



**The Bahamas
Maritime Authority**

**Report of the investigation into
the contact between the
High Speed Craft
HD1**

**And the moored High Speed Craft
CONDOR EXPRESS**

**During berthing operations
at St Helier, Jersey on
28th July 2007**

The Bahamas Maritime Authority investigates incidents at sea for the sole purpose of discovering any lessons which may be learned with a view to preventing any repetition. It is not the purpose of the investigation to establish liability or to apportion blame, except in so far as emerges as part of the process of investigating that incident.

It should be noted that the Bahamas Merchant Shipping Act, Para 170 (2) requires officers of a ship involved in an accident to answer an Inspector's questions fully and truly. If the contents of a report were subsequently submitted as evidence in court proceedings relating to an accident this could offend the principle that a person cannot be required to give evidence against himself. The Bahamas Maritime Authority makes this report available to any interested parties on the strict understanding that it will not be used as evidence in any court proceedings anywhere in the world.

The Bahamas Maritime Authority wishes to acknowledge the contribution to this investigation by the government of the States of Jersey, as represented by the UK Marine Accident Investigation Branch, (MAIB) and to thank it for its co-operation and support.

Date of Issue : 5th May 2008

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1. SUMMARY

- 1.1. At 2235 LT on 28th July 2007, during a berthing operation at the port of St Helier in Jersey, Channel Islands, the High Speed Craft HD1 carrying passengers and vehicles contacted the moored High Speed Craft CONDOR EXPRESS whilst attempting to berth at the West Berth of the Elizabeth Harbour.
- 1.2. At the time of the accident the CONDOR EXPRESS was completing loading at the East berth of Elizabeth Harbour.
- 1.3. Originally it had been planned for HD1 to berth on the East berth. The East berth is also the preferred operating berth for other HSC operating into the port as the Link span is self supporting and permits simultaneous load/discharge or 2 door load on the 74 & 86m Incat vessels. A delay in the loading operation and departure of CONDOR EXPRESS necessitated the change of berthing plan and alternative arrangements.
- 1.4. The decision to enter port and berth on the less suitable West berth was made by the master in conjunction with the port control. The choice was made in preference to waiting outside the harbour, in reaction to worsening weather conditions. The HD1 had a Jersey Pilot on board.
- 1.5. Both vessels were registered in the Bahamas.
- 1.6. There were no reported injuries to passengers or crew of either vessel.
- 1.7. HD1 suffered penetration of the hull on the port side, affecting three longitudinal compartments with distortion of shell plating and structure in a further two compartments. The damage was found to be about 0.7m above the waterline at the time. Apart from insignificant splash accumulations in the holed compartments of HD1 there was no influx of water to the damaged hull.
- 1.8. CONDOR EXPRESS sustained superficial damage to the starboard bow that, after inspection was deemed not to affect the seaworthiness of the vessel and there was no influx of water.
- 1.9. Both vessels were fitted with Voyage Data Recorders and the data from both has been utilised during the investigations, as was Jersey Harbour CCTV recordings of the incident.
- 1.10. A number of action points resulting from the incident have already been implemented and they are detailed together with further recommendations within this report.

2. PARTICULARS OF VESSELS AND BRIDGE TEAM

2.1. HD1 – Vessels Particulars

2.1.1. “HD1” is a High Speed Craft (HSC) carrying a maximum of 388 passengers (400 persons) and Roll-on Roll-off (ro-ro) traffic. The vessel is registered at Nassau, Bahamas, of welded aluminium construction having a twin hull catamaran construction. The following principal particulars apply:

Official Number	-	731002
IMO Number	-	9160114
Call Sign	-	C6PV4
Length overall	-	80.10 metres
Length BP	-	74.60 metres
Breadth	-	19.46 metres
Depth	-	5.65 metres
Gross Tonnage	-	2357 tons
Net Tonnage	-	708 tons
Date of Build		1998



- 2.1.2. The vessel was powered by four Ruston RK270 Mk II V16 diesel engines developing a power of 5500 kW each, transmitted through four Kamewa water jet units.
- 2.1.3. The cargo comprises ro-ro cargo and private vehicles, which were carried on the single vehicle deck that bridges the space between the two catamaran hulls.
- 2.1.4. Passengers are carried in accommodation above the vehicle deck.
- 2.1.5. The vessel was built in China at Panyu, Guangzhou Province and was formerly named INCAT K3. At the time of the incident the vessel was owned by Incat Chartering Ltd, bareboat chartered by HD Ferries Ltd. and managed by Northern Marine Management.
- 2.1.6. At the time of the contact the Permit to Operate High Speed Craft Certificate issued by the Bahamas Maritime Authority and agreed by all authority having jurisdiction over the operational area was in force.

2.2. HD1 – Vessel Managers

- 2.2.1. **Northern Marine Management Limited (NMM)** is a wholly owned subsidiary of Stena AB Gothenburg, formed in 1983 and located in Clydebank, Scotland with the primary commitment of providing ship management services to the various Stena sphere shipping divisions. They have considerable experience in the management and operation of ferry services, including High Speed Craft (HSC) services on a number of routes around the UK. The owners of HD1 selected NMM as the managers for the vessel based on this expertise and experience.
- 2.2.2. The vessel was registered under the Bahamas Flag in May 1999 transferring to Portuguese Flag in May 2006, returning to the Bahamas flag in February 2007. The vessel was entered with the DNV Classification Society. At the time of the accident she complied with all statutory, international requirements and certification.

- 2.2.3.** The HD1 was engaged on a high speed ferry service between the Channel Islands and France, as shown below, having met all the regulatory and High Speed Craft Code requirements as outlined in the Permit to Operate High Speed Craft, the vessel entered service in March 2007.



2.3. CONDOR EXPRESS – Vessel Particulars (HSC berthed at St Helier)

2.3.1. The second vessel - passive in the contact while completing loading operations at the East berth of Elizabeth Harbour - was the CONDOR EXPRESS, which carries a maximum of 741 passenger (800 persons) and ro-ro traffic, the principal particulars of which were as follows:

Official Number	-	8000472
IMO Number	-	9135896
Call Sign	-	C6SK5
Length overall	-	86.62 metres
Length BP	-	71.78 metres
Breadth	-	26.00 metres
Depth	-	4.12 metres
Gross Tonnage	-	5,005 tons
Net Tonnage	-	2,002 tons
Draught	-	3.63 metres
Deadweight	-	340 tons
Date of Build		1996



- 2.3.2. The vessel was powered by four Ruston 20V RK270M diesel engines developing a power of 7080 kW each, transmitted through 4 x Riva Lips LJ 145D, directional and reversible water jet units.
- 2.3.3. The cargo comprised ro-ro cargo and private vehicles carried on the vehicle decks that bridge the space between the two catamaran hulls.
- 2.3.4. Passengers were carried in accommodation above the vehicle deck.
- 2.3.5. The vessel was built in 1996 at INCAT Catamarans in Tasmania. At the time of the incident the vessel was owned by Condor Limited, and managed by Condor Marine Services, who have operated such vessels between the United Kingdom, Channel Islands and France for a number of years.
- 2.3.6. The vessel was first delivered in 1997 under the Singapore Flag and re-registered with the Bahamas Flag in 2002. The vessel was entered with DNV Classification Society. At the time of the accident she complied with the all statutory, international requirements and certification.

2.4 BRIDGE LAYOUT

- 2.4.1 The bridge of HD1 is centrally positioned. There is no direct over-side view available to any of the bridge team. There are two cameras trained forward, one over-side on each bow, but at the time of the incident they were not equipped with wash-wipe facilities and as a consequence they were reported to be regularly obscured by salt deposits.
- 2.4.2 There were no cameras positioned to view the after parts of the vessel and although the aft facing control position gives a better view than forward, it is still not ideally situated to view the vessel's extremities.
- 2.4.3 The vessel has two conning positions – the forward conning position and the after conning position
- 2.4.4 During cruising, the steering is controlled synchronously across all engines. The thrust direction of the water jets is controlled via the buckets, which are attached to the steering nozzles. Engines are controlled in cruising mode through a single (starboard) combinator set in the amidships position that combines both pitch of impeller and engine speed.
- 2.4.5 The aft control position consists of a repetition of the forward engine and steering controls – “the combinators” - but not the monitoring repeaters such as compass, engine and bucket direction indicators that indicate responses to "toe-in", "toe-out" and ahead or astern thrust orders. During the changeover from forward conning position to after conning position a procedure is in place to test the buckets response from the forward indicators

- 2.4.6** The control of nozzles (steering) and buckets (thrust) is affected during manoeuvring from both combinators, which are unlocked and individually apply steering as well as thrust movements. The engines are grouped in pairs. The port combinator controls both Port Inner Main Engine (PIME) and Port Outer Main Engine (POME). The starboard combinator controls both Starboard Inner Main Engine (SIME) and Starboard Outer Main Engine (SOME). There is a safeguard built into the control system that “disconnects” the control in the event of movements becoming too rapid for immediate execution.

2.5 BRIDGE TEAM

- 2.5.1** The Bridge Team on HD1 consisted of the master, the chief mate, the chief engineer and a rating lookout. There was also a Jersey pilot present and participating in the bridge team.

- 2.5.2** On arrival in St Helier the master had the conduct of the vessel. The chief mate was the master’s deputy. The chief engineer was seated at the engine control console monitoring engine and other machinery and in communication with the engine rooms, which by this time were locally monitored by the 2nd engineer.

- 2.5.3** The bridge team of HD1 were all experienced in High Speed Craft and had undergone training within the company Type Rating Training scheme. They were all in possession of type rating designation. The master a French national had been recently promoted to Master of HD1. He had previously served in high speed craft with a French company on vessels all of which had similar KaMeWa combinator controls, operating in the same area where, even as chief mate he would have gained experience of the particular handling characteristics of these craft.

- 2.6** Following the incident, the vessel was inspected by a Port State Control (PSC) officer from the UK Maritime and Coastguard Agency (MCA) at the request of the States of Jersey government whilst undergoing repairs in the port of St Helier. A number of deficiencies were noted and addressed before the vessel resumed services. The vessel was not detained, but was subject to withdrawal of the “ramp licence” issued by the States of Jersey.

3 NARRATIVE OF EVENTS

3.1 General and Weather

- 3.1.1 All times noted in this narrative are given in the style of the standard 24 hour clock without additional annotation and as local time in Jersey, which, at the time of the incident was UTC+1, was being kept on both vessels. All events listed below occurred on 28th July 2007 unless specifically stated otherwise.
- 3.1.2 Times were taken from the masters’, officers’ and crews’ testimonies together with log books and other record entries including VDR records, Electronic Chart system records from both affected vessels, port VHF and CCTV recordings, with some minor corrections to correlate the data where required.
- 3.1.3 The weather at the time of the incident was clear visibility, during the hours of darkness, with a wind from a direction variously described as between west south west and south south west, of 17 to 18 knots. The tide was falling and was at about half height.

3.2 Approach to St. Helier

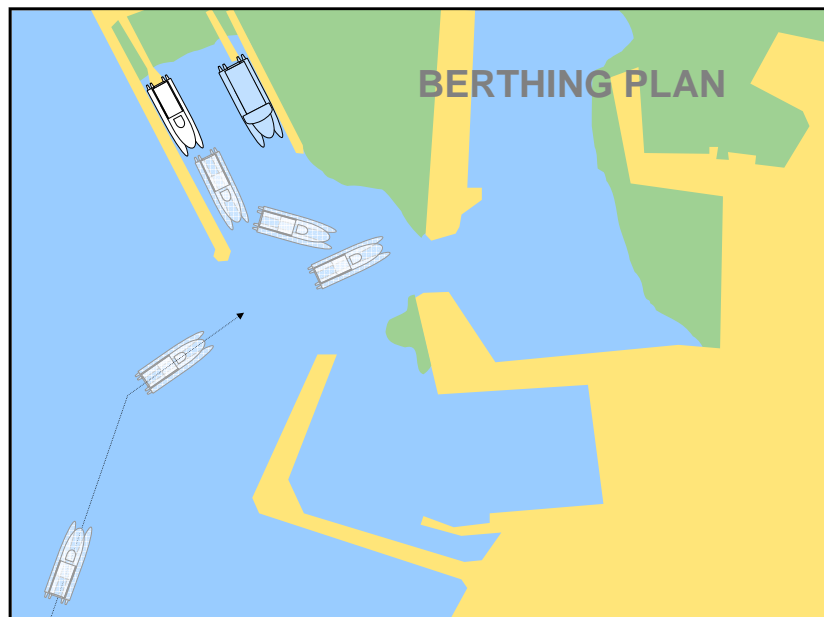
- 3.2.1 HD1 approached the harbour at St Helier on 28th July in the evening, reporting to the Port Control as the Demie de Pas lighthouse. 2225 is the 10 minute notice time given prior to arrival abeam Demie Des Pas lighthouse. The departure from St Malo at 2130 and the associated voyage to St Helier had been uneventful.
- 3.2.2 The St Helier pilot on board HD1 at the time had sailed with the vessel from the previous voyage to St Malo. His presence was necessary for St Helier as the master was not exempted from pilotage. The practice of over-carrying pilots is normal at St Helier for this vessel due to difficulties in embarking and disembarking at sea on the HD1.
- 3.2.3 The vessel had one significant mechanical deficiency which had been correctly reported by the Managers to the BMA and was known about by the master, crew, pilot and the harbour authority. The inner starboard engine and water jet had been decommissioned following a failure in the water jet pump during an earlier voyage. Consequences of this deficiency are discussed further in this report.
- 3.2.4 As HD1 was abeam Demie Des Pas Lighthouse, CONDOR EXPRESS revised her sailing time due to delays in the loading operation. Port VHF recordings verify this and confirm that it was at this late stage that the original plan for HD1 to berth at the East berth was frustrated by this delay and the presence of CONDOR EXPRESS occupying the berth.

3.2.5 The delay had necessitated a decision by the master of HD1, between waiting outside the harbour until after departure of CONDOR EXPRESS or entering and berthing at the West berth on the opposite side of Elizabeth Harbour to the East berth. This alternative was discussed between master, pilot and Port Control during the original reporting at Demie de Pas.

3.2.6 Due to the worsening weather conditions, the master considered the shelter would be better inside the harbour. The wind speed was increasing and approaching the limit imposed (20 knots) having been previously agreed the Managers, HD1 and Harbour Authority, at which HD1 would have had to be assisted by a tug as a precautionary measure due to the HD1 being deficient by one of four engines.

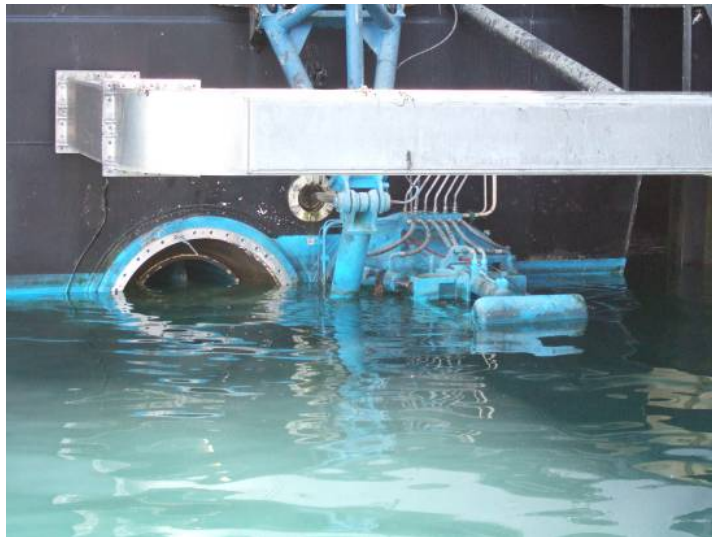
3.3 Entering Elizabeth Harbour. St Helier

3.3.1 The berthing plan represents the CONDOR EXPRESS berthed on the east berth and the planned manoeuvre for HD1 to enter the harbour and berth on the west berth.





The port nozzles of HD1



The starboard remaining nozzle, the inner unit having been removed.

3.3.2 It was necessary to give one hour's notice for mobilising the tug at St Helier. The late change of berthing plan and short notice available effectively ruled out tug use for the impending berthing and, with the wind speed below the 20kt limit, it was decided the tug requirement would not need to be imposed. Berthing would therefore be conducted without tug assistance in the normal fashion on the west berth.

3.3.3 HD1 entered the approaches known as the “Small Road” following a track slightly to the west of the normal track indicated on Admiralty Chart 3278 by the leading line of 022.7°. This deviation was advised by the pilot to position the vessel better in relation to the wind when it was required subsequently to swing to starboard and reverse in a north north westerly direction along the Elizabeth harbour.

3.3.4 The track followed by HD1 and confirmed by replay of the vessel’s electronic chart system followed a curve to starboard to the turning position as the West Breakwater was passed. This manoeuvre was normal and in keeping with the plan and confirmed by both VDR replay and the harbour CCTV footage from a camera situated on Victoria Pier.

3.3.5 After transfer from cruising control to combinator control the master moved to the after conning position and control was transferred followed by astern movements on the buckets. The transfer and astern movements were instigated at the after conning position and confirmed by the chief engineer. This action was used as a check on the response of the controls after transfer. The VDR voice recording confirmed the individual port and starboard “buckets astern”, in that order, which refers to the resulting thrust not the position of control.

3.4 Berthing in Elizabeth Harbour St Helier

3.4.1 Having turned the vessel to starboard inside the breakwaters, the reversing manoeuvre began. The reversing manoeuvre was conducted by the master from the after conning position on the bridge.

3.4.2 From the VDR voice recording it was evident that during the reversing manoeuvre the bow was initially reported as coming to starboard as the vessel aligned with the Elizabeth Harbour across the wind. The starboard swing was in a stationary, or near stationary position, prior to the vessel gathering sternway.

3.4.3 As the astern manoeuvre into Elizabeth Harbour progressed the bow started swinging to port, apparently under the influence of the wind pressure from the starboard side. This was very soon after the initial starboard swing was identified. On the voice recording of the VDR the fall off of the bow to port was reported as “paying off” by the pilot to indicate the movement. The master reacted immediately to query the meaning of the term “paying off”, which after a short discussion was clarified by intervention of the chief mate as “coming to port”.

3.4.4 At 22:34:49, immediately after the exchange between master and pilot referred to above, the heading was recorded as 136.9°. The VDR recording indicated that:

- the two port engine nozzles were toed in (to starboard) and responding to an astern call on the buckets;
- the starboard outer engine nozzle was toed in (to port) with zero demand on the bucket but 5% astern showing on response which was reducing from an earlier astern call now cancelled;

- the 100% toed in position of the starboard outer nozzle had not yet started responding to a reduction (60%) in toe in demand which equates to a movement towards amidships (0%); and the starboard inner engine was, as indicated earlier, out of service.

3.4.5 At 22:35:13 the above condition reversed. The master appears to have reacted correctly to the swing to port by placing the starboard engine astern and the port engines ahead. This is evident on the Victoria Pier CCTV recording when the port swing is reversed but the sternway also appears to be checked.

3.4.6 At 22:35:15 the VDR shows that the heading had altered to port to 127.4° by which time:

- the port engine nozzles had been moved to toed out (to port) and thrusting ahead;
- the starboard outer engine was toed in (to port) and thrusting astern in response to a considerable demand (100%); and
- the toe in of the starboard outer nozzle was only 5% in response to a demand for 85%, an indication of the lag behind rapid changes in directional demands that were occurring at this time.

3.4.7 At 22:35:30 the heading had altered further to port to 116.2°. The VDR showed a significant reversal on the port engines as follows:

- the port nozzles were now responding to a large demand for toe in (to starboard) and were at this instant amidships (0%). The thrust was however responding to an astern call on the buckets (70%) and all ahead thrust was reducing rapidly with the inner engine showing +30% and the outer +5% (+ = ahead); and
- the starboard outer nozzle was responding to another toe in (to port) call and the engines to a significant astern call, indicated by the RPM increase in addition to the 100% bucket demand.

3.4.8 The VDR voice recording indicated an increasing concern on the part of the chief mate regarding the “fall off” of the bow to port. After giving repeated advice to the master the chief mate moved to the forward conning position to gain a better view of the clearances on the port bow. From this position he called to the master to transfer control to him. The master immediately responded and transferred control. Control was confirmed at 22:35:38, 9 seconds after the chief mate called for it and 24 seconds before impact.

3.4.9 At 22:35:39 the heading was 109.8°. The VDR indicated that after the master had transferred control and the chief mate had just confirmed it at the forward conning position:

- the port engines were responding to a full toe out (to port) demand and the buckets were responding to a considerable astern call indicated by the RPM increase registering in addition to the 100% bucket demand;
- the starboard outer nozzle was responding to another reversal of demand – full toe out (to starboard) and the buckets to a full ahead call; and
- an increasing RPM on all engines indicated a significant demand.

3.4.10 The starboard engine was now at full ahead and the port engines were full astern, causing a turning couple that was increasing the swing to port. This increase of swing was very evident on the Victoria Pier CCTV as was the ahead thrust from the starboard engine as it impinges on the West Breakwater quay wall.

3.4.11 Following transfer of control at 22:35:38 the master moved forward to the conning position where the chief mate was at the controls. There was no formal handover of the con or command audible on the VDR voice recording. The Victoria Pier CCTV recording showed that progress of the vessel had intermittently continued astern with the bow repeatedly falling off to port towards the CONDOR EXPRESS then being intermittently partially corrected

3.4.12 At 22:35:58 the heading was 104.4° The VDR recording shows:

- the port nozzle and engine settings remained approximately the same as at 22:35:48 – fully toed out (to port) and responding to a full astern demand. The RPM increased further; and
- The starboard outer nozzle and engine settings remain unchanged on fully toed out (to starboard) and full ahead.

This is supported by footage from the Victoria Pier CCTV showing a plume of water emerging from the starboard stern of the vessel and impinging on the West Breakwater quay wall. Immediately prior to this time the chief mate is heard saying “we’re going to hit” and the master’s voice can be heard two seconds later apparently asking a question, “you kept full astern?”.

3.4.13 At 22:36:01 the heading shows 105.0° The VDR records:

- a rapid alteration of call on the port engines from full astern to ahead
- the port nozzles are reduced from full toe out (-100%) to a lesser angle shown as -30%. Demand is shown as +35% indicating a demand to toe in (to starboard).; and
- the starboard outer nozzles are also being reversed from full toe out to toe in but thrust remained full ahead.

3.5 Impact with the CONDOR EXPRESS

- 3.5.1** On board CONDOR EXPRESS the bridge team had become aware of the developing situation when the HD1 was reversing towards them. They recognised that it was becoming critical when the closing distance had reduced to approximately 50 metres ahead and the bow of HD1 continued to fall off to port towards them. The Master of the CONDOR EXPRESS took action on board the vessel and stopped all loading, cleared the stern ramps and initiated emergency stations (less lifejackets and alarms); ensuring passengers were seated and clear of stairwells before impact.
- 3.5.2** The final closing towards CONDOR EXPRESS was monitored and reported by internal radio from the forward mooring station by the bosun on HD1. As the bosun called closing distances the master could be heard on the voice recording apparently discussing the option to abort the manoeuvre but his intervention, “10 metre we can go out?” did not come until 5 metre was being called and events progressed too quickly for any response.
- 3.5.3** Immediately prior to impact the senior cabin service officer (OBS Manager) on HD1 recognised the worsening situation independently of any order from the bridge and instigated emergency procedures to safeguard passengers.
- 3.5.4** At 22:36:02 the heading of HD1 was 103.7°. An impact noise could be heard on the VDR voice recording strongly suggesting this was the time of contact. The CONDOR EXPRESS was heading 157.0° by virtue of being alongside the East berth. The angle of interception was therefore about 53°.



Left:
HD1 initial penetration and exit
gouge in an astern direction.

3.6 After Impact with the CONDOR EXPRESS

- 3.6.1** After the initial contact and penetration HD1 continued to move ahead. This forward movement did not initially clear the bow of the CONDOR EXPRESS. The HD1 port side shell traversed across the sharp wave piercing structure around the bow of CONDOR EXPRESS which caused further damage to the HD1 shell plating, breaching three compartments.

Right:

Secondary incisions and damage to the Hull of HD1



Left:

CONDOR EXPRESS moored at the East Berth

Right:

CONDOR EXPRESS starboard wave piercing bow upon which the HD1 landed.

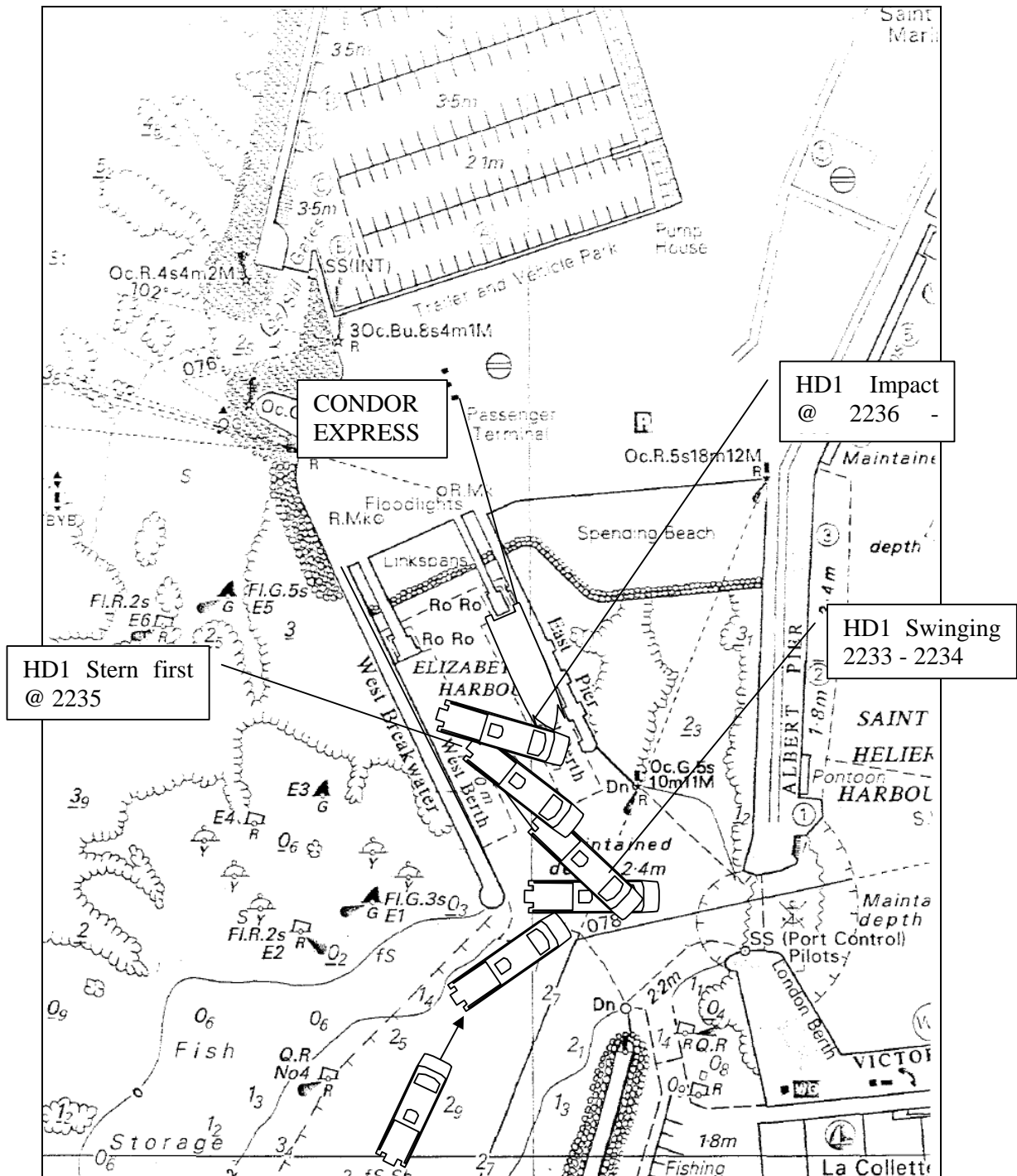


- 3.6.2** Immediately after impact the port engines of HD1 disconnected. About this time the decision to abort the manoeuvre was made. The disconnect alarm – a morse “D” group on an alarm tone - was heard on the VDR immediately after impact. When the port engines disconnected, they froze at the speed and direction selected. Disconnect happened as a result of speed of demand on the engines being too rapid for the engine installation to respond. The master was apparently involved in manoeuvring at this stage as he became agitated about the loss of engines and was only reassured by the intervention of the chief engineer pointing out that the engine control had been restored.
- 3.6.3** In the period immediately after the Engines were reconnected HD1 was manoeuvred ahead and away from CONDOR EXPRESS to pivot the vessel round the dolphin and reverse out of the harbour.
- 3.6.4** The VDR voice recording during this time further indicates that the master was on the controls as the chief mate can be heard apparently offering advice about slowing the engines down. The formality for handover of control between the master and chief mate was however unclear and confused during the period immediately prior to and following the impact.
- 3.6.5** The pilot requested tug assistance following the impact, as the HD1 manoeuvred clear of the harbour.
- 3.6.6** After the HD1 moved off the bow of CONDOR EXPRESS and along to the dolphin beyond the end of the East Pier the pilot could be heard on the VDR voice recording conferring with the chief mate who, by this time, had apparently taken control. The pilot confirmed that it was safe to place the port bow of HD1 on the dolphin and pivot the vessel round to port to re-align for exiting the area stern first. No formal handover was heard.
- 3.6.7** The voice recording supports the interview claims of chief engineer, chief mate and the master that the astern manoeuvre out of the harbour was after initial checks by the bosun had confirmed the nature of the damage in number 2, 3 and 4 void spaces. Further damage assessment was carried out by the second engineer in close contact with the chief engineer by internal radio during the stern first manoeuvre out the harbour.
- 3.6.8** The vessel proceeded out of the harbour stern first. Various conversations were audible on the VDR voice recording at this time including damage assessments between the chief engineer and the second engineer. There was another exchange in relation to navigation in which the vessel had to pass an inbound yacht. Three short blasts were given on the whistle to indicate to the yacht that HD1 was navigating stern first. There was concern that the vessel’s unusual manoeuvre might be misunderstood by the yacht. Control was continued at the after position. This necessitated relaying of the heading information from the forward consoles by the chief engineer as compass and bucket indicators are not included at the after position.

- 3.6.9** During the above manoeuvre the pilot was heard asking who was taking command. The chief mate replied that he was. Some comments were heard from the master but none to counter this assumption.
- 3.6.10** The bilge alarms indicated the breached spaces were not flooding and this was confirmed by the initial internal inspections carried out. Once outside the harbour the vessel took up a heading in which the damaged side was placed downwind and the chief engineer and chief mate made a more detailed assessment of the damage. This was carried out in St Aubins Bay to the west of the harbour.

3.7 Following departure of the CONDOR EXPRESS

- 3.7.1** After the CONDOR EXPRESS had finally sailed, having assessed damage from both within the hull and outside via the fast rescue boat, HD1 re-entered the harbour and berthed on the west berth. The berthing manoeuvre was assisted by the tug TITAN and the process was without further incident.
- 3.7.2** Following the discharge of passengers and cargo, HD1 moved across to the Inner Harbour and lay alongside Victoria Quay for repairs. By the time this manoeuvre was carried out, the senior master had been called to the vessel from ashore. He took the controls for the move to the Inner Harbour.
- 3.7.3** The vessel was inspected once alongside Victoria Quay and repairs put in hand. The extent of the damage was a diamond shaped incision in No. 2 port void space in way of frame 43 and a number of incisions and indentations along a line from just abaft the initial impact position crossing the after end of No. 2 Port void and passing across No. 3 and 4 port voids. The position of the impact in No. 3 void space was coincident with the line of the cables supplying the bilge pump and the signal lines from the bilge alarm for that space. Whilst they were displaced the cables were not damaged.
- 3.7.4** As a result of the incident the "Ramp Licence" of HD1 was suspended by the Jersey Harbour Authority, who also requested the attendance of the UK MAIB and MCA. The Bahamas Maritime Authority initiated an inquiry into the incident.
- 3.7.5** The approximate track of HD1 on the inward passage is shown in the diagram below. The inward and outward passages either side of the contact are shown in APPENDICES I, II, III and IV. APPENDIX V gives a description of techniques of manoeuvring with water jets and APPENDIX VI gives a detailed record of key engine and steering movements as extracted for VDR records.



HD1: Entrance to Impact:- Small Road (ahead) to Elizabeth Harbour (Stern First). Positions are approximate: derived from ECS (HD1), Victoria Pier CCTV, VDR voice (HD1 and CONDOR EXPRESS), and VHF Ch14 (Port Control), plus interviews and statements.

3.8 Timeline of Significant Events

Time	Event
22:32:55	Vessel entering harbour swinging to starboard. Transfer of controls Forward to aft manoeuvring position.
22:33:05	Chief engineer reports “Buckets (Port and Starboard) astern” signifying confirmation of successful transfer.
22:33:57	Master misunderstands advice from pilot regarding responses of the vessel. Master questions terminology. Quickly clarified by chief mate. Discussion continues for 30 seconds during reversing manoeuvre.
22:34:34	Chief mate advises “Bow coming to port”
22:35:06	Chief mate urgently advises master of need to get bow to starboard.
22:35:20	Bosun at mooring position advises “10m to CONDOR EXPRESS bow”
22:35:27	Chief mate requests control at forward position
22:35:38	Control transferred to chief mate at forward position
22:36:02	Contact made with bow of CONDOR EXPRESS
22:36:07	Decision (by chief mate supported by pilot) to abort and return to sea
22:36:13	Pilot notifies Port Control of decision
22:36:41	Port engines disconnect due rapid demand movements
22:37:05	Chief mate advises master (now on controls) to “Slow it down”
22:37:11	Vessel moves ahead continuing in intermittent contact with CONDOR EXPRESS bow.
22:37:25	Master of CONDOR EXPRESS reports contact to Port Control
22:38:01	HD1, now clear of CONDOR EXPRESS, contacts and pivots (deliberately) on dolphin. 2 nd engineer conducts provisional damage assessment.
22:39:44	Control transferred to aft position where chief mate on controls
22:40:12	HD1 moves off dolphin and proceeds stern first into Small Road.
22:47:18	HD1, having proceeded stern first out of harbour, turns off Tanker Berth and proceeds to St Aubin’s Bay for detailed damage assessment.

4 ANALYSIS

- 4.1** The vessel (HD1) was able to continue operation with a single engine on the starboard hull but some limitations on operation had been put in place by the Jersey Harbour Authority based on concerns over a number of earlier incidents. Restrictions were based on wind speed and direction. Prior to the incident the wind was WSW 17- 18 knots. The wind being from the south westerly sector meant it would be on the beam once the vessel was turned and aligned to reverse into Elizabeth Harbour.
- 4.2** Mobilisation of the tug would take one hour after ordering. This could have influenced the master to decide to enter the harbour and attempt to berth before the wind reached the critical limit of 20 knots when it would have been more prudent to wait. It is also recognised however that the commercial pressure to maintain schedules and keep passenger discomfort to a minimum may also have influenced the master’s decision. Crewing rosters were also likely to be disrupted if the vessel was delayed outside the harbour. The off-duty time available for rest periods would have been reduced,
- 4.3** The Master’s decision to go ahead with the berthing was made with the stated wind speed being within the prescribed 20 knot limitation. The contingency plan to exit the harbour in the event of the wind speed increasing above the 20 knot limitation and to wait on the availability of a tug to assist was in place. Neither the pilot nor the Port Control chose to intervene. This could have been taken by the master as an endorsement of his decision, even though the contractual limitations of pilotage would normally cover only local knowledge and communication with shore and/or tugs. They would not normally, and did not in this case, include any specialised involvement in the ship handling for which the master and chief mate were type rated in accordance with the operating company’s training scheme.
- 4.4** The cruising control is available at the forward position only. The routine for the turn and reverse, which culminated in transfer of control to the after position was carried out efficiently. Movements became critical after transfer of control to the aft facing position. A reversal of spacial awareness would have been necessary and it would appear from the erratic engine movements that the master became disorientated.
- 4.5** The VDR voice recording suggested a fairly relaxed and routine situation on the bridge during approach to the harbour and through the turn in the outer harbour until the reversing manoeuvre into Elizabeth Harbour began. The windage of the vessel then began to influence the movements however. Reports from bridge team members, including the pilot, suggest there was awareness of potential fall off from the wind. It was evident that there was increasing concern regarding what was interpreted as the cross wind effects forcing the bow of the light displacement vessel to port. In fact the VDR recordings indicate that the movement of the vessel was largely in response to engine movements.

- 4.6** The astern movements instigated at the turn were routinely used to take the ahead way off the vessel and begin the reversing manoeuvre into Elizabeth Harbour. This part of the manoeuvre was executed efficiently and confidently. Further adjustments on combinators were used to control the turn within this manoeuvre. The VDR recording shows the combinators calling for and nozzles and buckets responding to toe in on both sides with engines astern during this manoeuvre, which is in accordance with a routine operation.
- 4.7** As the manoeuvre stern first into Elizabeth Harbour progressed the Master of HD1 became distracted by the misunderstanding of the pilot’s advice. He then apparently became disorientated. The thrust through the buckets from the port and starboard engines was repeatedly demanded in the wrong direction as the vessel moved astern causing a turning moment to port in addition to the effects of the beam wind.
- 4.8** The term “paying off” would appear to have been the catalyst to distract the master when the pilot used it. The master did not understand it and appeared to be irritated. The master on this occasion was French. The nautical terms with which he would be familiar would have been completely different from English terms and he was working in a language that was not his own. The Chief Mate aware of the developing situation rephrased the Pilot advice for a better understanding of the Master.
- 4.9** The starboard ahead and port astern movement at 22:34:49 is illogical as the bow is being forced to port by the wind and the movement would only reinforce this effect. To hold the bow up to windward and move the vessel astern engine movements would need to have been starboard astern and port ahead throughout - the opposite of what was being applied.
- 4.10** The immediate reversal of engine demands at 22:35:13 and a further reversal at 22:35:30 suggest disorientation by the master. The first movement would indeed have worked to check the swing due to the windage had it been left long enough to activate. The excess of ahead thrust on the two port engines over the single starboard engine would however have injected an ahead component. This is evident on the Victoria Pier CCTV recording when the port swing is reversed but the sternway also appears to be checked. The subsequent rapid change however nullified any positive effect the movement would have had. Further evidence of disorientation by the master is provided by the fact that the chief mate had, by this stage, become very anxious about the continuing “fall off” of the bow to port. His anxiety and apparent frustration was evident having moved from providing information about the bow response e.g. “bow coming to port” to one of advice for suggested actions “get your bow to starboard”.
- 4.11** At 22:35:39 the master had placed the starboard engine to a full ahead condition and the port engines to full astern, again injecting a considerable turning couple to increase the swing to port – the opposite of what was required. This increase of swing was very evident on the Victoria Pier CCTV as was the ahead thrust from the starboard engine as it impinged on the West Breakwater quay wall. The vessel by this time was well inside the lee of the West Breakwater but it is not possible to determine if the windage “fall off” was still existing. Informal

discussion with the senior master, who was not involved in the incident, revealed that he had been aware on some occasions of an opposite effect close in to the breakwater caused by eddying of air currents into the void downwind creating a vortex. These would be more pronounced at low tide conditions. Whether this was the case on the 28th July is not known. The extreme engine induced couple however would have been more than adequate to impose a significant swing to port without any wind involvement.

- 4.12** Soon after 22:35:39 the master transferred control to the forward position where the chief mate was positioned to take over control. The VDR shows however that the configuration of the engine controls did not at this stage change. The port engines remained full astern and the starboard engine full ahead until at least 22:35:58, only 4 seconds before the time established as the most likely impact point. The turning moment to port would have been considerable at this time and it is reasonable to interpret the main cause of the rapid swing to port as being caused by the engines and steering, not the wind. The chief mate does not appear to have realised that the engines were thrusting in the wrong directions.
- 4.13** It appears that eventually there was realisation of the situation when the master asked about the engines being kept full astern at this time, which was followed within 3 seconds by a full ahead movement on the port engines. There was no formal transfer of command to the chief mate and it is not absolutely clear if the master, who had moved to the forward position, in any way adjusted the controls. The chief mate appeared to have been on the controls but from the record it appears he did not detect the engine configuration as opposite to requirement until the master’s intervention.
- 4.14** Having placed the port engines ahead there was no change in the ahead thrust of the starboard engine and therefore all engines were creating an ahead component, which by this time was at a broad angle across the bow of CONDOR EXPRESS. Furthermore the starboard nozzles were swung through from toe out (starboard) to toe in (port) at this time and this would have, with the continuing ahead thrust, reinforced the swing to port. Risk of contact was therefore still inevitable. Had an astern movement been introduced on the starboard engine, even at this late stage, the turning moment would have been working against the swing into the contact. It is not possible however to calculate if the action would have prevented contact at such a late stage.
- 4.15** Around the time of impact there was a confused situation on the bridge of HD1 in which it was apparent that the chief mate had believed he could, having control at the forward conning position, recover the situation. At the same time the master was still participating with questions about the state of the engines “you kept full astern?” and even a possibility of aborting the operation “10 metres, we can go out?” There was no formal handover of control, con or even command. It was not certain that the chief mate had control of the vessel although the master’s reference to “you” when referring to keeping full astern strongly suggests the chief mate had at that moment got control but it could just as easily be part of a check during resuming control. Exchanges of engine status would be a normal part of such handovers. The master was by this time in attendance at the live control position and could have been operating controls

although the voice recording suggests otherwise until later. The confusion was however indicative of a breakdown in the bridge team regime.

- 4.16** Immediately after impact the chief mate apparently made a decision, in which the master appears not to have been involved when he and the pilot discussed the need to take the vessel out. There had not been any formal handover from master to mate and according to voice recording the pilot made no attempt to check the decision with the master. Informally it appears the master had already been discounted although it is obvious from the voice recording that he is still in attendance and appears later to be affecting some control when he exclaims about not having any engines, followed by the chief mate telling him to “slow it down” being a reference to his agitated state rather than progress of the vessel.
- 4.17** Further confusion arose in turning the vessel around the dolphin when the chief mate could be heard offering a running commentary to the master, following the master request for advice about the position of the vessel and the desired manoeuvres to enable the reversing out, as suggested by the pilot. This suggests that the master had not in fact withdrawn or been eliminated from the bridge team but was again participating on the controls.
- 4.18** At no time during the incident was there any audible communication between the bridge and the passenger cabin. The situation was confused and the bridge team appeared to be struggling to reconstitute itself. The chief engineer did take the initiative to investigate damage by using the 2nd engineer initially and then later acting as a conduit of communication, collecting damage information before passing it on to whoever was listening on the bridge. He also alerted the master to communications coming in for his attention, further reinforcing the impression the master was still regarded as participating in a position of command.
- 4.19** The master remained in formal command throughout this period as there was no handover until later on when the vessel was well clear of the harbour on its outward stern first passage. The chief mate appears to have taken control when he replied “I am” to a question by the pilot about who was taking command, itself a loaded question as it implies that there is no clear command in place. The pilot is of course entitled to clarify to whom he is responsible in the particular pilotage contract.
- 4.20** Both Jersey and Guernsey PEC examinations require 3-4 weeks training with the local pilots prior to examination. The PEC certificate applicable to HD-1 and other commercial vessels operating into St Helier Harbour do not require training covering "all the harbours in Jersey" but only an area of the south coast covering the approaches to St Helier.

In St Malo the system requires a pilot or a PEC, the examination of which is all in the French language. The masters and mate/masters available for operating the HD1 were as yet to be submitted to pilotage training in Jersey. The lengthy shore based training covers not only St Helier but all the harbours in Jersey. As a result there were insufficient numbers to be able to release candidates to attend the training.

- 4.21** Pilots riding the vessel from Jersey informally train the masters for their PEC . The pilotage authority advised that their approach is to involve the master in as much of the local knowledge as possible prior to any formal training ashore. This would appear to be an effective and pragmatic approach to the training of masters. As would normally be expected the Jersey pilot appeared to be the main conduit of communication between the harbour and the vessel and his local knowledge advice to the master amounted to little more than an occasional reassurance that actions were correct. It was apparent that the HD1 master and mate were both familiar with the waters even if not formally confirmed as such. It was unfortunate that in participating in monitoring the manoeuvres and offering advice on the response of the vessel, which in strictest terms could be considered outside his remit, the pilot became embroiled in a misunderstanding that appears to have been the beginning of the incident.
- 4.22** All records indicated that the vessel had full clearance to enter the port from the second contact at Demi de Pas light beacon. The pilot was also heard offering advice during and subsequent to the incident. The port control did not suggest that the HD1 delayed entry until CONDOR EXPRESS was clear. It is an established fact that close proximity passing is a regular feature of harbour operations in St Helier. The more difficult handling characteristics of the HD1 with the SIME out of commission was known and the fact that the power from the single engine on the starboard hull was considerably less than the combined power of the two engines still in commission on the port hull was likely to work against the ability of the vessel to both keep sternway and hold the bow up against the wind. The excess ahead power on the port engines working against the stern way should have been apparent to the master and mate. This factor may have contributed to this and some previous incidents. The requirement for a tug had been introduced to assist in such circumstances but the point at which it would be required was still subject to adjustment as the wind speed limit less than 20 knots prior to this incident. On more detailed investigation the evidence suggests a ship induced swing from the engines was the principal cause of the contact rather than the wind. The tug however, had it been in place would have prevented either.
- 4.23** It is possible that lack of feedback as a result of the poor ergonomics of the bridge could have contributed to the master’s apparent confusion. Secondary information feedback, as was necessary for the engine and steering responses at the after control position introduces a time delay, which in a light displacement craft such as the HD1 could be critical. It also introduces an additional element of potential human error although it is evident that this aspect of the operations on the night of the incident was error free.
- 4.24** The berthing was taking place after dark. Without a full set of control indicators at the aft control position, in particular heading as well as bucket control indicators, the master may not have appreciated the full extent of the fall-off to port and did not identify the human error made in the incorrect engine movements. Neither was this error recognised by the other members of the bridge team, until it was too late to avoid the contact.

- 4.25** The bridge is positioned such that a view overside is impossible. The overside CCTV cameras were reported to be susceptible to encrustation with salt and this could not be removed prior to entry into port because access to those cameras were considered dangerous for crew in that they were unfenced and on the cabin roof at the outer extremes and there was no jackstay to which harnesses could be attached. The master and mate were therefore cocooned in a capsule with very little ability to gain first hand appreciation of movements of the vessel or closing distances.
- 4.26** The video monitor positioned at the aft control position for monitoring the CCTV cameras displaying overside towards each bow is exposed to bright sunlight and becomes difficult to view in daylight. During the investigation this monitor was seen to be shielded from sunlight by a home made cardboard screen. The incident occurred at night so this is unlikely to have been an imposition at the time; however it is indicative of a design culture that has not properly considered operational limitations.
- 4.27** Following the contact the Kamewa control systems on the port water jets "disconnected" (tripped) just after impact. This was probably as a result of changes in demand on the system that was too rapid and probably being a direct result of the increasing excitement of the master as he became spatially confused. The situation had rapidly deteriorated with the HD1 swinging towards the bow of CONDOR EXPRESS and neither the master nor the chief mate appreciated the effect of inappropriately configured engines. A defective proportional valve was detected by a technician from a specialist hydraulic contractor, Solent Fluid Power, employed by Northern Marine to investigate the steering control system after the Incident on 28th July. This would have reduced the available extent of variations in manoeuvring orders for which the master could feel confident of a response. The testing regime during pre-voyage checks was in line with industry practice and tested the function of the waterjets although with hindsight might be considered insufficient.
- 4.28** The tendency of the engines to disconnect conflicts with the need for adequate protection against failure of critical systems required in the HSC Code 11.2.1. The audible and visual alarm required by the code appears complied with but the further requirement not to prevent normal manual control appears more questionable. If the design is such that disconnect occurs rather than slowing or limitation of responses in reaction to high demand, this could be concentrating protection on internal systems at the cost of the vessel's overall safety. The resetting may be rapid but it is a break in control that allows for an escalation of events that are likely to be critical as was the case when the master became agitated at having lost his engines immediately after impact. Furthermore the disconnect function requires a positive human intervention to restore the situation. In critical situations masters will, almost certainly be more likely to place greater demands on the system. The term “disconnect” is in itself confusing as it could be interpreted to mean a cutting of power, which is not the case. It actually indicates a disconnection of the steering and a freezing of the power settings in the condition at which the event occurred. It could be that if not immediately corrected, this condition could drive the vessel effectively out of control towards a critical situation. In the circumstances of this incident it is

possible the disconnect worsened the subsequent damage after the initial impact. The need for a positive intervention to restore engines from disconnect also appears to conflict with the requirement in the HSC Code 5.2.6 to become operative automatically and respond correctly within 5 seconds of power or other failure.

- 4.29** The VDR voice record indicated that a number of communications were received on the bridge after turning on the dolphin and proceeding out of the harbour. The first of these communications was from the Bosun by handheld UHF reporting a hole in the number 2 port void space and penetrations in numbers 3 and 4 voids spaces. The reporters were entering the spaces, which are regularly ventilated, and this permitted early access.
- 4.30** Further to the above there were no bilge alarms. The bilge alarm system in each space is simple, amounting to a float switch that is closed to indicate an alarm. There is no open circuit alarm as one would find on the more sophisticated systems aboard bulk carriers. However, the wiring for both the bilge alarm and the bilge pump drive are led down the inner surface of the outboard side of each of the voids they serve. In the case of the penetration of void No. 3 the incision was made at precisely the same level as the run of the cable, which was displaced. In the event the cable did not break but if it had, the open circuit would have indicated a safe situation unless by chance the parting of the cable also caused a short circuit within it. The HSC Code refers to a number of alarms that must be fitted but most are concerned with machinery protection and fire. There is no specific mention of bilge or water ingress detection systems. The spaces occupied by the voids that were penetrated on HD1 represent a significant volume and if the penetration had extended below the water line which in a higher momentum penetration could have been expected, the stability of the craft and possibly its survival would have been compromised.
- 4.31** The vessel was some distance into the Small Road before a positive report was received that the hole was above the waterline. At interview the pilot was asked what would be the preferred action in the event of holing, to which his reply was to beach the vessel on the spending beach in the old St Helier harbour or subsequently in St Aubin's bay were both considered. The latter was considered a better option in sheltered waters on the west side of the bay. However subsequent damager reports indicated that the vessel was not taking in water.
- 4.32** After the vessel had cleared the harbour the chief engineer and chief mate assessed the damage in more detail when the vessel was held in St Aubin's bay with the damage on the lee side. There had been some spillage of wave tops and spray into the spaces but this was very limited and by this time the spaces were being monitored and the height of the penetrations above the waterline had been determined. The measures taken to position the vessel in such a way as to keep the damaged area sheltered was probably the best solution at the time to enable an early return to the shelter of the harbour.

5 CONCLUSIONS

5.1 In relation to HD1's manoeuvring characteristics:

- 5.1.1** The removal of the Starboard Inner Main Engine (SIME) had a significant effect even though the vessel retained sufficient power for safe operation, although it is not unusual for fast craft to operate with one waterjet or main engine out of operation.
- 5.1.2** The manoeuvring characteristics of the vessel, in particular its tendency to drift with limited draught to resist it, should be well known to the master. This conclusion does not infer that this was not the case, but it is a factor in the escalation of the situation into crisis and under the circumstances the measures taken on board were seen to be both inadequate and incorrect.
- 5.1.3** The 18 knot cross wind from the south west was strong enough to start the bow of the HD1 swinging to port as the vessel came astern into the lee of Elizabeth Harbour. The turning effect on the vessel increased as the stern section entered the lee of the harbour wall, with the starboard side of the bow section remaining exposed to the wind. Engine movements and not wind effect however were the main contributory factor in the final swing to port and contact.

5.2 In relation to bridge team management:

- 5.2.1** The pilot used a term – “paying off” that was not understood by the French master of HD1. It would have been prudent to be more careful with terminology used, which would probably have required determined effort. The nature of manning at sea however has for several years been involving more mixed nationality personnel. English is the accepted common language to be used but there will inevitably be varying levels of understanding of colloquialisms such as are often used by local mariners. Notwithstanding the above however it is a fine line that divides the pilot’s contractual obligation to provide local knowledge from good mannered observation of the handling and response of the vessel, which in the strictest interpretation is outside his terms of employment.
- 5.2.2** The master was distracted by his misunderstanding of the term “paying off” used by the pilot in relation to the movement of the bow swinging to port. The master allowed this to disrupt his concentration at a critical time.
- 5.2.3** The chief mate became increasingly concerned about the continued fall off of the bow and communications and responses between different members of the bridge team were inadequate to reverse the situation.
- 5.2.4** No member of the bridge team identified that the port and starboard buckets were thrusting in conjunction with and not against the turning effect of the wind until it was too late.

- 5.2.5** The transfer of control immediately before the impact may have lost vital seconds in the counteraction process due to the time it takes to effect transfer. At this time the situation was progressing rapidly towards the critical point at which it was impossible to check the swing.
- 5.2.6** The countdown of the bosun showed that the distance was closing rapidly. His reports of 10 metre, 5 metre and 1 metre spanned a period of 33 seconds and the 1 metre report preceded impact by only 6 seconds but early acknowledgement of this fact took the form of alarm in the team rather than calm and reasoned response.
- 5.2.7** When the controls were transferred from the after to the forward conning position it was not recognised that the buckets were thrusting in the wrong direction and they continued to do so i.e. port thrusting astern, starboard thrusting ahead. It was not until, upon arrival at the forward conning position that the master appeared to have checked the indicators, which were now visible to him whereupon he questioned the direction of thrust.
- 5.2.8** When the demand for port engine thrusts were changed to an ahead movement the starboard engine remained thrusting ahead and continued the turning to port due to the designed lag in response of the port engines from astern to ahead together with a forward vector on the vessel generally and the toe-in of the nozzle.
- 5.2.9** Immediately before impact, although there had been transfer of control to the chief mate’s position forward, there was no identifiable formal handover of the con or acknowledgement. Some verbal checks about responses of the controls were audible on the voice recording. From the voice recording it appears the master was attempting to continue in his command capacity but was clearly under some stress. The chief mate at the same time was confident to the point of sounding as though he had assumed control. The bridge team organization and chain of command was at best confused.
- 5.2.10** The chief mate could be considered decisive when it became obvious that a contact was imminent and also immediately after the impact, but this was too late to prevent the consequence and it appears he did not detect the incorrect engine movements that he inherited from the after position. His assertiveness however would appear to have eclipsed rather than enhanced the master’s authority. The bridge team were not operating effectively at this critical time.
- 5.2.11** When the vessel fell off so far to port that the bridge team, most notably the chief mate, recognised that the situation was becoming critical there appears to have been a period of indecision when the master did not, or was unable to act decisively in effecting an immediate abort before the positions of the two vessels overlapped too far. Had such a manoeuvre been executed early enough it would have prevented HD1 approaching too close to CONDOR EXPRESS.
- 5.2.12** The decision to abort was not taken until after contact had occurred when on the voice recording the chief mate can be heard saying to the pilot “I’m going to

have to take her out”. The master did not appear to have any involvement in this decision.

- 5.2.13** The VDR record revealed a number of erratic demands on engines immediately before the final swing to port into the contact. This would appear to suggest the master was disoriented to the point where he was indecisive as to which way to place the combinators. Most of the erratic orders were altered too fast for the engines and nozzles to have reacted.

5.3 In relation to the design of the vessel’s engines and steering:

- 5.3.1** The disconnect refers to the port waterjets. The engines did not disconnect, but the port waterjets stopped in the position they had reached to avoid contact damage between the buckets.
- 5.3.2** The disconnect ensured that the thrust being delivered by the engines at the time was maintained until the disconnect was manually reset. This probably contributed to further damage to the hull abaft the initial contact point.

5.4 After the initial impact:

- 5.4.1** The perceived urgency to vacate the area caused considerable additional damage, breaching three compartments by driving the HD1 ahead across the bow of the other vessel.
- 5.4.2** After impact with the CONDOR EXPRESS the HD1 should have been stopped within the harbour limits and a full assessment of the vessel’s condition of seaworthiness made.

5.5 In relation to ergonomics:

- 5.5.1** The lack of certain monitoring instrumentation such as engine, nozzles and buckets direction or heading at the after position is a fundamental flaw in the feed-back available to the master or whoever is controlling the vessel in that position.
- 5.5.2** Visibility from the centrally located bridge is limited, such that there is no direct view of the extremities of the vessel.
- 5.5.3** Cameras intended to compensate for the poor visibility from the bridge did not possess a wash-wipe facility and as a consequence they retained salt residues from spray, so as to obscure the visibility for most of the time.
- 5.5.4** Cameras had been placed in exposed positions with inadequate protection for the crew when maintaining them.

- 5.5.5** Further to the camera difficulties the display monitor in the after control position is poorly sited so that reflection from outside light in daylight makes viewing difficult without some form of improvised screening. This was not a contributory factor at night but still represents inadequate design for 24 hour operation.

5.6 Hull integrity safeguard systems were deficient

- 5.6.1** The bilge alarm and pumping system siting of cables on the outboard internal surfaces of the hulls ignores the most likely cause of hull damage. Severance of the cables serving both the alarm system and the bilge pump in the event of a penetrating impact could be a cause of failure at a time when both the alarm and the pumping capability were most needed. In the catamaran design the inner sides of the hulls are afforded additional protection and would be a better route for critical cabling.

- 5.6.2** The fact that the bilge alarm can fail open circuit without an alarm of that condition appears to be in conflict with the Code on Alarms and Indicators Resolution A.686(17). However this code does not appear to recognise bilge alarms as critical. On a catamaran the size of HD1 the size of No.2 void space could be considered a serious threat to progressive flooding in the event of a multi compartment penetration, as was the case in this incident. Had that penetration been crossing the waterline the stability and buoyancy of HD1 would have been seriously compromised.

- 5.6.3** The bilge pumping systems in the void spaces comprise a submersible pump, which, by definition is controlled remotely. The HSC Code requirement 11.2.1 to initiate audible and visual alarm in the case of failure may be complied with but because the power supply follows the same exposed route identified above for the bilge alarm signal lines, severance of the cables could prevent normal manual control, which cannot exist on a submersible pump. It is probable that this requirement was not aimed at bilge pumping systems but they could be viewed as critical to the survival of the craft in certain circumstances. Their controls and power supplies should therefore be afforded a high degree of protection from damage due to any cause. HSC Code 12.6.4.5 could be construed as requiring such protection under the heading “other damage”.

- 5.7** There was no viewable VDR record including engine or steering movements available in the early stages of the investigation. This prevented investigators being able to analyse what the engines and buckets were actually doing in terms of ahead or astern, toe-in or toe-out. The data was sent to the VDR but there was no suitable software available to interpret the data and display it in a recognizable format.

6 ACTIONS AND RECOMMENDATIONS

On 23rd November 2007 the management agreement was terminated, all actions and recommendations are to be reviewed by the new Managers/Operators of HD1.

Actions

Actions taken to address concerns raised as a result of this casualty as follows:

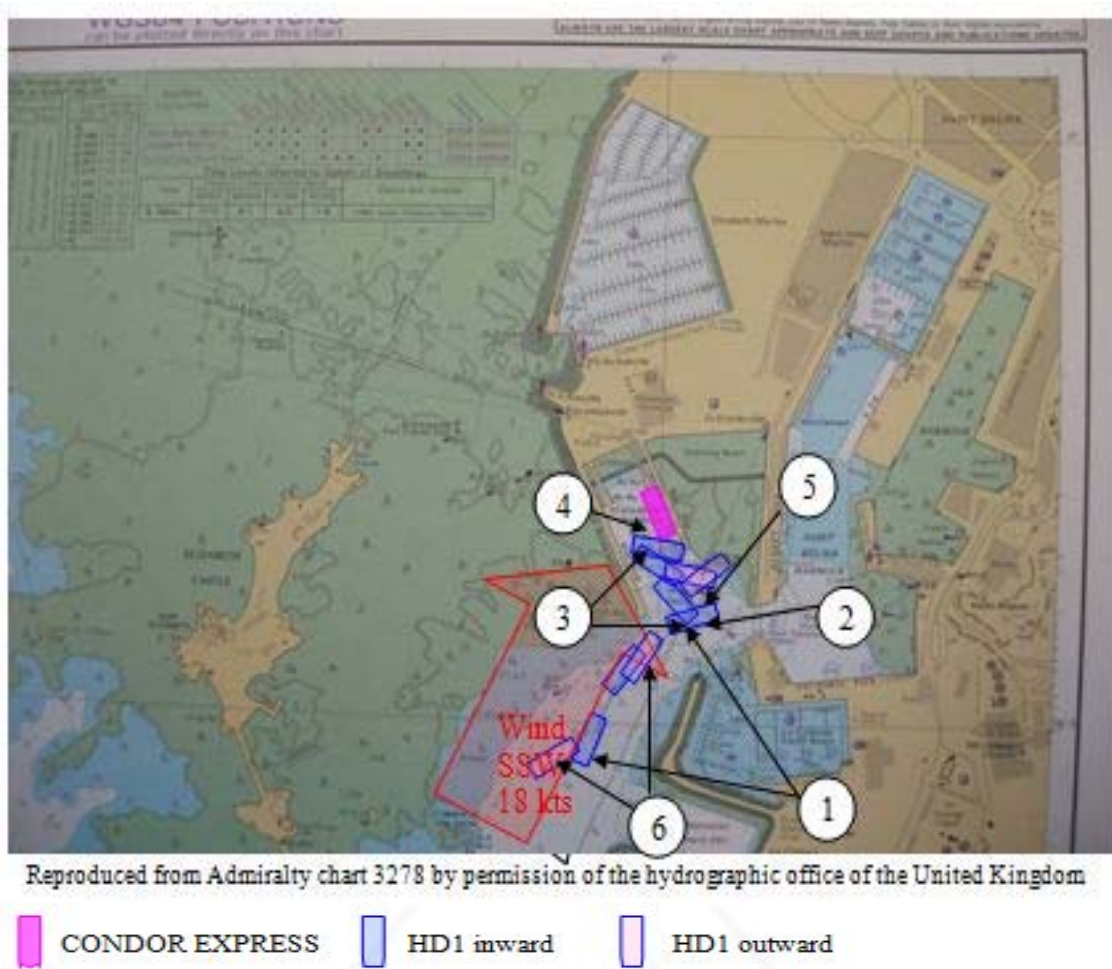
- 6.1** Since the incident the harbour authority has imposed a lower wind threshold at which the HD1 must utilise a tug at St Helier and this is included in the latest Failure Mode Effect Analysis (FMEA) for the vessels critical equipment, of which the engines are clearly a major item. In lowering the limit the harbour authority has further pre-empted the possibility of a repeat of the incident.
- 6.2** The High Speed Craft, Type Rating Training for the crew has been reviewed and the training manual updated to include craft specific terminology.
- 6.3** The HD1 winter schedule was brought forward to facilitate crew training with particular emphasis on Pilotage Exemption training for St. Helier and vessel manoeuvring. This training programme continued into 2008 prior to the commencement of the 2008 season.
- 6.4** The Route Operations Manual has been reviewed to include specific guidance for the operation of HD1 with less than the full compliment of four engines.
- 6.5** The structure of the vessel has been examined to ensure that it is suitably strengthened and marked, in areas likely to be used as tug contact points.

Recommendations:-

- 6.6** The owners and/or operators of the vessel should improve the provision of feedback and instrumentation in the after conning position.
- 6.7** The owners and operators of the vessel should ensure the Bridge Team is fully conversant and well practiced in the handling the vessel in varying propulsion conditions including berthing and unberthing in varying weather conditions.
- 6.8** The operators should, as well as updating the training manual, instigate additional content to their Type Rating Training to accommodate changes in handling characteristics of the vessel when significantly altered such as was the case with the missing starboard inner main engine. Training may necessitate a test voyage without passengers over the operational route to review the effect of internal systems and external conditions.

- 6.9** Bridge team training and performance monitoring should be incorporated into management systems, to ensure personnel are suited for the tasks to which they are assigned and are able to cooperate effectively as a team. Operators should instigate additional training for teams, which should involve monitoring of personnel, peer review and review of technical skills.
- 6.10** Operators should incorporate crisis management into training for type rating. The possibility of using simulators should be investigated. In this instance it was accepted on this occasion that both the Master and Chief Engineer were both certificated in Crisis Management and Human Behaviour.
- 6.11** CCTV cameras around the extremities of the vessel should be upgraded by the operators to include wash/wipe facilities where necessary. Additional cameras shall be positioned for the stern areas. Maintenance accessibility of the cameras shall be reviewed and addressed. They should be accessible without unnecessarily risking the personal safety of crew members.
- 6.12** Consideration should be given to the re-routing of the bilge alarm signal and bilge pump power supply cables to the inboard hull sides away from any potential contact damage. Operators should evaluate this alteration and should also consider the possibility of circuit monitoring for open circuits.
- 6.13** The classification society should be urged to consider their own policies on the routing of critical system power supplies and signal lines taking into account vulnerability of certain areas to effects other than fire, the most notable of which is collision or impact damage. Such consideration should also recognise the criticality of systems that monitor the watertight integrity and thus the survival capability of the vessel.
- 6.14** Manufacturers of VDR equipment should be mindful that if the data recorded is to be of value, software must be available to the vessel managers to easily interpret and display all VDR data following an incident or for audit and training purposes.

APPENDIX I



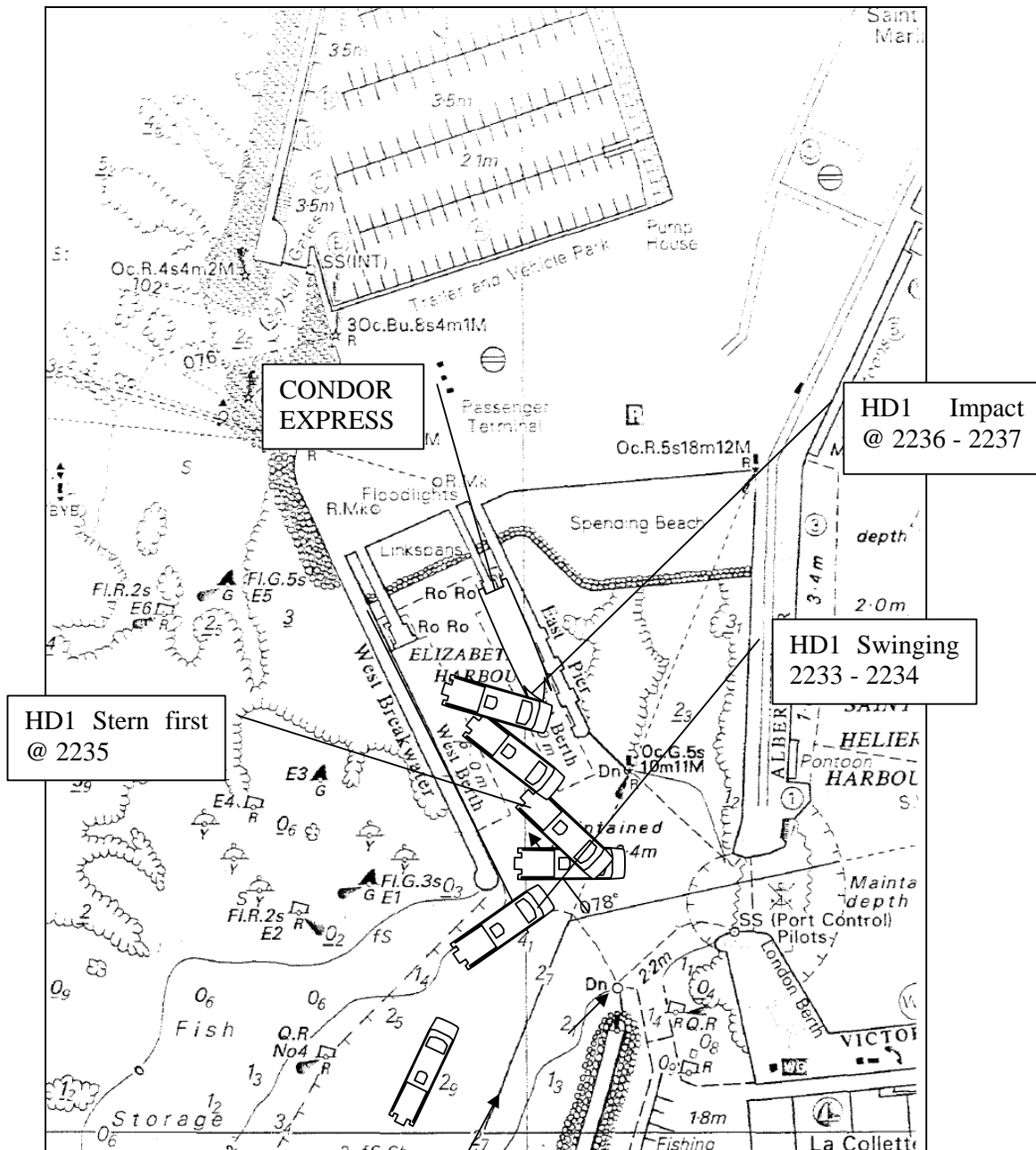
Approximate track taken by HD1 during attempted berthing 28th July 2007.

The track on entry to the port was a shallow turn to starboard (1) towards the turning point off the St Helier Harbour entrance (2), having positioned the vessel towards the west of the leading line to allow for any drift due to the strong south westerly wind.

As HD1 reversed up the Elizabeth Harbour towards the west berth her bow increasingly fell off the wind (3) until coming into contact with the starboard bow of CONDOR EXPRESS at 22:36:02 (4).

After impact (4), HD1 moved ahead, incurring further contacts in the process but eventually placing the port bow on the dolphin off the East Pier end (5), against which the vessel was driven round to port so as to enable a stern-first exit back to the Small Roads (6).

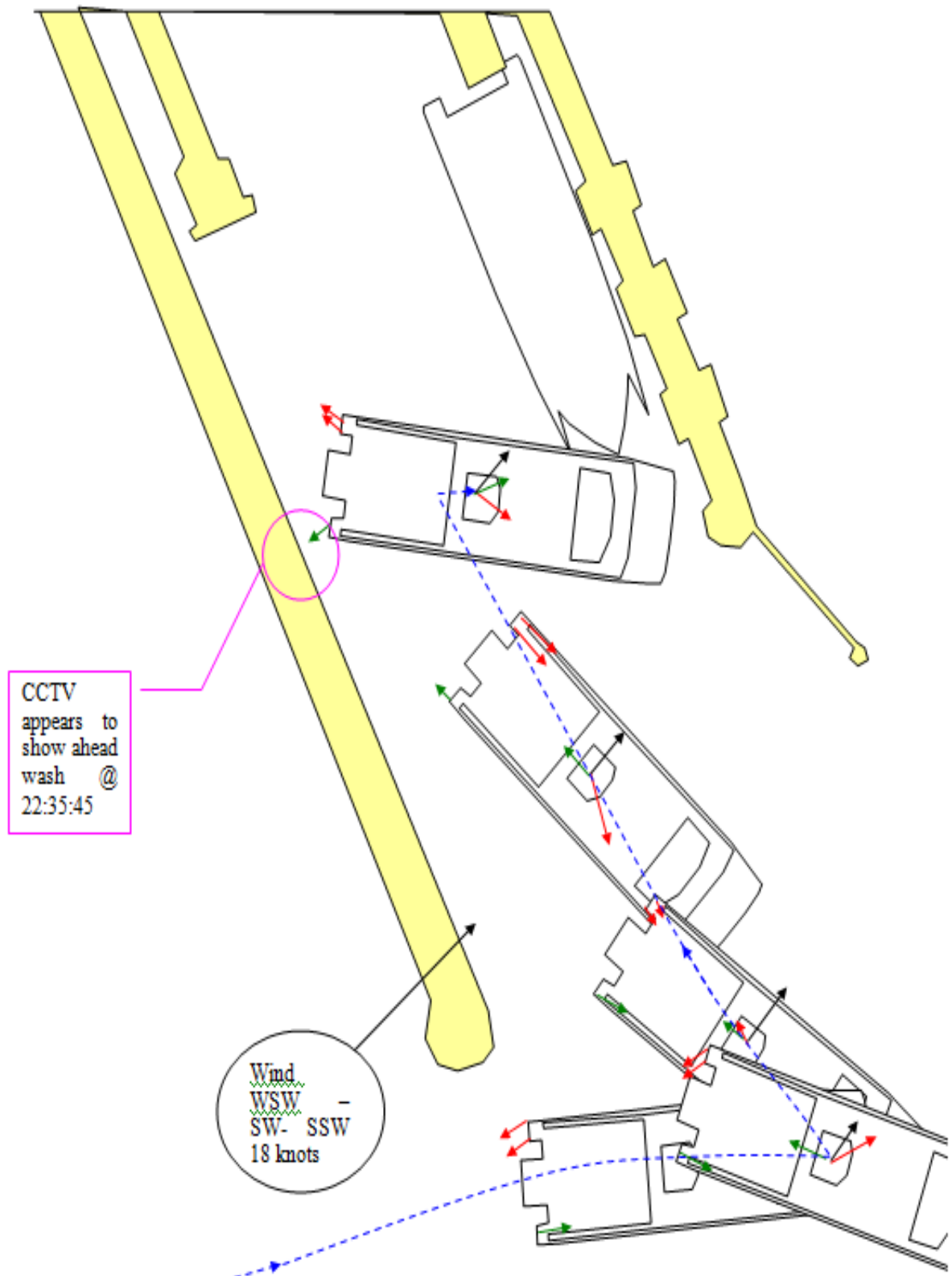
APPENDIX II



HD1: Entrance to Impact : Small Road (ahead) to Elizabeth Harbour (stern first)
Positions approximate; derived from ECS (HD1) VDR voice (HD1 and CONDOR EXPRESS) and VHF Ch14 (Port Control) + Interviews and written statements, HD1 Master, C/O, C/E, Pilot. CONDOR EXPRESS: Master.



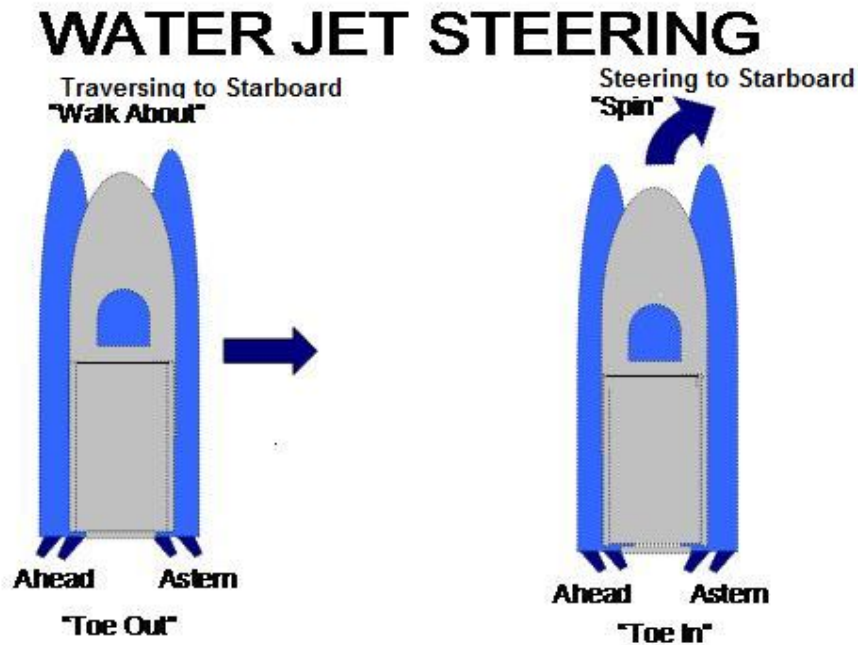
APPENDIX IV



APPENDIX V

MANOEUVRING WITH WATER JETS.

- 1.1 By using the opposing jets port and starboard effects on the vessel’s movements can be achieved, such as rotation of the vessel about the vertical axis (turning on the spot) or traversing in a particular direction, as well as ahead or astern. The normal convention is illustrated in the aide memoire used by deck officers associated with the craft. Nozzles can be "toe-in" for “spin” which achieves a greater turning moment and "toe-out" for “walkabout”.
- 1.2 The turning manoeuvre typically involves manipulation of the water jets to an inward pointing configuration known as “toe in” such that the starboard jet are directed to port and the port jets are directed to starboard to “spin” the vessel as shown in the diagram below.



- 1.3 Manoeuvring; the method of controlling the movement of the vessel is in the combinations of thrust power and direction from the multiple water jets. Each hull of the catamaran is provided with two water jets manufactured by Kamewa. Each is provided with control of the jet thrust by controllable pitch pump blades, working in combination with engine speed. The control is known as a “combinator” and consists of a handle pivoting ahead and astern over a graduated scale representing both engine speed and pitch of pump blades. The engines are directly coupled to the pumps, which are axial, drawing in water from the bottom of the hull forward and expelling it directly aligned with the pump shaft, which is itself aligned directly astern

- 1.4** Steering is effected by nozzles on each jet that can be directed up to 30 degrees to port or starboard. Each hull is fitted with two jets and these are coupled together in pairs, so that the starboard pair can be controlled independently of the port pair. The controls for steering in the manoeuvring mode are provided by the rotating base of each combinator. In cruising mode these would be aligned in a fore and aft direction and steering would be provided by a joystick, which combines control of both port and starboard pairs of jets

HD1 Forward conning position



HD1 After conning position

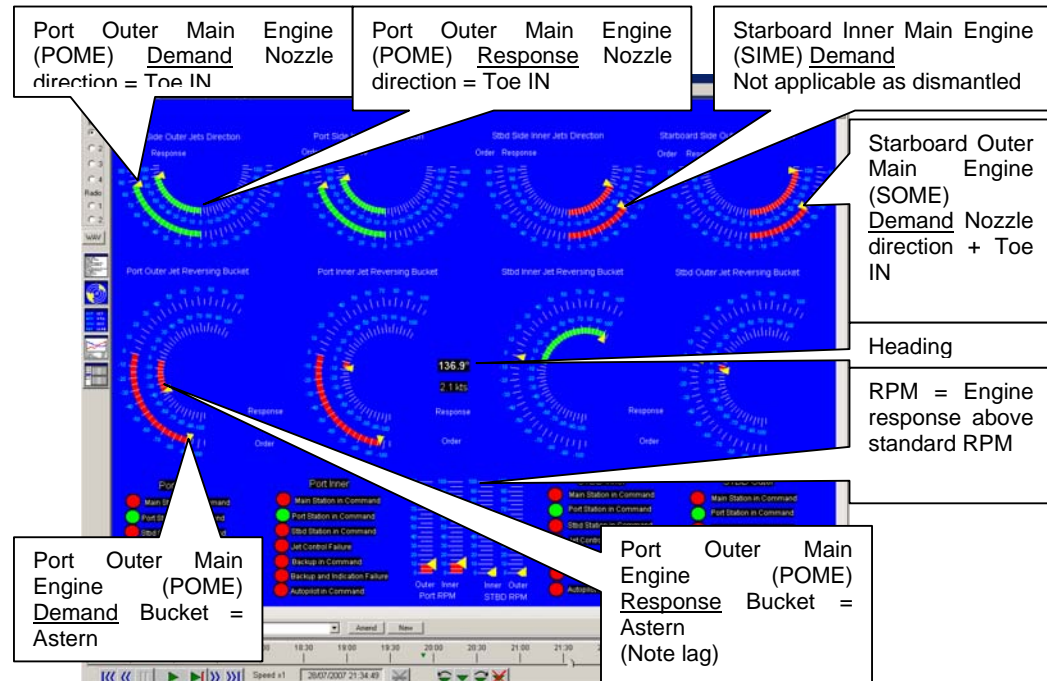


- 1.5** The water jet "toe-in" configuration is usually reversed during the astern manoeuvre to “toe-out”. This creates greater control for transverse forces, such as are necessary to move both bow and stern in the same direction creating a traversing effect, as shown above.
- 1.6** The thrust from each jet can be further modified by using a “bucket” that enters the flow from the nozzle and redirects it in the opposite direction beneath the hull. In reality the direction is down and ahead in relation to the normal direction of flow. The downward component translates into a thrust ahead and an equal and opposite reaction astern through the bucket mounting. Astern thrust is thus provided by the “bucket” in each jet which is controlled by the astern sector of the combinator control lever.

APPENDIX VI

ENGINE/BUCKET MOVEMENTS: VDR Output.

The VDR output illustrated below is a provisional version and some indicators show directions in the opposite sense to the reality of the situation. These ambiguities have been resolved using Senior Master input and the following is an explanation of the images:



The colouring of the nozzle directions is correct i.e. green on port engines is Toe In and red on starboard is Toe In although the arrow directions are a mirror image of reality.

In the VDR images the inner (response) lag the outer (demand) by several seconds as control systems respond. Indicators are calibrated in percentage.

Thus direction 100% is hard over. **Negative is Toe in Positive is Toe out.**

Similarly buckets use the convention negative is astern and positive ahead. Thus **+100% is indicative of no astern bucket** and **-100% is full astern bucket**

The Heading is indicated in the centre of the screen

The RPM indicators at the centre bottom of the screen calibrated in percent remain on zero until engine response speeds rise above a fixed standard RPM. Until that point response is achieved by pitch control. In the example above Port Outer and Port Inner main engines are indicating 10%. The demand is large enough to call for additional RPM and the response is a combination of pitch and engine speed increase.

In the tables below. D=Demand and R=Response

22:34:49



	Port Outer			Port Inner			Head'g	Starboard Inner			Starboard Outer		
	D	R		D	R			R	D		R	D	
Nozzle	-85	-85	RPM	-85	-85	RPM		RPM			RPM	-100	-60
Bucket	-92	-40	10	-40	-10	10	136.9°				0	-5	0

At 22:34:49 the master is on the controls at the after position. The pilot has advised him that the bow is “paying off”, which has confused him and he is still indicating his irritation. He appears to have become distracted as the port engine is astern and starboard is neither ahead nor astern, when it needs to be astern to provide the principal input for stern way. The port engine, will be applying a turning moment to port which is evident in the heading swinging to port and being advised by the pilot, and the chief mate..

In this a subsequent frames the Starboard Inner Main Engine is shaded purple to indicate that it is not operational. Some control signals continue despite this but should be ignored.

22:35:13



	Port Outer			Port Inner			Head'g	Starb'd Inner			Starboard Outer		
	D	R		D	R				R	D		R	D
Nozzle	+100	+100	RPM	+100	+100	RPM		R P M			RPM	-5	-85
Bucket	+60	+50	0	+60	+50	0	127.9°				48	-100	-100

The master, still in the after control position has now altered the engine controls so that the port engines are now responding to an ahead demand with nozzles toed out. This is necessary to counteract the swing to port still being identified by the chief mate and at one point the chief engineer. The heading has now come round to 127.9°, a change of 9 degrees in 24 seconds (0.38 °/s).

The starboard engine is now responding to a significant demand to astern. The direction of the nozzle however is subject to lag behind rapid movements from toed in to toed out. The result is a nozzle that is almost amidships.

The chief mate's advice to the master concerning the swing of the bow to port has turned to the more alarmed "get your bow to starboard" with the realization that the swing to port is not being checked

22:35:30



	Port Outer			Port Inner			Head'g	Starb'd Inner			Starboard Outer		
	D	R		D	R			R	D		R	D	
Nozzle	+85	0	RPM	+70	0	RPM		RPM			RPM	-60	-85
Bucket	-60	+5	0	-70	+30	0	116.2°				55	-90	-100

The master is becoming apparently more confused. The port engines have now been returned to an astern position thus fuelling the swing to port. The port nozzles are being altered to a toed in configuration but that lag at this point means that the thrust is amidships.

The starboard engine is still responding to the astern demand with increased RPM but the nozzle is being placed in a toed in position.

The heading is now 116.2°. a change of 11 degrees in 17 seconds (0.64 °/s)

22:35:39



	Port Outer			Port Inner			Head'g	Starb'd Inner			Starboard Outer		
	D	R		D	R				R	D		R	D
Nozzle	+100	+45	RPM	+100	+30	RPM		R P M			RPM	-5	+100
Bucket	-100	-85	18	-100	-60	18	109.8°				25	+100	+100

The master has now just transferred control to the forward position where the chief mate has forcefully suggested he should take control. The swing to port has increased and I distinctly visible on the CCTV footage from the port.

The heading is now 109.8°, a change of 6.4 degrees in 9 seconds (0.7 °/s)

The port engines are responding to the significant astern demand that has continued through the transfer of control and the starboard engine is responding to a similar demand ahead. Nozzle direction demands are swinging rapidly and the response is characteristically lagging behind.

The engines are contributing a sizeable turning moment to port now.

22:35:48



	Port Outer			Port Inner			Head'g	Starb'd Inner			Starboard Outer		
	D	R		D	R				R	D		R	D
Nozzle	+100	+100	RPM	+100	+100	RPM		R P M			RPM	+100	+100
Bucket	-100	-90	20	-100	-100	20	104.5°				35	+100	+100

The control now appears to have been transferred to the chief mate at the forward position but engines remain applying significant power astern on the port side and ahead on the starboard, which is continuing to apply a significant turning moment to port.

The heading is now 104.5°, a change of 5.3 degrees in 9 seconds (0.59 °/s), which continues to be visible on the CCTV footage as is the plume of water emerging from the starboard jet unit as it strikes the quay wall. The report from the deck is that there is 10m to “the CONDOR” just before this point and the master asks the question “10m – we can go out?” just as the 5m report comes in.

The jet nozzles are fully toed out on both sides.

23:35:58



	Port Outer			Port Inner			Head'g	Starb'd Inner			Starboard Outer		
	D	R		D	R				R	D		R	D
Nozzle	+100	+100	RPM	+100	+100	RPM		R P M			RPM	+100	+100
Bucket	-100	-95	30	-100	-100	30	104.4°				35	+100	+100

The deck has just reported 1m (distance from the CONDOR) and the chief mate – who it is presumed is on the controls and has resigned himself to the fact that “we’re going to hit”. The master can be heard in the vicinity of the control position, stating “you kept full astern?”, having presumably recognised that the engines are completely the reverse of where they need to be. i.e. full astern on port and full ahead on starboard. The plume of water from the starboard jet can be clearly seen on the CCTV footage at this point as it impinges on the quay wall.

22:36:01



	Port Outer			Port Inner			Head'g	Starb'd Inner			Starboard Outer		
	D	R		D	R				R	D		R	D
Nozzle	+35	+90	RPM	+40	+90	RPM		R P M			RPM	+70	-15
Bucket	+35	-30	0	+35	-30	0	105.0°				40	+100	+100

The chief mate– who it is assumed has control – has responded to the master’s question about the full astern and has immediately demanded full ahead on the port engines. Unfortunately this is too late. The impact is imminent and the starboard engine is still thrusting ahead forcefully. The heading has now ceased to alter, suggesting that impact has just occurred. The fact that the engines continued ahead after this impact is a reason for the continuing impacts along the hull over four compartments,