Report on the investigation of

an accident which caused major injury

to an engineer officer on board

Royal Princess

NE traffic lane, Dover Strait TSS

4 August 2001

Marine Accident Investigation Branch
First Floor
Carlton House
Carlton Place
Southampton
United Kingdom
SO15 2DZ

Report No 34/2002
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Extract from

The Merchant Shipping

(Accident Reporting and Investigation)

Regulations 1999

The fundamental purpose of investigating an accident under these Regulations is to determine its circumstances and the cause with the aim of improving the safety of life at sea and the avoidance of accidents in the future. It is not the purpose to apportion liability, nor, except so far as is necessary to achieve the fundamental purpose, to apportion blame.

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

2EO	-	Second Engineer Officer
3EO	-	Third Engineer Officer
cm	-	centimetre
FCN	-	Fleet Cautionary Notice
IMO	-	International Maritime Organization
kW	-	kilowatt (unit of power)
MCA	-	Maritime and Coastguard Agency
MGN	-	Marine Guidance Note
MSN	-	Merchant Shipping Notice
TSS	-	Traffic Separation Scheme
UTC	-	Universal Co-ordinated Time
VER	-	Voyage Event Recorder

SYNOPSIS

In the early hours of the morning of 4 August 2001, a third engineer officer (3EO) on board the P&O Princess Cruises vessel *Royal Princess*, was seriously injured when a power-operated watertight door closed, trapping his arm. He suffered extensive crush injuries which subsequently necessitated its amputation. The MAIB was informed of the accident later that morning and, after further enquiries, an investigation began 2 days later.

At the time of the accident, the 3EO was carrying out the first machinery space rounds of his watch. The precise circumstances of the accident are not known, but he had not waited for the door to open fully, and had set the door to close before starting to pass through. His boilersuit became snagged, or something else caused him to hesitate and momentarily delay or abort his progress through the door, which was enough to cause the accident.

The accident occurred because the 3EO did not comply with operating instructions with which he was familiar. His judgment was possibly influenced by fatigue brought on because he had just changed his watchkeeping routine. Additionally, the written instructions on board for the operation of the doors existed in three different versions, all of which were safe if applied, but, all of which in the MAIB's opinion were unnecessarily onerous for day-to-day operation. The unwritten accepted practice was different again. The number of doors that needed to be negotiated during routine machinery space rounds, and the time it took to operate each in strict accordance with instructions or accepted practice, led to the probability that short-cuts would be taken for expediency.

The MCA is recommended to review the rules and guidance concerning where, and when, power-operated watertight doors should be kept closed at sea, and the current guidance on operating procedures contained in Marine Guidance Note (MGN) 35, with the objective of encouraging compliance. Recommendations are also addressed to P&O Princess Cruises.

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *ROYAL PRINCESS* AND ACCIDENT

Vessel details

Manager	:	Princess Cruises, Santa Clarita, California
Port of registry	:	London
Flag	:	UK
Type	:	Passenger ship
Built	:	1984, Finland
Classification society	:	Lloyds Register of Shipping
Length overall	:	230.61m
Gross tonnage	:	44,588
Engine power and/or type	:	4 Pielstick Diesel Engines/23,200kW 2 controllable pitch propellers
Service speed	:	21.5 knots
Other relevant info	:	2 bow thrusters

Accident details

Time and date	:	0105 (UTC+1) 4 August 2001
Location of vessel	:	North-east lane of Dover Strait TSS
Location on vessel	:	No 2 watertight door, between Nos 2 and 3 pump rooms
Injuries	:	Major injury to third engineer officer
Damage	:	None

Royal Princess was fitted with a Voyage Event Recorder (VER) manufactured by Broadgate Ltd

1.2 BACKGROUND

Royal Princess is one of a number of large passenger cruise vessels owned by the P&O Princess group and operated by Princess Cruises. In August 2001, she was conducting a round-Britain cruise and had embarked over 1000 passengers in Southampton the day before the accident.

1.3 NARRATIVE

All times given are ship's time (UTC+1)

Royal Princess left Southampton to start a round-Britain cruise at about 1700 on 3 August 2001. At midnight, she was in the Dover Strait traffic separation scheme on the first leg to Rosyth. In accordance with statutory regulations which require watertight doors to be shut in certain situations, the vessel was deemed to be in a potentially hazardous situation; a fact which had been communicated to the relevant heads of department before her departure **(see Annex 1)**.

The engine room watch changed at midnight. The machinery was operating correctly and the watch hand-over was routine. The new watch consisted of a second engineer officer (2EO), a third engineer officer (3EO), a cadet and a motorman.

The watchkeepers had brought food to the control room and the watch began with the 2EO, 3EO and the cadet talking and eating snacks. At 0045, the 3EO left the control room to begin his rounds of the machinery spaces.

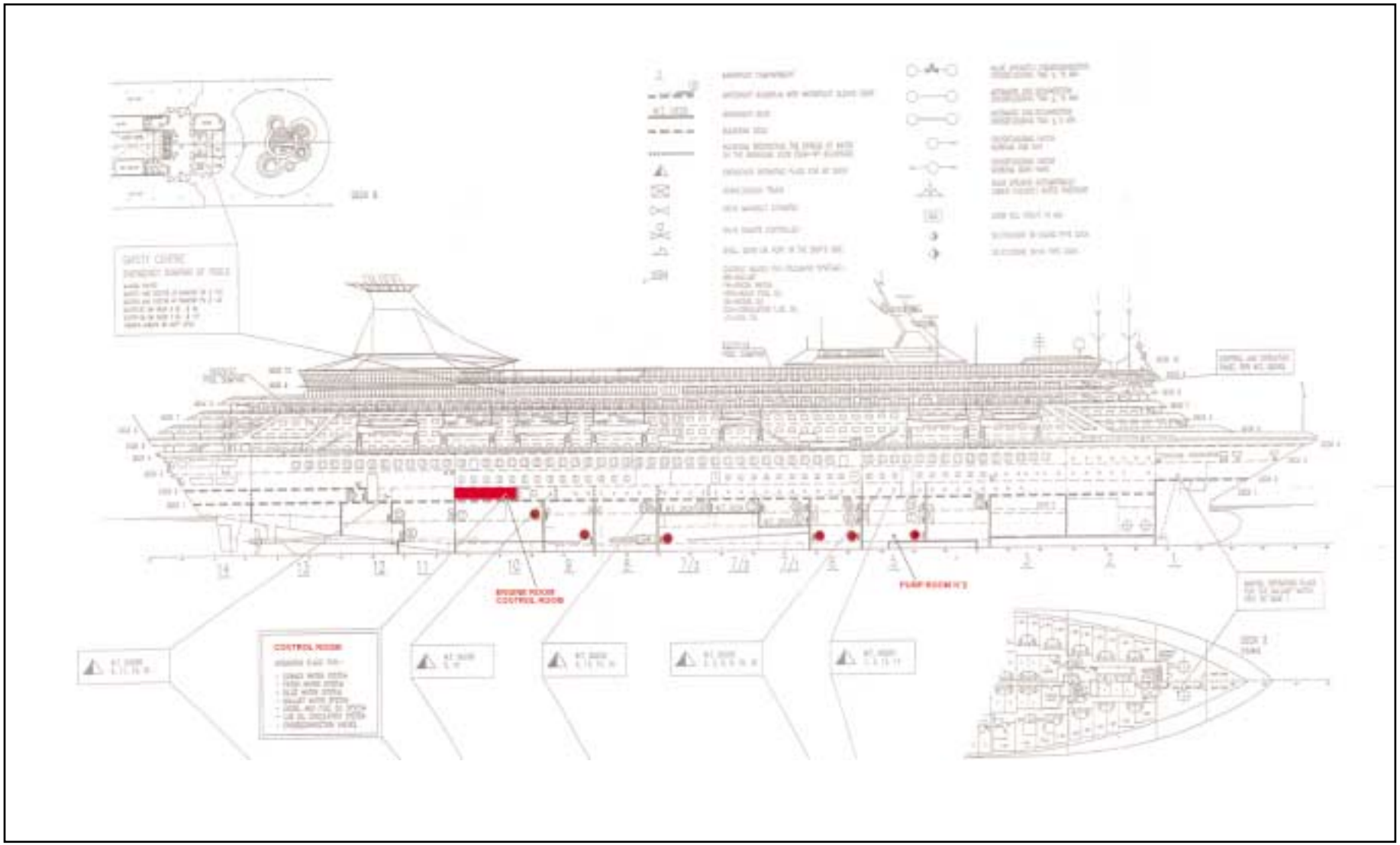
The 3EO's route took him down in the main machinery space to the tween deck level, forward through watertight door No.10 and down into the evaporator room **(see plans 1 + 2)**. From there, he intended to work his way forward at tank top level through watertight doors Nos 5, 4, 3, 2 and 1 to No 1 pump room, checking purifier, fresh water and sewage systems on the way. The motorman was carrying out maintenance work in the forward auxiliary machinery spaces.

At 0053, the 3EO called the control room using the talk-back system, to report an observation from the purifier flat. He called again at 0055, with a message about the sludge pump.

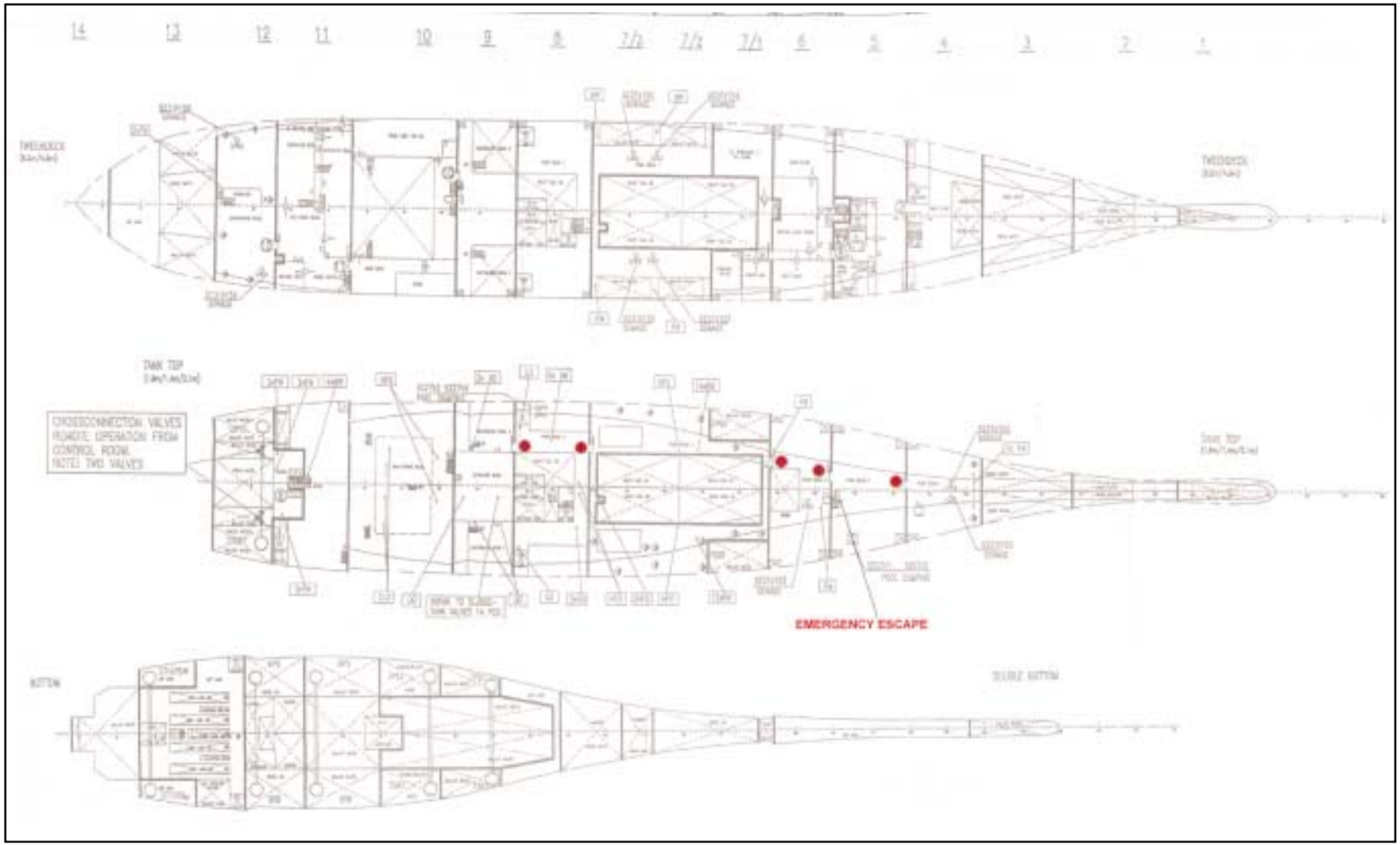
At about 0105, the 3EO attempted to pass through watertight door No 2 **(see photograph 1)**. He operated the controls to start the door opening and, when it had opened sufficiently to allow him to pass through, he locked the operating lever in the 'close' position. As the door was closing, he began to step through, but his boilersuit became snagged, or something else caused him to hesitate and momentarily delay or abort his progress through the doorway.

Despite his trying frantically to reverse the movement of the door, it closed on his upper left arm and crushed it. With difficulty, he managed to open the door and free his arm.

Plan 1



Royal Princess



Royal Princess

Photograph 1

No 2 watertight door, looking forward

The 3EO, supporting his very badly injured arm, then attempted to use the emergency escape from No 2 pump room **(see photograph 2)**. Two hands were needed to open the door, one to press the interlock button and one to turn the handle. Despite trying to use his knee and his one good hand, he was unable to open the door.

At 0109, a night steward who was resting in his cabin on Deck 0 (two decks above) and close to the emergency escape, heard screams and reported them to the purser's desk.

As the 3EO was unable to use the emergency escape, he returned to the engine control room through watertight door No 2 and opened and passed through four other watertight doors on the way. He was heard screaming for help at 0111 as he approached the control room. The 3EO entered the control room shouting that he had broken his arm.

The cadet comforted and administered first-aid to the 3EO, while the 2EO telephoned to alert the medical team to the emergency. At 0113 the cadet helped the 3EO from the control room and escorted him towards the medical centre. The duty nurse met them on the way. The 2EO alerted the staff engineer officer.

On their arrival at the medical centre, the duty nurse gave first-aid treatment and called the duty doctor - who arrived soon afterwards. Treatment continued, and a second doctor was called to assist.

Photograph 2

The escape door from No 2 pump room

At 0120 the staff engineer arrived in the control room. By this time it was known that the injury had been caused by a closing watertight door. The staff engineer went down into the machinery space from the control room with another 3EO. They followed a trail of bloodstains leading forward and discovered watertight doors Nos 10, 5, 4, 3, and 2 standing open. More bloodstains were in the vicinity of watertight door No 2 and the emergency escape door from No 2 pump room. He noted that No 1 watertight door was also open.

At 0130, the medical team advised the bridge about the seriousness of the situation. The captain was called to the bridge, and arrived there at 0137.

The coastguard was informed at 0146 and the other appropriate emergency services were alerted. *Royal Princess* was approximately 18 miles south of Dover in the north-east traffic lane.

Following a medilink call between Queen Alexandra Hospital, Portsmouth, and the medical team on board, it was decided to take the casualty to hospital as soon as possible. The coastguard suggested evacuation by RNLI lifeboat because a helicopter would, in all likelihood, take longer. The captain agreed and Dover lifeboat was called at 0205, and launched at 0216.

Meanwhile, *Royal Princess* moved to cross the traffic lanes towards Dover.

The lifeboat arrived and collected the casualty at 0258.

The 3EO was on a stretcher, and was accompanied by one of the ship's nurses.

An ambulance was called at about 0330, and met the lifeboat at Dover Boathouse. It picked up the 3EO and the nurse, and departed for William Harvey Hospital in Ashford at 0347.

At about 0408 they arrived at the hospital where, despite efforts to save the 3EO's left arm, subsequently, it had to be amputated.

1.4 WATERTIGHT DOORS - DESCRIPTION AND OPERATION

For damage stability purposes, all passenger vessels are subdivided by watertight bulkheads below the bulkhead deck. Access through a watertight bulkhead is achieved only by using an approved steel door which can be sealed watertight in the event of an emergency. Following underwater hull damage, these doors help to contain the flooding within the damaged compartments, thus minimising the loss of stability and buoyancy. *Royal Princess* was fitted with 20 such watertight doors.

The watertight doors and their controls were manufactured by Schoenrock Hydraulik GmbH. Each was of similar construction and classified as Type A, B or C. The purpose of the classification was to differentiate between groups of doors with respect to the circumstances under which they were permitted to remain open at sea. The most stringent requirements applied to Type C watertight doors, which were to be kept closed whenever the vessel was at sea, except only for sufficient time to allow through-passage of an authorised person.

All the watertight doors were of steel construction and operated by sliding horizontally under hydraulic power **(see photograph 1)**. In an emergency, the doors could be closed from the bridge or from one of five control positions on Deck 1.

The Captain's Standing Orders and the Damage Control Manual state:

The control for watertight doors at the navigating bridge can be set at either "doors closed" or "local control". It must be set at "local control", except during an emergency, or a drill, or for testing purposes.[1]

[1] Damage Control Manual - August 1997, para 3.8

All the watertight doors were correctly set to operate in local control on the night of 3/4 August: they were well maintained and in all respects met current statutory requirements.

The local controls consisted of two pairs of ganged hydraulic levers, one set on each side of the bulkhead adjacent to the door **(see photograph 3)**. Each set of controls comprised two levers on the same boss, an inner, longer, operating lever and an outer, shorter, locking lever. The controls were at approximately waist height, situated on the side to which the door closed.

When a door was closed, or closing, the operating lever was up and the locking lever was either up or down.

Photograph 3

The control levers

Photograph - video still 1

To open a door, it was necessary to move the locking lever. This caused both levers to spring to the horizontal position and the door to begin to open. The levers did not need to be held and the door would continue until it was fully open.

Photograph - video still 2

To start closing a door, the operating lever had to be moved and held up. This could be done either when the door was fully open, or while the door was in the process of opening. If, at any time, the operating lever was released, it would spring to the horizontal and the door would revert to opening. However, the operating lever could be locked in the 'close' position by moving the locking lever either up or down. The door would continue until fully closed without holding the operating levers. It took approximately 25 seconds for No 2 watertight door to close from the fully open position.

The door was sealed watertight in the closed position by being forced the last few centimetres by tapered wedges into a housing.

Photographs - video stills 3 + 4

The operation of watertight doors had to be powerful enough to overcome the possible effects of adverse list and water pressure.

In the event of a complete power failure, each watertight door could be operated by a hand pump sited close to the door.

Whenever the doors were moving under power, visible and audible alarms were activated automatically in the vicinity of the door.

A mimic diagram on the bridge **(see photograph 4)** clearly indicated whether each door was opened or closed. The Captain's Standing Orders stated:

The [Bridge] *officer of the watch should, at all times, be satisfied that all doors are correctly positioned in accordance with the voyage condition and should keep a watch on the indicator panel to ensure that doors are being correctly operated in accordance with the Operating Instructions for Watertight Doors.*[2]

In an emergency, the doors could be closed from the bridge indicator panel. If a bridge watchkeeping officer selected "doors closed", the alarm would sound at the door position for 10 seconds and then the door would begin to close. To open the door when in remote "doors closed" mode, it was necessary to move and hold the operating lever down.

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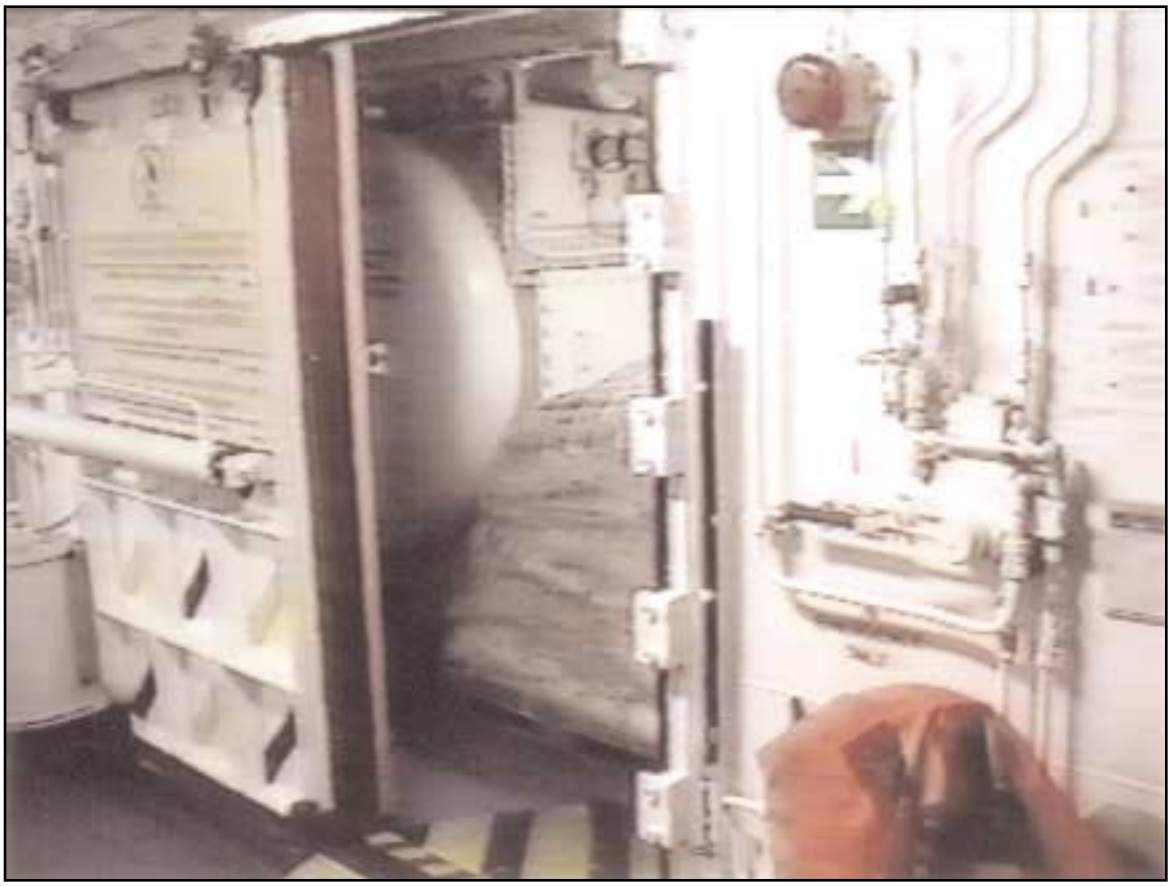
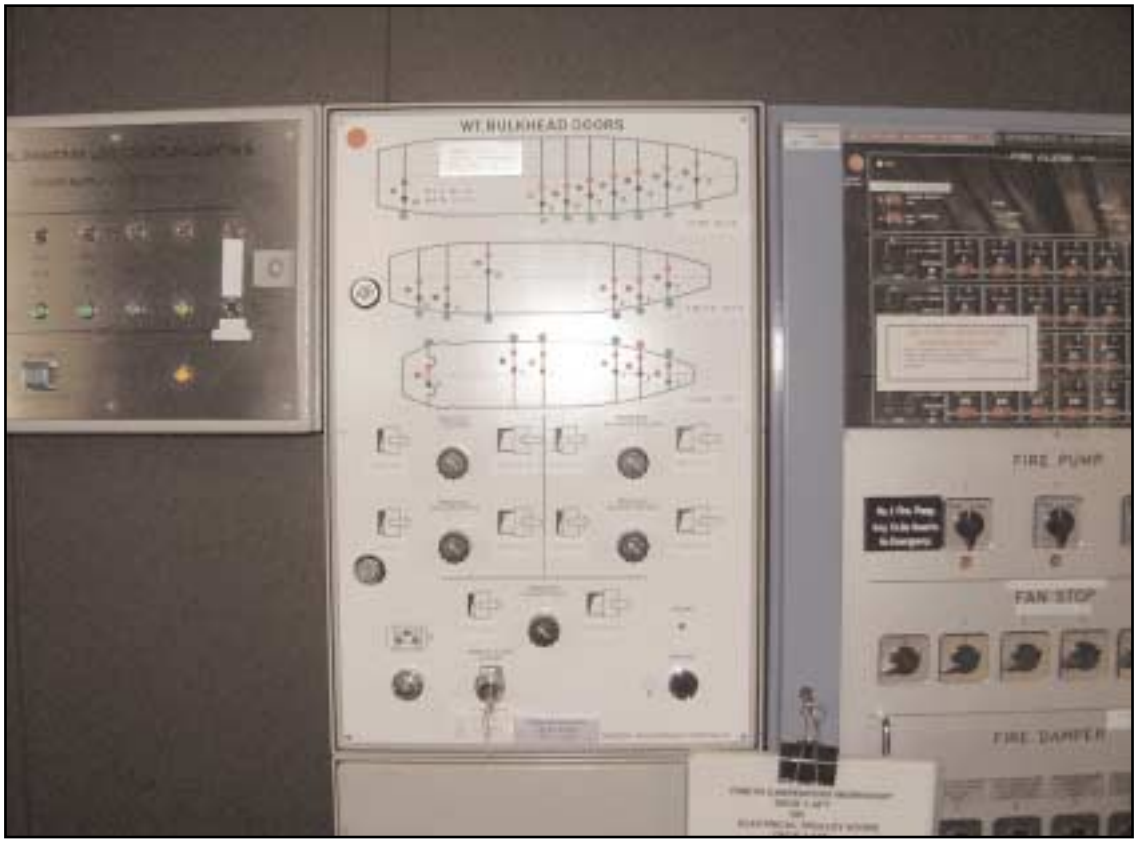
[2] Captain's Standing Orders, Watertight Door Instructions to Crew Members, para 2.5

Video Stills 1 and 2 - The partially closed door



Video Stills 3 and 4 - The watertight door and its tapered wedges

Photograph 4



The watertight door mimic board

1.5 INSTRUCTIONS FOR THE SAFE OPERATION OF WATERTIGHT DOORS

UK national legislation and guidance governs the construction and operation of watertight doors on UK passenger ships, in particular, *The Merchant Shipping (Passenger Ship Construction: Ships of Classes I, II and II(A)) Regulations 1998 and Marine Guidance Note (MGN) 35*. Additionally, guidance on the classification of doors, and their operation, is contained in *Instructions to Surveyors, Passenger Ship Construction (Classes I, II and IIA)*. The official guidance is followed closely in the Captain's Standing Orders, the Fleet Instructions and the vessel's approved Damage Control Manual, all of which contain specific instructions and guidance on the operation of these doors. Some of these are reproduced below and are shown in italics.

The instructions for the operation of the doors are given for two conditions for any voyage:

i. those applicable in potentially hazardous situations and

ii. those applicable in normal conditions.[3]

[3] Captain's Standing Orders

Each of the 20 watertight doors was classed as a category A, B or C door which governed its use in **normal conditions**.

Type C Door — one which was to be kept closed whenever the vessel was at sea except only for sufficient time to allow through-passage of an authorised person.

On *Royal Princess*, doors numbered 2, 4, 6 and 10 were Type C

Type B Door — one which could have been left open while an authorised person was working in an adjacent compartment.

On *Royal Princess*, doors numbered 1, 3, 5, 7, 8, 9, 11 and 12 were Type B

Type A Door — one which could have been left open at sea

On *Royal Princess*, doors numbered 13, 14, 15, 16, 17, 18, 19 and 20 were Type A

Each door had its number and classification letter displayed at the door position.

Note: A discrepancy has been noted between *Royal Princess*'s approved Damage Control Manual and the Captain's Standing Orders. The latter document referred to watertight door No 6 as Type B, and did not mention watertight doors Nos 6 or 10 in a list of those of Class C.

In **potentially hazardous situations** <u>all</u> watertight doors had to remain closed. However, an authorised person was permitted to open selected doors, including all those in the machinery spaces, for the time it took him to pass through.

Before sailing, the navigating officer was instructed to produce a chart indicating the foreseeable voyage conditions with respect to the operation of watertight doors. This was promulgated to heads of department who, in turn, ensured that all authorised persons within their department were aware, and working routines were adjusted accordingly **(see Annex 1)**. Since leaving Southampton on 3 August 2001, *Royal Princess* had been in a potentially hazardous situation with respect to the operation of watertight doors.

Potentially hazardous situations are defined as conditions where the ship is:

I. in conditions of restricted visibility;

II. on any part of a voyage within port limits or within compulsory pilotage limits;

III. where the depth of water is less than three times the draught;

IV. in a situation which the master considers potentially hazardous due to:

i. the proximity of underwater hazards;

ii. the density of traffic in the vicinity; or

iii. any other factor.[4]

The Captain's Standing Orders contained instructions for the safe opening and closing of the doors as follows:

i. Approach the door with both hands free.

ii. Take one handle in each hand.

iii. Rotate the small handle until both handles are in line.

iv Release both handles.

v. If the door remains shut, the door is on Bridge Control and no attempt whatsoever, unless your life is threatened, should be made to open the door. The levers should be put back into the original position and the door left alone.

vi. If the door opens, the door is in Local Control.

vii. Allow the door to open to its fullest extent and the warning bell to stop ringing.

viii. Once the bells have stopped ringing you may pass through the door.

ix. You must now close the door. Take the longer lever and move it in an upward direction.

x. Once the bells have stopped ringing and the door is fully closed, the small lever should be rotated up until the longer lever is latched in the closed position.[5]

Any diversion from these operating instructions was considered a disciplinary offence. In the time that the 3EO had been on board *Royal Princess*, three crew members had been disciplined (logged) and been formally warned for passing through watertight doors before they were fully opened.

With the exception of authorised persons it is a punishable offence to open a watertight door unless life is in danger. Unauthorised opening is a dismissable offence. There are alternative exits from all spaces affected by watertight doors.[6]

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[4] Captain's Standing Orders, Operating Instructions for Watertight Doors, para 5(1)

[5] Captain's Standing Orders, Direction for Opening and Closing of Watertight Doors.

[6] Captain's Standing Orders, Watertight Door Instructions to Crew Members, para 1.3

The Fleet Instructions defined an authorised person as *a member of the ship's company nominated by the captain who has passed the necessary test and is then permitted to operate selected watertight doors during the course of his duties*.

The test shall comprise of demonstrating to the safety officer:

i. a complete knowledge of the operating routines that must be followed and

ii. the ability to operate correctly, all the watertight doors the authorised person is permitted to use.[7]

The safety officer maintained a list of everyone authorised to operate watertight doors.

The 3EO, along with all engineer officers, was authorised to operate all the doors. However, although he had received the appropriate training when he joined the vessel in November 2000, and had signed the record again in June 2001, his name was not included on the register.

The 3EO had read the Captain's Standing Orders.

In addition to the operating instructions given in the Captain's Standing Orders, a notice was posted at each watertight door giving instructions on its safe operation **(see photograph 3)**. The two versions were different in a number of respects. Whereas the Captain's Standing Orders instructed personnel to hold the operating lever until the door was fully closed, before locking it in position, the posted instructions allowed the lever to be locked so that the door closed itself. The posted instructions required the lever to be held while the door was opening, and for personnel to hold the handles in the opening position while stepping through the doorway. The Captain's Standing orders did not. The Fleet Instructions also contained *Instructions for Passing through a Watertight Door*, which stated:

No attempt is to be made to pass through a watertight door whilst the door is moving and/or the bell or siren is sounding.

Use of Local Control.

.1 Both hands of an individual are to be free and the door is to be fully open before passing through. The second handle is to be grasped before the first one is released.

.2 Any individual who is unable to properly grasp both handles at the same time must have the door opened for him by another member of the ship's company who will operate the door on his behalf.[8]

These instructions differ slightly from the other two versions mentioned above.

[7] Fleet Instructions, S.A.F.9.2 Watertight Doors, para 6.1.3 and 6.1.4

[8] Fleet Instructions, S.A.F.9.2 Watertight Doors, para 6.4

In addition to the written instructions, the accepted practice for day-to-day operation of the doors was different again, as follows:

Approach the door; move the locking lever to allow the operating lever to spring to the horizontal; wait for the door to fully open; step through the door; move the operating lever to the close position and lock it; check that the door is closing and carry on.

1.6 THE ARRANGEMENT OF ENGINE ROOM EMERGENCY ESCAPES

Each engine room compartment bounded by watertight bulkheads had an emergency escape leading upwards into accommodation or store spaces on the tween deck or Deck 0. From there it was possible to effect escape to areas on, or above, the bulkhead deck (Deck 1). On or above the bulkhead deck, longitudinal movement was possible without the hindrance of passing through watertight doors. Most of the emergency escapes from engine room spaces, including the pump rooms, consisted of vertical ladders. However, the escape from No 2 pump room was by means of a stairway in a stairwell, with direct access up the three decks to Deck 1.

Deck 1 had a wide working alleyway, which allowed easy access to spaces including the medical centre and the engine room control room.

For security, all engine room escape doors were guarded by interlocks which could be over-ridden using number key pads from outside the engine room, and press-buttons from inside.

To open the door which allowed access to the emergency escape from No 2 pump room, it was necessary to push a red button at the same time as turning the door handle **(see photograph 2)**.

1.7 TRAINING

All crew members were instructed in their emergency duties and other safety routines within 24 hours of joining the vessel for each tour of duty. This training included instruction on the dangers associated with operating watertight doors. In the past, a short training video had been shown which, among other things, showed a door closing on a cow's leg bone with dramatic effect. Subsequently, the video was updated and a broom handle substituted for the leg bone because some crew members had been disturbed by the former version.

At the completion of the induction training, all those who were to be authorised to operate watertight doors, including the 3EO, were given a practical demonstration on the required correct method of operation as outlined in the Captain's Standing Orders. In addition, to become authorised, all relevant personnel must have completed a short written test in which they demonstrated their understanding of the safety purpose of watertight doors and their correct operation.

1.8 THE THIRD ENGINEER OFFICER

The 3EO was 25 years old at the time of the accident. He had been a Trinity House engineer cadet between 1995 and 1999, during which time he had taken a sandwich course at college and experienced periods at sea with Bank Line and the British Antarctic Survey. He obtained a Fourth Engineer's Certificate of Competency in 1999, and then served with Pacific Nuclear Transport Limited for 12 months before joining P&O Princess Cruises' *Royal Princess* in November 2000.

Voyage lengths were about 4½ months. He joined *Royal Princess* for a second tour of duty on 28 June 2001.

The 3EO was interviewed soon after the accident, at which time he could not remember precisely the events in the seconds immediately preceding the accident. He strongly believed that he had been going from aft to forward through the door, and that he was on the forward side of it when his left arm became trapped. He believed that his boilersuit had become snagged, but could remember neither which part, nor what it had snagged on. Several weeks after the accident, the 3EO had a clearer recollection of events in which he believed that he had been returning aft, having already been to No 1 pump room and that his progress through the door had been delayed by his noticing that No 1 door had been left open. This is discussed in Section 2 of the report at subsection 2.2 paragraph 4.

1.9 EXAMINATION OF THE 3EO'S BOILERSUIT

At the time of the accident, the 3EO was wearing a white cotton boilersuit and was carrying a 10" adjustable spanner in the ruler pocket. The boilersuit was examined by the MAIB after the accident and found to be in a relatively good condition, apart from the left sleeve. Buttons, buttonholes, seams and pockets were examined for signs of pulling and excessive strain. Nothing untoward was discovered, other than a small tear in a seam immediately below the ruler pocket on the right leg. The open seam revealed clean white material, suggesting that the tear had occurred recently. The left back pocket was slightly distorted, indicating that the 3EO habitually carried either his notebook or a rag in it. The left sleeve was extensively bloodstained and damaged in the accident, which obliterated any pre-existing faults or signs of excessive strain **(see photographs 5, 6, 7 and 8)**.

Photographs 5 and 6 - The examination of the boilersuit

Photographs 7 and 8 - The examination of the boilersuit (continued)

1.10 EXAMINATION OF NO 2 WATERTIGHT DOOR

The accident occurred at No 2 watertight door, situated between No 2 and No 3 pump rooms in the forward auxiliary machinery spaces. It was a steel, horizontally sliding door, of Type C which closed from port to starboard **(see photograph 1)**.

The door was examined to establish what might have caused the boilersuit to become snagged. Nothing obvious was found. There were no protrusions on the leading edge of the sliding door itself. On the upright of the door frame, the heads of the machine screws, which secured the tapered wedges, and one of the wedges itself, were identified as possible causes of snagging **(see photographs - video stills 2 + 3)**. It was also considered possible that the boilersuit sleeve might have become caught on one of the operating levers.

The staff engineer examined the door soon after the accident, and found it in local control and operating correctly. The speed of the door was in accordance with regulations. When examined by the MAIB it was found to take approximately 15 seconds to open and 25 seconds to close.

1.11 THE 3EO'S WORK/REST ROUTINE

Watchkeeping engineer officers on *Royal Princess* worked a four-hour on, eight-hour off rota. Generally, the watches were rotated once or twice during a tour of duty to give some variety to the work routine. The 3EO had started working the 0800-1200 and 2000-2400 watches when he joined the vessel on 28 June, and had changed to the 0000-0400 and 1200-1600 watches on 3 August, the day before the accident. On 3 August, the 2EO and 3EO had been on watch continuously between 0800 and 1600. When watches rotated, one team had to do an eight-hour shift and, on this occasion, it fell to their team.

Because of the change of watch, the 3EO's regular sleep pattern had been disrupted. For the 5 weeks before 4 August, his principal time for sleep had been between midnight and about 0730. He had also had the chance of a secondary rest period during the afternoon.

During the 24 hours before the accident, the 3EO had rested for nearly 8 hours before he went on watch at 0800. He then worked in the engine room for 8 hours, as described above, until soon after 1600 when he went to his cabin. He got cleaned up and telephoned his fiancée at 1700. During the call his fiancée commented that he sounded tired. He went to bed soon after 1700, but slept only fitfully. He got up at 2230 and went to a seaman's cabin where he bought snacks which he took down on watch just before midnight.

In the 24 hours before the accident, the 3EO had eaten only twice. He had eaten burger and chips in the control room at lunch time during his 0800 to 1600 watch, and pot noodle snacks in the control room just before the accident.

Good quality meals were available for officers on board at almost any time in the officers' mess or passenger restaurants. However, the 3EO rarely ate in the officers' mess or passenger areas because it meant having to change into uniform. Eating in cabins and in the engine control room was not usually permitted.

1.12 SUMMARY OF THE FACTUAL EVIDENCE

The 3EO was obviously, and not surprisingly, traumatised by the accident. He was interviewed a few days after the event, and again a few weeks later to establish exactly what had caused his arm to become trapped. Although he was extremely open, helpful and patently honest, and his memory was clear on certain aspects, the interviews could not determine, with accuracy, the precise circumstances of the accident.

The following information is a summary of what is considered to be fact:

- The door had not opened fully when he set the door to close. He locked the operating lever in the 'close' position and began to pass through the doorway.
- His boilersuit became snagged, or something else caused him to hesitate and momentarily delay or abort his progress through the door.
- He was unable to free himself or reverse the operation of the door in time to avoid the accident.
- The door closed on his upper left arm, causing a severe crush injury.
- The staff engineer was the first person on the scene after the accident and he found a number of watertight doors open, including No 1, which is situated forward of No 2 pump room.
- The accident occurred in the vicinity of watertight door No 2.
- Watertight door No 2 and all other watertight doors were in local control and working correctly.
- The 3EO was left handed.
- The 3EO was heard screaming for help in the vicinity of No 2 pump room at 0109.
- The 3EO officer had been wearing a cotton boilersuit which, on examination, showed a small tear in a seam just below the ruler pocket on the right leg. Damage and staining to the left sleeve obliterated any pre-existing faults in this area.

- Instructions on the correct operation of watertight doors were contained in the Captain's Standing Orders, Fleet Instructions, Damage Control Manual and on notices posted at each door position.The written instructions were not all the same and the accepted practice was different again.

1.13 PREVIOUS ACCIDENTS INVOLVING WATERTIGHT DOORS

This is the third serious accident involving personnel being trapped in closing watertight doors which the MAIB has investigated since its formation in 1989.

In 1989, a crew member on board a cross-channel ferry tried to pass through a door which was in local control. He had been operating the lever to close the door as he stepped through. Unlike the control mechanism on *Royal Princess,* the lever had to be held to move the door. The circumstances were never precisely discovered, but his progress was delayed and the door closed on his leg.

In 1998, one of the engine room ratings on another cross-channel ferry died as a result of being trapped in a watertight door which was set to operate in local control and which had a control mechanism that needed the lever to be held for the door to close. He had been carrying a bag of salt through the doorway. There were no witnesses to the accident, but it is thought that the door had not been opened fully and, for some unexplained reason, the operating lever must have been held in the 'close' position when he stepped though. Although the precise circumstances are not known, the rating must have been taking a short-cut and disobeying the door's operating instructions.

Earlier records indicate at least three previous accidents on board P&O Princess Cruises' vessels. In 1976 a crew member was killed in a power-operated watertight door and in 1985 and 1988 crew were seriously injured. All these incidents occurred in watertight doors that were in bridge control mode at the time, and at least two of them concerned crew members passing through closing watertight doors that had not been allowed to fully open. The details of an incident in 1979 are not known.

In the 4 years before the accident, there were 15 disciplinary offences on *Royal Princess* involving short-cuts with the operation of watertight doors.

1.14 ACTION BY P&O PRINCESS CRUISES SINCE THE ACCIDENT

Since the accident on 4 August 2001, a Fleet Cautionary Notice (FCN) has been issued and circulated to all vessels in the P&O Princess fleet **(Annex 2)**. The notice outlines the circumstances of the accident, and warns personnel that watertight doors are dangerous if they are not operated according to the correct procedures. Additionally, it warns those who operate watertight doors not to become complacent about the dangers.

SECTION 2 - ANALYSIS

2.1 AIM

The purpose of the analysis is to determine the contributing causes and circumstances of the accident as a basis for making recommendations to prevent similar accidents occurring in the future.

2.2 HOW DID THE ACCIDENT HAPPEN?

The 3EO allowed the watertight door to open only part way before setting the door to close, and then attempting to pass through. This was in contravention of the known operating instructions set out in the Captain's Standing Orders. Thanks to his frankness in assisting the investigation, only a few questions remain unanswered.

1. How far did he open the door before he started to go through?

It normally takes just a few seconds to free a snagged boilersuit, or reverse the movement of a door. Hesitation lasts, by definition, for only a short time. The door is slow moving, and takes about 25 seconds to close from fully open. It must be concluded, therefore, that the gap through which the 3EO tried to pass, must have been very small indeed; possibly as little as 40cm, and that this fact left no time to cater for unforeseen circumstances.

2. Was his passage through the door hindered in some way and, if so, how?

Detailed examinations of the boilersuit and the door have not led to conclusive evidence about whether the boilersuit snagged and caused the 3EO's progress through the door to be delayed.

Two possible scenarios are considered below.

(i) The adjustable spanner, which the 3EO was carrying in the ruler pocket of the right trouser-leg of his boilersuit, momentarily caught behind one of the tapered wedges on the door frame **(see photograph video still 4)**.

Examination of the ruler pocket by the MAIB, showed it to be gaping open as though strained **(see photograph 7)**.

The opening to the pocket was angled so that the handle of the spanner projected forward. This made it more vulnerable to becoming snagged when the wearer was moving in that direction.

Examination of the seam below the pocket opening indicates that it had been pulled undone over a distance of about 7cm **(see photograph 9)**. It is likely that this was caused by the pocket, or something in the pocket, becoming snagged and the consequent strain being transmitted to the seam. The exposed hem was cleaner than the surrounding material, indicating that the split in the seam had occurred recently.

The ruler pocket opening was about 90cm from the deck when the wearer was standing upright **(see photograph 9)**. This height coincided, approximately, with the third tapered wedge up from the deck **(see photograph video still 1)**. If the 3EO was passing through the doorway from aft, to forward, his right leg would have been adjacent to the wedge as he did so.

It is conceivable that the adjustable spanner, which had been protruding forward from the top of the pocket, might have caught behind the wedge, causing the damage to the pocket and a momentary delay to his progress.

If his boilersuit did become snagged in this way, and he was travelling from aft to forward, it must have occurred as he started to step through the door. Further, for his left arm to become trapped, and for him to end on the forward side of the door, he must have freed the snag and continued to pass through the closing door while facing to port, towards the door and away from the control levers.

Photograph 9

The open seam below the pocket opening

(ii) The longer operating lever caught inside the left sleeve of the 3EO's boilersuit as he moved to pass through the door.

When operating watertight doors, the 3EO was in the habit of using his left hand for the longer operating lever and his right hand for the locking lever. It is possible that he started the door opening and then, as soon as it was open far enough to allow him to pass through, he lifted the operating lever with his left hand and operated the locking lever with his right. At that time he would have been facing the controls **(see photograph video still 1)**. He might have simultaneously started to move through the opening. As he moved forward through the doorway, the longer lever could have caught inside the sleeve of the boilersuit and the twisting motion brought on by his movement might have accentuated this. To free himself, he would have needed to move aft; momentarily causing a delay to his progress.

Alternatively, the boilersuit did not become snagged, and the 3EO simply misjudged how long it would take him to pass through the door.

As explained above, it needed two hands to lock the control levers in the closing position. While he was doing this he would have had his back to the opening door and thus not been in the best position to judge accurately when the door was sufficiently open. It is possible that his judgment failed him on this occasion, and that the door had not been opened sufficiently to give him enough time to pass through completely.

3. Why was No 1 watertight door open?

The staff engineer discovered No 1 watertight door to be open soon after the accident. It was a Type B door, which under normal conditions can be left open when someone is working in an adjacent compartment. However, *Royal Princess* was in a potentially hazardous situation, and all watertight doors should have been kept closed.

A mimic diagram on the navigating bridge indicated when a watertight door was open. The regime of keeping them closed at sea, especially in a potentially hazardous situation, was strictly adhered to and monitored by the bridge watchkeeping team in accordance with the Captain's Standing Orders. Anecdotal evidence indicates the bridge watchkeeping officers were generally very quick to inform the engine room if they noticed a door to be open. However, on the night in question, Nos 10, 5, 4, 3, 2 and 1 doors were open between at least 0105 and 0130 without the navigating officers reporting it to the engine room.

Some possible explanations for No 1 door being open follow:

(i) The previous engine room watch team might have left it open. If so, however, it must have remained open, unnoticed, for over an hour.

(ii) The motorman on the 0000 to 0400 watch could have left the door open. However, although he had been working in the forward auxiliary machinery spaces, he had not been as far forward as No 1 pump room.

(iii) The 3EO might have already been to No 1 pump room before the accident.

(iv) It is possible that someone else opened the door after the accident, without the knowledge of the staff engineer.

4. Was the 3EO returning aft at the time of the accident?

After the first interviews, held soon after the accident, the 3EO provided more evidence to the investigation. He was confident then that he knew how the accident happened. He believed that he had opened the door to No 1 pump room before the accident when his progress was interrupted by a call on the talk-back phone from the control room. He answered the phone in No 2 pump room, and on being informed that an alarm needed his attention further aft in the machinery spaces, he went immediately to No 2 watertight door to pass through, from forward to aft. He was passing though the doorway when he realised No 1 door had been left open. This made him hesitate for a moment, and the closing door trapped him.

This scenario is possible and goes some way to explain many of the unknown factors in this accident. However, the MAIB has learned to place little store by witness recollection formed some weeks after the event and with the benefit of the other factual information. Under such circumstances, it is human nature to make the “recollection” fit the facts unconsciously. The Voyage Event Recorder (VER) recorded the conversations and alarms in the engine room control room throughout the period of the accident. When the MAIB inspectors listened to the recording, they paid special attention to any conversations or other indications of a call from the control room to the 3EO at around 0100. The printout of engine room alarms has also been inspected by the MAIB. Unfortunately, the quality of the recording, and frequency of alarms, are such that the scenario cannot be confirmed or contradicted.

No firm conclusion on this matter can be reached in this investigation. However this issue is thought to have little impact on the fundamental contributing factors of the accident.

2.3 WHY DID THE ACCIDENT HAPPEN?

P&O Princess Cruises went to considerable lengths to apply the current legislation and guidance concerning the operation of watertight doors on *Royal Princess*. Despite prominent notices, frequent induction training and strong disciplinary action, crew members continued to circumvent the operating procedures.

The watertight doors on *Royal Princess* were operated in accordance with national legislation and guidance. In particular, the guidance contained in the *Instructions to Surveyors, Passenger Ship Construction (Classes I, II and IIA*) which details the classification of doors, and when they need to be kept closed at sea, was followed closely. The application of these instructions effectively meant that all engine room watertight doors on *Royal Princess* were kept closed at sea for long periods, and only opened for the time it took an authorised person to pass through. UK legislation and guidance, with respect to watertight door operation, applies lessons learned after serious accidents involving progressive flooding, and is more prescriptive than those of many other flag states. Ensuring the vessel was protected from the chances of sudden catastrophic flooding, meant that doors were kept closed.This was inconvenient and:

- the number of doors that had to be negotiated during routine machinery space rounds; and,

- the time it took to open and close each door in strict accordance with instructions or accepted practice

led to the probability that short-cuts would be taken for expediency. The 3EO was taking such a short-cut at the time of the accident.

Senior officers on board took a very serious view if any person tried to pass through when a door was moving under any circumstances. It is apparent that some personnel on *Royal Princess* questioned the necessity in having to wait 15 seconds until the door was fully open before passing through. It is suspected that, at times when no senior officer was present, passing through while the door was opening was probably common practice. In the previous 4 years, 15 crew members had been disciplined for this offence, which adds weight to this suspicion.

On 4 August, the 3EO had already opened and closed at least four or possibly six (if he had already been to No 1 pump room) doors. Following the instructions contained in the Captain’s Standing Orders could take about 40 seconds for each door, and about 20 seconds when following the accepted practice. It is believed that the 3EO frequently passed through doors when they were opening. On this occasion, he was possibly in a slight hurry because his rounds had started late and, as it was the early hours of the morning, he was unlikely to be noticed if he took a further short-cut. He set the door to close before it was fully open and before attempting to pass through.

The 3EO took a risk when he attempted to pass through a closing watertight door, and in so doing, violated procedures with which he was familiar.

The following factors might have influenced the 3EO's decision to pass through a closing watertight door:

He might have done it -

- to save time;
- to improve efficiency;
- because fatigue had possibly affected his decision-making capability;
- because he was distracted;
- if he was a natural risk-taker, who enjoyed the sense of danger;
- in open defiance of those in authority; or
- to overcome the boredom of the watchkeeping routine.

It is possible, and perhaps likely, that it occurred through a combination of two or more of the above.

It is well-known that crew members on many vessels regularly circumvent the operating guidelines concerning watertight doors. This has always been the case. Fortunately, statistics show that watertight door accidents occur very infrequently, however they always have serious consequences.

One way of reducing the accident rate would be to reduce the number of times that doors need to be opened and closed. However, if changes to the guidance in this respect are contemplated, the implications on the vessel's survivability in case of collision or grounding must be borne in mind.

2.4 WAS THE 3EO DISTRACTED?

The 3EO had a stressful relationship with the staff engineer. One of the ways this showed itself was in the 3EO's different perception of the importance placed on certain areas of work. In particular, the 3EO thought that the staff engineer placed too much emphasis on all duties associated with the fresh water systems. The staff engineer admonished the engineer officers if stringent checks were not carried out precisely. There was nothing particularly unusual about either the staff engineer's management style, or the comparatively young 3EO's apparent reaction to it.

On the morning of 4 August, the 3EO was carrying out checks on the fresh water systems. He did not share the staff engineer's perception of the value of these checks, and considered that his first priority should have been the propulsion machinery. This factor might have caused distraction, and a desire to get the task done and out of the way as quickly as possible. This possible distraction might, or might not, have contributed to the accident.

2.5 WAS THE 3EO SUFFERING FROM THE EFFECTS OF FATIGUE?

For 5 weeks the 3EO had been keeping the 8-12 watch and had, therefore, been used to sleeping in the early hours of the morning. He had kept a double watch the day before the accident, and had slept only fitfully in the hours immediately preceding the midnight to 0400 watch. His circadian rhythm would have been upset. He had tried to sleep when previously he would have been awake and, at the time of the accident, was working when previously he would have been asleep or, at least, preparing to sleep.

In the IMO's Maritime Safety Committee Circular 1014 (MSC/Circ 1014) "Guidance on Fatigue Mitigation and Management", some of the possible effects of fatigue on performance are tabulated. These include the following, which might be relevant to this accident:

- Inability to concentrate including being less vigilant than usual.
- Diminished decision-making ability including:
    - Misjudging distance, speed, time etc
    - Overlooking items
    - Choosing risky options
- Poor memory including forgetting to complete a task or part of a task
- Slow response including responding slowly to normal, abnormal or emergency situations
- Attitude change, including:
    - Failing to anticipate danger
    - Failing to observe warning signs
    - Being too willing to take risks
    - Displaying a "don't care" attitude

The report also includes the following factors which can cause fatigue, and which may apply to this accident:

- Poor quality of sleep

  - quality had been affected by his circadian clock

- Stress (eg due to relationship problems, work environment)

  - he had a stressful relationship with the staff engineer

- Monotonous tasking

  -watchkeeping can be monotonous

- Shipboard environment (noise, vibration, movement, humidity and temperature)

- Food (timing, frequency, content and quality)

  - d-espite excellent food being available on board, the 3EO had only eaten a burger and chips for lunch while on watch in the control room, and pot noodle snacks, again while on watch during the 24 hours before the accident.

  Despite his recent work/rest hours being well within current STCW guidelines, for the reasons explained it is concluded that in the early morning of 4 August, the 3EO's judgment was possibly adversely affected by fatigue. This might explain why a procedure, which he had successfully adopted a number of times before, went disastrously wrong on this occasion.

2.6 THE OPERATING INSTRUCTIONS FOR THE WATERTIGHT DOORS ON *ROYAL PRINCESS*

Until about 1987, it was general practice to keep power-operated watertight doors closed under remote control from the bridge. This meant that anyone wishing to pass through a doorway had to operate the lever locally, and hold it in the opening position, until the door was fully open. They were then instructed to lean through while still holding the handle in the opening position, and grab hold of the handle on the other side of the bulkhead. They then stepped through while still holding both handles in the open position. Once through, they could release the handles, and the door closed under the default control from the bridge. Although cautious, this operation was necessary as the default operation was for the door to close.

In 1987, after a few accidents and incidents, the Merchant Shipping (Closing of Openings in Hulls and Watertight Bulkheads) Regulations 1987 came into force. Among other things, the regulations required vessels to be provided with operational instructions based upon advice contained in a new Merchant Shipping Notice (M1283). The guidance included a recommendation that the remote control "doors closed" position on the bridge should be used only in an emergency, during drills or for training purposes. At all other times the doors should be in "local control" so that a positive action is needed to close them. Although both the regulation and the Merchant Shipping Notice have been superseded, the guidance has been carried forward in all later applicable regulations and guidance. On 4 August 2001, the doors on *Royal Princess* were in local control.

The local control levers on *Royal Princess* were arranged so that they could be locked in the closing position, and did not need to be held in the opening position. However, one version of the on-board operating instructions required the handle to be held for the 25 seconds or so while the door was closing, and another required the handles to be held while the door was opening. In both instances this was unnecessary, and led to the possibility that the instructions would be disobeyed routinely. The instructions posted near each door required operating levers on both sides of the door to be held while passing through the doorway. This is in accord with guidance from the MCA contained in MGN 35, issued in October 1999 which states:

It is essential therefore that when using a watertight door which has been closed, irrespective of the mode of closure, that both the local controls - one on each side of the bulkhead - are held in the "open" position while passing through the door. That can be done by first fully opening the door using the nearside control with one hand, reaching through the opening to the control on the far side and using the far side control to keep the door fully open until passage is complete.

Note: The *mode of closure* referred to above means either "local control" or "door closed" as previously explained.

On *Royal Princess*, if the door is fully open in local control it is not necessary to hold the handles in the open position to safely pass through. Should the bridge decide to close the doors, the alarms will sound for 10 seconds before the door begins to move. Although there was potential for confusion in the differing instructions, the 3EO was fully aware of the accepted method for operating the doors, which neither required both levers to be held while passing through, nor the closing lever to be held while the door was closing. It did, however, require the door to be fully opened before passing though. The accident occurred because the 3EO disobeyed the instructions.

There were a number of different versions of operating instructions for the watertight doors on board *Royal Princess*. The unwritten accepted practice was different again. Clear, consistent, unambiguous and practical safety instructions can provide a safety barrier which was not in place on *Royal Princess*.

In 1998, the MAIB investigated a fatal accident aboard *P&OSL Kent* (see 1.12) and concluded that there was *a culture of passing through watertight doors when not fully open……practised by all levels of staff.* As a result of that investigation, the MCA and P&O Stena Line were recommended to review the instructions for operating doors in "local control".

In the MAIB's view, there are two fundamental principles which would guarantee safe passage through a power-operated watertight door, irrespective of the operating mechanism and operational mode. They are:

- Always open the door fully; and,
- Never pass through a door that is closing.

2.7 THE DESIGN OF THE OPERATING MECHANISM

One way in which exactly the same accident could be avoided in the future, would be to change the design of the operating mechanism so that the operating lever could not be locked in the close position and, therefore, would have to be held until the door was closed. This would bring the operating mechanism in line with that commonly found on other vessels, and for which the guidance written by MCA was produced. However, an operating mechanism of this type was in place on the cross-channel ferries that had the accidents, including one fatality, mentioned in section 1.12. The MAIB believes that, while such a design change would prevent recurrence of this accident, the fundamental flaw that some officers and crew will continue to disobey the operating instructions for expediency, would still be in place. It could be further argued that such a change would increase still further the time needed for passage through a door and, therefore, encourage even more widespread disobeying of the instructions.

2.8 THE OPERATION OF THE EMERGENCY ESCAPE DOOR

After the accident, the 3EO tried to leave the engine room by the quickest way, that is, through the escape door from No 2 pump room. He was unable to do so because operation of the door required two hands.

Although this was a feature in the aftermath of this particular accident, it should not be considered as indicative of a fundamental flaw in the evacuation system. Interlocks on doors to the engine room are a necessary safety feature on a

passenger vessel to prevent unauthorised access. The cancelling of the interlock, by operating a button to exit the space, is an unfortunate feature in the design of the interlock chosen for *Royal Princess*. There is no specific need to control the exit from the space as opposed to the entry.

In normal circumstances, the door could have been operated easily from inside the engine room in an emergency. However, in addition to the circumstances of this accident, a number of other foreseeable circumstances exist where the interlock would make exit from the space impossible, or very difficult. This includes the carrying of an injured person. Anything which unnecessarily complicates the emergency exit procedure is detrimental to safety.

2.9 THE GENERAL SAFETY MANAGEMENT ON *ROYAL PRINCESS*

In the MAIB inspectors' opinion, the general safety management on board *Royal Princess* appeared good. However :

- the 3EO had not been registered as an authorised operator of watertight doors;
- there were conflicting instructions on the operation of the watertight doors; and
- there was a discrepancy in the classification of the doors.

As stated previously, P&O Princess Cruises had gone to considerable lengths to apply the current appropriate legislation and guidance. Among other things, it took strong disciplinary action against any crew member found to be circumventing the accepted operating practice.

On *Royal Princess*, crew members were disciplined regularly for not operating the doors correctly (15 crew members had been disciplined during the previous 4 years, para 2.3). However, it appears that this non-compliance was not recognised as both a safety and a discipline issue. Records of these disciplinary proceedings were forwarded to the Personnel Department ashore, but not to the Safety Department. This process did not help the managers responsible for safety to recognise the extent of the problem and, perhaps, act to reduce the frequency of these hazardous incidents. Disciplining the offenders was only one way of approaching the problem of non-compliance. Additional, and perhaps more effective, action aimed at combating the root causes of the previous incidents might have helped prevent this accident.

SECTION 3 - CONCLUSIONS

3.1 SAFETY ISSUES

1. The 3EO disobeyed operating instructions with which he was familiar, in that he did not allow No 2 watertight door to open fully and he set it to 'close' before attempting to pass through. [2.2]

2. P&O Princess Cruises had gone to considerable lengths to apply the current appropriate legislation and guidance. Despite prominent notices, induction training and strong disciplinary action, crew members continued to circumvent the operating procedures. [2.3]

3. UK legislation and guidance with respect to watertight door operation applies lessons learned after previous serious accidents which involved progressive flooding and is more prescriptive than those of many other flag states. Its strict application ensured the vessel was protected from the chances of sudden catastrophic flooding, by keeping all watertight doors closed for long periods while at sea. This, in turn, meant that watertight doors needed to be opened and closed frequently during routine machinery space rounds. This was inconvenient and, bearing in mind:

   - the many doors which had to be negotiated; and,

   - the time it took to open and close each door;

   engine room staff and others were liable to take short-cuts for expediency. The 3EO was taking a short-cut when the accident occurred. [2.3]

4. There were a number of different versions of operating instructions for the watertight doors on board *Royal Princess*. The accepted practice was different again. Clear, consistent, unambiguous and practical safety instructions provide a safety barrier that was not in place on *Royal Princess*. [2.6]

5. Those on board *Royal Princess* had been proactive in encouraging crew to obey the watertight door operating instructions. However, previous incidents of non-compliance were dealt with purely as disciplinary offences. That details of these incidents were not passed to the Safety Department did not help management to recognise the safety implications. Additional, and perhaps more effective, action aimed at combating the root causes of the previous incidents might have helped prevent this accident. [2.9]

6. The 3EO's judgment was possibly adversely affected by fatigue. Fatigue, in this case, could have been caused by a combination of the following factors:

    - Poor quality of sleep – his quality of sleep had been affected by the recent disruption to his watchkeeping schedule.
    - Stress (eg due to relationship problems, work environment) - he had a stressful relationship with the staff engineer.
    - Monotonous tasking - watchkeeping can be monotonous.
    - Shipboard environment (noise, vibration, movement, humidity and temperature).
    - Food (timing, frequency, content and quality) - despite excellent food being available on board, in the 24 hours before the accident, the 3EO had only eaten burger and chips for lunch while on watch in the control room, and pot noodle snacks again while on watch. [2.5]

Fatigue possibly affected the 3EO's performance in one or more of the following ways:

- Inability to concentrate, including being less vigilant than usual.
- Diminished decision-making ability including:
    - Misjudging distance, speed, time etc
    - Overlooking items
    - Choosing risky options
- Poor memory, including forgetting to complete a task or part of a task
- Slow response including responding slowly to normal, abnormal or emergency situations
- Attitude change, including:
    - Failing to anticipate danger
    - Failing to observe warning signs
    - Being too willing to take risks
    - Displaying a "don't care" attitude.

[2.5]

7. The possible factors involved with the 3EO's decision to pass through a closing watertight door include one, or a combination of, the following:

He might have done it -

- to save time;
- to improve efficiency;
- because his decision-making capability was possibly affected by fatigue;
- because he was distracted;
- if he was a natural risk-taker, who enjoyed the sense of danger;
- in open defiance of those in authority; or,
- to overcome the boredom of the watchkeeping routine.

[2.3, 2.4, 2.5]

8. The emergency escape door from No 2 pump room cannot be operated with only one hand free. [2.8]

SECTION 4 - RECOMMENDATIONS

P&O Princess Cruises is recommended to:

1. Ensure that the operating rules for watertight doors on *Royal Princess* are practical and common throughout the management system.

2. Review its safety management procedures to ensure that safety messages are learned from records of disciplinary procedures where appropriate.

3. Review and, if necessary, change its policy of when, where and how changes to watchkeeping routines are undertaken, so as to avoid the possibility of watchkeepers being fatigued.

4. Carry out a risk assessment of the operation of engine room escape doors on *Royal Princess*, with a view to considering whether a change of interlock design would be beneficial.

The Maritime and Coastguard Agency is recommended to:

5. Review the rules and guidance concerning where, and when, power-operated watertight doors should be kept closed at sea. The objective of the review should be to encourage compliance, without jeopardising the safety of the vessel or the operators. In doing this, consideration might be given to the application of a more risk-based approach appropriate to the individual vessel.

6. Review the current guidance on operating procedures contained in Marine Guidance Note (MGN) 35, with the objective of encouraging compliance. In doing this, consideration might be given to the application of a more specific risk-based approach, bearing in mind the particular control ergonomics and the human factors outlined in this report.

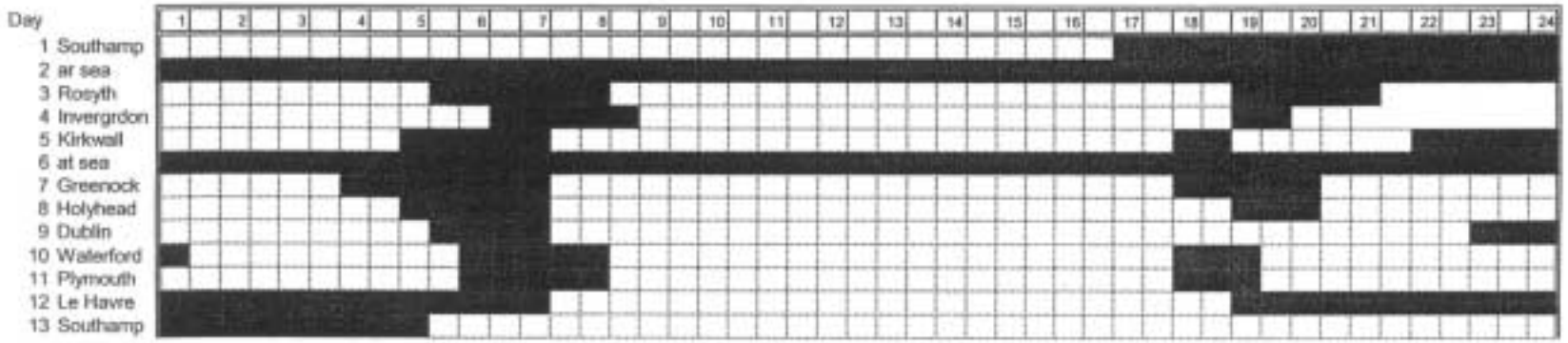
Marine Accident Investigation Branch
November 2002

Cruise 1114

WTD Potentially Hazardous times And Time of RED ZONE

Southampton-Southampton

Comm 03 August 2001 14 days Itinery



The Above time relate to the expected times of closure, The watertight doors may and will be closed at other times at the discretion of the OOW on the Bridge. If in During RED ZONE, only Operational and EMERGENCY calls to the Bridge and Engine Control room

Distribution: Captain, Staff Captain, Chief Engineer, CETO, Passenger Service Director, 1st Purser ADMIN, F&B Director, Bridge, ECR, Laundry, Hotel Storekeeper

Annex 1

Annex 2

P&O PRINCESS

FLEET REGULATIONS | INSTRUCTION LETTERS & NOTICES

FCN 2001	Fleet Cautionary Notices Issued June 2001

FCN 08/2001 Watertight Doors Incident

Watertight Door Incident

A recent incident on board a Company ship involved an Engineer Officer trapping his arm in a watertight door. He was landed ashore to hospital where his injuries were such that his arm was amputated below the shoulder.

Investigations have taken place internally, and the Marine Accident Investigation Branch are conducting a full investigation and will publish their report in due course.

The ship was at sea in 'potentially hazardous conditions' which required the watertight doors to be closed. All doors were set to local control. The Engineer was on the 00-04 watch and was carrying out normal watchkeeping routines which required him to pass through the Engine Room watertight doors. Having become trapped he managed to free himself and return to the Engine Control Room where he reported his injury. No-one observed the incident.

The following lessons can be drawn from the incident:

1. Passing through a moving watertight door is dangerous and against Company policy.

2. If properly operated in accordance with Company and onboard instructions, passing through a watertight door is a safe procedure. If the correct procedures for passing through watertight doors are not fully followed, the consequences can be fatal.

3. Whilst these points are clearly explained during onboard instruction, Supervisors should emphasise this to those persons authorised to operate watertight doors.

4. Those who regularly operate watertight doors must not become complacent of the inherent dangers.

A copy of the MAIB report will be sent to all ships when it is published.

August 22, 2001