Report of the Investigation
of heavy weather damage
to Hovercraft GH-2007

The Princess Anne

while crossing from Calais to Dover
on 29 February 2000

Marine Accident Investigation Branch
First Floor, Carlton House
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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 causes 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

BST	-	British Summer Time
CA3	-	Designated Navigational Buoy
LVA	-	Light Vessel Automatic
m	-	metres
MAIB	-	Marine Accident Investigation Branch
MCA	-	Maritime and Coastguard Agency
TRE	-	Type Rating Examiner

GLOSSARY OF TERMS

Maximum wave height	-	maximum height of wave
Met Office	-	Meteorological Office, Bracknell, UK
Met Report	-	actual and predicted weather conditions
Pad	-	hard landing area for hovercraft
Significant wave height	-	average of the highest one third waves observed at a point and is approximately equal to the wave height an experienced observer would visually estimate for a given sea state.
Type Certification	-	conditions under which the craft is licensed to operate
Waverider buoy	-	moored buoy with in-built system to measure and record vertical movement of buoy under the action of waves.

SYNOPSIS

Sea Containers Services Ltd notified this accident which caused heavy weather damage to the hovercraft *The Princess Anne* to the Marine Accident Investigation Branch (MAIB) on Tuesday 29 February 2000. MCA supplied additional information on Monday 6 March and an investigation began later that day.

After studying the weather forecast and local conditions, *The Princess Anne*'s captain took her into service at 0730 on 29 February. The wind and wave heights were within the designated operational limits. The hovercraft left Dover at 0740 and arrived in Calais at 0825.

At 0850 *The Princess Anne* left Calais for Dover, the wind on departure was south-west 25 knots. On receiving information that local wind speeds had increased to 42 knots, the captain decided that this would be the last trip until the weather improved. He informed Dover Base One of his decision and, after confirming that conditions were still within operational limits, continued to Dover.

About 30 minutes later, when in mid-channel, the hovercraft dropped into a wave trough, resulting in a minor impact on the port forward side of the craft. The starboard bow sustained damage in the vicinity of the first three windows and above.

Apart from one person suffering from shock and wet clothing, there were no injuries. There was no reported damage to the vehicles.

The captain immediately turned the craft to starboard and returned to Calais.

On arrival in Calais, the passengers and their vehicles were off-loaded and an inspection of the damage carried out. The damaged area was covered and the hovercraft returned to Dover at 0605 the next day for repairs. These were largely completed by 10 March when the craft resumed service.

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF VESSEL AND ACCIDENT

Name	:	*The Princess Anne*
Official No	:	GH-2007
All Up Weight	:	325 tonnes
Overall Length	:	56.3m
Breadth	:	12.5m
Capacity	:	50 - 55 cars 424 passengers max
Crew	:	18 minimum
Built	:	British Hovercraft Corp 1968 (stretched 78/79)
Type	:	SRN4 Mk3 Hovercraft
Main Engines	:	4 x Rolls Royce Marine Proteus Type 15m/529 gas turbines Each 4,250 max shp
Owners	:	Sea Containers Ltd Sea Container House 20 Upper Ground London SE1 9PF
Date and Time	:	0925 GMT, 29 February 2000
Place of Incident	:	Off Dover
Injuries	:	One, wet and shocked
Damage	:	Starboard bow area around windows, small ingress of water to cabin area

1.2 NARRATIVE

1.2.1 On the morning of 29 February 2000, the Meteorological Office (Met) issued its early morning forecast at 0334 for Hoverspeed Dover Straits. This forecast showed that the wind direction would be south south-west to start and gradually swing to west-south-west during the day. The winds would increase throughout the day

reaching severe gale force at times by late morning. The significant wave height could reach 3.6m at noon but during the morning would range from 2.3 to 3.0m. The maximum wind speed during the day would be 38 knots at noon.

The captain of *The Princess Anne*, who was to make the first cross-channel run of the day, was given this meteorological report together with other weather information on his arrival at the Hoverspeed offices. Hoverspeed is a subsidiary of Sea Containers Ltd, the owners of *The Princess Anne*. A study of this weather information forms the basis on which a decision is reached as to whether or not the hovercraft will provide a service that day. The other weather information available that morning was:

Calais weather actual	SW 20 knots
Cap Gris Nez actual	SW 20-25 knots
Dover Port Control	SW 35-40 knots, gusting 45 knots
P&OSL *Aquitaine*	2-2.5m seas
Southampton weather 0600	SSW 27 knots, gusting 38 knots Max sea 3.7 metres
Radio 4 weather 0505	Dover area - SW 6, increasing severe gale 9 for a time, decreasing 4 to 5, veering W or NW later, rain then showers, moderate becoming good.
Sandettie LVA	SSW 6, 1012 falling quickly
Greenwich LVA	S by SW, 1011 falling quickly
High water Dover	0619
Waverider buoy	2.6m significant wave height

1.2.2 In addition to the weather information provided above, the captain also took into account tidal considerations. High water Dover was at 0619 and the tidal stream was running in a north-easterly direction - broadly with the wind. It would run in this direction for approximately four hours after high water. With wind and sea in the same direction, sea conditions are invariably better than when in opposition. A departure at 0730 was therefore the best time to take advantage of the sea conditions.

1.2.3 The captain, having studied the weather reports, decided at about 0645 that the predicted conditions were such that the first service of the day, 0730 Dover to Calais, could proceed. The wind force and wave heights were within the designated operational limits and there was, therefore, no reason to delay the start of the service. His experience was that in marginal weather from the prevailing direction of the south-west, hovercraft can make an easy and uneventful voyage to Calais and then wait for either the wind and sea to abate, or the tide to turn before returning to Dover. He did however tell the Operations Controller in Dover that the 0730 departure might well be the only one of the day. With the second trip at about 1030 occurring when the tidal stream was turning against the wind direction, there would be an increase in the severity of conditions in the Channel.

Once the decision had been made, the craft was made ready for service with 128 passengers and 33 vehicles being loaded. With a flight crew of three plus a trainee, *The Princess Anne* left Dover at 0740 for Calais.

The sea conditions outside Dover's Western Entrance was lumpy, not an unusual occurrence, given the wind speed and direction. Progress was steady at around 30 knots with the captain reporting mid-channel weather conditions as south, 35-38 knots with 3-3.5m seas. The wind and seas decreased as the hovercraft approached the French coast with Calais reporting south-west 20-25 knots off the docking pad.

1.2.4 At 0825, *The Princess Anne* arrived on the pad and discharged her passengers and vehicles. The hovercraft remained on the pad for 25 minutes and, during that time, the captain considered that the wind and sea conditions remained similar to that on his arrival. He did not consider that these conditions would affect his return passage, other than extending the transit time to about one hour. The wind was from the south or south south-west and this seemed favourable for the return journey.

Although the scheduled departure time was 0830, by the time the 104 passengers and 34 vehicles had been loaded, the actual departure time was 0850. The wind on departure was given as south-west 25 knots.

On leaving the pad, the captain took *The Princess Anne* along the coast as far as the CA3 buoy, turning to starboard to pass close east of the buoy - fairly normal procedure for weather conditions prevalent at the time.

1.2.5 When the captain reported *The Princess Anne*'s position to Cap Gris Traffic at about 0908, he asked for the wind speed and direction. He was told south-west 42 knots, a marked increase on previous information. On hearing this information, the captain decided that conditions were deteriorating and that further hovercraft operations should be cancelled.

The captain contacted Dover Base One at 0910 and told them that he was cancelling further operations due to the weather conditions. During this conversation, he asked for a waverider buoy (reading), and was told that it was 2.87m.

Based on this reading, the captain decided to continue the passage to Dover as the wind and sea conditions were still inside the designated operating limits. The hovercraft was progressing reasonably well and maintaining a speed of 20-25 knots, course 275-280°, with course made good of 300-310°.

1.2.6 At about 0920, when in mid-channel, the captain felt a minor thump on the port side of the hovercraft as she dropped into a trough. The forward speed dropped, and while progressing at this lower speed an impact was felt at 0925.

The hovercraft was at this time in the middle of the south-west shipping lane, bearing 192°, 5 miles from the South Goodwin Light, and about 7 miles from Dover harbour.

When the captain received reports from the starboard cabin that there was damage around the forward windows, he immediately turned to starboard to return to Calais. Further progress towards Dover was not considered acceptable. While the captain told Dover Base One of his decision, the second officer was sent down to assess the damage. The officer under training, remained in the right hand seat of the cockpit. On return, the second officer reported that damage had been sustained around the starboard bow, in the vicinity of the first three windows and above. Water was also entering the hovercraft through the damaged roof. The captain told Dover Base One of the damage and confirmed that he was returning to Calais.

The passengers were kept informed, and were told that due to the unfavourable weather and the damage to *The Princess Anne*, they were returning to Calais. Those in the starboard forward cabin, where the damage had occurred, were quickly moved aft together with the cabin crew. At the time there were no reports of injuries or damage to vehicles.

The return to Calais was uneventful, no operating systems had been affected, and the hovercraft settled on the pad at 1001.

The captain carried out a visual inspection of the starboard forward area and found damage in and around the forward windows. No major structures appeared to have been damaged.

1.3 DESCRIPTION OF DAMAGE

When *The Princess Anne* was taken out of service, the owners' technical management team visited the craft in Calais and carried out a full survey of the damaged area. The damage was very localised, affecting a number of roof ribs, the roof lining, the support structure above and below the windows between main frames 2 and 3, and water damage to carpets, seats, electrical items, and cabin fittings. A detailed list of the damage is in **Annex 1**.

1.4 COMPANY INVESTIGATION

1.4.1 After the incident, the captain followed company procedures, made a formal report, attached it to an incident report, and submitted it to the technical and operations manager **(see Annex 3 and 4)**. The manager's preliminary comments suggest he considered the captain had placed too much emphasis on vessel speed. He also thought that the captain's decision to depart Calais might have been influenced by the weather recorded by *Hoverspeed Great Britain* during her passage from Dover to Calais. She had left Dover half an hour later than *The Princess Anne*, at 0805, and had reported the mid-channel weather as being similar to that experienced by *The Princess Anne.*

Against "additional recommendations" the manager wrote:

Review re-writing operational limits to better reflect 30 years experience which is closer to 3.5m max wave height as opposed to 3.5m significant. This will also define cat/hover limits.

Review issuing guidelines as recommended by TRE.

1.4.2 After the preliminary report had been received, an internal investigation of the accident was arranged with John Hawkins, a type rating examiner (TRE) appointed to undertake the investigation.

During the course of this investigation, he interviewed the flight crew, some of the cabin staff, the duty control staff at both Dover and Calais and collected documentation on the craft loading and passenger distribution. A copy of his report in is **Annex 5**.

The main points of the report are as follows:

- The captain was familiar with the sea conditions, as he had been in command some 12 hours earlier. The tide conditions on departure were similar to those he would have experienced the previous day.
- The weather conditions on arrival in Dover could be expected to be broadly similar to those experienced on his outward passage.
- Although the captain did not ascertain the weather conditions in Dover before leaving Calais, the weather recorded at Dover at 1000 would probably have endorsed his decision to sail.
- From the evidence obtained, the hovercraft was at no time operating outside the prescribed limits.
- The cabin crew handled the incident well and rapidly moved the passengers away from the damaged area. Initially there were no reported injuries although some of the passengers suffered wet clothing and shoes. Subsequently a female crew member reported a sharp pain in her knee due to the impact.

1.4.3 One of the main areas that the TRE examined in detail was the actual weather conditions prevailing at the time of departing Calais, through to the time at which the accident happened in mid-channel.

The weather reports confirmed the deteriorating situation as:

0850	departure Calais	wind speed SW 25 knots
0851	Cap Gris Nez	" " SW 32-34 knots
0908	" " "	" " SW 42 knots

At the Dover end, the weather was recorded as:

0900	Eastern entrance	wind speed SW 30 knots gusting 42 knots
1000	" "	wind speed SW 35 knots gusting 45 knots

In the TRE's opinion, the weather conditions on departure Calais, plus the captain's earlier experience of conditions at Dover, would have encouraged him to make the return trip. Even if he had contacted Dover for current weather conditions before leaving Calais, that information would only have confirmed his earlier opinion that the return trip could be made.

He concludes that:

From the evidence obtained it would suggest that the craft was not at any stage being operated outside the described limits and the decision by Captain MacFarlan to operate the 0730 departure, and subsequent return from Calais was, in my opinion, soundly based.

1.4.4 The report does question the captain's report as to what action he did, or could have done, to either avoid or to minimise the impact. The captain's response was as follows:

As to the minor "thump," I was and continued to make every effort to avoid further impacts. As the seas became ever more confused the options to "pay off" were greatly reduced. As I was making a safe speed - one that allowed for quick reductions to avoid hard impacts - I continued towards the English coast. At the time of the second impact, I do not remember taking avoiding action, but given the increasingly confused state of the sea could have been "yoking" away from a wave front. I believe I was acting in the best interests of safety for passengers, crew and hovercraft, and could not have prevented the impact.

1.4.5 The TRE's report made the following recommendation:

There have been a number of wave impact incidents over the years, which have resulted in craft damage. I feel it is worth looking more closely at the detail of past incidents, the areas of occurrence and the correlation of craft headings at the time. Such findings may merit the issue of broad guidelines, which would serve to minimise the likelihood of further such events.

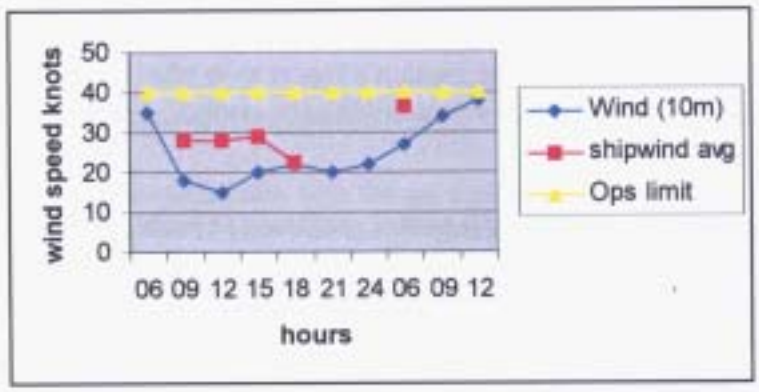
1.5 OPERATING CONDITIONS

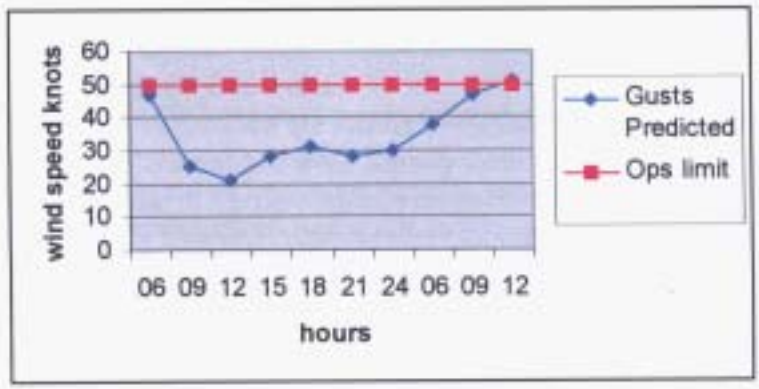
1.5.1 *The Princess Anne*'s captain recorded the weather and sea conditions at the time of the incident as follows:

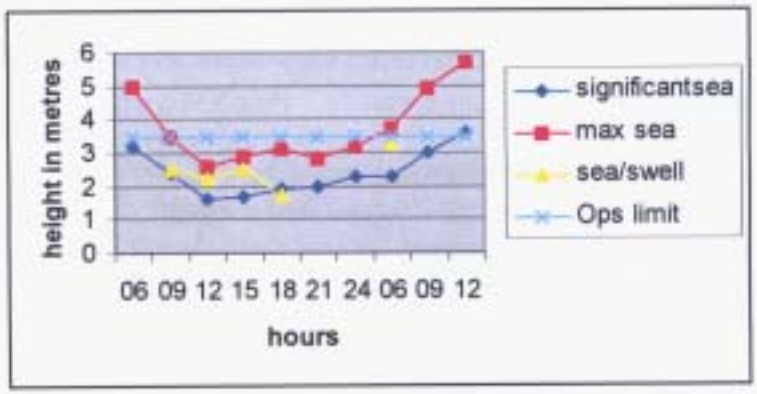
At about 0920, when approximately mid-Channel, there was a minor "thump" on the port side as the hovercraft dropped into a trough. Speed was lost temporarily and at 0925 the impact occurred. At this stage the position was 192° - South Goodwin Light - five miles. This is in the middle of the SW shipping lane and about seven miles from Dover Harbour. Damage was sustained on the starboard bow area, in the vicinity of the forward-looking windows and the curved roof above. This was the downwind side of the hovercraft, and therefore not looked at very often, as all the concentration is kept on the upwind side. I am unable to

offer any probable cause for the damage. Seas were very confused at the time, though predominantly from the SSW. Information gleaned from the HGB captain who crossed from Calais to Dover one and a half hours later, bears out that the SW shipping lane was where the seas were most confused. Weather conditions at the time of impact were SSW 35-40+ knots; 3 to 3 5m confused seas, 2 to 3miles visibility.

1.5.2 The Meteorological Office weather predictions for 28 February and the first 12 hours of 29 February, and the actual weather as recorded by the hovercraft staff while in service, have been tabulated and are shown below in graphical form:







The supplementary remarks written on the Met Office report stated:

28/29 February

Bands of very strong winds are expected to affect the area at first on Monday morning ahead of an active frontal system and again on Tuesday.

29 Feb/1 March

SSW winds will increase to reach severe gale force at times by late morning.

1.5.3 Dover Coastguard, as part of its usual monitoring duties, plotted the track of hovercraft 2007 *The Princess Anne* and fed the information into its Direct Image Plotter. Waypoints were plotted at six minute intervals on the chart. The print derived from this information has been examined and shows the average speed of the hovercraft between the waypoints was as follows:

Between 2 & 3	34 knots
" 3 & 4	26 knots
" 4 & 5	26 knots

This is broadly in line with the speeds given in the captain's report ie 20-25 knots while moving into the mid-channel area.

1.5.4 The operating limitations of the hovercraft **(see Annex 2)** have been given as:

Weather limitations - Up to gale force 8 wind and 3.5m seas.

Condition 4 (Operation Manual) para 2.
The hovercraft shall not be deliberately operated in wind and sea conditions beyond those specified as the worst intended environmental conditions applicable to the craft and given in the Type Operating Manual or in the Safety Certificate. ***(Significant Wave Height 3.5m (day-time), 2.7m (night-time) and wind of 40 knots).***

The operating limits given in the "MOUNTBATTEN CLASS HOVERCRAFT" **(Issue 4 August 1979)** Operating Manual is stated as follows:

1. INTRODUCTION

The type certification of the Mountbatten Class (SR.N4) Mk. 3 hovercraft is based on the assumption that the craft will not be intentionally operated in any condition which is worse than the corresponding Worst Intended Environment Condition. To implement this, the captain must satisfy himself before a journey is commenced from relevant weather reports and forecasts taken in conjunction with knowledge of local conditions that for the intended journey or any planned or likely diversions therefrom that the Worst Intended Environmental Conditions are not likely to be exceeded.

2. WORST INTENDED ENVIRONMENTAL CONDITIONS

(1) Worst Intended Wind Speed (at the location of the craft).

(a) A mean wind speed of 40 knots or gusts of 50 knots.

(b) In harbours, terminal approaches and at terminals local conditions may necessitate setting lower wind speed than the figures given above.

(2) Worst Intended Sea State (at the location of the craft).

(a) For wave lengths of less than 1½ times the craft length (ie less than 85m.) 3.5m significant.
(b) For steep isolated waves including surf, maximum wave height 3.5m.
(c) Where the sea takes the form of a long swell with gentle wave slopes height is not critical.

1.5.5 Previous experience with heavy weather damage on hovercraft, apart from one incident in November 1979, has been when the craft has been proceeding in a direction with the wind forward of the beam.

It has also been the case that in many instances when the forward part of the craft has been damaged as a result of wave impact, the wave height has been less than 3.0m. In the previous damage incident that occurred on the 22 October 1998, the captain reported the wind speed as 30 knots and the wave height as 2.5m. Structural damage to the craft on the starboard side was very similar to the damage found on this latest incident.

SECTION 2 - ANALYSIS

2.1 THE DECISION TO ENTER SERVICE

Before making any decision as to whether the prevalent weather conditions would allow the hovercraft to operate, the captain obtained and studied the available weather forecasts and local conditions. Only after that did he decide that the hovercraft could enter service.

This procedure was standard practice and it is evident from the weather and wind details that the conditions at the time of departure were within the operating limits.

It is noticeable, however, that from about midday on 28 February, the day before the incident, there was an upward trend on all three weather operating criteria. Furthermore, the sea reading on the first crossing from Dover to Calais by *The Princess Anne* on 29 February was 3 to 3.5m actual, whereas the earlier P&OSL *Aquitaine* report had indicated 2 to 2.5m. This later actual reading confirmed that the weather was getting worse.

2.2 PASSENGER REACTION

Given the very visible operating conditions, it must be assumed that the 104 passengers who boarded the vessel in Calais were well aware that the crossing was likely to be rough and that the hovercraft would move about a bit in the conditions. Their apparent acceptance of the conditions reflects their faith in the crew's professionalism, and the knowledge that, if conditions were unsafe, the captain would cancel the passage.

Nonetheless when the impact occurred, it was fortunate that only five passengers were seated in the starboard forward cabin and that none had chosen to sit in the front row of inboard seats. If they had, it is probable that injuries would have occurred when a section of the internal trim panelling fell down in that area.

According to the senior crew members, the passengers remained calm at the time of the incident, and subsequently seemed to accept the incident as a "fact of life."

2.3 OWNER'S RESPONSE

2.3.1 Immediately after the incident, company procedures were put into practice with the captain completing the incident report and filing it with the operation manager. He, in turn, arranged for the TRE to carry out a full investigation and report back with any recommendations that he considered necessary. The captain's report was filed the same day as the incident and the TRE's report was available eight days later on 8 March. The operations manager passed his comment to senior management the following day.

2.3.2 The hovercraft remained at Calais overnight on 29 February to allow the weather to moderate. At 0605 on Wednesday 1 March, it returned to Dover for repairs.

The main forward window structure, roof ribs etc were replaced at the repair berth during the next two days. Protracted delivery times for other cabin linings and fittings prevented immediate completion of the repairs. With the craft fully operational apart from the starboard forward cabin space, she was allowed to re-enter service on Friday 10 March. When the other fittings arrived, repairs were completed during Friday and Saturday nights.

Before the hovercraft re-entered service on the Friday morning, a full operational check was carried out.

2.4 GENERAL OBSERVATIONS

2.4.1 Both the captain's and the TRE's reports, confirm that any decision on the entry to, or the continuation of, a cross-channel commercial service, was based on daily weather information obtained from a variety of sources. Among this information were predictions on developing weather trends covering the following 24 to 36 hours, the interpretation of which should form the basis of the captain's forward planning.

In this case, the available information showed a deteriorating weather trend, with it peaking around midday on 29 February. Although local conditions do vary from forecast, sometimes better, sometimes worse, this particular forecast did demand careful consideration. It indicated that both the significant and maximum sea states would be outside the operating limits, with the wind speed close to the permitted maximum at midday.

With all the indicators confirming the original forecast of rising weather trends, the report from Cap Gris Nez stating that there had been a rapid increase in wind strength, placed the captain in a difficult position. The new information showed that he could be entering a weather situation that was outside the operating limits, yet the sea conditions he was in at the time, were within them. The captain's previous experience, combined with existing conditions, encouraged him to proceed with the trip. That this was subsequently aborted due to damage, illustrates the importance that needs to be placed on accurate weather forecasting and its interpretation when faced with actual conditions. It does seem, however, that the significance of the 24-36 hour forecast is not sufficiently taken into account when decisions are being made regarding high-speed ferry and hovercraft operations.

One of the problems of basing an operating limit on wave height, is that apart from moored buoys such as the Waverider, estimating the actual height is a subjective practice. As such, it places the captain in a difficult position, particularly when operating near the limit. With the wave height limit being

defined as "*3.5 metres significant*" the margin for error is quite large. There was no commercial pressure on the captain to sail in these conditions, but there is an undercurrent of doubt in the reports about the present operating limits which were set in August 1979.

This doubt comes into sharp focus when comments made by the operations manager are considered:

Review re-writing operational limits to better reflect 30 years of experience which probably is closer to 3.5m max wave height as opposed to 3.5m significant. This will also de-link cat/hover limits.

Review issuing guidelines as recommended by TRE.

2.4.2 If, as this comment seems to suggest, the operating limit for the hovercraft had been 3.5m max wave height, and not 3.5m significant, then the 0730 trip from Dover would not have taken place and the incident would not have occurred.

As stated earlier in the report, TRE has suggested that a number of wave impact incidents have occurred over the years and that a re-examination of each incident, including where it occurred and the craft headings, should be carried out. From that "in house" examination, further broad operating guidelines might well evolve. In the interest of safety at sea, the MAIB would endorse and encourage such a re-examination by Sea Containers Limited.

It seems therefore, that a review of the operating limits in terms of wave height needs to be instigated by the licensing authority and that the company needs to consider the question of weather trends as a factor in the decision making process. Implementation of these suggestions will impact on the commercial operation of the hovercraft. It is important however that they are seriously considered.

SECTION 3 - CONCLUSIONS

3.1 FINDINGS

3.1.1 The captain, having studied the weather reports, decided, as the predicted conditions of wind force and wave heights were within the designated operational limits, the first service of the day, the 0730 Dover to Calais, could proceed. [Ref: 1.2.2, 1.2.1, 2.1]

3.1.2 The sea reading on the first crossing from Dover to Calais by *The Princess Anne* was 3 to 3.5m, actual, whereas the earlier P&OSL *Aquitaine* report had indicated 2 to 2.5m. [Ref: 2.1]

3.1.3 The Type Rating Examiner stated that, based on actual weather reports, the craft was not at any stage being operated outside the described limits; and the decision by Captain MacFarlan to operate the 0730 departure, and subsequent return from Calais was, in his opinion, soundly based. [Ref: 1.4.3]

3.1.4 With all the indicators confirming the original forecast of rising weather trends, and the report from Cap Gris Nez stating that there had been a rapid increase in wind strength, the captain was placed in a difficult position. The new information showed that he could be entering a weather situation that was outside the operating limits, yet the sea conditions he was in at the time, were within limits. The captain's previous experience, combined with existing conditions, encouraged him to proceed with the trip. That this was subsequently aborted due to damage, illustrates the importance that needs to be placed on accurate weather forecasting and its interpretation when faced with actual conditions. It does seem, however, that the significance of the 24-36 hour forecast is not sufficiently taken into account when decisions are being made regarding high-speed ferry and hovercraft operations. [Ref: 2.4.1]

3.1.5 The TRE's report recommends that previous incidents involving wave impacts should be re-examined in more detail and could possibly lead to the issue of broad guidelines on operational limitations and practices. [Ref: 1.4.5, 2.4.2]

3.1.6 The operational manager's comments on a review of operating limits to reflect 30 years of experience, and his observation that the 3.5m maximum as opposed to 3.5m significant wave height is more relevant, should be examined in more detail. [Ref: 2.4.2]

3.2 CAUSE

The vessel suffered damage as a result of a wave impact while moving at a relatively slow speed in an area of confused seas at the time. The hovercraft was operating within the designated operating limits.

SECTION 4 - RECOMMENDATIONS

Sea Containers Limited is recommended to:

1. Review operational procedures, and ensure that hovercraft captains are supplied with, and take into account, developing trends of predicted weather conditions before hovercraft enter service.

The Maritime and Coastguard Agency is recommended to:

2. Review and consider the current hovercraft operating limitations, with particular emphasis on the increased safety margins likely to be obtained, by reducing the significant wave height limitation as defined in the Permit to Operate.

ANNEX 1

1. Details of Hovercraft

The Princess Anne

Draft 3 - 05 June 2000

SRN4 MK 3 HOVERCRAFT

Mountbatten Class SR.N4 Mk 3 Hovercraft

GH-2006 Princess Margaret & GH-2007 Princess Anne

Built as Mk 1 hovercraft in 1968 by British Hovercraft Corporation (now called GKN Westland Aerospace). Stretched in 1978 and 1979 and redesignated Mk 3

18 Crew Captain
First Officer (Radar Navigator)
Second Officer (Flight Engineer)
Cabin Crew
Car Deck Crew

Capacity 50-55 cars
Up to 424 passengers

LOADING ACCESS

Vehicles Through bow ramp and the stern doors (using ramp)

Passengers By way of portable side steps and up-and-over doors on each side of the craft.

DIMENSIONS

Weight 325 tonnes AUW
Length 56.3 metres
Width 12.5 metres

MAIN ENGINES & TRANSMISSION

Main engines Four Rolls Royce 'Marine Proteus' Type 15m/529 gas turbines, each rated at 4,250 max s.h.p.

Transmission Four independent systems, each incorporating shaft drives with primary and propeller gearboxes, integrating the drive to a lift fan and propeller.

Lift fans Four BHC 3.5m centrifugal, 12 blade fixed pitch

Propellers Four Hawker Siddeley Dynamics, Type PF258/48SA/2. 21 ft. (6.4m) diameter. Blade pitch angles controllable between +30°/-13°

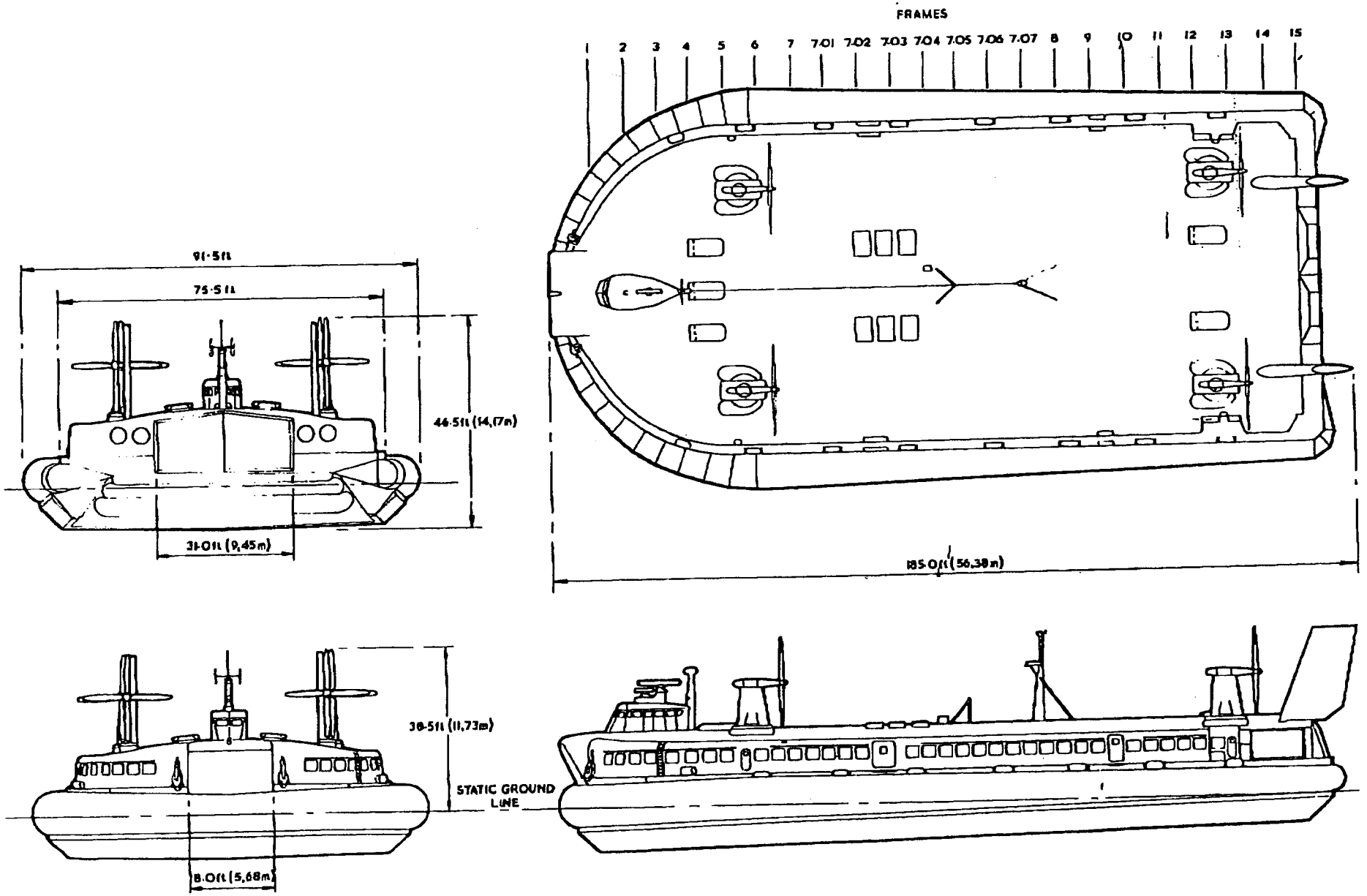
AUXILIARY POWER UNITS

APU engines Two Rover Type IS/90 gas turbines with continuous power rating of 90 *h.p.*

FUEL SYSTEM

Maximum fuel capacity	8068 galls) 36676.8 litres) 28.8 tons
Fuel consumption	Approximately 1,000 galls per hour at cruise (50 knots). Range approximately 150 miles.
Approved fuel	Kerosene.
Refuelling	Flight refuelling self-sealing connectors Type 072500/2 Mk 25 on each side of the craft. A standard 2½ inch aircraft type self-sealing hose end coupling is suitable.
NAVIGATION	Dual radar for navigation purposes allowing the craft to operate in zero visibility. Type Racal Decca Bridgemaster with GPS navigation system.
WEATHER LIMITATIONS	Up to gale force 8 wind and 3.5m seas.
LIFERAFTS	14 Beaufort and RFD Type each with a capacity for 30 people.

Max speed with pax 65 knots = 75 mph.



General arrangement Mk.3 craft

ANNEX 2

2. Operational Limitations

CHAPTER 2 APPROVED INFORMATION

CONTENTS

	Para.
INTRODUCTION	1
WORST INTENDED ENVIRONMENTAL CONDITIONS	2
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NIGHT OPERATION	6
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ILLUSTRATIONS

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Maximum permissible yaw angle-v-craft speed conditions	1

1. INTRODUCTION

The type certification of the Mountbatten Class (SR. N4) Mk. 3 hovercraft is based on the assumption that the craft will not be intentionally operated in any condition which is worse than the corresponding Worst Intended Environmental Condition. To implement this, the Captain must satisfy himself before a journey is commenced from relevant weather reports and forecasts taken in conjunction with knowledge of local conditions that for the intended journey or any planned or likely diversions therefrom that the Worst Intended Environmental Conditions are not likely to be exceeded.

2. WORST INTENDED ENVIRONMENTAL CONDITIONS

(1) Worst Intended Wind Speed (at the location of the craft).

◀ (a) A mean wind speed of 40 kts. or gusts of 50 kts. ▶

(b) In Harbours, terminal approaches and at terminals local conditions may necessitate setting lower wind speeds than the figures given above.

(2) Worst Intended Sea State (at the location of the craft).

(a) For wave lengths of less than $1\frac{1}{2}$ times the ◀ craft length (i.e. less than 85 m.) 3.5 m ▶ significant.

(b) For steep isolated waves including surf, ◀ maximum wave height 3.5 m. ▶

(c) Where the sea takes the form of a long swell with gentle wave slopes wave height is not critical.

CONDITION 4 - OPERATIONAL

1. The Captain shall pay due regard to the information and handling instructions contained in the Type Operating Manual.

2. The hovercraft shall not be deliberately operated in wind and sea conditions beyond those specified as the worst intended environmental conditions applicable to the craft and given in the Type Operating Manual or in the Safety Certificate. **(Significant Wave Height 3.5m (day-time), 2.7m (night-time) and wind of 40 Kts).**

3. When the craft is operated at night or in conditions when the range of visibility is less than 3 miles a constant radar watch shall be maintained by a trained and experienced radrar operator.

4. Due regard shall be paid to any condition of operation or regulations affecting the operation which may be imposed by an authority having jurisdiction over any part of the operational area.

5. During each voyage the Captain shall report the craft's departure and arrival to the local VTS and report the position of the craft at the required intervals.

6. The Captain of the craft shall be responsible for indicating his acceptance of the craft following any maintenance carried out during the Lay-over by completing the pre-departure Check-List.

7. The Captain of the craft shall make a report to the Maritime and Coastguard Agency of any defect which affects the seaworthiness of the craft and any case of leading skirt tuck-under which results in a plough-in, together with all relevant details.

8. Except in an emergency, operations should only take place in the area specified in this permit.

9. The craft shall be maintained in accordance with the requirements of this permit and the builders maintenance manual.

10. Practice emergency drills shall be held at intervals of not more than 7 days to ensure that the crew understand and are drilled in the duties assigned to them in the event of an emergency.

11. Dedicated procedures for maintaining an all round lookout should be present in the operating compartment at all times when the craft is underway.

12. At least two members of the crew shall be in attendance in the Car Deck at all times when motor vehicles are carried.

13. A life jacket shall be worn by any person outside the enclosed area of the hovercraft when it is on or over water.

14. The ladder between the control cabin and the car deck shall be secured in position during operation.

3. Copy of Incident Report Form

INCIDENT REPORT FORM
SEA CONTAINERS FERRIES & PORTS DIVISION

Near Miss Report Only - ☐ (mark 'X' if applicable and complete below if appropriate)	**Report No:** P07 P07 P01 (Location / No / Year)
Date of Incident: 29 02 00 (Day, Month, Year)	**Time of incident:** 0925 **LOCAL** 0925 **GMT (UTC)**
Company: HOVERSPEED	**Location of Incident** (e.g. booking office, workshop, engine room, car deck, etc.) STBD CABIN
Site/Craft: 2007 PRINCESS ANNE	

Subject's Name: N/A **(Injured Person(s)/Owner(s) of Damaged Property etc.)**
(PRINT CLEARLY)

EMPLOYEE	
MEMBER OF PUBLIC	
DATE OF BIRTH: | : | : | : | (Day, Month, Year)	

Address: .....

Incident Type:

01	02	03	04	(05)	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

Injury Type:

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	(18)	19	20	21	22	23	24

Statutory Reporting: **Date reported** 29.2.00

Has this been reported? (YES)/NO **To whom** HOVERSPEED TECHNICAL AND OPERATIONS MANAGER.

Brief description of incident: DAMAGE TO STBD BOW AREA AROUND WINDOWS, DUE TO IMPACT FROM SKIRT OR WAVES.

(continue on separate page if necessary)

Details of injury/damage: .....

Injury first reported on: | : | : | : | (date) **at:** | : | : | (time) **to:** .....

Personal Protective Equipment worn by the injured person (employee injuries only): N/A

FLOTATION DEVICE ☐ HARD HAT ☐ HIGH VIS. ☐ SAFETY FOOTWEAR ☐ GLOVES ☐ RESPIRATORY ☐

FACE PROTECTION ☐ BODY PROTECTION ☐ EYE PROTECTION ☐ EAR PROTECTION ☐ OTHER ☐

Did this comply with requirements for the job? YES/NO

Name of attending First Aider: .....

Details of treatment given: .....

Has the incident been investigated YES/~~NO~~ **Report No:** |0:0:7|0:0:7|0:0|

Nature of investigation: (e.g. on-site, interviews, etc.) VISUAL INSPECTION OF DAMAGE, WRITTEN REPORT. (ATTACHED) VARIOUS MEETINGS WITH G. MACFARLAN & TRE

Photographic Evidence? YES/~~NO~~ (Where possible this should be included)

Witnesses (names/addresses) (please include job title if employed by Division):

Name:	REVIEW ISSUING GUIDELINES ~~AFTER~~		
Address:	AS RECOMMENDED BY TRE		

Investigation findings: LOOK AT THE REPORT.

NO CHANGE TO COURSE OR SPEED AFTER FIRST IMPACT - NO CONSCIOUS DECISION MADE FOR ANY FURTHER PRECAUTIONARY ACTION AFTER FIRST IMPACT. THE CAPTAIN PUTS A LOT OF (continue on separate page if necessary) WEIGHT ON THE CRAFT SPEED ON DECIDING WHETHER

Action taken to prevent recurrence:

1.	TO ABORT OR BEAR FURTHER AWAY FROM THE
2.	WIND. OBVIOUSLY THE FASTER THE CRAFT
3.	HIGHER THE RISK OF IMPACT. THE CAPT MIGHT
4.	ALSO HAVE BEEN INFLUENCED BY CATAMARAN
5.	DECISION TO SAIL - THEY SHARE SIMILAR LIMITS.

Additional Recommendations:

1.	REVIEW REWRITING OPERATIONAL LIMITS TO
2.	BETTER REFLECT 30 YRS OF EXPERIENCE
3.	WHICH PROBABLY IS CLOSER TO 3.5M MAX WAVE
4.	HEIGHT AS OPPOSED TO 3.5M SIGNIFICANT. THIS
5.	WILL ALSO DELINK CAT/HOVER LIMITS

Recommendations approved? YES/NO **Recommendations implemented?** YES/NO

Scheduled Completion Date: | : | : | : |

Signature of Person completing report [signature] **Date** 29.2.00

Print Name G.C. MACFARLAN **Job Title** CAPTAIN.

Signature of Manager/Master [signature] **Date** 9/3/00

Print Name HUNT **Job Title** OPS

Report sighted and closed out by DPA

Signature .... **Comments** ....

Date ....

Distribution Seaco 01 Vers 1

White	Local Manager	Pink	Group Risk Management
Blue	Divisional Safety Manager & DPA, Ferries & Ports Division	Yellow	File Copy Administrator

ANNEX 4

4. Copy of Captain's Report

Hovercraft Incident – Damage to 2007, 29 February 2000

From : G MacFarlan
To : C Hunt

The decision to depart from Dover for the 0730 service to Calais was made at approximately 0645, having received several reports from different sources.

a. Calais weather actual SW 20 kts
b. Cap Gris Nez actual SW 20-25 kts
c. Dover Port Control SW 35-40 kts, gusting 45 kts
d. P&OSL Aquitaine 2-2.5 metre seas
e. Southampton weather 0600 SSW 27 kts, gusts to 38 kts, max sea 3.7 metres
f. Radio 4 weather forecast 0505 Dover area – SW6, incr. severe Gale 9 for a time, decr. 4 to 5, veering W or NW later, rain then showers, mod. becoming good
g. Sandettie LVA SSW6, 1012 falling quickly
h. Greenwich LVA S by SW, 1011 falling quickly
i. High Water Dover 0619
j. Waverider buoy 2.6 metres significant wave height

Given the above data, I decided that it was within operational limits to operate the 0730 departure to Calais. Seacat HGB had also decided to operate their first service, presumably after considering all of the above information.

I left Dover at 0740. Sea conditions outside the Western Entrance were lumpy – not unusual with the wind speed and direction. Progress was steady at around 30 kts and I reported mid-Channel weather as South, 35-38 kts, 3-3.5 metre seas.The wind and sea decreased as progress towards the French coast was made. Calais reported SW 20-25 kts for approach to the pad.

Whilst on the pad weather conditions remained the same, and I was not concerned about the return trip to Dover, other than that I knew it would take up to one hour. The wind was from the South or SSW and this seemed favourable for the return journey.

On leaving Calais at 0850, wind was given as SW 25 kts. I proceeded along the French coast as far as the CA3 buoy, turning to starboard to pass close East of the buoy – fairly normal procedure for weather conditions as they were.

On reporting the position to Cap Gris Nez Traffic at 0908 (approximately), I asked for a wind speed and direction. I was told SW 42 kts. This was a marked increase on previous information, and I decided to cancel any further hovercraft operations. I informed Base 1 at 0910, and also asked for a Waverider buoy reading. I was told 2.87 metres.

I decided to continue towards Dover, as wind and sea conditions were still inside operating limits, and I was progressing reasonably well at 20-25 kts, course 275-280, course made good 300-310.

At about 0920, when approximately mid-Channel, there was a minor "thump" on the port side as the hovercraft dropped into a trough. Speed was lost only temporarily and at 0925 the impact occurred. At this stage the position was 192 – South Goodwin Light – 5 miles. This is in the middle of the SW shipping lane and about 7 miles from Dover Harbour. Damage was sustained on the starboard bow area, in the vicinity of the forward-looking windows and the curved roof above. This was the downwind side of the hovercraft, and therefore not looked at very often, as all the concentration is kept on the upwind side. I am unable to offer any probable cause of the damage. Seas were very confused at the time, though predominantly from the SSW. Information gleaned from the HGB Captain, who crossed from Calais to Dover one and a half hours later, bears out that the SW shipping lane was where the seas were most confused. Weather conditions at the time of the impact were SSW 35-40+ kts, 3-3.5 metre confused seas, 2-3 miles visibility.

On receiving reports from the starboard cabin that there was damage around the forward windows, I immediately turned to starboard in order to return to Calais. Further progress towards Dover was unacceptable. I informed Base 1 of my decision, and having received further reports from the damaged area, informed Base 1 of the reason for returning to Calais. Return to Calais was uneventful, no operating systems were affected, and arrival was at 1001.

Passengers were kept well-informed and remained calm. Those in the starboard forward cabin were quickly moved aft, together with the cabin staff. There were no reports of injuries, and no vehicles were damaged.

Provisional visual inspection suggested that damage had only been sustained in and around the forward window area, and not to major structures.

G C MacFarlan

From: G. MACFARLANE file incident

To: C. HUNT

Re: Damage to Hovercraft 2007 - 29.2.00.

Time: 0925
Posn: 192° - S. Goodwin Lt - 5 miles
Course: 275° - 280°
Speed: 20 - 22 kts.
Weather: S - SSW 35-40 kts, 3 - 3.5m seas, 5-6 miles vis.

Flight Crew: Captain G. MACFARLANE
First Officer C. SPAIN
Second Officer S. PHILLIPS
Second Officer (V/T) R. WARREN.

Report:

Whilst proceeding from Calais to Dover, damage was sustained around the starboard bow, in the vicinity of the first three windows and above. Weather conditions were marginal but just within defined limits. A sudden impact was followed by reports from the starboard cabin that there was damage around the forward windows. Passengers were immediately moved to the rear of the main cabin, with cabin staff from the forward cabin.

On receiving this report I immediately turned the hovercraft to starboard in order to return to Calais, as further progress towards Dover was unacceptable. I informed Base 1 of my decision. 2O Phillips was sent down to assess the damage, 2O Warren remaining in the right hand seat. Phillips reported ~~that~~ damage, as described above, and that water was entering the hovercraft through the damaged roof. No operating systems were affected and an

uneventful return to Calais was made, arriving at 1001. Passengers were kept well-informed and remained calm. There were no reports of injuries to passengers or crew.

I made a visual inspection of the bow area, from above and below the frame ramp. There did not seem to be any structural damage in these areas.

I reported my findings by telephone to M. Wells and C. Hunt.

Whilst in Calais a cover was placed over the damaged area.

From: G MacFarlan
To: C Hunt

Re: Damage to Hovercraft 2007 – 29.2.00

Time: 0925
Pos'n: 192° - S Goodwin Lt – 5 miles
Course: 275° -280°
Speed: 20 – 22 kts
Weather: S – SSW 35-40 kts, 3 – 3.5m seas, 5 – 6 miles vis.

Flight Crew:	Captain	- G MacFarlan
	First Officer	- C Spain
	Second Officer	- S Phillips
	Second Officer (v/t)	- R Warren

Report:

Whilst proceeding from Calais to Dover, damage was sustained around the starboard bow, in the vicinity of the first three windows and above. Weather conditions were marginal but just within defined limits. A sudden impact was followed by reports from the starboard cabin that there was damage around the forward windows.

Passengers were immediately moved to the rear of the main cabin, with cabin staff from the forward cabin.

On receiving this report I immediately turned the hovercraft to starboard in order to return to Calais, as further progress towards Dover was unacceptable. I informed Base 1 of my decision. 2O Phillips was sent down to assess the damage, 2O Warren remaining in the right hand seat. Phillips reported damage, as described above, and that water was entering the hovercraft through the damaged roof. No operating systems were affected, and an uneventful return to Calais was made, arriving at 1001. Passengers were kept well-informed and remained calm. There were no reports of injuries to passengers or crew.

I made a usual inspection of the bow area, from above and below the .... There did not seem to be any structural damage in these areas.

I reported my findings by telephone to M Wells and C Hunt.

Whilst in Calais a cover was placed over the damaged area.

G MacFarlan

ANNEX 5

5. Copy of TRE's Report

The Princess Anne

Draft 3 - 05 June 2000

hoverspeed

HOVERCRAFT DAMAGE - GH-2007 - 29.2.00

I have investigated the conditions and circumstances leading up to the wave impact damage sustained by GH-2007 on 29th February 2000.

As part of this investigation I have consulted with the Duty Operations Assistant at Dover and the Duty Controller in the tower at Calais. I have also interviewed 4 members of the Cabin Crew, 2 of whom were stationed in the starboard forward servery at the time of the impact and ascertained the passenger load distribution figures from the Senior Cabin Crew members (see appendix).

A frank and lengthy discussion took place with Captain MacFarlan which concentrated on the detail of the information he had sought with regard to the prevailing weather conditions and the factors affecting his decision making.

Background; Captain MacFarlan had completed the afternoon shift on 28th February 2000 operating 3 round trips to Calais; initially in a WSW wind of 28-30 knots and seas around 2½ metres which had eased to WSW 20-25 knots and seas of 1½ - 2m for his last departure of the day which left Dover at 1849 hrs. I feel that it is of considerable benefit to have the experience of actual sea heights and the conditions that were prevailing in the period 12 hours before. When this is coupled with the fact that the 0730 hrs departure occurs at near identical states of the tide as the 1830 hrs departure of the preceding day, then in this regard Captain MacFarlan was in the best possible position to gauge the expected sea conditions he was likely to encounter.

The weather information obtained prior to his departure was extensive and is well documented in his report. It is worth noting, however, that the sea heights of 3-3½m recorded by Captain MacFarlan at mid channel was the same as that given by the Hoverspeed Great Britain which departed Dover at 08.05.

In view of the incident I have tended to concentrate my findings on the weather conditions prevailing at the time of departure from Calais. The information from Calais tower gave a wind speed on departure of SW 25. Shortly afterwards Cap Gris Nez reported the wind as SW 32-34 and some 18 minutes later as SW 42 knots. As Captain MacFarlan states in his report this was a 'marked increase on previous information' and was the point at which he decided to cancel further hovercraft operations. He admits that he did not contact Dover

Port Control to ascertain their weather but he has stated that he was not concerned about conditions off the Eastern entrance at Dover as he had good sight of conditions there on his departure. The tide, on his return, was still favourable with over an hour of easterly ebb remaining. With such, and a falling water level, it would be expected, in my opinion, even in a freshening south westerly wind that the sea conditions off Eastern would, at their worst, be broadly similar to those he had sighted on his departure.

On the occasions that I have felt it necessary to enquire of the conditions at Dover Port Control before leaving the French coast, I have chosen to do so in the vicinity of the CA5 buoy. I would suggest that the craft on this occasion was close to such a position at 09.00 hours. Dover Port Control record weather conditions once an hour, on the hour. At 09.00 the report for Eastern entrance was; rough seas, SW 30 gusting 42. This was a lesser wind strength than that given prior to Captain MacFarlan's departure at 0740. I feel that had this information been sought it would have only endorsed his decision to continue towards Dover. (At 10.00 hrs Dover Port Control recorded; rough seas, SW 35 gusting 45).

From the evidence obtained it would suggest that the craft was not at any stage being operated outside the prescribed limits and the decision by Captain MacFarlan to operate the 07.30 departure, and subsequent return from Calais was, in my opinion, soundly based.

I am less happy with the detail of Captain MacFarlan's report. In particular having received a minor 'thump' on the port side what precautions were taken to prevent a re-occurrence? In addition although his report states "I am unable to offer any probable cause of the damage" it is not made clear whether any avoiding action was being taken at the time.

Captain MacFarlan has subsequently responded to these queries as follows. "As to the minor 'thump', I was and continued to make every effort to avoid further impacts. As the seas became ever more confused the options to 'pay off' were greatly reduced. As I was making a safe speed - one that allowed for quick reductions to avoid hard impacts - I continued towards the English coast. At the time of the second impact, I do not remember taking avoiding action, but given the increasingly confused state of the sea could have been 'yoking' away from a wave front. I believe I was acting in the best interests of safety for passengers, crew and hovercraft, and could not have prevented the impact".

Summary

The area of craft damage is very similar to that sustained by GH-2006 on 22nd October 1998. Whereas damage on that occasion was attributed to skirt contact with cabin tertiary structure, there was no visible evidence of skirt contact with such structure here. The other common factor was the confused sea state both craft found themselves in . The Hoverspeed Great Britain at 11.10 (1 hour and 45 minutes after this incident) reported being in very confused seas some 6 or 7 miles off Dover.

Recommendations

There have been a number of wave impact incidents over the years which have resulted in craft damage. I feel it is worth looking more closely at the detail of past incidents, the areas of occurrence and the correlation of craft headings at the time. Such findings may merit the issue of broad guidelines which would serve to minimise the likelihood of further such events.

John Hawkins
Type Rating Examiner

8 March 2000

Appendix

Interviews with various members of the cabin crew revealed that the passenger load distribution was balanced with near equal numbers of people seated on each side of the craft.

The passenger total was 104 with only 5 persons occupying the starboard forward cabin, 2 in outboard seats row 5, 2 in outboard seats row 8 and 1 person lying across the three inboard seats in row 3 (see diagram).

Reports from 2 crew members situated in the starboard servery described the craft as going down into a trough with a juddering sensation followed by a sudden crack as the wave damage occurred. In what little that was seen of the impact by crew members there was nothing specific to suggest that this was caused other than by water. All 3 cabin crew members in the starboard forward servery remained standing on impact. Cabin crew member J Barton immediately informed the flight deck and instructed passengers in the outboard seats to move aft. The lone passenger in row 3 inboard was soaked by water ingress and was subsequently ushered aft. Other passengers and crew were reported to have only suffered wet shoes. A section of trim panelling came off with the impact and landed in the front row of inboard seats. The cabin crew used carpet runners, in rolled form, in an attempt to stem the flow of ingressed water moving aft.

The senior crew members confirmed that passengers remained calm and seemed not unduly perturbed by the incident.

Elizabeth Kirkham, situated in the port forward cabin, filed an incident report after landing on her feet with the impact and reported a sharp pain in her right knee.

JW/LS

7 March 2000

The Met. Office, Southampton

The Met.Office

Forecast : Hoverspeed Dover Straits

Issued: Tuesday 29 February 2000 At: 03:34

All heights are In Metres, all wind speeds are in Knots.

Day Tuesday 29 Feb 2000 Wednesday 01 Mar 2000

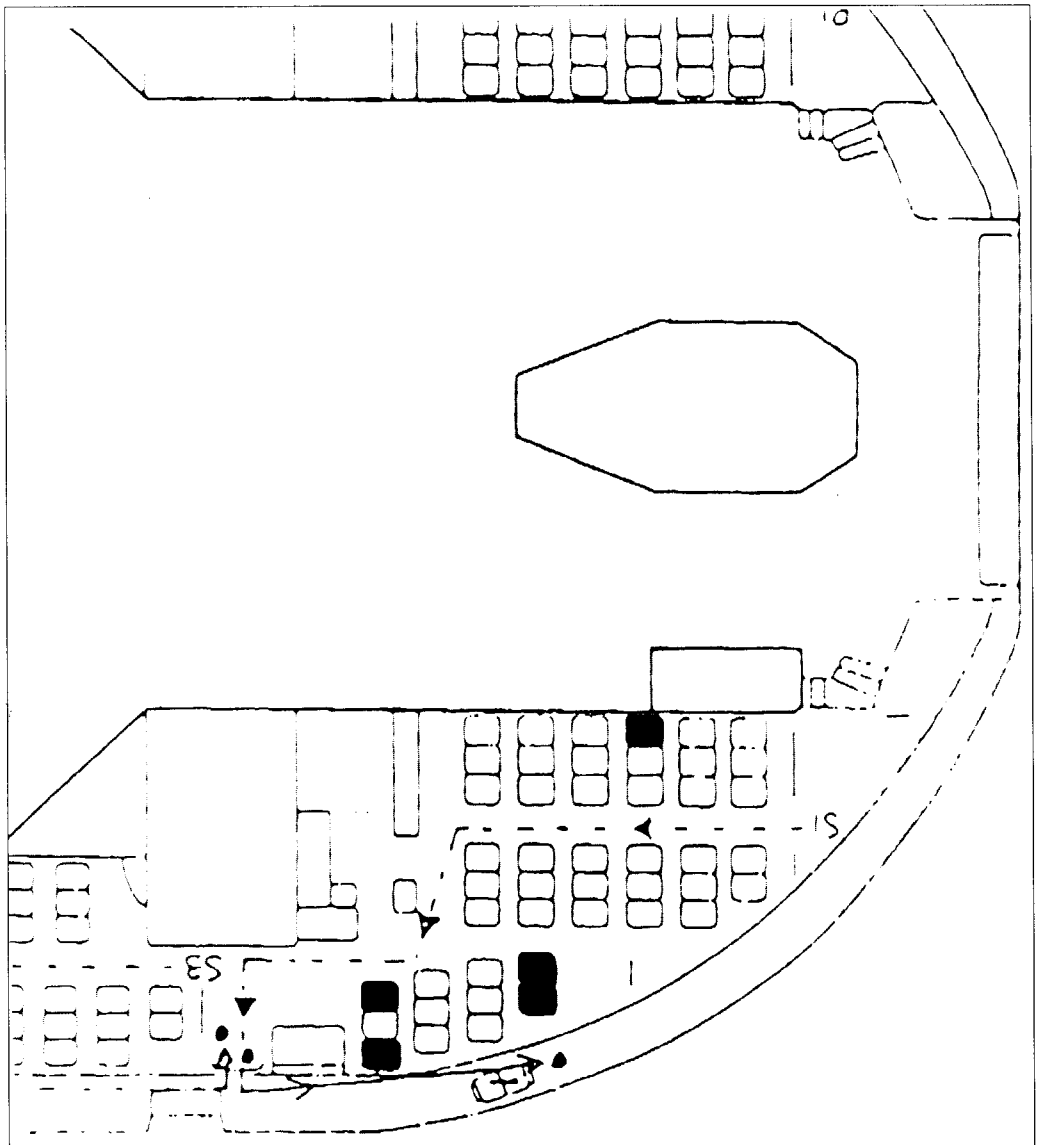
Mid Channel	06	09	12	15	18	21	24	06	12	18	24
Wind (10M)	27	34	38	33	24	20	17	16	20	18	19
Wind Dir.	SSW	SSW	SSW	SW	WSW	WSW	WSW	WNW	NW	NW	NW
Gusts	38	47	51	45	35	30	23	23	28	25	27
Sig. Sea	2.3	3.0	3.6	3.2	2.5	2.1	1.7	1.5	1.6	1.6	1.7
Period (Sec.)	6	6	6	6	6	5	5	5	5	5	5
Max Sea	3.7	4.9	5.7	5.1	3.8	3.2	2.7	2.3	2.5	2.5	2.7
Swell	0.3	0.3	0.1	0.1	0.2	0.4	0.4	0.6	0.3	0.2	0.2
Dir./Period	SW/8	SW/8	SW/8	SW/9	WSW/11	WSW/10	WSW/10	WSW/8	W/10	WEST/11	WEST/10
Weather	Rain	Rain	Rain	Showers	Showers	Showers	Showers	Showers	Showers	Showers	Showers
Visibility (NM)	2	2	3	15	30	30	25	15	30	30	30

Supplementary Data:

	Tuesday 29 Feb 2000							Wednesday 01 Mar 2000			
Mean Wind 10M	06	09	12	15	18	21	24	06	12	18	24
Dover	27	33	37	32	22	18	16	16	20	17	19
Folkestone	27	33	36	32	20	17	16	16	19	17	18
Calais	27	34	38	36	22	18	17	16	21	18	20
Ostende	24	33	41	37	22	19	17	14	20	19	20
Dunkirk	25	32	40	37	23	20	17	15	21	18	19
Boulogne	26	33	36	33	24	20	18	16	20	17	18

Remarks: SSW winds will increase to reach severe gale force at times by late morning

Strictly for addressee use only.
The Met Office - Marine Weather Group



Passenger distribution in forward starboard cabin

Preceding day.

hoverspeed

DATE 28/02/00 HW: AM 0503 LW: AM 1157 SUNRISE 0649 TWILIGHT

CRAFT GH-2007 PM 1749 PM — SUNSET 1738 TWILIGHT 1812

FLIGHT CREW	Total Crew	SCH DEP	ACT DEP	Crossing Time	ARR	Pos'n	Turn-around	Wind Dir	Wind Speed	Sea & Swell	Vis	Pax	UNITS			
													Veh	Camp C'van	M/C	Bag Trlly
Morris Bown	21	0730	0727	34	0756	E	30	SW	24	2½	Good	146	37			
McMurdo	21	0830	0826	42	0908	W	24					109	29	+3 Dogs!		
"	21	0930	0932	32	1004	E	28	WSW	26	2		187	47			
"	21	1030	1032	42	1114	W	23	SW	30	2½		102	29			
"	20	1130	1137	33	1210	E	36					187	42			
"	20	1230	1240	48	1328	W	27	WSW	26	2½-3		198+2	48			
MacFarlan McGahan Phillips. Lucas (T).	18+2	1330	1355	36	1431	Eoc	28	WSW	28-30	2-2½	VG	176	43			
	18+2	1500	1500	60	1603	W	23	WSW	28-30	2½	G	187+1	48			
"	19+2	1600	1626	35	1701	Eoc	33					130	36			
"	19+2	1730	1734	56	1830	Woc	19					206+1	48			
"	19+2	1830	1849	35	1924	Eoc	27	WSW	20-25	1½-2m	VG	72	19			
"	19+2	1930	1951	50	2041	SAX						175	45	+2 Dogs.		

Preceding day

The Met. Office, Southampton

The Met.Office

Forecast : Hoverspeed Dover Straits

Issued: Monday 28 February 2000 At: 03:33

All heights are in Metres, all wind speeds are in Knots.

Day Monday 28 Feb 2000 Tuesday 29 Feb 2000

Mid Channel	06	09	12	15	18	21	24	06	12	18	24
Wind (10M)	35	18	15	20	22	20	22	34	43	20	13
Wind Dir.	SSW	WEST	WSW	WSW	WSW	SW	SW	SSW	SSW	WEST	WNW
Gusts	47	25	21	28	31	28	30	42	54	28	18
Sig. Sea	3.2	2.4	1.6	1.7	1.9	2.0	2.3	3.2	3.7	2.2	1.4
Period (Sec.)	6	6	5	5	5	5	5	6	6	6	5
Max Sea	5.0	3.5	2.6	2.9	3.1	2.8	3.2	4.8	5.5	3.4	2.2
Swell	0.5	0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.5	0.5	0.9
Dir./Period	WSW/9	WSW/10	WSW/9	WSW/9	WSW/10	WSW/10	WSW/10	WSW/9	WSW/9	WSW/10	WSW/8
Weather	Rain	Rain	Cloudy	Fine	Fine	Showers	Fair	Cloudy	Rain	Rain	Cloudy
Visibility (NM)	3	5	15	20	20	12	20	18	5	3	8

Supplementary Data:

	Monday 28 Feb 2000						Tuesday 29 Feb 2000				
Mean Wind 10M	06	09	12	15	18	21	24	06	12	18	24
Dover	35	25	14	17	21	22	17	27	40	22	15
Folkestone	32	25	14	17	20	23	17	27	42	23	16
Calais	30	19	16	15	23	17	16	25	37	20	13
Ostende	30	23	18	13	19	15	15	24	36	22	13
Dunkirk	30	21	17	15	18	17	16	23	35	21	13
Boulogne	35	24	15	18	22	22	18	27	39	23	16

Remarks: Bands of very strong winds are expected to affect the area at first on Monday morning ahead of an active frontal system and again during Tuesday.

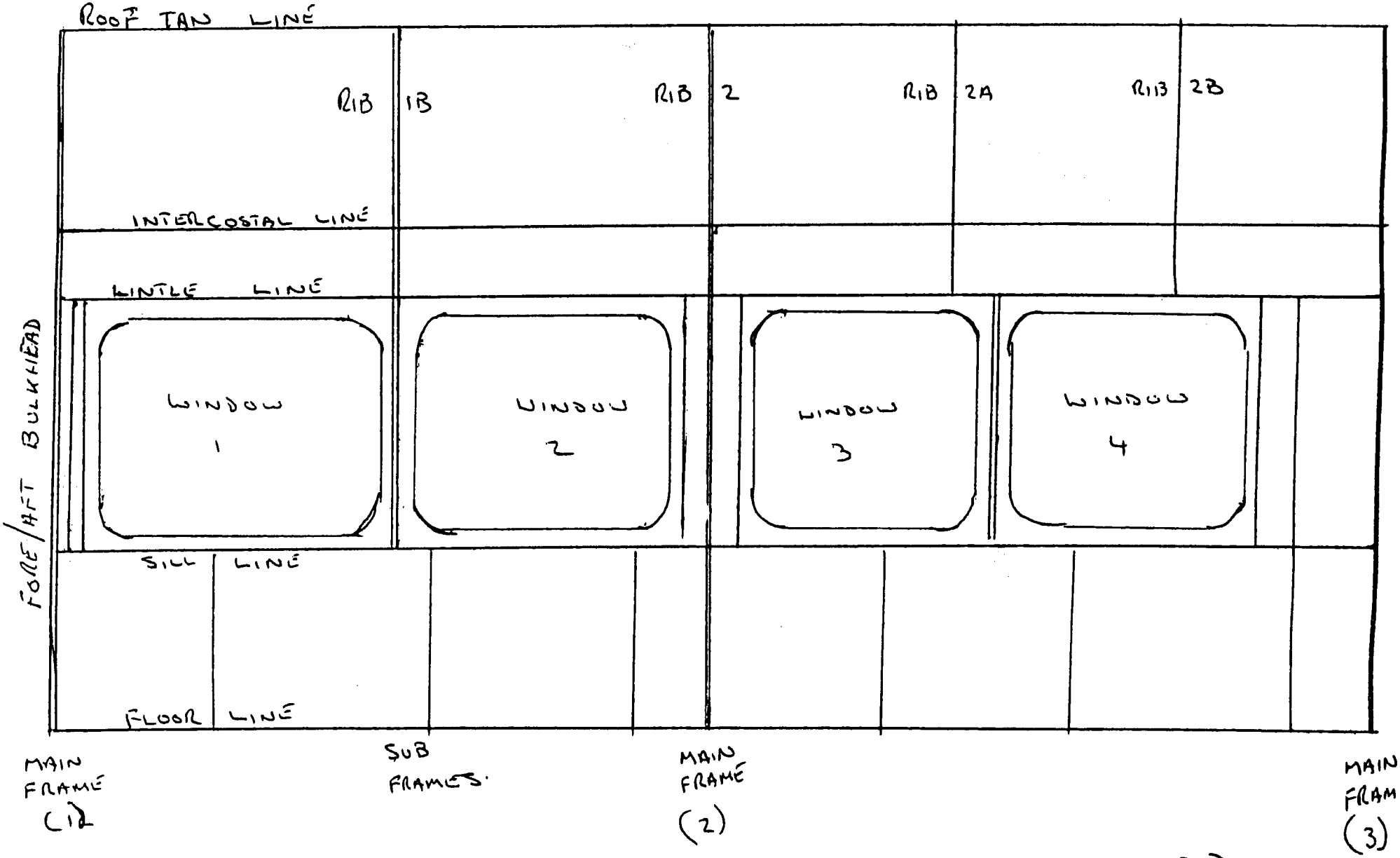
Strictly for addressee use only.

hoverspeed

DATE 29/02/00 HW: AM 0619 LW: AM 0028 SUNRISE 0649 TWILIGHT

CRAFT GH-2007 PM 1904 PM 1320 SUNSET 1738 TWILIGHT 1812

FLIGHT CREW	Total Crew	SCH DEP	ACT DEP	Crossing Time	ARR	Pos'n	Turn-around	Wind Dir	Wind Speed	Sea & Swell	Vis	Pax	UNITS			
													Veh	Camp C'van	M/C	Bag Trlly
G. MACFARLAN C. SPAIN S. PHILLIPS R. WARREN (T)	2+1	0730	0740	45	0825	E1	25	SLY	35-38	3-3½M [redacted]	GOOD	128	33			
	2+1	0830	0850	75	1001	E1	ditto					104	34			



GH2007 STBD FWD CABIN VIEWED FROM INSIDE LOOKING FWD.

29-2-00

hoverspeed

GH-2007 STARBOARD FORWARD CABIN DAMAGE 29.2.00.

Damage from fore/aft bulkhead to cabin third main frame just forward of craft frame 2.

1. Roof tan line down to intercostal line fibreglass skin damaged/torn/missing.
2. Qty 4, roof ribs, numbers 1B - 2 - 2A - 2B damaged/broken.
3. Intercostals from fore/aft bulkhead to third cabin frame damaged/broken, 5 sections.
4. Window lintel from fore/aft bulkhead to third cabin frame damaged/broken.
5. Window sill from fore/aft bulkhead to third window damaged/broken.
6. Vertical frame between first/second windows broken.
7. Main vertical frame no. 2 between second/third windows broken.
8. Five sub frames below windows bent back.
9. Fibreglass skin below windows split/torn, aluminium doublers bent.
10. Roof trim back to craft frame 1 damaged.
11. Roof trim back to craft frame 3 full of water.
12. Speakers and lights water damage.
13. Carpet back to aft main door wet.
14. Seats and trim wet.
15. Window and lifejacket trims damaged.

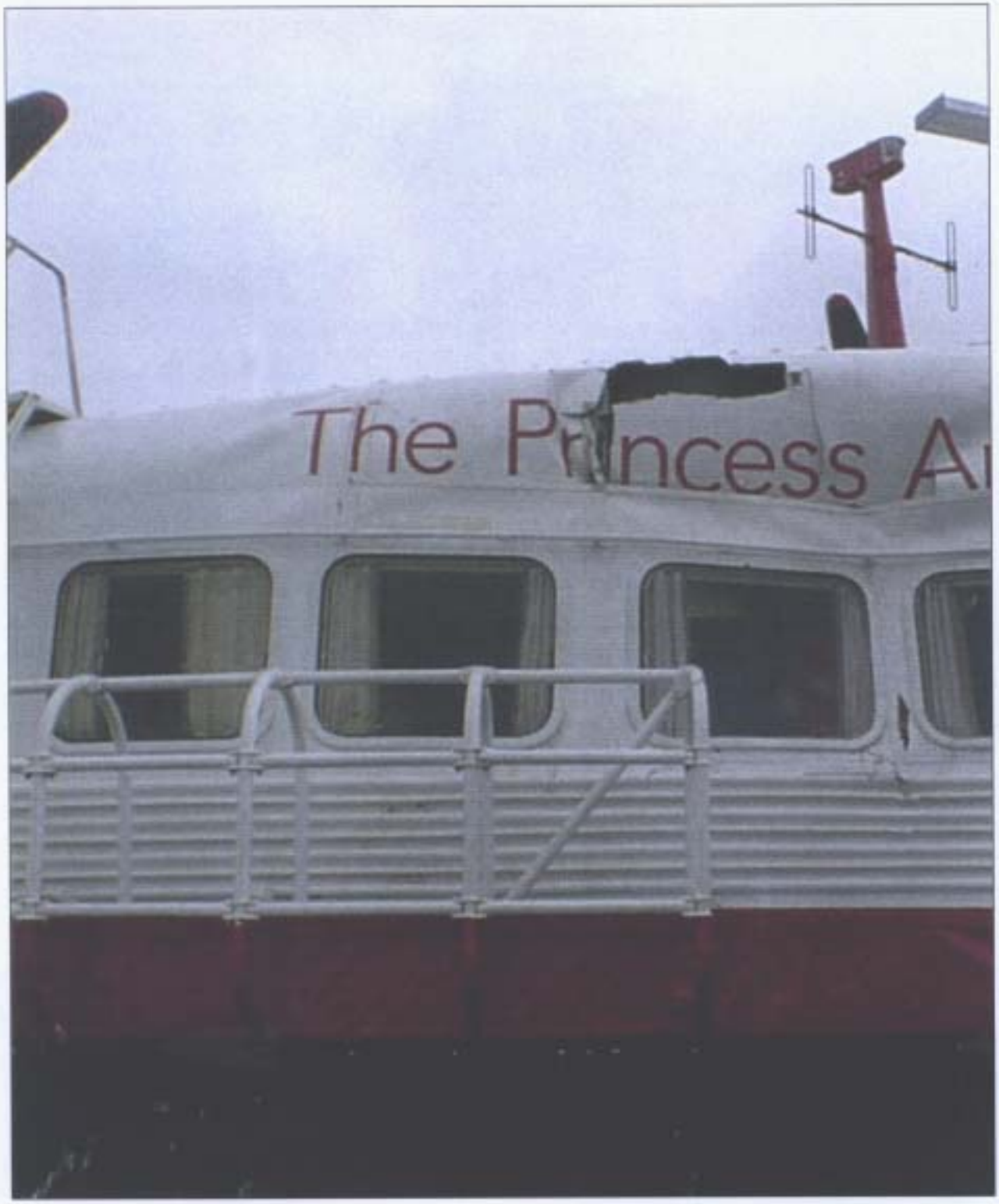
IC/LS
9 March 2000

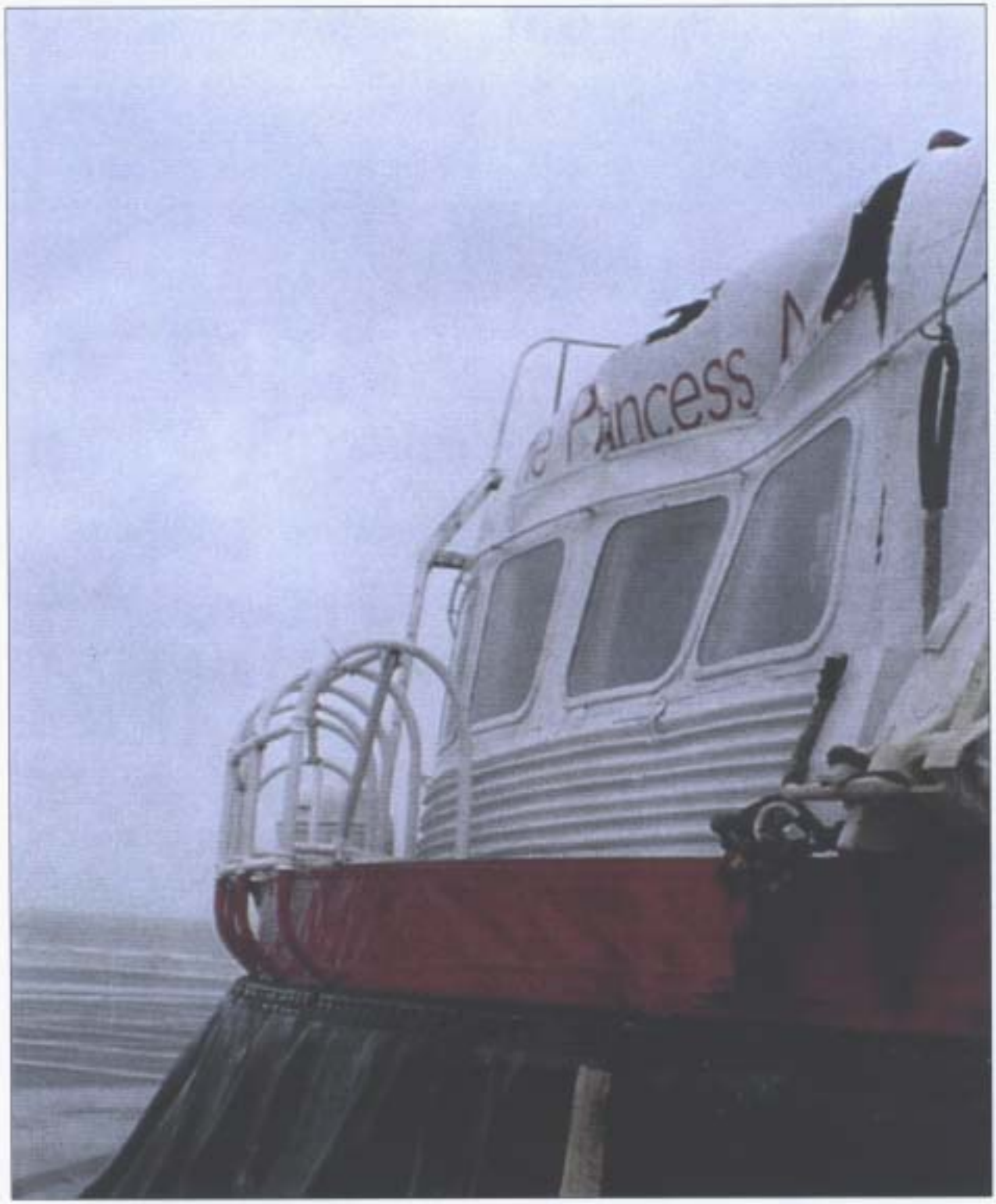
ANNEX 6

6. Photographs - damage to vessel

The Princess Anne


The Princess
HOVERSPEE


The Princess A


Princess