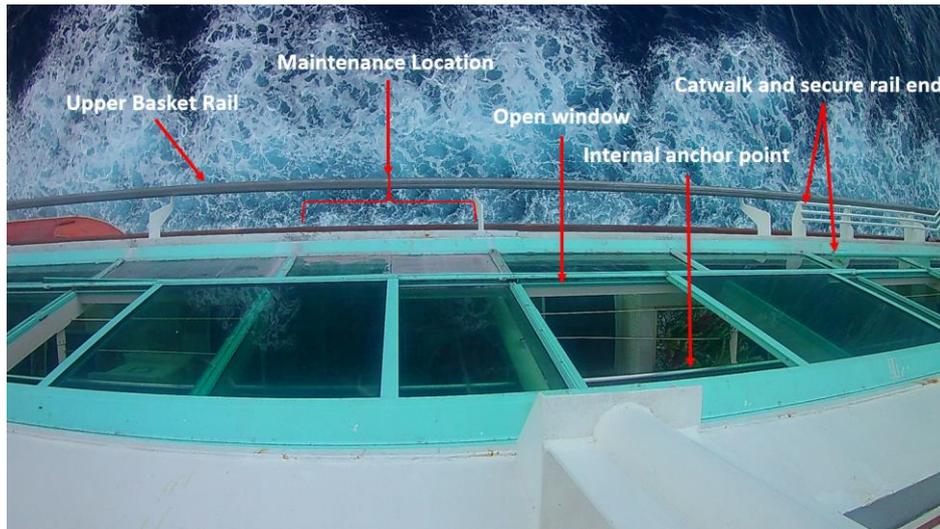


Figure 10: External view and description of safety apparatus of the starboard side Solarium windows in the location of the maintenance work and where the fall occurred

The work undertaken by the crew to maintain the exterior windows required a Permit to Work procedure to be completed. In addition to this, a Job Safety Analysis was also to be conducted as the task was not considered a routine in accordance with the on board standard operating procedures. Both Permit to Work and JSA were signed by the crew undertaking the task and by the Authorizing Officer (1st Officer Deck), Team Leader (2nd Bosun) and Supervisor (Bosun).

During the course of the investigation it was determined the correct procedure as described by the SQM for the production of the Permit to Work and JSA was not followed by the 1st Officer Deck who was responsible for deck maintenance. The correct procedure requires the Bosun to fill in the Permit to Work and JSA and then seek the approval of work, in accordance with the contents of the Permit to Work and JSA from the 1st Officer Deck prior to the commencement of work and upon completion of a safety brief and inspection of safety critical equipment. On this occasion the Permit to Work and JSA was signed in the early hours by the 1st Officer Deck when coming off watch at 0005, 8 hours prior to the commencement of work. Further, the 1st Officer Deck signed a blank Permit to Work and JSA without knowing fully the task to be conducted or the hazards presented.

It was determined by the 1st Officer Deck that he considered this as “normal” practice and nearly all occasions when a Permit to Work and JSA is required for deck maintenance he signed the permits in advance of the work commencing. This is a systemic failure to comply with the SQM policy and procedures and demonstrates a flagrant disregard of company safety practices.

A morning meeting amongst the Deck department personnel was held, led by the Bosun and attended by all Deck department personnel with the exception of an Ordinary Seaman (OS(1)) who was assisting with the embarkation of freshwater and the 1st Officer Deck who was in the process of conducting an inspection of deck 10.

Instructions were provided by the Bosun on the deck maintenance activities to be conducted throughout the ship before dividing the department into teams to disperse to conduct the maintenance. At no point during the morning meeting was a safety brief conducted, reminding personnel about the hazards, risk and subsequent prevention and mitigation techniques required for each task. The 2nd Bosun assigned as the Team Leader⁹ and supervising the maintenance being conducted on the Solarium windows on deck 9 did not provide a safety brief at the location of the maintenance nor checked the team's safety equipment as required by the SQM. The third member of this maintenance team, the OS(1), arrived after the team had commenced work. Upon arrival he was instructed to sign the JSA but was not given a safety brief nor was his personal protective equipment verified by the Team Leader. Further evidence was provided upon examination of the CCTV when it was identified that a *'two person check on equipment condition and to ensure it is secured properly'*¹⁰ did not take place prior to commencing the job.

Human Element

A Monthly Safety & Injury Prevention Divisional Meeting is held by the Supervisor of the department (1st Officer Deck) and attended by all Deck department personnel.

The meeting is designed to identify hazards, review injuries sustained, review pending safety items, employee safety concerns and record any training conducted during the monthly meeting. The minutes of the last three meetings (June, July, August) were reviewed and one common theme is recorded in all three meetings. The theme recorded is titled *"Inspection of the pipes for attaching safety harness"* and specifically refers to concerns raised during the course of the meeting in regard to a request to have all pipes (external secure anchor points) to be replaced with wires identical to those fitted on the Quantum¹¹ class ships. It was determined during the course of the investigation that this request was not included within the vessel maintenance schedule or dry dock schedule.

The minutes state: *"by the time being at first opportunity welding has to be done on some of the brackets and one missing bar to be installed"*. This information was documented however no evidence exists as to who received or whether it was acknowledged by the shore team. As there was no external pipe or secure anchor point in the location of the fall, this observation raised within the minutes is not directly related to the incident. However, it does provide an indication to the investigator that this observation recorded during the meeting did not receive the appropriate attention by the required authority to action the concerns raised, given the same concern was raised every month, for three continuous months.

⁹ Team Leader is identified within SQM 4.02 as the responsible person to ensure that the crewmember has all PPE required; that the crewmembers properly use the equipment; and, properly completes the Working Aloft and Overboard Permit.

¹⁰ As stipulated within the JSA under Controls and Barriers

¹¹ Currently four ships within this Class; Quantum of the Seas, Anthem of the Seas, Ovation of the Seas & Spectrum of the Seas built between 2014 – 2019.

In the same document, it is reiterated the importance of following the correct procedure for a permit to work. It states: *“Follow work permits, fill them up properly, do not skip steps and sign in an appropriate place. Always have a permit at location of work. Do not take shortcuts”*. The actual process undertaken in reality undermined the effectiveness of this statement given the procedure for completing a permit to work was known to be incorrectly followed by three senior Deck department personnel. This demonstrates that the three senior Deck department personnel understood the correct procedure but failed to implement it.

The SQM procedure for working aloft and overboard (4.02) describes the requirement to wear a flotation device¹² when working over the side and above water at a height in excess of 2m. The corresponding risk assessment described within the required Permit to Work does not mention this requirement however the Job Safety Analysis accompanying the Permit to Work stipulates that a life vest should be worn when working over the side and above water.



Figure 11: (A) life vest and (B) life jacket available on board for use by crew members

No life vest or flotation device (figure 11 left (A) and right (B)) was worn by the OS(2). It was well known and accepted by Deck department personnel, from the Staff Captain to the Ordinary Seaman on board, that life jackets were considered dangerous on account of the injuries that could be sustained on entering the water from any height. Further, the opinion shared amongst the same individuals when knowingly required to wear a life vest or life jacket is that it cannot be worn as it restricts the wearers ability to move freely and is deemed very uncomfortable. It was determined through witness testimony that discussions during the Shipboard Safety Steering Committee Meetings¹³ held on board that sections of the SQM and JSA regarding the wearing of a flotation device of any kind does not apply. However, no record of those discussions was documented within the minutes of the Shipboard Safety Steering Committee Meeting. The OS(2) who fell, entered the water wearing a harness,

¹² Of an approved type

¹³ The decision was made during Shipboard Safety Steering Committee Meeting, which was attended by the Department Heads, Chief Officer Safety and under the responsibility of the Master.

coveralls and safety shoes. As he entered the water, he maintained sufficient buoyancy to swim to a life buoy which was released upon the alarm being raised¹⁴. Unable to reach this life buoy he altered direction and swam to an alternate life buoy that was located closer. This indicates that the OS(2) was conscious and capable of making decisions in order to seek a flotation device. Unable to reach the life buoy, the OS(2) remained afloat for 3 minutes and 10 seconds before sinking beneath the surface of the water. If the OS(2) had been wearing an operational flotation device the likelihood of it keeping the individual buoyant to prevent drowning is considered probable.

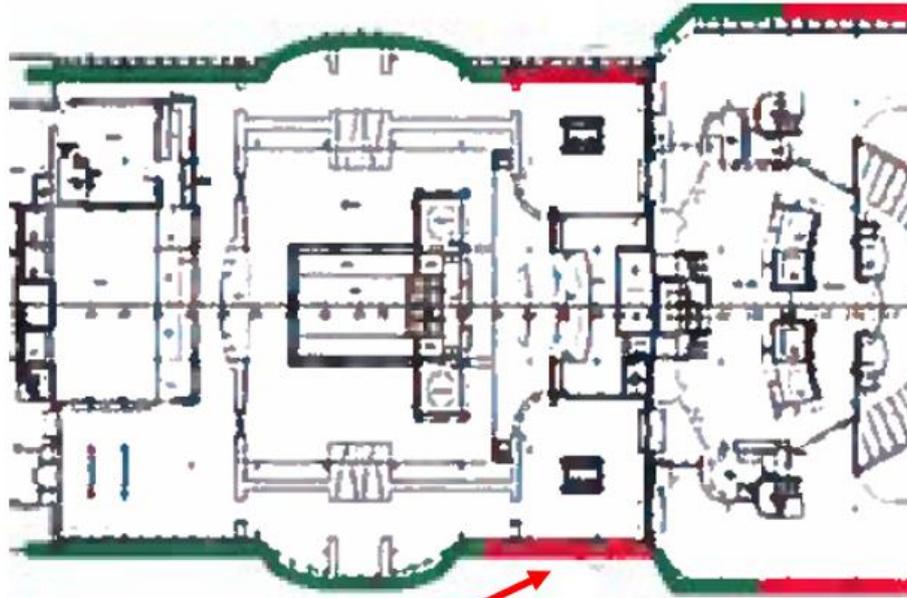
Fall Prevention

The proper procedure for amending an SQM was understood on board however no attempt to raise this procedural change requirement through the proper channels was sought and as such, local arrangements were made to the detriment of safety.

On the 31st August 2019, the port side external windows of the Solarium underwent the identical maintenance plan in the port of Livorno, approximately one week prior to the incident. It is known that no incident occurred during the maintenance of the external windows of the Solarium on the port side of the vessel. The identical technique in terms of working aloft and overboard was employed on the starboard side, as was tried and tested on the port side. It was determined during the investigation that the port and starboard external windows in vicinity of the Solarium are not provided with an external platform¹⁵ or external securing mechanism. As can be seen in figure 12 the ‘catwalk’ stops and does not continue until outside the pool area on deck 9, approximately 15m in length.

¹⁴ OSCAR OSCAR OSCAR starboard side.

¹⁵ Often referred to as a ‘catwalk’



Location of fall

Figure 12: General arrangement of deck 9 external catwalk and safety rail locations. Area highlighted in red depicts no catwalk or safety rail, area in green depicts external catwalk and safety rail present

At this point, the maintenance of external windows cannot be easily achieved and is described within SQM 4.02 as inaccessible by virtue of there not being a platform/basket or shoreside equipment available. It recommends that the use of ladders, stages, bosuns chairs should be *“used with caution. The use of such equipment should be limited and considered only when an area is inaccessible.”* The investigation determined that the use of ladders, stages or a bosuns chair was not used nor was it considered by the Authorizing Officer, despite reservations raised as to how to safely navigate the external 15m section which was void of a catwalk or external securing mechanism.



Figure 13: External 15-meter section of missing catwalk and safety rail in the location where the maintenance work and fall occurred

The JSA requires any CM working aloft to be secured at all times to at least one securing point. Both crew members working over the side were provided with a full body harness¹⁶ and two energy absorbing lanyards with one hook connected to each lanyard.



Figure 14: Full body harness as worn by the OS(1) and OS(2) with 2 energy absorbing lanyards with hooks attached

¹⁶ Full body harness manufactured by MSA, model V-Form No. C10180137 constructed from polyester. Date of construction 01/2018, date first used on board 08/2019, expiration date of harness 01/2028. The policy on board requires the Harnesses to be discarded 10 years after manufacture or 5 years from when first put in use, whichever is shortest.



Figure 15: Energy absorbing lanyard connected to the harness with a locking carabiner

Both crew members had undertaken training on the use of the harness and could demonstrate how to properly secure the lanyard to a fixed secure anchor point. As there were no external securing points on this section of the Solarium the two OS's had to improvise and utilise the internal handrail running fore and aft along the length of the Solarium as indicated in figure 16.

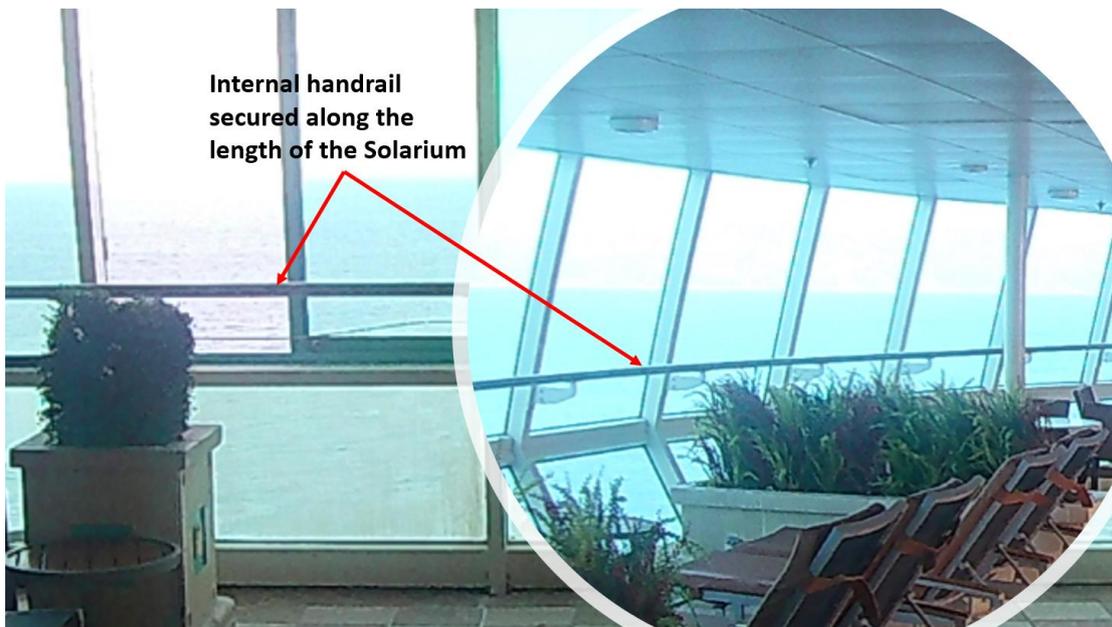


Figure 16: Internal view of the Solarium and handrail used as a secure anchor point

This restricted the free movement of each crew member as the hooks could not run unobstructed along the length of the Solarium. The window structure, by design, required the OS(2) to connect and disconnect more frequently in order to reach the glass that required maintenance either side of the window frame. The SQM 4.02 (working aloft and overboard) states: *'lanyards and lifelines are to be attached to an anchor point at all times during work. When moving from point to point, a two-lanyard method is to be employed'* as described within figure 17.



Figure 17: Diagram obtained from SQM 4.02 describing 2-lanyard method of connecting to two secure anchor points

It is known that the point at which the crew member fell, neither lanyard was attached to an anchor point. The Italian Coastguard conducted an inspection of the harness, lanyard and hook and found no defects. It is understood but cannot be categorically determined as no CCTV captured the precise location of the fall, that the OS(2) may have been adjusting the length of one lanyard by using a strop which was known to be wrapped¹⁷ around the handrail prior to the fall. It was acknowledged by the Deck department personnel that using a strop in this method was forbidden.



Figure 18: Description and dimensions of single strop connected via choker method to the internal handrail within the Solarium

¹⁷ Method used is a choker knot as demonstrated within figure 18, photo B

The strop used was not a designated safety critical piece of equipment for the purpose of securing a lanyard to a securing point and is not covered directly by a safety policy or instruction. As can be seen within figure 19, the hook provided with the lanyard and attached to the harness will connect directly to the internal handrail without the need for a strop. The strop was determined by the maintenance team to be a necessity in order to extend the reach of the OS(2) in between the open window frames so the OS(2) could conduct maintenance furthest from the securing point. Additional risk was therefore introduced by this adhoc securing method which was in violation of the SQM procedure which requires the lanyard and lifelines to be attached to a secure anchor point at all times.



Figure 19: Demonstration of lanyard hook connected to internal handrail and dimensions

Within SQM 4.11.02 titled ‘General Safety Standards’ it states that when performing a job: *‘Do not use temporary solutions or arrangements that could compromise safety. In rare instances when a temporary solution is necessary, obtain the approval of you your supervisor to use it. Replace or correct it with appropriate equipment or procedure as soon as possible. While using the temporary solution, make others aware of it.’* It could not be determined during the course of the investigation if it was the understanding of the Supervisor that the use of a strop constituted a temporary solution or arrangement. However, on the basis that a strop is not a secure anchor point, this arrangement contradicts the procedure for Working Aloft and Overboard (SQM 4.02) as lanyards and lifelines are to be attached to an anchor point at all times during work. In accordance with SQM 4.02 it defines a suitable anchor point as a *‘bulkhead or other steel support, such as railings or frames’*. Therefore, a strop is considered a temporary securing method and as such approval for use should have been sought from the Supervisor. The temporary arrangement employed by the team in attaching the harness to a secure anchor point via a strop was not considered by the Team Leader to be temporary as it had been used on previous occasions, in particular on the port side of the external Solarium windows the week prior.



Figure 20: Actual image of the scene immediately after the incident. The strops used were known to be used by the OS(1). The pictures on the right was a demonstration to the Italian Coast Guard Officers on how the crew members connected to a single strop using both lanyard hooks.

Securing Mechanism Design

The location of the fall the OS(2) was stood on top of a metal circular tube designed to support the basket when cleaning and maintaining external windows beneath the Solarium. The circular tube was not designed to be stood on. No secure external anchor point existed on the external superstructure of the vessel in vicinity of the Solarium windows as seen in figure 21.

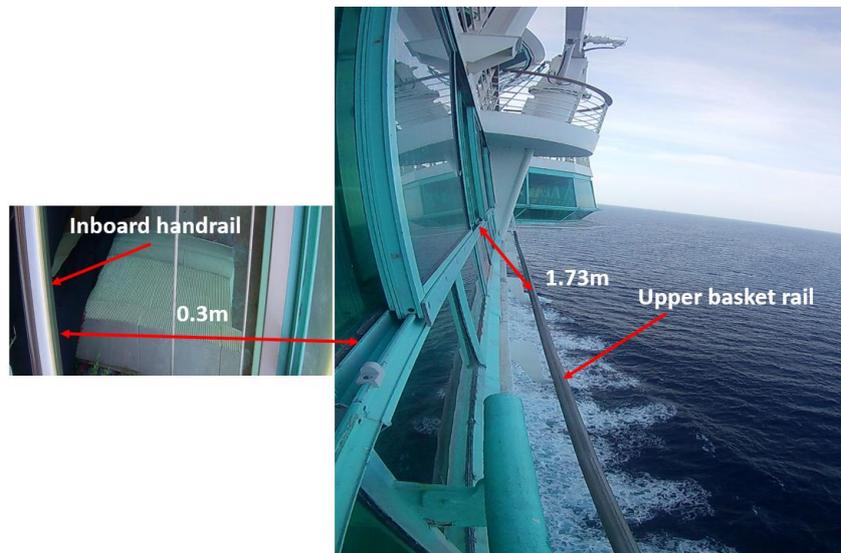


Figure 21: Dimensions of the internal handrail and external basket rail taken from the frame of the window of the Solarium in the location of incident

The lack of an adequate external catwalk and safety rail did significantly reduce the manoeuvrability of both crew members working externally with the safety equipment provided. As demonstrated in figure 22, the maximum length of the harness with

lanyard attached is 1.23m to the centre of the wearers back. The distance from the internal handrail (known securing point used) to the the centre of the precise work location was 2.25m. When being worn by the crew member who is 1.70m tall, the individual would be able to reach the centre of the work location but would be unable to extend a reach beyond that point. Therefore, the use of a strop would have provided an additional 0.6m of reach affording the individual more room to manoeuvre. A further strop attached to another strop was also utilised as indicated in figure 20 to further increase the users reach by an additional 0.6m.

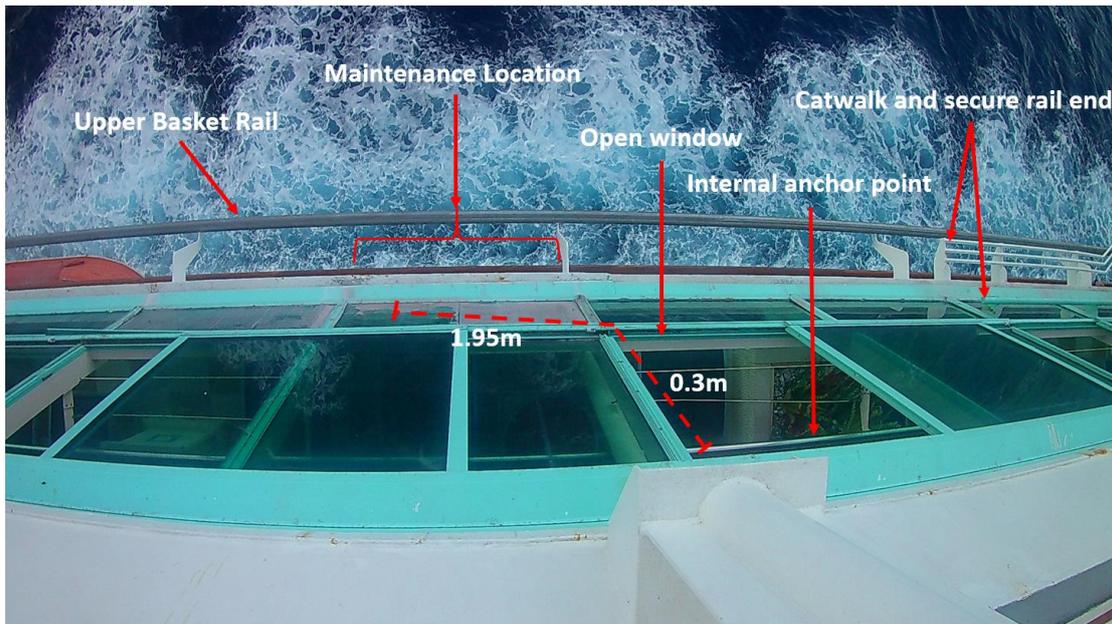


Figure 22: Location of the incident with distances taken from the known secure anchor point (internal handrail)

The Vision of the Seas was designed without a catwalk or securing mechanism in a number of locations on the external superstructure on deck 6 and deck 9. In total 283m of catwalk across deck 6 and deck 9 respectively is not fitted. The Staff Captain had identified that conducting maintenance to the external superstructure in these locations was “*less safe as no access is provided for maintenance*” compared to areas of the vessel where a catwalk and a securing mechanism was present. In September 2017 a proposal to install a catwalk and adequate securing mechanism in all vacant locations was devised and submitted for approval in a dry dock work specification proforma. The work requested was declined but no reason was provided.

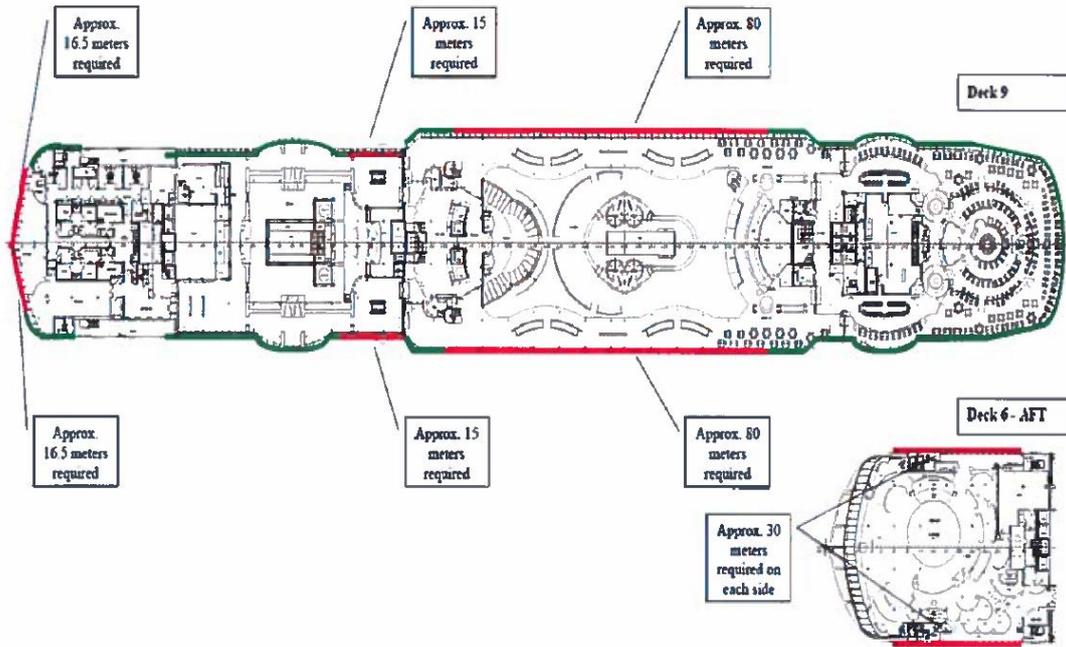


Figure 23: General arrangement plan of catwalk and external rail proposal submitted to indicate locations (red line) where catwalk and rail are not present.

Fatigue and Resource Management

The Staff Captain is ultimately responsible for the proper implementation of the procedures for Working Aloft and Overboard (SQM 4.02). Each Department Head is responsible to ensure that the policy is being followed within their designated area. In the case of the 1st Officer Deck, he is responsible, under the authority of the Staff Captain for the Deck Department and their activities on board Vision of the Seas.

Neither the Staff Captain who is a not a watch keeper nor the 1st Officer Deck exceeded their maximum hours¹⁸ of work for the period in question. The 1st Officer Deck is a watch keeper and is required on the bridge for navigational duties for 8 hours per day. The remaining period of a standard 24-hour day is to be used to manage the Deck department and achieve sufficient rest to remain compliant with MLC, 2006 convention. Although fatigue was determined not to be a contributory factor given all crew members involved with the maintenance and management of the task remained within the allowable working hours. However, the 1st Officer Deck raised concerns to the investigator of his ability to fulfil his responsibilities. In a 7-day period the 1st Officer Deck will have approximately 10 hours of available time in which to conduct his duties. The majority (8-hours) will be undertaken on the bridge (navigational watch) leaving 2-hours to manage the Deck department and their respective activities.

¹⁸ Maritime Labour Convention, 2006, as amended. Adopted by the International Labour Conference at its 94th (Maritime) Session (2006). Regulation 2.3 (Hours of work and hours of rest) mandates that a crew member shall not exceed 14 hours work in any 24-hour period; and, 72 hours work in any seven-day period.

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The Staff Captain delegates the responsibility for the proper implementation of the policies in relation to working aloft and overboard to the 1st Officer Deck who in turn has 2 hours per day in which to ensure the safe conduct of each task is complete, identify maintenance requirements, verify compliance with policies to ensure a safe working environment. It is considered that this is an unrealistic time frame in which to contribute effectively to the overall safety and welfare of Deck department personnel.

6 CONCLUSIONS

The maintenance task to be conducted by the Deck department personnel was not considered a routine task as described within the SQM policy due to a temporary securing method being utilised in lieu of any readily available, adequate external infrastructure.

The SQM policy does not provide a detailed description of the task of maintaining external windows, therefore requiring the correct adoption and implementation of a JSA.

It was determined that despite the JSA being signed by a Supervisor, Team Leader and those crew members participating in the task, not all conditions specified in the permit to work and JSA were adhered to which is in contravention of the required procedure.

The process used to initiate and evaluate the potential risk of the maintenance task was incorrectly administered. A blank permit to work was signed by the Supervisor undermining the process and purpose of evaluating any potential risks. It was determined during the course of the investigation that this Supervisor considers this practise routine and is understood to have conducted similar practices on previous contracts fulfilled on other RCCL vessels. No subordinates questioned this practice and participated fully in the execution of falsifying information on required permits.

Considering the above, the practical application of assessing the risk and following safety procedures in the conduct of a task was no more than a paper exercise.

Although the personal protective equipment worn by the OS(2) did not fail, the harness did not undergo a two person check immediately after donning and prior to commencing the work and therefore its condition could not be known or verified prior to the fall.

The correct procedure was not followed by either OS when moving between one location and another while working overboard. Had a two-lanyard method of securing to an anchor point been adopted, the likelihood of falling 30m into the water below would be considered extremely low.

The lack of adequate external securing anchors in the proximity of the Solarium windows, resulted in the OS(2) having to connect to a secure anchor point inside the frame of the window. This shortened the available reach and as such a temporary solution was determined necessary in order to conduct the maintenance required. The temporary solution complicated the securing method by introducing another failure mechanism in the form of a strop. The strop therefore had to be looped inside itself to provide an anchor point increasing the risk of confusing the secure end of the strop with the loose end.

Conducting the task without the appropriate equipment required in accordance with the procedures (SQM 4.11.02 and SQM 4.02) was not questioned primarily because no alternative solution was available despite the Supervisor's reservations on how to achieve the task in that particular location. The Supervisor did not bring these reservations to the attention of a Supervisor or stop the work entirely until all risks were fully evaluated.

The catwalk fixed to the external superstructure was vacant in the location where the maintenance was to be conducted and the fall occurred. An alternative option¹⁹ was available to the team conducting the maintenance externally without utilising an 80mm circular tube in which to stand on. Despite the Supervisor's reservations in regard to its suitability, the crew members continued with the task required of them. At no point was an additional risk assessment, utilising the Job Safety Analysis conducted to assess the inherent dangers posed by this improvised method.

The investigation raised doubts about the understanding of safety at the on board management level. Due to the lack of supervision in the workplace, it was effectively left to the individuals conducting the task to eliminate any and all observed safety risks.

Without sufficient managerial oversight, the level of authority ensuring a safe working environment was diminished and as a consequence, compliance with the various internal Company policies went unheeded.

RCCL require all personnel working aloft and overboard to wear a flotation device. No flotation device was worn by the OS(2) who, on entering the water was unable to maintain positive buoyancy. The SQM does not specify which flotation device is to be worn when working over the side, however the JSA does stipulate that a life vest should be worn. Despite both options, a life jacket and a life vest being readily available on board, the decision was made by the senior leadership and endorsed by the Deck department personnel that a flotation device of any sort would not be worn. There is no doubt that had a flotation device been worn, positive buoyancy would have been maintained and as such the recovery of the OS(2), from the water would have been achievable.

¹⁹ SQM 4.02 states: For work over the side of the ship, the rigging of ladders, stages, bosuns chair should be done with caution, Use of such appliances should be limited and considered only when an area is inaccessible by other means such as maintenance platforms/baskets or shore side equipment.

7 LESSONS LEARNED

Working at height whilst overboard without wearing an appropriate flotation device is hazardous and in the event of a fall into the water, a flotation device will provide positive buoyancy enabling search and rescue teams the opportunity to find and recover.

Adequate resources should be made available to ensure experienced personnel are available to oversee the maintenance procedures ensuring all safety procedures are implemented and verified.

When working at height on board a ship, appropriately designed structures and equipment shall be in place to support and secure any individual.

Adequate risk assessments shall be conducted and utilised to assess all risks. The risks and hazards identified should then be discussed with the team conducting the task to ensure thorough understanding.

Adhering to procedures is a fundamental requirement in achieving safe working practices. In this instance, adhering to the 2-lanyard method of securing to a secure anchor point would have prevented the fall.

8 RECOMMENDATIONS

Royal Caribbean Cruise Line is recommended to:

Consider providing a secure installation by which crew members can adequately conduct maintenance on the external Solarium windows.

Require all personnel working overboard and at height²⁰ to wear an approved floatation device.

Require all personnel working aloft to secure themselves to a secure anchor point by the 2-lanyard method at all times.

Consider a review of the responsibilities required of Supervisors in relation to their capacity to manage department activities in consideration of Maritime Labour Convention requirements.

Consider a thorough review of the Safety Quality Management System specific to working aloft and overboard to remove discrepancies and align procedures across the system, ensuring that the required policies are adhered to and procedures implemented.

²⁰ Working at height is defined within SQM 4.02 as a height greater than 2 meters

9 ACTIONS TAKEN

Royal Caribbean Cruise Line has taken the following actions:

Risk Management in conjunction with Maritime Safety issued a fleetwide working aloft safety bulletin requiring a review of all working aloft policies and procedures as well as identification and inspection of working aloft equipment on board each vessel.

Royal Caribbean has contracted with an industry leading working aloft/fall protection company to visit the vessel and provide an assessment of fall protection equipment and a review of working areas of open decks where fall protection is required.

An analysis of the demands on the Maintenance Officer is underway focusing on deck and safety related responsibilities, class of ship, itinerary and compliance with Maritime Labour Convention requirements.

A review of the Company's working aloft permit is underway, including the possible use of auto-inflating flotation devices when working over the side.
