Report on the investigation of

the grounding of

HC Katia

while undergoing sea trials in the Solent

on

3 December 2003

Marine Accident Investigation Branch
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Report No 8/2004
July 2004

Extract from

The Merchant Shipping

(Accident Reporting and Investigation)

Regulations 1999

The fundamental purpose of investigating an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 1999 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.

NOTE

This report is not written with liability in mind and is not intended to be used in court for the purpose of litigation. It endeavours to identify and analyse the relevant safety issues pertaining to the specific accident, and to make recommendations aimed at preventing similar accidents in the future.

CONTENTS

GLOSSARY OF ABBREVIATIONS AND ACRONYMS

✠	-	Notates vessel built under supervision of DNV. Ref DNV's "Rules for Ships".
1A1 HSLC EO	-	Designates the main character of class. The notation 1A1 will be given to ships with hull machinery and equipment found to be in compliance with the rule requirements stated in DNV's "Rules for High Speed and Light Craft".
ABP	-	Associated British Ports
CHA	-	Competent Harbour Authority
DfT	-	Department for Transport
DNV	-	Det Norske Veritas classification society
ECDIS	-	Electronic Chart Display and Information System
ENC	-	Electronic Navigational Chart
EO	-	Notation for controlling the main propulsion machinery and alarms from outside the engine room
GPS	-	Global Positioning System
HC	-	Hydro Craft
Hp	-	Horse power
HSC	-	High Speed Craft
IMO	-	International Maritime Organization
MCA	-	Maritime and Coastguard Agency
Operating compartment	-	The enclosed area from which the navigationand control of the craft is exercised, ie the bridge of the vessel
Operating station	-	A confined area of the operating compartment equipped with necessary means for navigation, manoeuvring and communication, and from where the functions of navigating, manoeuvring, communication, commanding, conning and lookout are carried out
PEC	-	Pilotage Exemption Certificate
RAPP	-	Risk Assessment Passage Plan
ROB	-	Remaining Onboard
SI	-	Statutory Instrument
TRC	-	Type Rating Certificate
UTC	-	Universal Co-ordinated Time
VDR	-	Voyage Data Recorder
VTS	-	Vessel Traffic Services

SYNOPSIS (All times are UTC)

At 1735, on 3 December 2003, *Katia*, a United Kingdom owned and registered high speed passenger craft, which was undergoing the first day of sea trials, ran aground on Hurst Spit, in the western Solent, on the south coast of England.

Katia had a complement of 25 people on board including trials crew, shipyard personnel, technicians and surveyors.

At the time of grounding, the vessel was being conned by the chief officer seated in the centre pilot position. The trials captain was seated to his left in the co-pilot's seat, and the trials engineer was seated to his right at the engineer's position.

The vessel grounded during maximum speed endurance trials, while making a speed of 38 knots and approaching a turn on the most westerly section of a planned 32-mile circuit of the Solent. The accident occurred towards the end of a long day of trials. The chief officer had become distracted by another person in the operating compartment, and a turn was started too late, causing the vessel to momentarily ground on a shingle spit.

One person was injured during the grounding, and the vessel sustained minor hull and propeller damage.

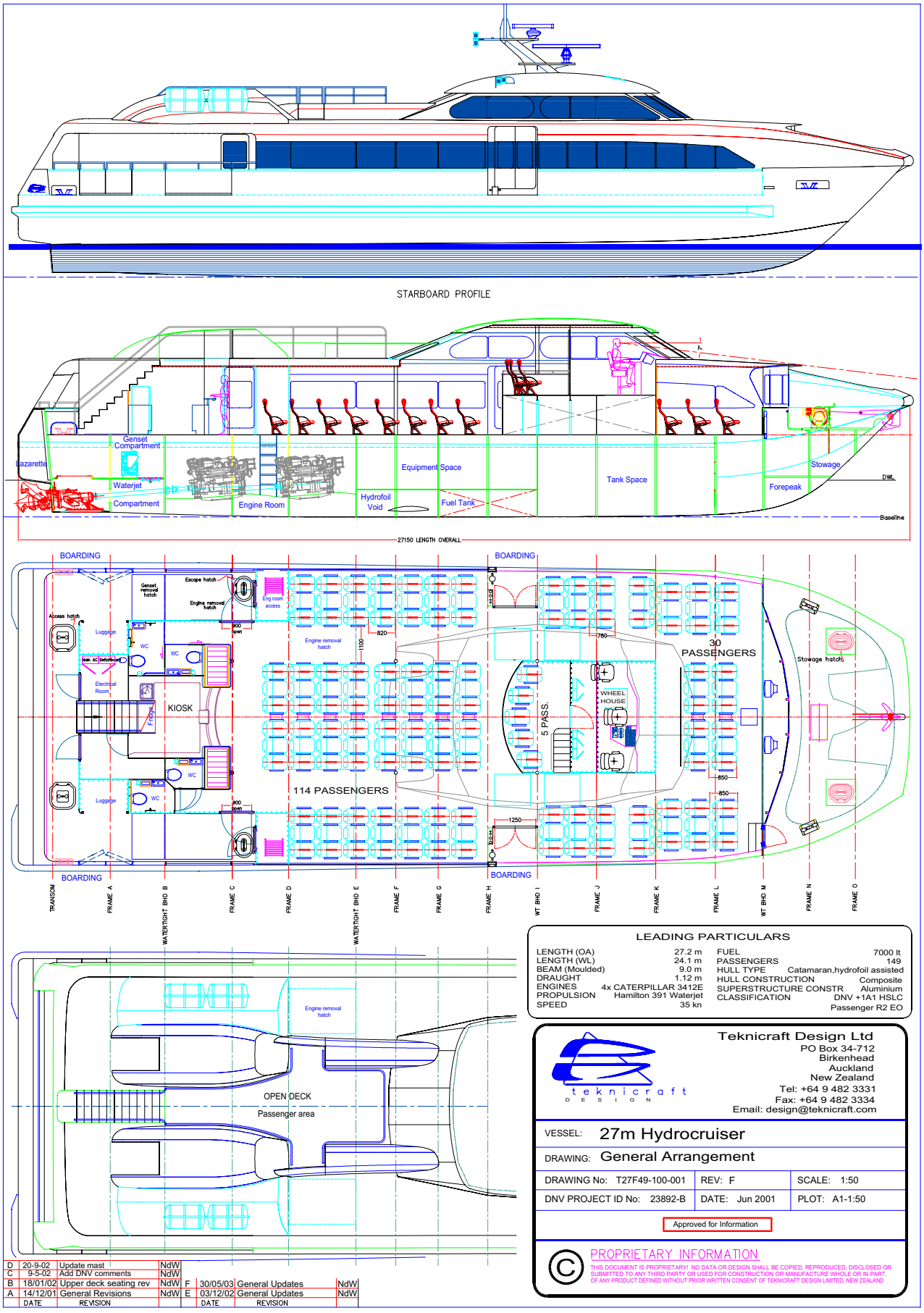
The wind was light and the visibility moderate. It was after sunset, and it was the first time the vessel had attempted this turn in darkness. Passage planning for the trials had been rudimentary.

The vessel's operating compartment was poorly designed and equipped and non-compliant with the High Speed Craft Code. During the day, further deficiencies had come to light including poor instrumentation layout, the existence of light pollution from the passenger cabin, faulty instrumentation and control station window demisting difficulties.

At an early stage in the investigation, the Chief Inspector of Marine Accidents issued a letter to the builders, which recommended that they should complete a thorough risk assessment before any further trials took place.

Recommendations have also been made to the Maritime and Coastguard Agency (MCA) to take forward with the International Maritime Organization (IMO) on: the navigational instruments fitted on all high speed craft (HSC); at least two qualified persons being required to navigate an HSC (apart from short line-of-sight voyages); a standardised HSC bridge instrumentation layout; and administrations having early involvement in the design of HSC operating compartments.

Further recommendations have also been made to the MCA on considerations in the issue of trials exemption certificates, and to HSC builders regarding trials, crewing and planning procedures.



LEADING PARTICULARS

LENGTH (OA)	27.2 m	FUEL	7000 lt
LENGTH (WL)	24.1 m	PASSENGERS	149
BEAM (Moulded)	9.0 m	HULL TYPE	Catamaran,hydrofoil assisted
DRAUGHT	1.12 m	HULL CONSTRUCTION	Composite
ENGINES	4x CATERPILLAR 3412E	SUPERSTRUCTURE CONSTR	Aluminium
PROPULSION	Hamilton 391 Waterjet	CLASSIFICATION	DNV +1A1 HSLC Passenger R2 EO
SPEED	35 kn		

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VESSEL: 27m Hydrocruiser

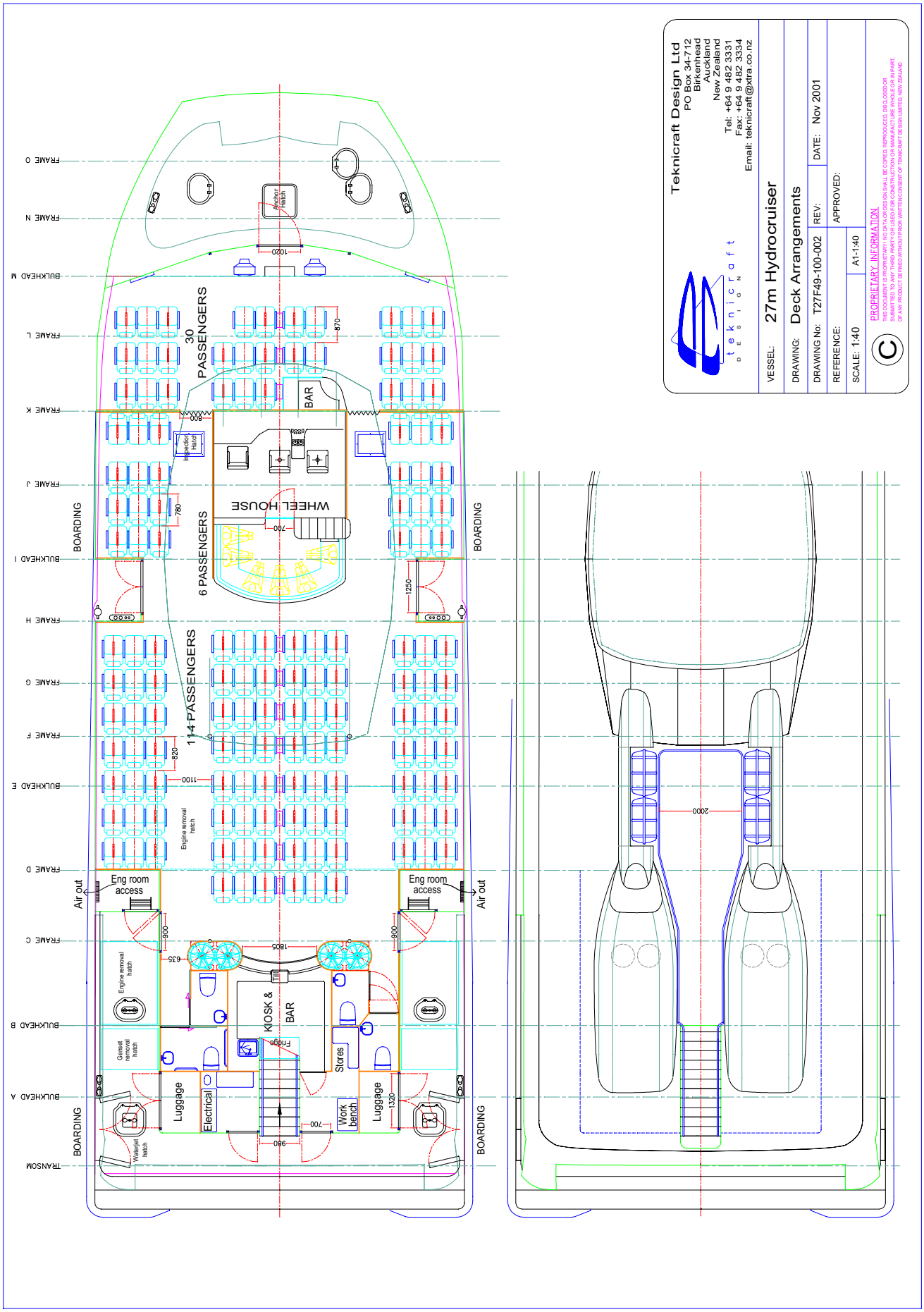
DRAWING: General Arrangement

DRAWING No: T27F49-100-001	REV: F	SCALE: 1:50
DNV PROJECT ID No: 23892-B	DATE: Jun 2001	PLOT: A1-1:50

Approved for Information

	DATE	REVISION			DATE	REVISION	
D	20-9-02	Update mast	NdW				
C	9-5-02	Add DNV comments	NdW				
B	18/01/02	Upper deck seating rev	NdW	F	30/05/03	General Updates	NdW
A	14/12/01	General Revisions	NdW	E	03/12/02	General Updates	NdW

HC Katia - general arrangement



HC Katia - deck arrangement

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *KATIA* AND ACCIDENT (See Figure 1a and b)

Vessel details

Registered owner	:	Vosper Thornycroft Group
Builder	:	Vosper Thornycroft (UK) Ltd
Ship type	:	Ferry, twin hull
Launched	:	June 2003
Flag	:	UK
Port of registry	:	Southampton
Passengers	:	150
Gross	:	186
Classification	:	DNV, HSC code
Superstructure	:	Aluminium
Hull	:	Fibre reinforced plastic
Length overall	:	27.0m
Beam	:	9.0m
Draft	:	1.0m
Engine type	:	4 X Caterpillar 3412E
Engine rating	:	820 kw/2300rpm
Propulsion	:	4 X Hamilton jet 391
Maximum speed	:	Approx. 39 knots

Accident details

Time and date	:	1735 on 3 December 2003
Location of incident	:	Hurst Spit, Western Solent
Persons on board	:	25
Injuries/fatalities	:	One injury
Damage	:	Hull and propellers

The vessel was built to comply with Det Norske Veritas (DNV) classification namely DNV ✠1A1 HSLC Passenger 2 Passenger EO and in survey to MCA-UK

1.2 BACKGROUND

Katia was the first of three identical vessels to be built at Vosper Thorneycroft's Gosport yard. On completion, it was planned that the vessels would remain in the ownership of the shipbuilders but be operated by a long-term charterer. The long-term charterer supplied the shipbuilder with the detailed design specification for the vessels based on their expected operating requirements.

1.3 VESSEL SEA TRIALS - GENERAL PRECAUTIONS

Shipbuilders' trials are designed to fully test a vessel and will, in the process, uncover defective equipment or faults. Trials should be carried out cautiously, bearing in mind that malfunctions and problems may arise at any time. The inherent danger is increased when the vessel is a prototype, as was the case with *Katia*, because not only is the quality of the build being tested, but also the vessel's basic design and seaworthiness.

The trials master must be aware of all faults as they become apparent, and must be at liberty to abort the trials as soon as he/she believes the vessel's safety has been compromised to an unacceptable degree. The master will also take into account such factors as the weather and visibility when deciding if trials shall be undertaken, and also whether the trials can safely continue during darkness.

The master has ultimate responsibility during the trials to ensure they are carried out in a safe manner. He/she also has the responsibility to ensure that the trials are completed in an area where the vessel is safe and remains safe, and does not adversely affect the local environment or other waterway users.

To this end, the passage plan is of the utmost importance. The passage plan should be detailed and should take into consideration all aspects of HSC operation, including their inherent high speed, manoeuvrability and wake / wash effect.

The trials operating area should be chosen with care, bearing in mind that the vessel may manoeuvre erratically when the vessel is tested.

1.4 NARRATIVE (All times are UTC)

The shipbuilders appointed *Katia*'s trials master 18 months before the planned date of the trials. During the design and build stages, he was given copies of the vessel's operations manual, and details of the bridge layout.

In the intervening time, he brought some deficiencies to the attention of the builders, including the fact that no "eye line" gyro heading indication, or rate of turn indication, were available at the control position, and that there was no navigation equipment at the co-pilot's position. However, on contacting the future charterers, the builders were told that no changes should be made to the operating compartment layout.

Before the trials, an MCA surveyor issued the builders with a trials exemption certificate, after a successful seaworthiness and safety survey.

The builders prepared a sea trials programme to cover 3 days of trials **(Figure 2)**. The trials were programmed to continue after sunset for at least the first 2 days.

The day before the trials, the master and chief officer prepared the charts and nautical equipment which were to be used.

At 0600 on the morning of the trials, the crew, technicians and surveyors boarded *Katia*, and, after successfully testing her bridge gear and systems, she departed the berth with 27 people on board. The wind was south-easterly force 2, but forecast to increase later in the day.

A call was made to Southampton Vessel Traffic Services (VTS) informing them of the intention to undertake trials in the Solent.

The trials engineer gave a safety talk, in which he advised everyone to remain seated whenever possible.

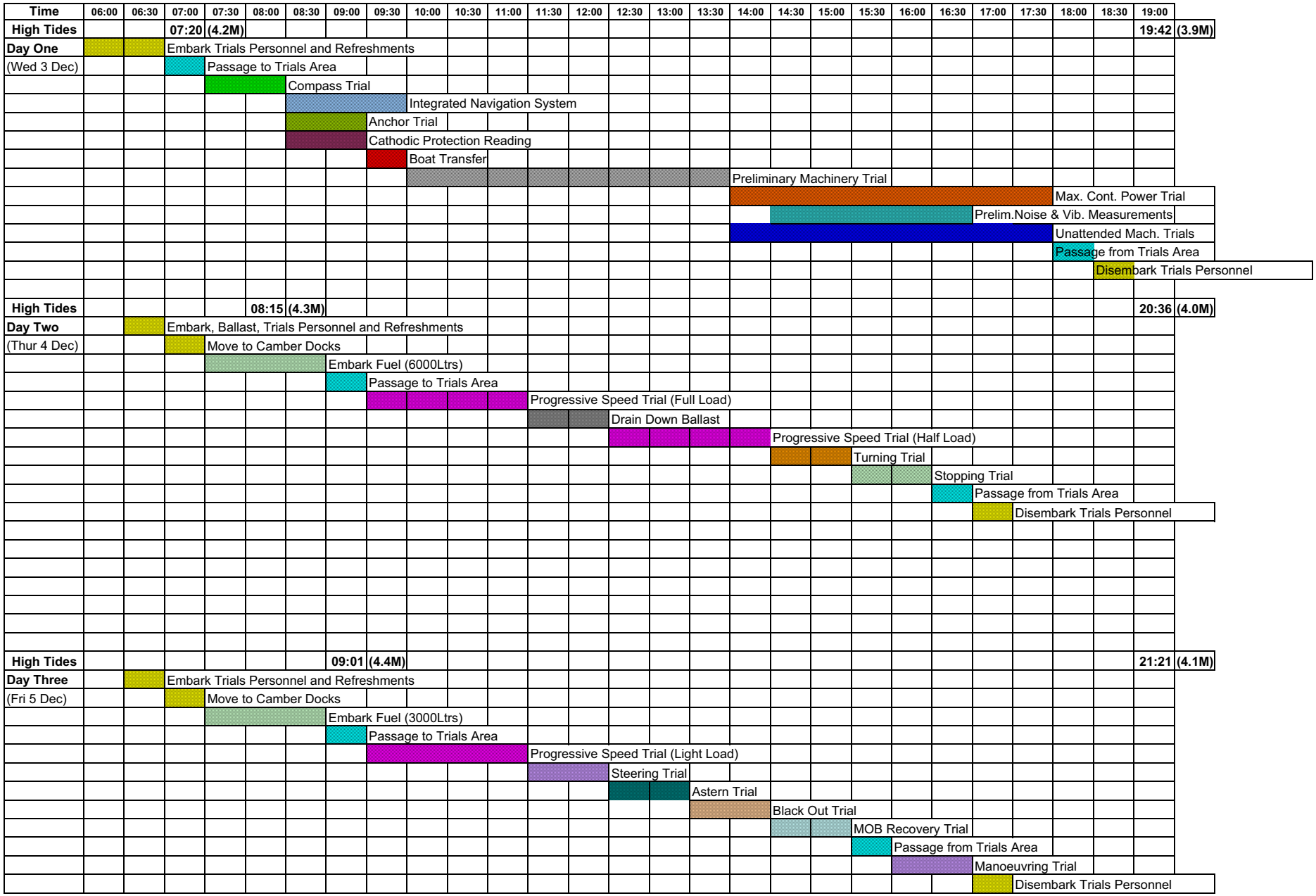
The compass was swung, and tests of the vessel's anchoring and autopilot equipment were successfully completed. Two people were then disembarked by boat.

Between 1134 and 1143, basic steering trials were completed, followed by progressive engine trials until 1430. During the progressive engine trials, the vessel's main engines were continually monitored as their speed was slowly increased, then decreased to stop and progressively increased again, until they were producing full power. These engine trials were conducted between Sturbridge buoy in the east, and Hurst Point in the west, while the vessel followed a pre-arranged route around the 32-mile circuit **(Figure 3)**. Reports were made to VTS, in accordance with local rules, as she passed the charted reporting points.

During these engine trials, it was found that neither the speed log nor the echo sounder were reliable at speeds over 20 knots. The maximum speed of the vessel calculated by the GPS receiver was estimated to be about 38 knots.

At 1430, a 4-hour maximum speed endurance test was begun, with the intention of following the same circuit. The master and chief officer began alternating the con at approximately hourly intervals.

At 1630, the con was passed from the master to the chief officer, who moved to the pilot's position. The light was fading at this time as the sun had set at about 1600.



Sea trials programme

Figure 2

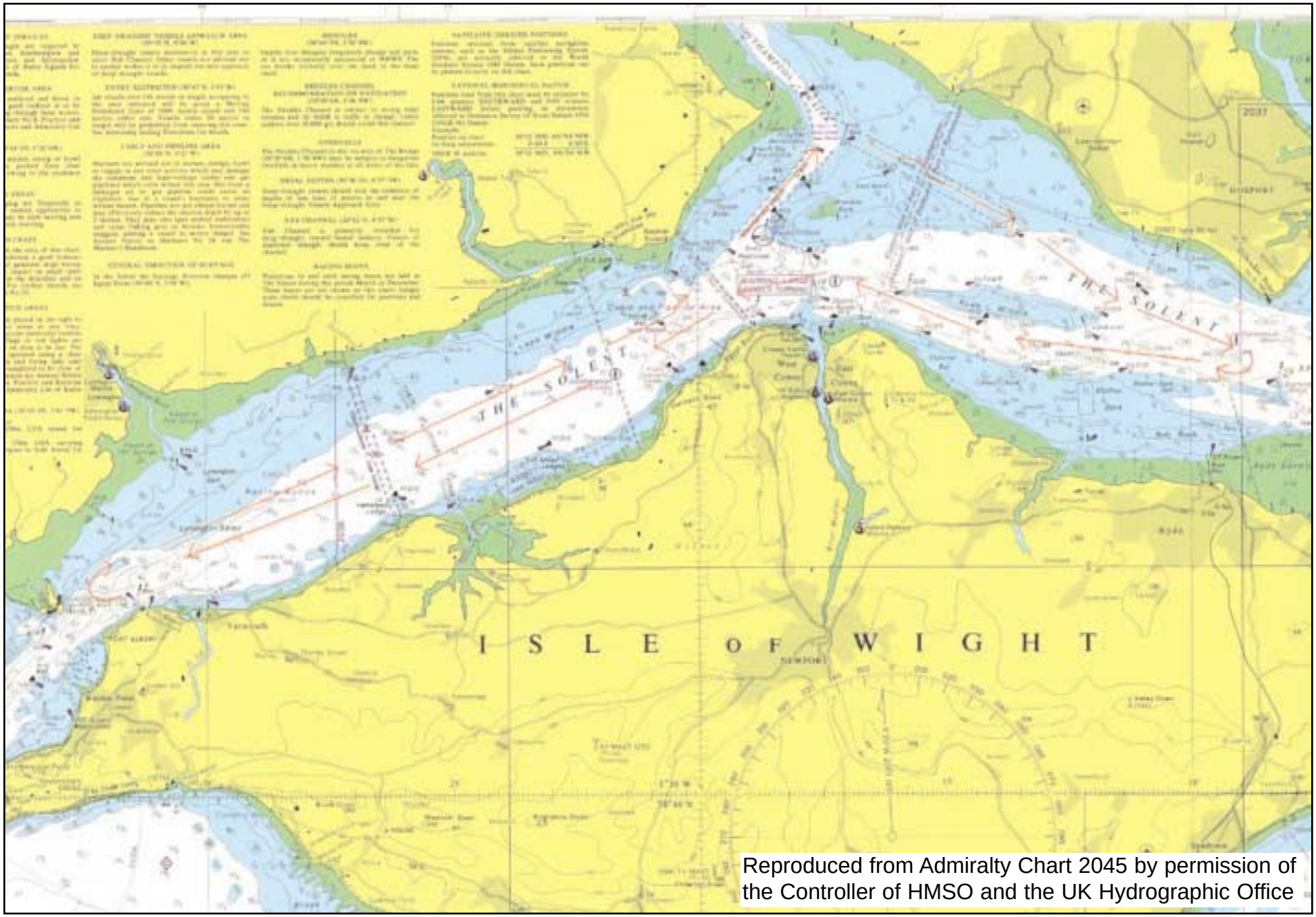
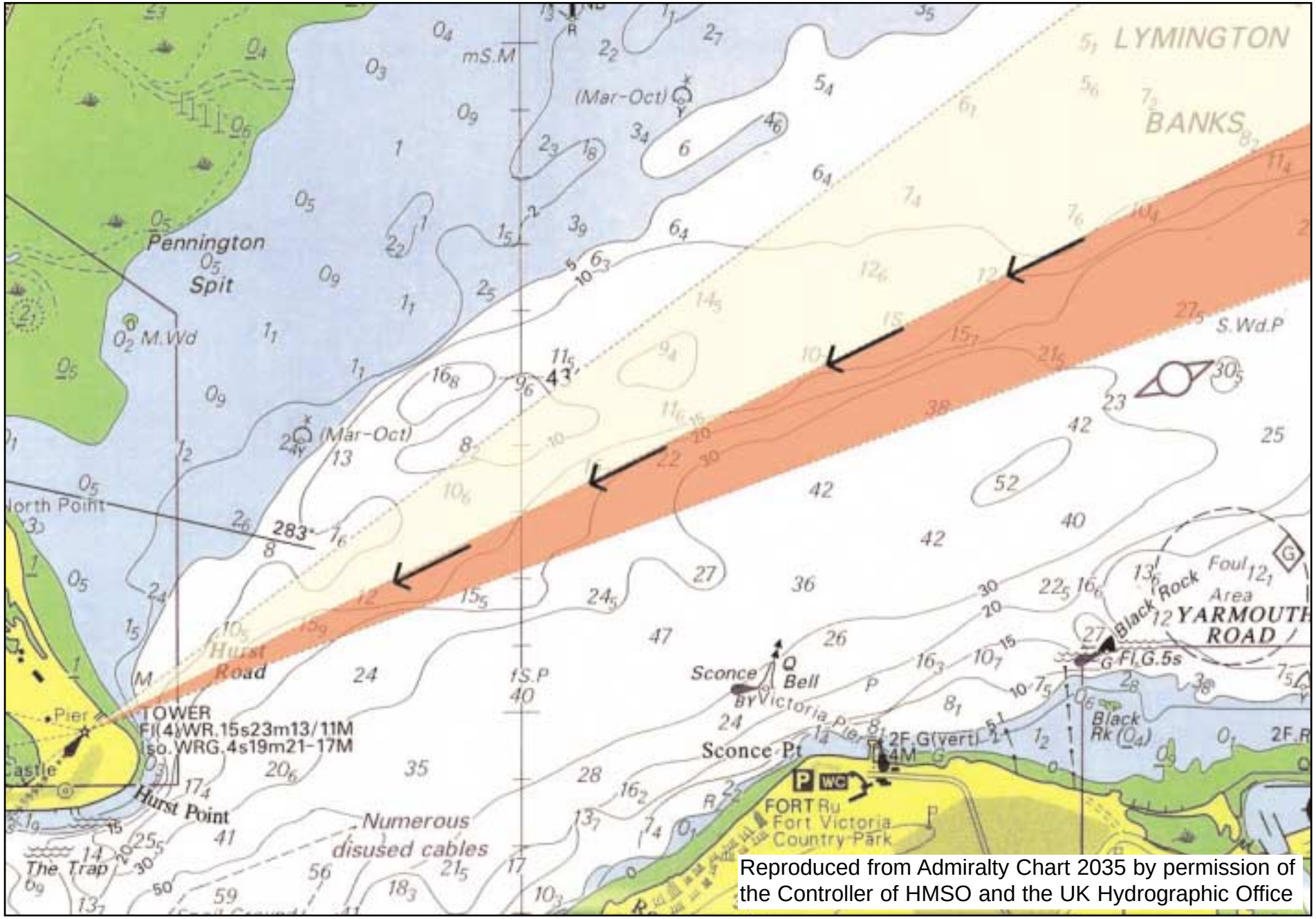


Figure 3

Planned trial circuit



Reproduced from Admiralty Chart 2035 by permission of the Controller of HMSO and the UK Hydrographic Office

Figure 4

Hurst Point chartlet

The classification society surveyor, who was on board to witness the trials, asked the master whether he was willing to continue after nightfall; he replied that he was.

As the trials had progressed, more problems with the bridge design and equipment had been discovered, including:

- The bridge side windows became obscured by condensation because no demisters had been fitted. They required frequent wiping with a cloth. The engineer leant over to wipe dry the starboard windows, and the person seated at the co-pilot's position wiped those on the port side. Demisters had been fitted to the forward facing bridge windows.
- No blackout screens were fitted between the aft cabin and the bridge. Light from the cabin affected the night vision of those on the bridge.
- A white bridge deckhead and a light grey navigation console also adversely affected night vision due to reflected light.
- The fixed range rings of the radar, sited at the pilot's position, were scaled in kilometres, and attempts to change them to nautical miles before and during the trials had failed.
- The tiller did not have an "amidships" notch fitted, and it was not spring-loaded. This added considerably to the concentration needed to steer a steady course.

Katia's engine fuel gauges gave erroneous readings so that, at 1715, it was decided to stop the vessel to manually check the fuel ROB. During this time, the master gave a charterer's representative permission to visit the bridge.

There was sufficient fuel to safely complete the trial and, at 1724, it was decided to continue from the vessel's position off Salt Mead Ledges **(Figure 3)** heading in a westerly direction. The chief officer still had the con.

A little time later, *Katia* approached the turn at Hurst Spit, for the first time at night. The chief officer was steering towards the spit, using the boundary between Hurst Point light's red and white sectors to maintain his track.

The vessel passed Sconce Buoy **(Figure 4)** at 1734, and the master noted this in the log, assisted by a small flashlight.

The charterer's representative was still on the bridge and was talking to the chief officer. The chief officer suddenly realised that the vessel was too close to Hurst Spit, and put the control lever hard to port. At the same time, the master told him that he was too far over to starboard. The vessel turned rapidly to port, but, when about 90 degrees from her original course, her starboard side rose abruptly and dropped down again as she momentarily grounded on Hurst Spit. The chief officer stopped the engines, and many alarms sounded in the wheelhouse.

The master took over control of the vessel, and found she was afloat once again.

The vessel's complement was mustered. One man was found to have been injured.

The trials engineer led a damage control party to assess *Katia*'s condition. No internal damage or sign of flooding was found and the master set course for their berth at Gosport using reduced speed. The chief officer contacted Solent coastguard and VTS, informing them of the situation. It was arranged for an ambulance to meet the vessel on her arrival.

Katia returned to her berth at 1906, and the injured man was disembarked into the waiting ambulance. Subsequent investigations found that he had been thrown against some railings during the grounding, injuring his back.

1.5 ENVIRONMENTAL FACTORS

The weather during the day of the sea trials was partly cloudy, with light winds from the south-east and an air temperature of 7ºC. Visibility was between 2 and 5 miles.

Strong winds were forecast for that night and the following day.

Low Water at Hurst Point occurred at 1228, and high water at 1918.

At 1735 the tidal stream was still just flooding (flowing into the Solent from the west) but rapidly reducing towards slack water. It is calculated to have been less than 1 knot at the time of the accident.

Sunset occurred at about 1600.

1.6 THE TRIALS AREA

The shipbuilder's trials took place in the central and western Solent area. The Solent is the name given to the waters separating the south coast of England and the Isle of Wight. It forms the approaches to the ports of Portsmouth and Southampton. The 32-mile circuit used for both the progressive engine trials, and then the maximum power endurance test, took *Katia* past the entrance to the River Medina off Cowes and into areas of quite heavy commercial and leisure traffic **(Figure 3)**.

At the western end of the circuit, the vessel was required to turn off Hurst Spit, which is a shingle beach and narrow neck of land extending 1¼ miles south-east from Milford-on-Sea to Hurst Point.

Hurst Point Lighthouse is a white round tower 26m in height. The light is also an important leading mark and aid to navigation in the western Solent, the characteristics of which are Fl(4) WR.15s 23m 13/11M and Iso.WRG.4s 19m 21-17M.

1.7 THE MASTER AND CHIEF OFFICER

The trials master was 67 years old at the time of the accident. He worked as a consultant specialising in matters concerning HSC, and held a valid Class 1 Certificate of Competency. He had experience on HSC dating back more than 30 years. He was a certificated HSC Type Rating Examiner for many vessel types and for various flag states. He had been trials master many times on similar craft in the Solent and elsewhere.

The trials chief officer also worked as a consultant/surveyor, and held a valid Class 1 Certificate of Competency. He had some previous experience on similar vessels carrying out trials in the Solent.

1.8 PASSAGE PLANNING

The trials master was fully aware of the requirements of the trials programme. It was decided that the progressive engine trials and full speed endurance trials would be conducted around a 32-mile circuit in the central and western Solent.

The positions of the main channel buoys were entered into the vessel's GPS so that a course between them could be acquired to assist in navigation. Some emergency anchoring areas were identified as a precaution.

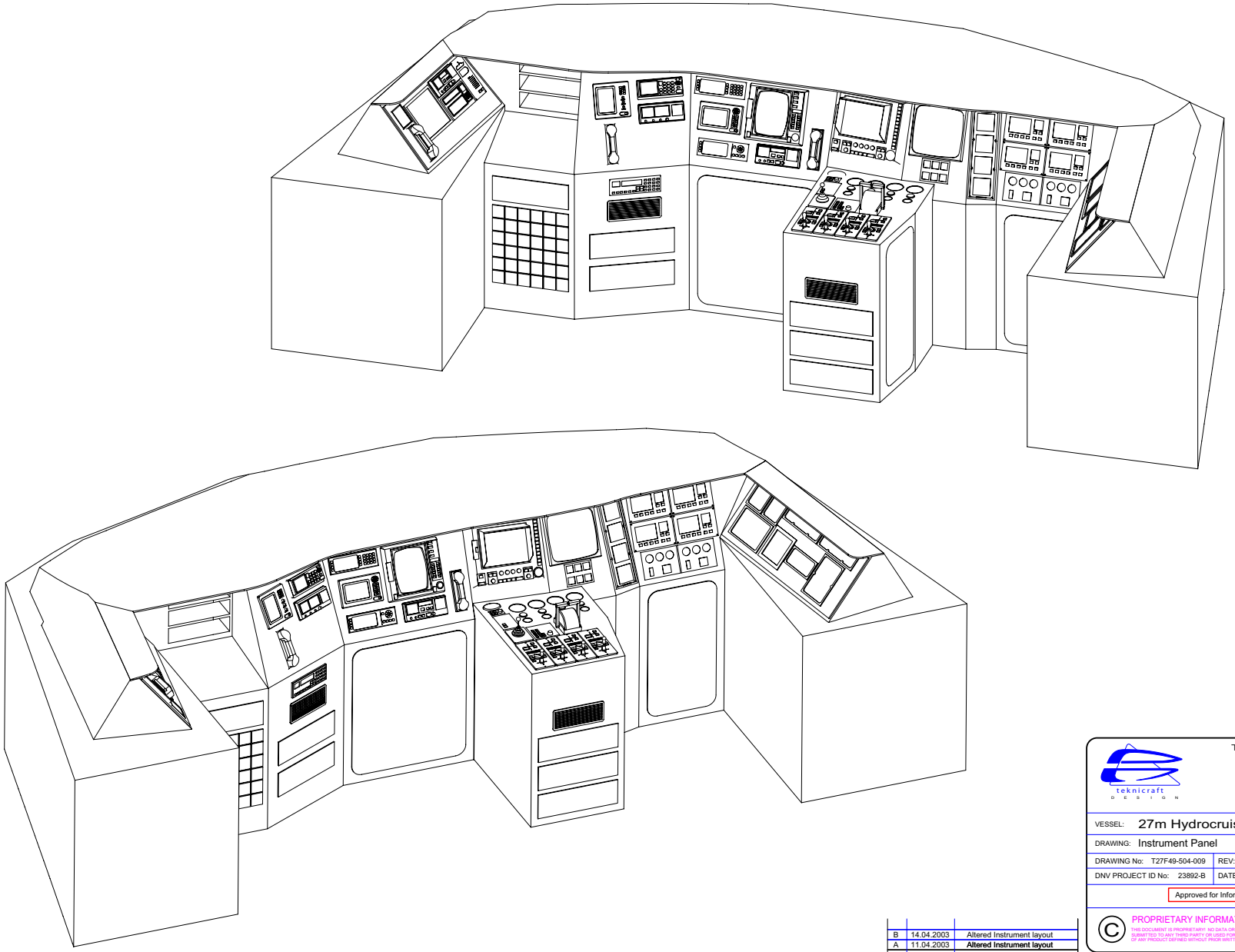
1.9 THE BRIDGE DESIGN AND LAYOUT

Although the bridge layout of the prototype vessel was unique, it was similar to those of some other HSC passenger vessels **(Figures 5, 6 and 7)**. The layout was designed and determined by a master from the vessel's future operator, who based the design on an HSC passenger vessel with which he was familiar. This design layout was given to the vessel's designer, a naval architect, who incorporated it into the shipbuilding specification and drawings. The bridge was then constructed using this information.

The operating compartment was designed for two people to safely navigate and control the vessel. It was designed for the master to operate from the pilot's position and the engineer from the engineer's position. The designer believed two people were the minimum required, and that the engineer would be able to assist the master and keep a lookout as necessary. A seat for another navigator/lookout/co-pilot was also included to port of the pilot's position, but no navigational instrumentation was sited in front of this position and the co-pilot had only an oblique view of the pilot's instruments.

Although outline structural plans of the bridge were submitted to the MCA, detailed bridge control layout plans were not made available before the accident, and therefore no formal approval of the bridge layout, by a flag state nautical professional, was possible.

The builder fitted decorative mouldings around the large scantling stiffeners between the bridge front windows, to conceal wiring and pipework, which restricted the visibility from the pilot's control position.



Rev	Date	Modification
B	14.04.2003	Altered Instrument layout
A	11.04.2003	Altered Instrument layout

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VESSEL: 27m Hydrocruiser

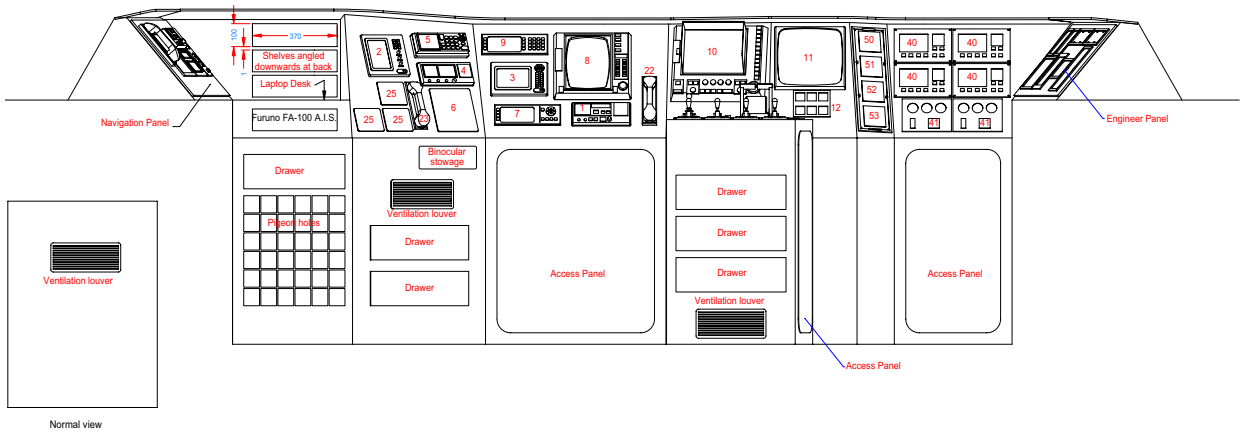
DRAWING: Instrument Panel

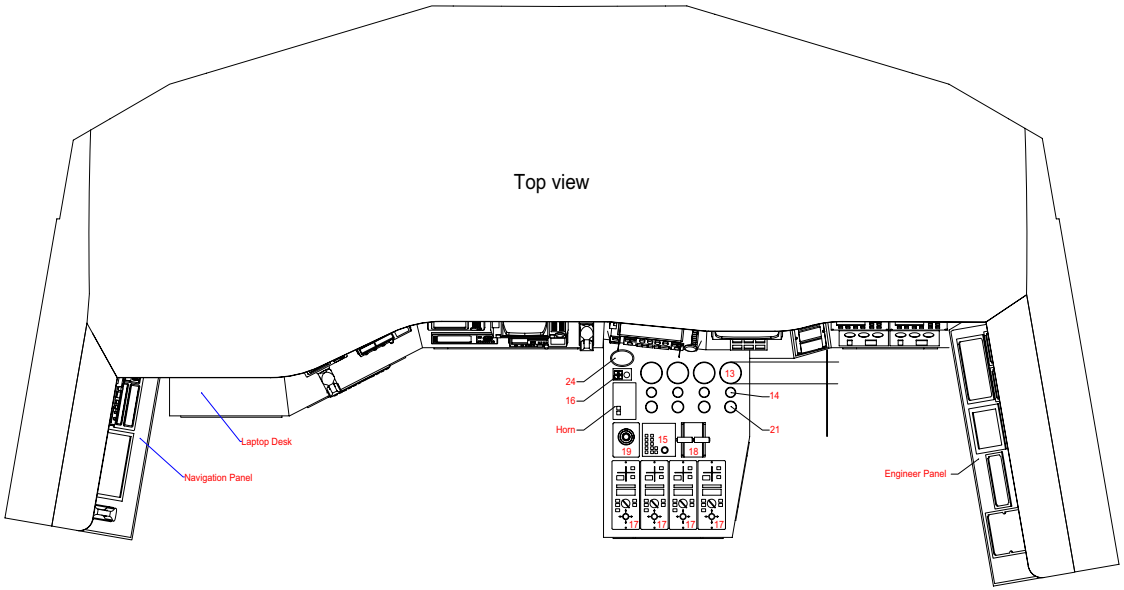
DRAWING No: T27F49-504-009	REV: B	SCALE: NTS
DNV PROJECT ID No: 23892-B	DATE: April 2003	PLOT: A1:10

Approved for Information

Figure 5

Bridge layout - general





Rev	Date	Modification
C	09.06.2003	Updates to GS email
B	14.04.2003	Altered Instrument layout
A	11.04.2003	Altered Instrument layout

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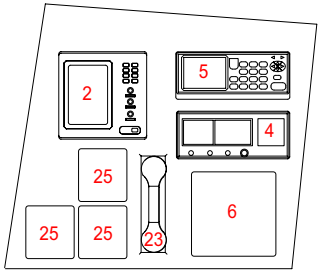
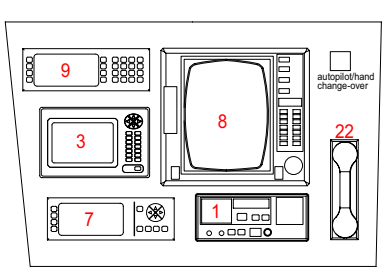
VESSEL: 27m Hydrocruiser		
DRAWING: Instrument Panel		
DRAWING No: T27F49-504-008	REV: C	SCALE: NTS
DNV PROJECT ID No: 23892-B	DATE: April 2003	PLOT: A1:10

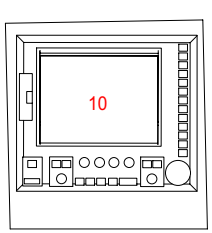
Approved for Information

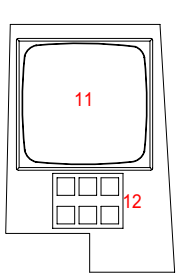
Figure 6

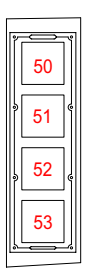
Bridge layout - front and top views

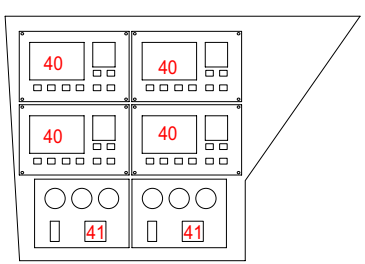


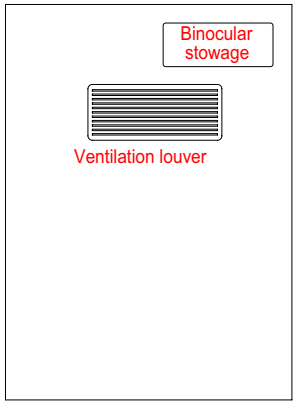


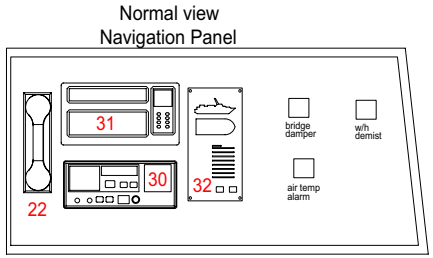


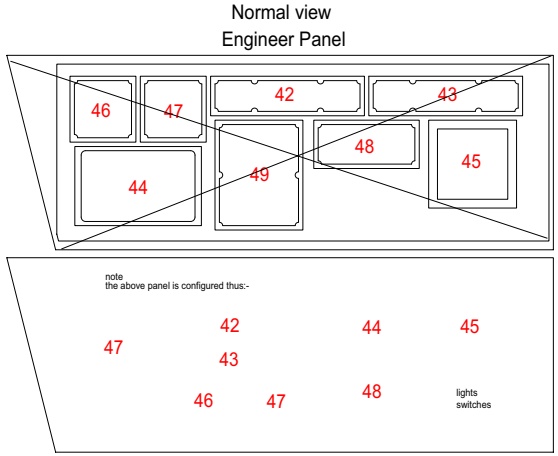












Navigation panel equipment list

1 VHF/DSC FM 8500
2 Echo sounder FE - 700
3 Gps GP - 80
4 MF/HF DSC FS - 1562
5 MF/HF DSC-60
6 Gyro controller SR-180 MK 1
7 Autopilot LMP HSC
8 Radar FR-7051
9 Speed log EM200
10 Radar FR-1510
11 CCTV monitor 1
12 CCTV Switch Panel
13 Engine RPM X 4 (SLAVE)
14 Engine EM stop X 4 (SLAVE)
15 Intercom Talkback system
16 General alarm/PA switch panel
17 W/Jet backup X 4
18 W/Jet controls X 1
19 Steering Joystick
20 GMDSS lamp
21 Rudder angle Indicators X 4
22 Handset for the VHFs X 2
23 Handset for the MF/HF
24 Mic for PA system
25 Airconditioning control

3RD seat Navigation instrument panel

30 VHF/ DSC FM 8500
31 Navtex
32 Navigation lights control panel
35 Laptop PC

Engineer instrument panels

40 Main engine control panels X 4 DCU 305
41 Gennie control panels X 2
42 Port emergency shut down panel
43 Stbd emergency shut down panel
44 Fire detection control panel
45 FM200 Release control panel
46 E/R vent control panel
47 Pumps control panel
48 Tank Gauge panel
49 Bilge pump control panel
50 Bilge alarms panel 1
51 Auxilary systems alarms panel 2
52 Tanks level alarms panel 3
53 ICLL integrity alarms panel 4

Note:
All views are normal view onto the panel

Rev	Date	Modification
C	11.06.2003	Remove #34 and re-arrange
B	09.06.2003	Updates to GS email
A	14.04.2003	Altered Instrument layout

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VESSEL:	27m Hydrocruiser		
DRAWING:	Instrument Panel		
DRAWING No: T27F49-504-010	C		SCALE: 1:5
DNV PROJECT ID No: 23892-B	DATE: April 2003		PLOT: A1 1:5

Approved for Information

Bridge layout - equipment details

Figure 7

In addition to the problems and faults found with the bridge design and instrumentation before and during the trials, as detailed in the Narrative section of this report:

- No ECDIS or ENS system was fitted to the vessel. The navigators only had a GPS and paper charts with which to plot the vessel's position; and,
- The vessel was not fitted with a Voyage Data Recorder (VDR) at the time of the trials. Data from a VDR would have been of great benefit to the MAIB investigation.

1.10 THE DESIGNED TRADING AREA

The initial design for the prototype vessel, including that of the operating compartment, was based on the need to operate on short domestic routes in the Mediterranean Sea, including between Nice and St Tropez. However, the designers and shipbuilders were requested by the future charterer to seek approval from the MCA for the vessels' use in other areas of operation, with the following restrictions:

- The vessels were expected to be operating in areas where other maritime traffic is common, not in remote locations.
- Operation would generally be on coastal passages, estuaries of rivers, or short runs between offshore islands where the vessels were not expected to be more than 1 hour/20 nautical miles from a port of refuge.

At the time of the accident, the MCA was aware of this request but felt that such matters should be considered when an application for a Permit to Operate was made.

1.11 HSC PERMIT TO OPERATE

The flag state issues a Permit to Operate High Speed Craft after it has checked both the suitability of the craft for the service intended and the information contained in the route operations manual. The permit is issued subject to restrictions which may include:

- Provisions relating to position fixing;
- Requirements covering operations by night or in restricted visibility, including the use of radar and/or other electronic aids to navigation; and
- Additional equipment required because of the specific characteristics of the area of operation, for example night operation.

It should also be noted that the MCA HSC Code 2000, Instructions for the Guidance of Surveyors, requires a statement from the relevant harbour authorities and/or borough council, to confirm that the local authorities have agreed with arrangements made by the operators concerning, for example, noise pollution, air pollution, and respect for other beach and water users.

The trials exemption certificate issued by the MCA before the start of the trials exempted the vessel from the need to have a permit to operate.

1.12 ROUTE OPERATION MANUAL

An HSC route operations manual includes information concerning operating limitations, specific route conditions and requirements relating to position fixing, operations by night and operations in restricted visibility for vessels in commercial operation. However, there is no requirement for vessels on trials to have such a manual.

1.13 THE VESSEL'S DESIGNER

The vessel's designer has considerable experience in high speed craft design and, to date, has completed around 65 vessels, ranging in various sizes and types including patrol craft, fire-fighting, research and eco-tourism boats as well as passenger vessels. The particular design of the vessels varied depending on the specific requirements of the client, the area of operation and the application.

1.14 TURNING RADIUS OF VESSEL

The designer's recommended safe turning radius for *Katia* when carrying passengers, and when travelling at maximum lightweight speed of 40 knots, was 250 metres.

The minimum emergency turning radius achievable, without endangering the vessel or her equipment, while travelling at a maximum lightweight speed of 40 knots, was 110 metres. However, unless it was an emergency, this would only be attempted after having warned those on board that such a manoeuvre was about to take place, to enable them to steady themselves. None of this information was known to the crew prior to the accident, as turning circle tests had been scheduled to be completed at a later date. In fact, the chief officer had been told the anticipated maximum speed of the vessel was around 30 knots.

1.15 THE DAMAGE TO *KATIA*

Shortly after the grounding, *Katia'*s chief engineer led a damage assessment party, and confirmed that no ingress of water was apparent.

The chief engineer then confirmed that the engines appeared to be operational.

Subsequently, the vessel was inspected out of the water. Both hulls were found to have suffered minor damage **(Figures 8 and 9)**, and the water jet impellers were damaged by shingle and sand to the extent that two required replacing.

Figures 8 and 9 - Hull damage

SECTION 2 - ANALYSIS

2.1 AIM

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

2.2 PASSAGE PLANNING

Passage planning for *Katia*'s sea trials was rudimentary. Navigation was to be accomplished mainly by eye. Additionally, the main channel buoy positions were entered into the GPS, and this was used as a "rolling road" to indicate the vessel's approximate position on the circuit and her approximate required course to steer. Little or no consideration appears to have been given to how turns would be conducted, especially after nightfall, when much of the visual landscape became obscured.

Planning of the passage, general navigation and manoeuvres would have been greatly assisted had an electronic chart system been fitted to the vessel. There is insufficient time to use traditional chart work techniques for navigation on craft travelling at high speeds.

Far more attention should have been given to passage planning. The planning should have included detailed advice on how to ensure the vessel stayed in safe water when making the turn off Hurst Spit. This could have been accomplished by detailing the method by which the vessel's track towards the alteration point could be established and held, and by then counting down to a wheel-over position after passing Sconce Buoy abeam to port.

The route the master adopted for the engine trials periodically took the vessel past Cowes at full speed. This conflicts with advice given in the Admiralty Sailing Directions which is designed to protect other craft and people from the effects of wash. Thorough passage planning would have identified this conflict and, perhaps, prompted a reconsideration of the planned circuit.

Reference:

Admiralty Sailing Directions

Chapter 7, section 7.25:

As considerable damage is caused to boats and embankments at Cowes, as well as danger to life, by vessels proceeding at high speed past the entrance to the harbour, mariners should proceed at a moderate speed when passing through the area …

In 2002, the MAIB investigated an incident when an HSC passed Cowes at high speed (Report 14/2003). The vessel's wash caused injuries to five members of the public and substantial damage to property. As a result, strong recommendations were made to HSC operators, harbour authorities and the MCA to avoid a recurrence.

The MAIB believes that, in this case, it would have been appropriate to have sent a passage plan to ABP Southampton in advance of the trials, to enable VTS to be kept fully informed. In this respect the following guidelines from ABP should have been noted:

Port Users Information And Navigation Guidelines

Section 6 – "The Harbour Authority and Harbour Masters' powers to regulate the time and manner of ships' entry to, departure from and movement within their waters serve to complement port passage planning. Passage plans are therefore to be operated and enforced as an adjunct to the powers of direction. The object of passage planning guidance as required by by the Port Marine Safety Code is to ensure that:

a) *All parties know relevant details of any particular port passage in advance.*

b) *There is a clear, shared understanding of potential hazards, margins of safety, and the ship's characteristics.*

c) *Intentions and required actions are agreed for the conduct of the port passage … and any significant deviation should it become necessary.*

2.3 BRIDGE TEAM MANAGEMENT

The chief officer was conning *Katia* from the pilot's position at the time of the accident, and the vessel was approaching the western limit of the pre-arranged circuit **(Figure 3)**. *Katia* was being kept on track by slewing the vessel between the red and white sectors of Hurst Point Light as shown in **Figure 4**. Using this method, the chief officer knew he was maintaining the required track towards the point of land. He was aware the vessel had passed Sconce Buoy on his port side, and was intending to allow a safe period before altering course to port so there would be no danger of colliding with the buoy during the turn. The chief officer was then distracted by a conversation with the charterer's representative. This caused him to miss the correct position for the start of the turn and ultimately led to the vessel grounding.

The charterer's representative had been allowed to visit the bridge while the vessel was underway at night. Basic ground rules had been established by the master at a departure briefing as to the conduct of persons visiting the bridge, however, these were not being enforced by the master leading up to the accident.

The chief officer and master considered navigation on *Katia* to be mainly visual. However, at night, where the turn was to be made, there were no visual lateral marks to assist the navigator. Notwithstanding the fact that the chief officer had been distracted, an important contributing factor to the accident was that he had little visual indication of his advance towards Hurst Spit once he had passed Sconce Buoy. He could have used the radar, but this would have meant him

turning his concentration away from the navigational light which he was using to maintain his track and, in any case, the fixed range rings on the radar were scaled in kilometres, rendering them of little use. The method of monitoring this particular turn had received no consideration.

The master did not appear to appreciate the importance of modern bridge team work practices. The co-pilot, who ever it was at the time, would generally not be idle during his off-duty period, but, no routine, and division of responsibilities, for the interaction of the two navigators had been agreed.

At the time of the accident, the chief officer was navigating by eye with little help from instrumentation, while trying to steer and maintain a steady track without the help of an eye-line compass or rate-of-turn indicator. He had no chart visible and had responsibility as lookout, helmsman and officer with the con.

The master, who was seated at the co-pilot position, was aware *Katia* had passed Sconce Buoy, and had written the time of passing into his rough log. However, in the time it took him to write the entry, assisted by a small flashlight, the vessel had closed dangerously on Hurst Spit. Due to the lack of navigation equipment and instrumentation at the co-pilot's position, the master had no ready means of checking the vessel's position, except by looking out of the bridge windows. The master was not efficiently monitoring the chief officer's actions at this important time. He knew that the vessel had to turn shortly after passing Sconce Buoy, but was not checking that she did so in good time.

The chief officer and the master were aware that there was limited time to alter course after passing Sconce Buoy before grounding on the spit. However, it would appear that no attempt was made to establish how long this might be. Had they done so, they would have discovered that the calculated time taken from passing Sconce Buoy, to grounding on the spit, at 38 knots is 1 minute 22 seconds.

There was little communication between the master and the chief officer at this crucial time, despite the master being present at the co-pilot's position. A high level of proactive bridge team management and co-operation is essential when operating HSCs because one person cannot safely perform all of the necessary duties including steering, navigating, keeping a proper lookout and keeping a safe radar watch.

Ideally, the pilot of a high speed craft should be able to concentrate on steering and lookout while his co-pilot should monitor the radar, electronic chart and other instruments. At high speeds there is little time to plot positions on paper charts. An electronic chart is, therefore, considered an essential item of equipment on any HSC.

The engineer was sitting in the starboard control position throughout but, despite having better access to radar and other instrumentation, he had no navigational role to play in this bridge team.

The trials master was an experienced HSC type rating examiner who, on paper, showed the qualities necessary for an adequate trials master of a prototype vessel. Yet, in practice, he demonstrated a lack of bridge team management skills. This was possibly because he did not have current commercial experience operating these craft. The trials master, and the chief officer, were both consultants/surveyors, and had worked ashore for many years revalidating their certificates of competency on the basis of the work they carried out ashore. A better choice for a trials master and chief officer might have been people with current HSC operating experience, thus individuals used to operating in a modern bridge management environment. Good indicators for shipbuilders choosing a trials team in the future, would be a current type rating certificate for a similar craft and, perhaps, a current Pilotage Exemption Certificate (PEC) to demonstrate local knowledge.

2.4 THE DECISION TO CONTINUE THE TRIALS AFTER SUNSET

Safe navigation on *Katia* was hampered by:

- The poor visibility from the control position caused by the restriction posed by the large supports between the windows and the lack of some demisters.
- The lack of important navigational instrumentation such as an electronic chart and rate-of-turn indicator.
- Poor positioning of the navigational instrumentation. For example, there was no compass at, or near, the eye-line when viewed from the pilot's position.
- The lack of any navigational instrumentation at the co-pilot's position.
- The lack of blackout curtains between the passenger compartment and the operating compartment.
- Faults which either occurred, or were noticed, after setting out on trials, including the lack of an accurate log and echo sounder and the scale of the range rings on the radar.

The master's decision to carry on after nightfall might have been partly influenced by the poor weather forecast for the following day. Bearing in mind the above shortfalls in the design and equipping of the operating compartment, the MAIB believes that this was a flawed decision. The poor visibility and light pollution problems, in particular, indicated that night time operation at maximum speed was going to be hazardous. At the very least, extra precautions, including passage planning for night time operations, a dedicated lookout and a specific navigational role for the co-pilot, were called for.

2.5 THE MANNING AND DESIGN OF THE OPERATING COMPARTMENT

There is no requirement for the flag state to consider and approve the design and equipment layout of an operating compartment of an HSC during the building stage. In any case, there is no definitive standard for the flag state to use to approve the instrumentation and control console plans. Much is left to the surveyor who subsequently issues the Permit to Operate to ensure the

bridge is properly designed, manned and equipped for the planned operation. If major changes are deemed necessary at a late stage, this can have serious consequences for the viability of the operation.

The operating compartment on *Katia* was non-compliant with the HSC Code in at least two respects:

1. The restrictions to visibility posed by the window frame stiffeners **(Figure 10)**.

   Reference:

   2000 High Speed Craft Code

   Chapter 15, paragraph 15.3.2:

   Blind sectors shall be as few and as small as possible, and not adversely affect the keeping of a safe look-out from the operating station. If stiffeners between windows are to be covered, this shall not cause further obstruction inside the wheelhouse.

   Chapter 15, paragraph 15.3.3:

   The total arc of blind sectors from right ahead to 22.5º abaft the beam on either side shall not exceed 20º. Each individual blind sector shall not exceed 5º. The clear sector between two blind sectors shall not be less than 10º.

Figure 10

Operating compartment window frames

2. The fact that no rate-of-turn indicator was fitted.

   Reference:

   2000 High Speed Craft Code

   Chapter 13.7.1

   A rate-of-turn indicator shall be provided in craft of less than 500 gross tonnage if the test according to annex 9 shows that the turn rate can exceed safety level 1.

   Level 1 is defined as having *a minor effect* – the effect, described by the designers of the vessel's minimum emergency turning radius (see Section 1.14) is more than *a minor effect*. Therefore, a rate-of-turn indicator should have been fitted to *Katia.*

It was questionable whether the design was also compliant in other respects, including, among other things:

i. The lack of eye-line compass information;

ii. The general positioning of navigation and control instrumentation;

   Reference:

   2000 High Speed Craft Code

   Chapter 15, paragraph 15.5.3:

   Instruments required for use by any member of the operating crew shall be plainly visible and easily read:

   .1 with minimum practicable deviation from his normal seating position and line of vision; and

   .2 with the minimum risk of confusion under all likely operating conditions.

and,

iii. The light colour of the consoles and deckhead.

   Reference:

   Chapter 15, paragraph 15.5.6:

   The surfaces of the console tops and instruments shall have dark glare free colours.

   Chapter 15, paragraph 15.6.2:

   Care shall be taken to avoid glare and stray image refection in the operating area environment. High contrast in brightness between work area and surroundings shall be avoided. Non-reflective or matt surfaces shall be used to reduce indirect glare to a minimum.

The MAIB believes that flag states should be more proactive at an early stage in the design of HSC to ensure that operating compartments are compliant with the HSC Code, and are suitable for the intended area and mode of operation.

The operating compartment on *Katia* was designed for a master and chief engineer only, with a third seat for an occasional co-pilot but with no instrumentation to help him in his role. The MCA did not become aware of this design feature until late in the design/build stage. The MCA had made it clear to the operator that it would not accept a two man bridge operation. However, if it had been aware of the problem at an earlier stage in the design process, an acceptable solution could have been agreed by all parties. The operator had made it clear that they wished the MCA to deal with the builder, however, it is apparent that the builder had no design authority to make changes. The MAIB believes that for any voyages longer than line-of-sight, an HSC should be navigated by a type rated pilot and co-pilot, each of whom should have ready access to well-equipped navigation and control consoles. This is especially true if night operation is envisaged.

The MAIB investigated an accident which occurred in April 1995 and involved the grounding of the passenger catamaran *Saint-Malo*, off the coast of Jersey. As a result of that investigation, recommendations were directed at the IMO to try and ensure that:

- A separate console is provided in all HSC for a person whose primary role would be to navigate the vessel.
- Navigational instruments on HSC are specifically designed to cope with the unique requirements of the craft.
- A display, giving an instantaneous indication of the vessel's position with respect to the planned passage and relevant fixed dangers (i.e. an ECDIS or ENC), is fitted.

In 2001, a Norwegian Commission report issued its findings on the grounding and subsequent sinking of the high speed ferry *Sleipner*, in which 16 lives were lost. Navigational error was found to be the initial cause of the disaster, because the navigators had lost positional awareness at the time of the grounding. One of the principal recommendations issued as a result of the investigation, was that ECDIS should be introduced on high speed craft as soon as the charts permit it, and, as a stop gap, the Commission recommended that HSC obtain good electronic navigational charts (ENC).

A further finding indicated the need for good bridge procedures, especially between navigators.

The MAIB believes that there is now cause to strengthen and reinforce these findings. In particular there appears to be a need for:

- A standardised layout of instruments on HSC, which will not only enable operators to move more easily between vessels, but would also form the basis for flag states and classification societies to more easily judge and approve bridge console design.
- A requirement for the fitting of an electronic chart system on all HSC
- A requirement for two type rated officers to man and operate all HSC, except those on short, line-of-sight voyages.
- A requirement for each of the officers to be equipped with suitable instrumentation to enable them to perform their allotted role in the bridge team.

The MAIB believes that the MCA should take forward the above findings in the IMO Design and Equipment Sub-Committee's intercessional correspondence group, which is presently considering another revision of the HSC Code.

2.6 THE TRIALS PROGRAMME

Katia's trials programme involved the maximum speed endurance test on the first of 3 days. Manoeuvring trials were scheduled for much later in the programme.

A trials programme should incrementally increase the demands made on a vessel. Had manoeuvring trials been carried out early in the programme, the trials crew would have had the opportunity to learn the handling characteristics of the vessel before she underwent the more testing full speed trials. Scheduling the less onerous trials early on would also have the advantage of highlighting many of the minor failures in bridge instrumentation and, possibly, enable many of them to be rectified before undergoing full sea speed trials.

2.7 THE TRIALS EXEMPTION CERTIFICATE

A vessel on trials does not require a Permit to Operate or a Route Operations manual, however, the trials exemption certificate issued by the MCA allows the MCA to specify requirements or conditions. Taking this into consideration, the MAIB feels that the suitability of the manning, design and equipping of the operating compartment should be taken into account by the MCA, and the exemption certificate should be endorsed accordingly.

SECTION 3 - CONCLUSIONS

3.1 SAFETY ISSUES

The following safety issues have been identified from the foregoing analysis. They are not listed in any order of priority.

- The passage planning for the trials was rudimentary and lacked detailed information on how the turn should be conducted off Hurst Spit. (2.2)
- The master did not appear to appreciate the importance of modern Bridge Team Management practices. (2.3)
- Nobody was closely monitoring the actions of the person with the con. (2.3)
- The chief officer was distracted by the charterer's representative, who had been allowed to visit the bridge at night while the vessel was underway, and ground rules on the conduct of visitors to the bridge were not enforced by the master. (2.3)
- An electronic chart system linked to a GPS would have given the navigators an instant visual reference of where the vessel was in relation to navigational dangers. There is currently no requirement for an electronic chart on an HSC like *Katia.* (2.3, 2.5)
- The engineer had access to navigational instrumentation but no role to assist in the navigation. (2.3)
- The trials master and chief officer lacked current operational experience. (2.3)
- The trials should have been aborted before nightfall due to the many faults which had come to light during the day. (2.4)
- Visibility from the operating compartment was not in accordance with minimum standards laid down in the HSC Code. (2.5)
- The operating compartment was non-compliant with the HSC Code but there is no requirement for these plans to be approved by the flag state during the building stage. (2.5)
- There is no standard against which the flag state or classification society can judge the suitability of the instrumentation and control console plans. (2.5)
- A rate-of-turn indicator should have been fitted to *Katia.* (2.5)

- The operating compartment was designed for only a master and a chief engineer, with a third seat for the occasional use of a co-pilot. In the opinion of the MAIB, this level of manning should only be permissible on short line-of-sight voyages. (2.5)

- There was no navigational instrumentation at the co-pilot's control position. (2.3,2.5)

- It would have been better to schedule the maximum speed endurance test for later in the trials and after the steering and manoeuvring trials had been conducted. (2.6)

- The exemption certificate could have addressed the operating compartment design faults, and specified some requirements or conditions to be complied with prior to the sea trials. (2.7)

- The Admiralty Sailing Directions advise all mariners to pass Cowes at a moderate speed. *Katia* passed at full speed on a number of occasions. Better passage planning would have identified the conflict between the planned route and this advice. (2.2)

SECTION 4 - ACTION TAKEN

The MAIB issued a Chief Inspector's letter to the shipbuilders (copied to ABP Southampton and the MCA), recommending them to conduct no further sea trials without first completing a thorough risk assessment including, but not limited to:

- Visibility from the "control" position.
- Lack of instrumentation available at the co-pilot's position.
- Positioning of the gyro repeater, rate of turn indicator, engine speed indicator.
- Lack of navigation systems.
- The ergonomics of the bridge.
- Requirements for a dedicated lookout.
- Control of visitors to the bridge.
- Bridge resource management.
- Conduct of the trial:
    - Area for the trial
    - Speed requirements
    - Navigation plan, including high speed RAPP
    - Requirements for trials after dark.

They were additionally advised that, in conducting a risk assessment, they should consult closely with the MCA and ABP Southampton.

Vosper Thornycroft took the above recommendations into consideration during subsequent trials after *Katia* was repaired. The crew used during these trials also had current commercial experience on similar vessels in the Solent.

SECTION 5 - RECOMMENDATIONS

The Maritime and Coastguard Agency is recommended to take forward the following issues at the appropriate committees and subcommittees of the IMO:

2004/176 The introduction of a requirement for all high-speed craft to be fitted with navigational instruments designed to cope with the unique requirements of high-speed craft. In particular, a display such as ECDIS or ENC, which gives an instantaneous indication of charted position, to be fitted on all vessels except those solely engaged on line-of-sight voyages.

2004/177 The introduction of a requirement that a minimum of two type rated people shall be required to navigate an HSC except where the vessel's voyage is a short line-of-sight passage. Each of the navigators should have navigation/control stations within the operating compartment.

2004/178 The introduction of a requirement for a global standard layout of navigational instrumentation for the operating compartment of all high speed craft.

2004/179 The introduction of measures to ensure that the administration has early involvement in the design approval of all HSC operating compartments.

The Maritime and Coastguard Agency is additionally recommended to:

2004/180 Consider the limitations of bridge design when specifying the scope and validity of HSCs' trials exemption certificates.

All UK-based HSC builders are recommended to:

2004/181 Appoint trials masters and officers who possess relevant current commercial operating experience on the same or similar vessels and, preferably, with knowledge of the local area. To this end, a valid type rating certificate (TRC), and a valid PEC for the area, would be good indicators of current competence, whether or not a PEC is normally required.

2004/182 Ensure that on HSCs, the manoeuvrability tests are completed early in the trials programme so that the master and officers are fully aware of the vessel's handling characteristics before she undergoes high speed tests such as full power endurance trials.

Marine Accident Investigation Branch
July 2004