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21 July 2002

BOARD OF INQUIRY REPORT INTO THE GROUNDING OF HMS NOTTINGHAM AT WOLF ROCK, LORD HOWE ISLAND, AUSTRALIA ON 7 JULY 2002

Sir,

We have the honour to submit at the Enclosure the Board of Inquiry report into the grounding of HMS NOTTINGHAM at Wolf Rock, Lord Howe Island, Australia on 7 July 2002.

We, have the honour to be,
Sir,
Your obedient Servants

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Lieutenant Commander Royal Navy

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Commander Royal Navy

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Commodore Royal Navy

Enclosure:

1. Report of Board of Inquiry

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**ENCLOSURE 1 TO COMDEVFLOT's
FLEET/259/2/1 DATED 21 JUL 02**

**BOARD OF INQUIRY INTO THE GROUNDING OF HMS NOTTINGHAM OFF LORD
HOWE ISLAND 7 JULY 2002**

References:

- A. QRRN Ch57
- B. CINCFLEET PORTSMOUTH ABA/Z5A 090700Z JUL 02

INTRODUCTION

1. A Board of Inquiry was convened aboard HMNZS ENDEAVOUR between 13-16 July, to investigate the grounding of HMS NOTTINGHAM off Lord Howe Island. The inquiry was conducted in accordance with Reference A and with the full co-operation of the Commanding Officer and the Ship's Company of HMS NOTTINGHAM. The aim of the Board of Inquiry was to establish the causes and circumstances surrounding the grounding of HMS NOTTINGHAM on 7 July 2002, and to report on the matters pertaining to the subsequent action.
2. Timings in the report refer to ship's time. A time zone change was conducted at 071730K to 071830L July 2002.
3. An Executive Summary of the full report is included at Annex A. Enclosure 3 to the main report is particularly useful in showing graphically the ship's track.

BACKGROUND

4. The Ship's Programme. The Ship had emerged from an extensive refit in September 2000 and spent the next 6 months conducting sea trials and Safety Readiness Checks, prior to conducting Basic Operational Sea Training (BOST) in April-May 2001. Whilst it has not been confirmed by the Board of Inquiry, it is possible that no external navigation Continuation Training would have been provided for the ship between May 01 and Dec 02. It is acknowledged that the ship had requested support from CMST in September 2002 but, it is understood, that this was rejected. After completing Joint Maritime Course (JMC) in June that year, the ship deployed to Oman to take part in Exercise Argonaut 01/Saif Sarrea in August, returning to Portsmouth just before Christmas. After a maintenance period in the new year, HMS NOTTINGHAM conducted a High Seas Firing and then sailed for the Far East Deployment in March 2002.
5. Far East Deployment. HMS NOTTINGHAM had sailed from Portsmouth on 18 March to undertake a 9 month deployment to the Far East including involvement in the Five Powers Defence Arrangement Exercise, and was due to undertake high profile visits to Tokyo and Shanghai. The ship sailed from Cairns, Australia, on 4 July and was due to arrive in Wellington, New Zealand on 9 July.

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6. Passage from Cairns to Wellington. The passage to Wellington had been planned by Sub Lieutenantxxxxxxxa Specialist Fleet Time (Warfare) Officer, and approved by the Commanding Officer 2 weeks previously. The intention was to transit the Great Barrier Reef, then anchor in the vicinity of Lord Howe Island on 7 July, in order to land members of the Ship's Company for recreation, and on an opportunity basis, meet members of the local community. At an unspecified time on the morning of 7 July, the Commanding Officer was informed that there was a requirement to land a casualty that day for onward move back to the UK. The ETA at Lord Howe Island was 1600K
7. Lord Howe Island. Lord Howe Island lies 420 nautical miles (nm) to the north east of Sydney, and is the southern most of the outlying islands off the east coast of Australia. This is shown at Enclosure 1. The island is 6 nm long and 2nm at the widest point. There are a number of off lying features including Wolf Rock, a 350 yard by 200 yard partly submerged rock lying 8 cables to the east of the island. The summit of this feature is dome shaped and is reported to be 10 metres in diameter, and has a height of 1.2nm above Mean High Water Springs (MHWS). MHWS for Lord Howe Island is 1.8 metres. The chart Aus 610 is a UK Hydrographic Office copy of an Australian chart, and is divided into 4 sections. The first section is a 1:150000 scale chart of the island and surrounding area, the second section is a 1:25000 scale chart showing the island in greater detail, and the third and fourth sections are 1:12500 scale showing the lagoon on the western side of the island. The third and fourth sections of the chart do not feature in this inquiry. Although exact survey details and methods of survey are not known, the chart has a diagram showing the positional accuracy and depth variation of the survey which gives an indication of its accuracy. The area around Wolf Rock has a positional accuracy of +/- 500 metres, and a depth accuracy of 2 metres. In addition there is a note to say that depth anomalies may be expected. Positions on the chart are referred to Datum WGS 84 and Global Positioning System fixes may be plotted directly onto this chart.
8. Material State. Propulsion plant reliability had been satisfactory throughout the deployment. Whilst M2 diesel generator was out of action and subject to Operational Defect (OPDEF) and the port Tyne engine had suffered from 'hot starts'; there were no propulsion or steering defects which affected ship handling or propulsion power leading up to or during the incident. Electronic Navigation Aids were serviceable, although the Radar 1007 aerial was suffering from water ingress to the rotating joint, and was due to be repaired in Wellington on 11 July. During Standard Operator Checks (SOCs) on 24 June it was reported that the Echo Sounder 778 Bridge Unit (BU) had an intermittent fault when reading below 20 metres. No fault was found during the subsequent investigation carried out by the maintainer that day. It is concluded that whilst none of these defects contributed directly to the grounding, caution would have been appropriate when using the Echo Sounder 778 BU in depths of less than 20 metres. The Echo Sounder 778 was serviceable.
9. Change of Personnel. A number of key Bridge personnel had changed since OST the previous year, namely the Executive Officer, Navigating Officer and Officers of the Watch 1,2 and 3. Nevertheless, the ship had made the most of many opportunities to maintain its operational capability, and to integrate new personnel into the team. Specifically, a rigorous bridge training programme had been instituted although, as will be discussed later, the standard and supervision of the conduct of navigation was poor.

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10. Key Personalities. Key personalities mentioned in the narrative together with the dates of their joining the ship and, where pertinent to the discussion in this report, a brief resume of their experience are:

Commanding Officer	Cdr xxxxxxxxxxxxxx RN	Joined Sep 00
Executive Officer	Lt Cdrxxxxx RN	Joined Feb 02
-	Awarded Bridge Watchkeeping Certificate in HMS EXETER 94-95.	
-	NBCDO HMS FEARLESS 2000 to 2001	
Navigating Officer	Lt xxxxxxxxxxxx RN	Joined May 02
-	Previous apointment as Navigating Officer of HMS CHIDDINGFOLD	
Principal Warfare Officer	1/0 xxxxxxxx RFA	Joined Jul 02
Officer Of the Watch	Lt xxxxxxxxxxxx RN	Joined Dec 01
-	Awarded Bridge Watchkeeping Certificate in previous appointment in OPV.	
Second Officer Of the Watch	S/Lt xxxxxxxx RN	Joined Jan 02
Marine Engineer Officer	Lt Cdr xxxxxxxxxxxx RN	Joined Mar 00

RECORDS

11. The records pertaining to the incident were in sufficiently good condition to allow an accurate re-construction of the incident to be made. In particular, the Wordsafe recorder, which records voice on the bridge and various internal and external circuits, proved to be particularly valuable, and provided much of the information gleaned by the Board.

NARRATIVE

12. In order to give a full account of the events surrounding the grounding and subsequent recovery of HMS NOTTINGHAM, the narrative is divided into 3 parts. The first and most pertinent part to this Inquiry, deals with the circumstances leading up to the ship grounding at 2202:38L. In the second part, the aspects of Damage Control and Command decision making are described. Finally, the third part deals with the external assistance requested and received in the following 24 hours.

PART ONE- EVENTS BEFORE THE GROUNDING

LORD HOWE ISLAND ANCHORAGE

13. Planning. The Navigating Officer planned an anchorage in the vicinity of Ned's Beach on the north east side of Lord Howe Island, with a secondary anchorage off Middle Beach, as shown at Enclosure 3. Although there was sufficient time to plan the anchorage, there were serious omissions in the final plan. Specifically, there were no clearing bearings drawn on the chart in order to make an

assessment of safe water, insufficient blind safety information, and no indication of tidal stream. Wolf Rock, situated 3nm south of the intended anchorage, had not been identified as a danger, despite the intention to pass this feature at 1.5nm later in the day. The rock had not been 'hatched off' by the Navigating Officer, nor had he constructed any method of keeping the ship safe from this danger. The requirements for preparing charts are contained in the Admiralty Manual of Navigation Volume 1.

14. Briefing. During the anchorage brief, the Commanding Officer approved the Navigator's plan and then discussed with the Navigator manning requirements and precautions to be taken. Despite the fact that the ship intended to anchor within 3 cables of land, and that there were off lying dangers with a positional accuracy of +/- 500 m, it was decided not to close up Special Sea Dutymen, but to anchor 'on the watch' instead. The Damage Control state was however increased to 3Y, and the Blind Pilotage Safety Officer (BPSO) was closed up 20 minutes before the Estimated Time of Arrival.

15. HMS NOTTINGHAM made landfall at 1400K and despite the poor chart preparations and inadequate precautions, anchored safely at 1534K.

EVENTS WHILST AT ANCHOR

16. Whilst at anchor, a number of personnel transfers took place using both the seaboat and Lynx, and clocks were advanced at 1730K to 1830L. The Executive Officer proceeded ashore with the intent of returning before 1900L, to allow the ship to depart for Wellington at that time. The weather was fine, visibility good, wind 230/12-16 knots with a long swell running from the south. The swell was causing difficulties in operating the helicopter at anchor. At 1920L, some discussion took place between the Commanding Officer, Principal Warfare Officer and Officer Of the Watch about the possibility of weighing anchor to reduce the roll of the ship, after the Lynx had been waved off 3 times. On completion of this discussion, the ship shortened in to 4 shackles of cable, and main engines were started.

17. Alcohol Consumption. All key personnel were asked during interview if they had consumed any alcohol in the course of the day, prior to the incident. The Executive Officer had consumed one bottle of beer whilst ashore, although it is assessed that this is not a contributing factor in the events that led to the eventual grounding of HMS NOTTINGHAM.

TRANSFER OF CONDUCT

18. Commanding Officer's Brief to the Navigator. At 1941L, the Lynx finally managed to land on with the Executive Officer embarked. The Commanding Officer then decided to proceed ashore. Before leaving the bridge he instructed the Navigator to "run a racetrack in here, and stay out to the east,"; and added that he would be back about 2100L. The Navigating Officer replied that he was happy with these instructions.

19. Commanding Officer's Brief to the Executive Officer. The Commanding Officer met the Executive Officer on his way to the hangar in 1N flat at about 1955L and informed him that he was now going ashore, and that the Executive Officer was to take conduct. A short brief took place in which the Commanding Officer instructed the Executive Officer to get under way and carry on down

the navtrack, recovering the Lynx on route. These instructions are at variance with those given to the Navigator, 15 minutes before. The Commanding Officer did not clarify his requirements in the Sea Order Book or check the navigation plan on the chart. He did believe however that in passing conduct to the Executive Officer, it was implicit that he intended for him to plan and execute the task of weighing anchor and joining the navtrack to Wellington, recovering the Lynx at the same time. The Commanding Officer departed in the Lynx at 2005L, while the Executive Officer made his way to the bridge to inform the Officer Of the Watch that he had conduct. Although he joined in February 2002, the Executive Officer had not yet completed his Platform Endorsement in a Type 42 Destroyer.

GETTING UNDER WAY

20. Discussion. After some discussion between the Executive Officer and the Navigator, it was agreed to weigh by 2100L, and proceed to the east to await the arrival of the Lynx. Although a plan of action was agreed verbally, no reference was made to the chart. The significance of poor navigation planning was now becoming significant. The navtrack passed within 1.5nm of Wolf Rock, which had not been identified as a hazard, and consequently no clearing bearings or clearing ranges had been constructed to keep the ship away from this danger. In addition, the position of Wolf Rock had not been registered into the Electronic Navigation Aids, Command System or Command Support System, as an added precaution.

21. Preparations for Getting Under Way. Despite being just 300 yards from the limiting danger line, neither Special Sea Dutymen, Tiller Flat personnel nor the Blind Pilotage Safety Officer were closed up, nor was the echo sounder 778 switched on. The Navigating Officer had still not constructed clearing bearings around the anchorage, however he had put clearing ranges onto the radar, although these were not recorded on the chart. The ship remained in Damage Control State 3 condition Yankee. Shortening in commenced at 2040L and the anchor was reported aweigh at 2057L. The Navigator instructed the Officer Of the Watch to 'run an east west racetrack in the vicinity of the anchorage', as he had been instructed to do by the Commanding Officer.

22. Conduct of Navigation. Before departing the anchorage, the Second Officer Of the Watch drew a track of 090 degrees away from the anchorage, towards where he believed the ship needed to proceed in order to join the track to Wellington. He asked the Officer Of the Watch for approval of his plan, which he agreed without reference to the chart. The Officer Of the Watch manoeuvred the ship out of Ned's Bay under the supervision of the Navigator and the Executive Officer. The Second Officer Of the Watch took a final radar fix at 2057L (not reported to the Officer of the Watch) which upon reconstruction, placed the ship 300 yards from the limiting danger line without any member of the navigating team knowing. Nevertheless, the ship departed Ned's Bay safely and proceeded down the racetrack at 12 knots. It was agreed that the flying operations would be conducted in Bridge Control, with the Principal Warfare Officer monitoring in the Operations Room

CONDUCT OF NAVIGATION FROM ANCHORAGE TO GROUNDING

23. Execution of the Plan. At no time between getting under way at 2057L and the ship grounding at 2202:38L, did the Executive Officer or the Navigator refer to the chart or track, take a fix or ask for a fix to be reported to them. The Officer Of the Watch consulted the chart only once at 2144L, but at no

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time did he fix the ship himself or supervise the Second Officer of the Watch. No soundings were taken at any point. The Navigating Officer, content that the ship was safely clear of the anchorage, left the Bridge at 2112L to have dinner. The ship was informed at 2124L via VHF, that the Lynx would leave Lord Howe Island in 15 minutes time. The Executive Officer decided therefore, that the ship should proceed down the navtrack at 12 knots, as he had been instructed to do by the Commanding Officer during the hand over of conduct. The Lynx was then informed of the ship's position and intentions for recovery. At about that time, the ship reverted to State 3 condition X-ray and the Second Officer of the Watch changed charts onto the 1:150000 scale section (see Enclosure 2). HMS NOTTINGHAM altered course to 140 degrees at 2125L, in order to regain the track for Wellington. The new course was not checked for hazards either visually, by the radar or on the chart. The Navigating Officer returned to the bridge at 2137L and noticed from the gyro tape repeat, that the ship had altered onto the navtrack to Wellington. He commented later during interview, that 'he was somewhat annoyed to find that he had not been consulted about the change of plan, from running an east/west racetrack, to proceeding down the navtrack'.

24. Recovering the Lynx and Commanding Officer. The Lynx estimated time of arrival was now passed as 2150L, and some discussion now took place between the Principal Warfare Officer and the Officer Of the Watch about a suitable flying course, given the wind direction and considerable swell. The Executive Officer suggested a course of 230 degrees, which he believed would be a suitable flying course, and would leave Lord Howe Island safely on the starboard bow. The new course was checked on the 1:150000 scale chart by the Officer Of the Watch, and the ship altered course to 230 degrees at 2144L, modified to 235 degrees at 2149L. The implications of inadequate planning and chart preparations now came to the fore. Without any plan to navigate the ship away from the navtrack, HMS NOTTINGHAM was now 2nm away from a significant danger with no safety considerations or plan in place. The Lynx, with the Commanding Officer embarked, landed at 2153L, in the position shown on chartlet at Enclosure 3, shutting down some 2 minutes later.

25. Planning to Stow the Helicopter. A number of important events now occurred at the same time. The Executive Officer, content that the Lynx had been safely recovered, asked the Navigating Officer his intentions for re-gaining the navtrack. He replied that he wished to get into the lee of the island, in order to stow the helicopter in the hangar, and suggested that a course of north west would achieve this. The Executive Officer agreed with this intention, and then left the Bridge to have a shower. The Principal Warfare Officer, content that flying had completed, left his position in the Operations Room; it was 2155L, and NOTTINGHAM was now just over a mile from Wolf rock.

26. Navigation Error. Without checking the new course by any means, the Navigator advised the Officer Of the Watch, to alter to the north west, initially suggesting a course of 350 degrees. This was modified to 320 degrees shortly afterwards and before the ship had completed its turn. During interview, the Officer Of the Watch stated that he *assumed* that the Navigating Officer was looking after the navigation and 'would watch his six,' (ie to supervise the navigation while the Officer Of the Watch concentrated on the helicopter movement). As the ship steadied on the new course, it was decided to shut down the Starboard Tyne, and there followed a 4 minute discussion between the Navigator and the Officer Of the Watch concerning the correct procedure for shutting down engines. During this time, the Officer Of the Watch was distracted from his primary function of navigation and maintaining a proper lookout. Neither the Navigator nor the Officer of the Watch noticed that the

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Second Officer of the Watch had fixed the Ship at 2200L, in a position 4 cables south east of Wolf Rock, and heading directly towards it at 12 knots. This fix was initially plotted onto the 1:150000 scale chart, the Second Officer Of the Watch inadvertently drawing part of the fix over Wolf Rock completely obscuring it from view. The Second Officer Of the Watch did not report this fix and then proceeded to change onto the 1:25000 scale section of the chart.

27. The Grounding. The Officer Of the Watch was again distracted by a call from the Flight Deck asking permission to move the Lynx to Fly 2, which he approved. This was followed by a further call from the Machinery Control Room (MCR), requesting permission to shut down the port steering motor. Fully occupied with the safety of the helicopter, he closely monitored the pitch and roll gauges mounted on the side of the pelorus. He stated later during interview, that he was "petrified of losing or damaging the Lynx". Now finally looking out the window at 2202L, he spotted a 'pale white glow on the water' some 100 yards on the starboard bow, and thinking it was moonlight, looked towards the sky out of the front bridge window. At the same moment, now just 20 seconds from impact, the Navigator finally saw white foam on the water, and immediately went to the chart to check the ship's position. Realising the ship was in immediate danger, he called to the Officer Of the Watch 'come right mate', but just 5 seconds later at 2202:38L, the ship struck the western side of Wolf Rock.

28. The impact of the collision caused a sudden jolt in the ship and considerable damage to the starboard side. The Navigating Officer piped 'Emergency Emergency, close all red openings' and ordered the Officer Of the Watch to come astern. The Commanding Officer arrived on the bridge within 30 seconds, with the Executive Officer closely behind him.

PART TWO - EVENTS IMMEDIATELY AFTER GROUNDING

29. MCR Initial Reactions. At the point of grounding the Marine Engineer Officer Of the Watch started all High Pressure Salt Water (HPSW) pumps and the standby diesel generator. The mechanic on rounds in the Forward Engine Room (FER) reported a large flow of water entering the compartment in the vicinity of the starboard stabiliser. Flood alarms in the forward Sewage Treatment Plant (STP) 4/5C, 4/5E Seadart Spray Compartment and 4/5K FER sounded in HQ1.

30. Initial Command Appraisal. The Commanding Officer made an immediate appraisal from the bridge (although without any knowledge of damage sustained), and quickly realised that the ship was stuck hard aground. He ordered that the engine be stopped, the Officer Of the Watch complying and then starting the starboard Tyne. As the Command team closed up around the ship, the Marine Engineer Officer piped 'Hands to Emergency Stations' from HQ1 and the Commanding Officer ordered that everyone be issued with lifejackets. The ship was now listing 10-15 degrees to starboard and clearly taking on water forward. Deciding that the ship would founder if they did not move off the rocks quickly, the Commanding Officer took charge of the ship, and rang on full astern, followed one minute later by slow astern on both engines. At the same time, the Yeoman contacted Lord Howe Island and informed them that HMS NOTTINGHAM was aground on Wolf Rock.

31. As the Commanding Officer attempted to manoeuvre the ship off the rocks, the water level continued to rise in the FER, and the routine eductor was operated in a effort to stem the flow. Soon

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after, the control of Tyne power was lost, and quickly transferred to local control although control of pitch was maintained throughout using the MCR Power Control Levers.

32. Power Isolation to the Conversion Machinery Room. The ship was clear of the rocks by 2209L, and the first damage sitrep was given to the Command by the Weapon Engineer Officer. He reported that there was a slow flood in the FER and free floods in the Sea Dart Spray Compartment and 4.5 magazine. In order to stem the flooding in the Conversion Machinery Room (CMR) 4G, the Marine Engineer Officer ordered power isolation without informing or requesting permission of the Command. Instantly, both gyros, steering gear control and shaft and telegraph indication were lost. As the alarms sounded on the bridge, the Weapon Engineer Officer informed the Command that the gyros had tripped, but did not explain that the CMR had been isolated, nor the full implications of this action. Steering control was transferred to the mechanical wheel, and it was decided to stop the ship in the water to the south of Wolf Rock, in order to assess fully the damage and remain within the lee of the island. The Commanding Officer then asked for a suitable place to beach the ship, and ordered hydraulics supplies to be started on the forecastle, giving the option of using the anchor. At the same time Sydney Maritime Co-ordination Centre was informed of the grounding via Global Maritime Distress and Safety System (GMDSS).

33. First Full Damage Sitrep. At 2220L the Marine Engineer Officer reported to the Commanding Officer that there was free flooding in C, D, E, F, and G sections on 4 and 5 decks. In addition, 3D messdeck, 3E Seadart Quarters and 3E Seadart Hydraulic and Power Rooms were flooded to a depth of 7 feet. The FER was flooded to a depth of 5 feet and rising. The Marine Engineer Officer then advised that the ship was not in danger of sinking or plunging. Shortly afterwards and without informing HQ1, the Commanding Officer ordered that the boats, ammunition lockers and ammunition on the starboard side be ditched, in an effort to reduce top weight, - although this was never carried out the flight deck awning was thrown over board from the hangar roof. The decision was now taken to anchor the ship rather than beaching, although by now, much of the Commanding Officer's decision making time was taken by conning the ship and establishing communications with the tiller flat.

34. Ship Comes to Anchor. The Commanding Officer conned the ship to anchor by 2340L in the vicinity of Middle Beach, and was then able to devote some attention to the Damage Control effort. By this time the hatches to 4G CMR and 4 F Storeroom were dropped as flooding rates could no longer be contained. Secondary flooding was also occurring above free flooded compartments from water passing through cable glands and ventilation penetrations. At 2355L the main computer supplies were lost, however main broadcast and internal communication facilities were restored, allowing an improvement to overall Command and Control.

35. Situation Stabilised. By approximately 2359L the flooding levels had stabilised throughout the ship with the level in the FER steady at 18 feet, just below the level of the hatch coaming. Shoring and pumping operations continued protecting compartments, notably the After Engine Room (AER), and the water level in 3D messdeck had by now reduced to 6 feet as a result of pumping efforts. The ship had settled at a trim of approximately 2.5 degrees by the bow but was in a stable and safe condition.

36. Details of the structural damage, damage control related observations, recovery plan and marine engineering related aspects, are detailed at Annexes B, and C respectively.

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PART THREE – EXTERNAL ASSISTANCE

37. Fleet HQ and WSA. Fleet Headquarters was informed of the grounding via INMARSAT 10 minutes after the incident, backed up by hard copy signal one hour later. Following the loss of the CMR, both Mentor and INMARSAT facilities were unavailable. Once safely at anchor, the Commanding Officer and Marine Engineer Officer decided to proceed ashore with the intention of obtaining expert advice from the Warship Support Agency (WSA) and discuss early repair options, including stability considerations and provision of specialist diving support. They finally went ashore at 0342L.

ROYAL NEW ZEALAND NAVY

38. TG 648.1. HMNZS ENDEAVOUR and HMNZS TE MANA (CTG) were formed into TG 648.1 under the OPCON of the Military Co-ordination Centre (MCC) Australia on 080524L July 2002, with the aim of providing assistance to HMS NOTTINGHAM.

39. HMNZS ENDEAVOUR. The New Zealand replenishment ship arrived in the vicinity of Lord Howe Island from the east coast of Australia at 090200L July 2002, and immediately met with HMS NOTTINGHAM's Command Team to discuss how they could assist. Initial priorities were to supply damage control equipment in the form of concrete, timber and steel strapping as well as personnel to assist in limiting the spread of flooding. HMNZS ENDEAVOUR was also able to supply diesel, fresh water, hot food and the use of their domestic facilities. The extra boats also provided transport capability. It was initially expected that HMNZS ENDEAVOUR would remain in the vicinity of Lord Howe Island providing assistance to HMS NOTTINGHAM for a period of 5-10 days.

40. HMNZS TE MANA. The frigate HMNZS TE MANA departed Mackay, New Zealand at 081750L July 2002 and arrived at Lord Howe Island 100600L July 2002. Giving a welcome boost to the Ship's Company of HMS NOTTINGHAM, HMNZS TE MANA was able to provide additional damage control stores, boats, domestic services and a place of rest.

ROYAL AUSTRALIAN NAVY/AIR FORCE

41. Royal Australian Navy. A detachment from the Royal Australian Navy Clearance Diving Team arrived at 080700L July 2002 and immediately conducted an underwater survey. They confirmed significant underwater structural damage from the stem through A, B, C, D, E, F, G, J and K sections, including the total loss of the FER starboard stabiliser fin. H Section had escaped damage. The full underwater survey was recorded on video, a copy of which is at Enclosure 4. A second diving detachment remained at 4 hours notice in Sydney.

42. Royal Australian Air Force. The Australian Air Force responded quickly to the MCA's request for transport aircraft, in order to move the Australian diving teams, and salvage teams from the UK, as well as additional damage control equipment out to Lord Howe Island.

MWIPT

43. The Major Warship Integrated Platform Team (MWIPT) construction representative, (who was also responsible for compiling the ship's post refit stability criteria), arrived at the ship at midday on 8 July, and confirmed that the ship was in a stable condition. There was, however, concern about the degree of damage and particularly of the implications of the stresses imposed as a result of severe distortion of the stem forging, and partial loss of the vertical keel in A and B Sections.

44. Before leaving the UK, the MWIPT had calculated the trim from the damage report sent from the ship. They were pleasantly surprised on arrival at HMS NOTTINGHAM that the trim was less than they had predicted. It was also confirmed that the Marine Engineer Officer's advice to the Command, regarding stability was correct. In addition, the actions taken to limit flooding, particularly onto 2 deck, and the rapid shoring actions, all contributed towards stabilising the platform and prevented potential further damage from failing bulkheads. As a result of the damage HMS NOTTINGHAM's Certificate of Safety – Structural Strength was formally rescinded on 9 July.

LORD HOWE MARINE PARKS AUTHORITY

45. The Lord Howe Marine Parks Authority conducted a dive on Wolf Rock to ascertain the extent of damage to marine life at the site and to assess if there is any significant environmental damage. Their report concluded that there had been no environmental impact as a result of this incident. Photographs of debris in the vicinity of Wolf Rock are at Enclosure 5.

DISCUSSION

STANDARDS OF NAVIGATION PLANNING

46. The formulation of a safe navigation plan is fundamental to the safety of operating a Warship at sea. This responsibility is the primary function of the Navigating Officer closely supervised by the Commanding Officer. Given his previous experience of navigating a Minor War Vessel, and attendance at 'n' course earlier this year,XXXXXXXXXXXXXXXXX, should have been capable of carrying out this duty.

47. It has become apparent during the course of this inquiry that the standards of navigation, bridgemanhip and sea sense in HMS NOTTINGHAM are inadequate. The original navtrack to Wellington intended to pass Wolf Rock by 1.5nm however, this feature had not been identified as a danger and subsequently had not been 'hatched' off and clearing ranges constructed.

48. Similarly, from the manner in which the anchorage during the afternoon on 7 July was planned, it would appear that the Navigating Officer's quality and standard of work in pilotage planning were also far from adequate. The omission of basic safety requirements such as comprehensive visual clearing bearings when approaching confined waters, demonstrates a disregard for standard practice, and the safety of the ship. Additionally, the quality of the Navigating Officer's chart preparations and notebook, and his execution of the manoeuvre out of the anchorage, belie a casual approach to his duties, and a lack of understanding of risk.

49. The inadequate standards of navigation planning and chart preparation, contributed directly to the grounding of 7 July and are indicative of a Navigation team that disregarded standard procedures designed to keep a ship safe. Specifically, the failure to produce a navigation plan to achieve a safe departure from the anchorage, the successful recovery of the Lynx and then re-gaining the track to Wellington, are considered to be contributing factors in the eventual grounding of HMS NOTTINGHAM.

PRECAUTIONS WHEN OPERATING IN COASTAL OR PILOTAGE WATERS

50. Precautions taken when operating in coastal waters, and in particular poorly surveyed areas, or operating in close company with other vessels, are designed to reduce the risk of grounding or collision. They are also there to minimise the damage should such an event occur. As with the conduct of planning, HMS NOTTINGHAM appeared to accept an increased risk whilst conducting these manoeuvres which is at variance with established practice and common sea sense.

51. On the afternoon of 7 July, the ship anchored within 3 cables of the coast, in an area that was poorly surveyed and was subject to positional inaccuracies, without closing up Special Sea Dutymen. Later that day, the ship departed the anchorage at night again without Special Sea Dutymen closing up, without the Blind Pilotage Safety Officer and without the echo sounder operating. During the reconstruction, it was apparent that the ship closed to less than 300 yards of the Limiting Danger Line without anyone on the bridge appearing to notice.

52. In the 50 minutes leading up to anchorage, the Command team in HMS NOTTINGHAM reduced the Damage Control State of the ship to 3X-Ray, reduced to single engine running and reduced to a single steering motor. All of these decisions were made when the ship was closing the coast, within 2 nm of land and in the proximity of navigational hazards. Although none of these additional factors had any bearing on the grounding, it is again indicative of a team that is willing to take unnecessary risks with the safety of the ship.

53. It has been noted from the Ship's Log that HMS NOTTINGHAM conducted Officer Of the Watch manoeuvres with HMAS WARRAMUNGA on 1 July without any additional precautions apart from increasing the Damage Control State and manning the Tiller Flat.

DELEGATION OF CONDUCT

54. Although the Commanding Officer issued conflicting instructions to the Executive Officer and Navigator, and did not clarify his intentions in the Sea Order Book, it is assessed that he left sufficient intentions to enable the Executive Officer and Navigator to both plan and execute the task that he had set. The conflicting orders issued by the Commanding Officer were therefore not a contributing factor in the grounding.

CONDUCT OF THE NAVIGATION

55. In analysing the causes and circumstances pertaining to this incident, it is impossible not to lean towards the failure of the Officer Of the Watch to maintain the correct navigation of the ship. Specifically, he was unaware of the ship's position in proximity to a significant navigation hazard, namely, Wolf Rock. His failure to refer to the chart more than once between sailing at 2057L, and grounding at 2202:38L, and his failure to fix the ship's position at all during this time are contrary to accepted practice. In addition, he failed to supervise an unqualified Second Officer of the Watch.

56. The Officer Of the Watch stated during interview, that he became fully occupied with the recovery and movement of the Lynx helicopter during the 20 minutes leading up to the incident. He further added that he was petrified of damaging or losing the Lynx. Under these circumstances, it is the duty of the Officer Of the Watch to seek assistance from the Navigator, who was present on the bridge. He instead wrongly *assumed* that the Navigating Officer would conduct or, at least oversee, the navigation for him. These basic tasks are fundamental to the duties of the Officer Of the Watch, and a qualified Officer of Lieutenant ~~xxxxxxxx~~experience, might reasonably be expected to carry out these duties efficiently and conscientiously.

57. Despite that fact that the Navigating Officer was present on the bridge between 2137L and the time of grounding (some 40 minutes), he did not once refer to the chart or offer to assist in the navigation of the ship. Even when the Officer Of the Watch appeared to be fully occupied with the recovery and movement of the helicopter, the Navigator offered no assistance. Indeed the Navigator not only inadvertently distracted the Officer Of the Watch at a crucial time, but also advised him to alter course in a direction that took the ship towards Wolf Rock with no appreciation himself of where the ship was, or the presence of danger.

58. Platform Endorsement. Although not contributing to the grounding, it has been noted that the Executive Officer has not been Platform Endorsed in a Type 42 Destroyer, and therefore was not eligible to take conduct.

59. Electronic Charts. HMS NOTTINGHAM ran aground because insufficient attention was being paid to the safe navigation of the ship by the Officer Of Watch. This was due in part to the fact that he had focused his attention, for some of the time, in the recovery and movement of the Lynx. Although it in no way excuses the actions of the navigation team on the bridge, the rear facing chart table with a curtain drawn around it, was not conducive to monitoring the progress of the ship. Had HMS NOTTINGHAM been fitted with an Electronic Chart display at the front of the bridge, the Officer Of the Watch *may* have been able to monitor the navigation of the ship and conduct the recovery of the helicopter. The Admiralty Raster Chart System (ARCS) would still have necessitated a chart change onto the 1:25000 scale chart, however it would have been carried out automatically. A Vector chart system would of course not have the same limitations. It should be remembered however that there were 4 Officers on the bridge of HMS NOTTINGHAM in the time leading up to the grounding, including the Officer with conduct and the Officer trusted with the Navigation of the ship. Neither the Executive Officer, Navigating Officer nor the Officer Of the Watch took any interest in the navigation of the ship for 65 minutes before the grounding.

DAMAGE CONTROL

60. The Ship's Company response to the main broadcast alarm was instinctive and prompt enabling Marine Engineering Officer to provide the Command with an outline brief within 5 minutes of the incident. The watertight integrity discipline certainly contributed to limit flooding and with the exception of 3D magazine access hatch, the X-Ray hatches functioned as expected. In the case of 3D hatch, it is uncertain whether it was distorted or whether the "blow off" kidney hatch had lifted - the result was the 7 feet flood in 3D messdeck.

61. Despite the severity of the flooding, the Ship's Company pulled together in impressive style. Within 25 minutes of grounding all flooding boundaries were established, primary and, in some cases secondary, shoring had taken place and all available pumping systems were being used. The priorities issued by HQ1 were entirely correct. Apart from the FER, main machinery spaces were safeguarded and bulkheads in danger of failing, especially adjoining the Seadart Magazine, were quickly attended to.

62. It is of note that the MWIPT ship construction representative and the salvage team leader also stated that the actions taken were prompt and sufficiently robust to prevent further deck and bulkhead failure. It is not possible to say whether the actions taken saved the ship but they certainly prevented further failures which could have been catastrophic.

63. The HQ1 C2 team was calm and decisive throughout. Equipment and manpower resources were well managed and the Marine Engineering Officer's performance was particularly noteworthy as was that of the senior rates at FRPPs. Both CMEM(M)s provided top quality advice and help with shoring. Many junior rates commented that their presence, leadership and good humour provided reassurance in a difficult and dangerous situation and confidence that the ship would survive. In addition all those involved said that the damage control training both ashore and at OST prepared them well for the incident.

64. Propulsion plant reliability was satisfactory and propulsive power was fully maintained. Minor machinery failures were dealt with competently and the transfer of Tyne engine control to the After Engine Room was well practiced and calmly undertaken.

65. The loss of converted power supplies to the bridge instrumentation - gyros, gyro repeat, rudder indicator and shaft indicators - caused considerable confusion during the stage at which the Command was trying to formulate his plans. Because of the lack of rudder indicator response the bridge team assumed that steering was lost although this was not the case, both steering motors ran uninterrupted. Whilst the Marine Engineer Officer informed the Weapon Engineer Officer of his intentions to isolate supplies, formal approval was not sought.

CONCLUSIONS

66. HMS NOTTINGHAM grounded on Wolf Rock because insufficient attention was being paid by the Officer Of the Watch to the safe navigation of the ship and specifically, the position of the ship in relation to navigational hazards. [Paras 22, 23, 26 and 55]
67. The Executive Officer and Navigating Officer had not ensured that a navigational plan, ensuring a safe departure from the anchorage and catering for changes required for the recovery of the helicopter had been constructed. [Paras 20, 23, 24, 46 and 49]
68. The Navigating Officer issued navigation advice to the Officer Of the Watch without any reference to the chart or knowledge of the ship's position or the proximity of dangers. Specifically, he inadvertently advised him to alter course directly towards a navigation hazard, namely Wolf Rock. [Paras 26, 27 and 57]
69. The ship failed to ensure that correct standards of bridgemanship, navigation planning and execution were maintained. [Paras 23, 26, and 55]
70. This incident has not highlighted any limitations of Royal Navy navigation training. [Paras 23, 26 and 55]
71. Management and execution of the damage control effort was highly effective, the result of which was in limiting the damage and increasing the survivability of HMS NOTTINGHAM. Members of the Ship's Company are worthy of collective praise and possible commendation for outstanding contribution by some individuals. [Paras 60, 61 and 62]
72. The damage control training provided at PHOENIX and during OST prepared the Ship's Company effectively to cope with the scale and nature of the damage experienced. [Para 63]

RECOMMENDATIONS

73. It is recommended that:
- a. The frequency of periods of continuation training for navigation is reviewed.
 - b. Current methods and standards of navigation training are maintained without recourse to any review as a result of this incident.
 - c. The comments and recommendations identified at Annex C and pertinent to Damage Control are noted and, if deemed appropriate, implemented.
 - d. A full damage control study be undertaken to evaluate fully the actions taken in response to the damage.

Annexes:

- A. Executive Summary
- B. Structural Damage and Outline Recovery Plan
- C. Damage Control and Marine Engineering Related Aspects

Enclosures:

- 1. Chart of Tasman Sea including Lord Howe Island.
- 2. 1:150000 scale section of chart Aus 610.
- 3. 1:25000 scale section of chart Aus 610 and Timeline.
- 4. Video of Underwater Survey taken by RAN Diving Detachment 08 July 2002
- 5. Lord Howe Island Marine Parks – Photographs of Underwater Debris

ANNEX A TO COMDEVFLOT's
FLEET 259/2/1 DATED 21 JUL 02

EXECUTIVE SUMMARY

INTRODUCTION

1. HMS NOTTINGHAM (NOTT) sailed from Cairns on 4 July and was due to arrive in Wellington, New Zealand, on 9 July. The intention was to transit the Great Barrier Reef, then to anchor in the vicinity of Lord Howe Island on 7 July, in order to land members of the Ship's Company for recreation. The ETA at Lord Howe Island was 1600K.

NARRATIVE

2. Transfer of Conduct. After the ship had anchored off Lord Howe Island, the XO and others, proceeded ashore. The XO returned at about 1945L and was passed Conduct by the CO who then went ashore himself. While the XO was content with the detail of his CO's instructions, the BOI noted that these instructions differed slightly from those passed by the CO to the Navigator, only moments before. The CO did not detail the instructions for the XO's period of conduct in the Sea Order Book. Neither the detail of the instructions to the XO and NO nor the fact that the Sea Order Book was not used did not contribute directly to the grounding.

3. Inadequate Navigation Plan. The XO and NO agreed to weigh anchor by 2100L. Although a plan of action was agreed verbally, no reference was made to the chart. The navtrack passed within 1.5nm of Wolf Rock, which had not been identified as a hazard and consequently, no clearing bearings or clearing ranges had been constructed to keep the ship away from this danger. In addition, clearing bearings had not been constructed around the anchorage, however clearing ranges had been placed onto the radar display. These preparations were inadequate and indicative of a general slackness of the standards of navigation and Bridgemanhip in the ship.

4. Execution of the Plan. At no time between getting under way at 2057L and the ship grounding at 2202:38L, did the XO or the NO refer to the chart or track, take a fix or ask for a fix to be reported to them. The OOW consulted the chart only once at 2144L, but did not fix the ship himself or supervise the 2OOW. No soundings were taken at any point.

5. Recovering the Lynx and CO. With the Lynx due back at 2153L, a flying course of 230 was agreed given the wind and swell. The ship altered course at 2144L, which took the ship off the original (and inadequate) plan. The implications of inadequate planning and chart preparations now came to the fore. No attempt was made to construct a navigation plan.

6. Helicopter Operations. Once the Lynx was safely recovered, the XO asked the NO his intentions. He replied that he wished to get into the lee of the island in order to stow the Lynx. The XO agreed with this intention and then left the Bridge. It was 2155L, and NOTT was now just over a mile from Wolf rock.

7. Navigation Error. Without checking the new course by any means, the NO advised the OOW to alter to the north west to a course of 320. After altering at 2154L, Wolf Rock was 9 cables fine on the starboard bow and the ship was heading towards it at 12 knots. A fix was taken at 2200L but not reported. The ship was then 4 cables south east of Wolf Rock.

8. The Moments before Grounding. In the 2 or 3 minutes before grounding a number of factors contributing to the grounding came in to play:

- The OOW and Navigator had a lengthy discussion about the correct procedure to shut down an engine;
- The helicopter needed to be moved to 'Fly 2' – the OOW became totally focused on the pitch and roll of the ship;
- Unbeknown to the Navigator or OOW, the 2OOW was transferring his latest fix from the larger scale projection of the area back onto the small scale projection. Wolf Rock is only marked as a '+' on the large scale section but is much more visible on the small scale. The fix placed the ship 4 cables to the south east of Wolf Rock;
- With a lot for the OOW to do, the OOW assumed that the Navigator was overseeing the navigation for him. No formal transfer of responsibility for navigation occurred and the Navigator had taken no interest in the chart while he was on the Bridge.

9. The Grounding. Both the Navigator and Officer Of the watch saw a 'white glow' on the water at the same time 100 yards on the starboard bow. The Officer Of the Watch thought it was moonlight, however the Navigator believing that something was amiss, immediately went to the chart to check the ship's position. After checking the chart he called to the Officer Of the Watch 'come right mate', but just 5 seconds later at 2202:38L, the ship struck the western side of Wolf Rock.

DAMAGE CONTROL

10. The grounding caused considerable damage to the starboard side of the ship. The Commanding Officer arrived on the bridge within 30 seconds, with the Executive Officer closely behind him.

11. There then ensued about 2 hours of frantic Damage Control effort which was, in the main, well controlled and highly effective. The response of the Ship's Company was first class and many individuals can be singled out for specific praise. The ship anchored at about 2359L, by which time the situation had been stabilised. The damage control effort continued in order to recover spaces lost to flooding and to prevent further damage.

CONCLUSIONS

12. The Board of Inquiry concluded, *inter alia*, that:
- a. HMS NOTTINGHAM grounded on Wolf Rock because insufficient attention was paid by the OOW to the navigation of the ship and in particular, the position of the ship in relation to navigational hazards.
 - b. The XO and NO had not ensured that a safe navigational plan was constructed which ensured a safe departure from the island and catered for the changes required for the recovery of the helicopter.
 - c. Management of the damage control effort was highly effective. The Ship's Company is worthy of collective praise; some individuals merit commendation.

RECOMMENDATIONS

13. It is recommended that:
- a. The frequency of periods of continuation training for navigation is reviewed.
 - b. Current methods and standards of navigation training are maintained without recourse to any review as a result of this incident.
 - c. That the comments and recommendations identified at Annex C and pertinent to Damage Control are noted.
 - d. A full damage control study be undertaken to evaluate fully the incident and materiel aspects.

**ANNEX B TO COMDEVFLOT's
FLEET/259/2/1 DATED 21 JUL 02**

STRUCTURAL DAMAGE AND OUTLINE RECOVERY PLAN

1. HMS NOTTINGHAM suffered the following underwater, internal and upperdeck structural damage:

- a. A and B Sections (WTC, Fwd Trim Tank). A large section of the stem forging and vertical keel is missing. The missing area extends across No 0 to No 3 frame and is approximately 21 feet in length. There is also creasing of 1 deck starboard slightly forward of the breakwater indicative of loss of structural support. The creasing deformation increased by approximately 3-4 cm over a 4-day period.
- b. C Section (Sewage Treatment Plant & Pump Space). Multiple split panels exist throughout the section and there is widespread and significant distortion to stiffening members and plates.
- c. D Section (4.5 Magazine and 3D Messdeck). There are multiple split panels and significant distortion to stiffening members and plates in the region of the upper swimmer line. Severe distortion is also evident to 3D messdeck deck; this had deteriorated over a 3-day period commensurate with the lack of structural support.
- d. E Section (Seadart Spray Compartment & Magazine). The section suffered from severe plate distortion and has been punctured by a hole approximately 1m high by 2m long. The magazine structure failed at an undetermined point, it is likely that magazine flooding was caused by weld fractures.
- e. F & G Sections (Stores, Fresh Water Tanks, FW Pump Space, CMR, and Battery Charging Shop). There are 12, predominantly vertical, splits throughout the Sections some of which have propagated, into "Y" formation. The length of the splits varies between 30 – 90 cm. The front section of the sonar dome is missing and many sonar transducers have been lost. There is severe distortion to 3F deck. The forward bulkhead panels and vertical stiffeners which abut the Seadart Magazine and Seadart Spray Compartment are severely distorted.
- f. J Section (Forward Auxiliary Machinery Room, J3 and J6 Fuel Tanks) The leading edge of the bilge keel has suffered weld fracture and there is significant distortion especially at the forward end. Although unconfirmed, the abutment welds to the hull at the turn of bilge are probably fractured and, if so, would have caused the fuel tank contamination.
- g. K Section (Forward Engine Room, K7 Fuel Tanks). The starboard stabiliser fin has been lost. The stabiliser rams, stub shaft and machinery in the FER stabiliser housing have been displaced and the stub shaft has also been bent towards the after end of the ship. There has also been undetermined, but possibly internal, failing of K7 fuel tank structure causing fuel tank contamination.

RECOVERY

2. A salvage team from the Warship Support Agency (WSA) attended the ship to formulate the recovery plan in consultation with the Major Warship Integrated Project Team ship construction representative and ship's staff. Some preparatory work had been undertaken by the RAN diving team in removing "peeled away" underwater structure but it was considered impracticable to try to fit temporary repairs over damaged areas. The plugging of the FER stabiliser stub shaft/housing void has been successful.

3. The bulkhead, deck and creasing on the upperdeck continue to be monitored for deterioration with the intention of stiffening those areas with steel "T" bar sections. The deck at 3F has suffered significant buckling and will likewise need to be stiffened. In order to reduce stresses the WSA has advised that the ship should be towed astern. A proposal to fit a breakwater on the flight deck and to stiffen the hangar door is being evaluated. Ship's staff continue to monitor and tighten shoring and remove flood water transferring through cable and ventilation deck and bulkhead penetrations.

ANNEX C TO COMDEVFLOT's
FLEET /259/2/1 DATED 21 JUL 02

DAMAGE CONTROL AND MARINE ENGINEERING RELATED ASPECTS

DC INITIAL ACTIONS

1. As soon as the grounding impact was felt, the Marine Engineering Officer (MEO) and the Supply Officer (SO) proceeded to HQ1 and were debriefed by the Marine Engineering Officer of the Watch (MEOOW) and the HQ1 watchkeeper. Multiple alarms were sounding from the HQ1 panel indicating floods in 4/5C Sewage Treatment Plant (STP) Compartment, 4/5E Seadart Spray Compartment, 4G Conversion Machinery Room (CMR) and 4/5K Forward Engine Room (FER). A number of system alarms including loss of chilled water were also sounding.
2. It was clear that from the noise, vibration and initial list to starboard of some 10-15 degrees that significant damage had been sustained to the forward sections of the ship. The MEO made the "Hands to Emergency Stations" broadcast as delegated to him by the Command, mustering spare personnel in the Junior Rates Dining Hall.
3. As the ship moved off the rocks the list reduced and the ship returned to the upright position. At 2205, "C" HPSW Pump running indication failed, soon after it was confirmed that the Forward STP Compartment at 4/5C was free flooded and was being held on 3C hatch which was being shored. At 2209 the MEO was able to provide the Command with an outline report via the Weapon Engineer Officer (WEO).
4. Free flooding was reported in C, D and E, Sections on 4 and 5 decks. There was also slow flooding at 4 F and 4G and this was confirmed on the remote compartment cameras. In addition 3D messdeck, 3E Seadart Quarters Position and 3E Seadart Hydraulic and Power Room were also flooded to a depth of 7 feet. At this time it was not possible to ascertain the condition of 4/5A and B compartments, which were presumed to be flooded but this could not be confirmed until the underwater inspection was carried out the following day. The Damage Control Officer immediately deployed manpower from the After Fire and Repair Party Post (FRPP) and from those mustered in the JRDH to supplement the Forward FRPP. Immediate action was taken to undertake shoring and pumping and to determine the flooding boundaries.
5. The MEO stated his priorities and nominated the After FRPP to tackle the CMR flood. Electrical isolations were made to the CMR resulting in the loss of all converted supplies. Whilst WEO was informed of the intention it was not passed to the Command until bridge gyro alarms sounded and the rudder and shaft indications were lost.
6. The MEOOW instigated Main Machinery Space searches and confirmed to MEO that the FER was the only space affected – the water level at 2230 had increased to 5 feet. Personnel from the Mobile Repair Party were attempting to identify and stem the flood. The MEO called his first "Command Huddle" at 2214. Main Broadcast, Incident Board Operators (IBO) net and Rationalised Internal Communications Equipment (RICE) failed immediately afterwards and the telephone

exchange was lost at 2220. Communications were conducted using the NBCD communications suite, radios and by runners this working well until main broadcast and RICE facilities were restored at 072335L.

7. After the flooding boundaries were determined it became clear that the only compartments that could be recovered were:

- a. 3D messdeck which was subject to a slow flood (5 feet and rising) from water issuing from the 4.5 magazine access hatch and blow off kidney hatch.
- b. 4F storerooms where the water level was at 7 feet and rising.
- c. 4G CMR which was flooded to a depth of 6 feet and rising from floodwater passing into the compartment from the Fresh Water Pump space at 4G.
- d. 4K FER which was flooded to a depth of 5 feet and rising.

8. After referring to the Stability and Survivability Book (CB 9500 (10)) and the Class Book (CB 4538W(1)) the MEO updated the Command at 2230 and advised that the ship was not in danger of sinking or plunging.

9. All pumping facilities were being used with the focus on limiting flooding in the FER to improve the stability state. At 072245L MEO ordered that K HPSW Pump battle override be operated. The pump ran underwater until 080030L when it eventually failed.

10. At 2335 the hatches to 4G CMR and 4F Storeroom were dropped as flooding rates could no longer be contained. Secondary flooding was also occurring above all free flooded compartments from water passing through cable glands, ventilation penetrations and through the fixed hatch waterwall sealing arrangements. At 2355 the main computer supplies were lost.

11. Flooding levels stabilised at approximately 2359 at which point the FER water level was at 18 feet - just below the level of the hatch coaming. The flood at 3 D messdeck had been contained and had reduced to 6 feet. The water levels in 3E Seadart Quarters Position and 3E Seadart Hydraulics and Power Room were also just below the level of the hatch coaming. The ship had settled at a trim of approximately 2.5 degrees by the bow but was in a safe and stable condition

DC CONSOLIDATION

12. Once it was clear that flooding boundaries had been firmly established HQ1 prioritised the FER forward and after bulkheads and the Seadart Magazine forward and after bulkheads for shoring. Secondary shoring in other areas was erected throughout the night and well into the next day until onboard stocks were expended.

13. Cement boxes were used to stem the secondary floodwater but stocks were quickly expended as was the tongue and grooved timber used to form the boxes. Acceptable water levels were maintained

by use of portable eductors, Weda pumps, hand bailing and adapting AFFF in line inductors for use as eductors. Examples of the shoring effort and cement box arrangement is at Enclosure 1 to this Annex.

14. At 080325L floodwater ingress through cables resulted in an electrical fire and subsequent loss of 3G Electrical Distribution Centre (EDC). The fire was extinguished at 080330L. Power was lost to the main refrigeration plants; emergency cables were run with minimum loss of plant operation. A temporary "hard cable" run was later achieved.

15 Power supplies to the CMR, Mentor and IMARSAT facilities were lost following isolation of supplies. Consequently the CO and MEO proceeded ashore at 080342L to establish contact with Fleet and the WSA to discuss early repair options including stability considerations and provision of specialist diving support.

16. Following flooding of the FER, water migrated into the After Engine Room bilge via the Olympus torque tube covers and the torque tube removal soft patches. This also caused significant main lubrication oil system contamination. Levels in the After Engine Room were carefully monitored and water educted. Despite the oil contamination MEO decided that the propulsion plant should remain available should the Command needed power for safety reasons.

17. High Pressure Salt Water (HPSW) Main Management. The loss of C and K HPSW pumps resulted in the main pressure dropping to 60 psi due to the number of eductors in use. The MEO ordered the Godiva and the Rover gas turbine emergency fire pumps to be started to supplement the HPSW Main. The Godiva unit ran until 080300L before it was shut down due to overheating. The Rover gas turbine pump continued unrestricted operation.

DC RECOVERY ACTIONS

18. Ten members of the RAN Clearance Diving Team arrived in the early hours of the 8 Jul. The RAN also provided four diesel driven and 6 electrically driven portable pumps and 200 metres of shoring timber. On arrival the diving team conducted an underwater survey. They reported widespread underwater damage on the starboard side from the stem to H sections and that the starboard FER stabiliser fin was missing. Priority was given to stemming the water ingress around the FER stabiliser and at 081400L the water level was reduced to plate level.

19. As the situation stabilised, and in order to provide respite the Command ordered that the ship shifted into Defence Watches at 081200L. The manpower loading was also eased by the arrival of HMNZS ENDEAVOUR and TE MANA who provided manpower to assist in shoring and bailing out compartments as well as supplying an additional 50m of shoring timber and cement.

20. As the recovery gathered momentum MEO requested diving team to close 3E port and starboard hatches, which enabled the Seadart Quarters Position and the Seadart Spray to be recovered, shoring was conducted underwater and the compartments were fully recovered by 081900L.

21. Having discussed options with the WSA the MEO arranged for 5Q Watertight Compartments to be filled to improve stability. The FER was finally drained at 082200L and the ship's trim reduced to approximately 1 degree by the bow.

22. A deck plan representation of the damage control situation at 072230L, 072359L and 090630L is at Enclosure 2 to this Annex.

DC COMMENT

23. HMS NOTTINGHAM was subjected to the largest and most dangerous flooding incident in recent years. The HQ1 team managed the incident in a calm and competent manner providing sound and well considered advice.

24. Considerable effort was made by the Ship's Company to stem the flooding, erect shoring, and re-instate electrical supplies in dangerous conditions. Personnel attempting to stem floodwater from 3D hatch worked in water 5 feet deep until their evacuation. Those engaged in the FER effort swam in the diesel contaminated floodwater attempting to locate damage and conduct leakstopping.

25. It was reported that moral remained high throughout and that teams were cheerful and enthusiastic focusing on their tasks. A good deal of ingenuity was evident in solving shoring problems, running ad hoc cable supplies and stemming water ingress. When questioned all felt that their training prepared them well for this incident.

26. Whilst the overall management of this incident was effective it was nevertheless hampered by the following material shortcomings which will warrant further investigation:

- a. Lack of portable pump sockets in each section. Those in the Main Machinery Spaces are fitted in a position which makes them vulnerable to flood damage.
- b. There were insufficient discharge overboards to cater for a pumping requirement of this magnitude.
- c. The number of portable pumps were insufficient to cope with the extensive flooding experienced in this incident.
- d. The 2 portable eductors were insufficient to cope with the minor secondary floods.
- e. Fixed hatch waterwalls profile sealing arrangements were inadequate – all leaked following free flooding of compartments below.
- f. The standard shoring timber allowance of 75m and the tongue and groove timber allowance was insufficient. The ship embarked an additional 200m but even this proved inadequate. HMS NOTTINGHAM used in excess of 500m of shoring timber.

- g. The policy of lashing WEDA pumps down should be reviewed. If this was done in this instance pumps in the FER would have been lost until the compartment was recovered.
- h. The wheels fitted to WEDA pumps reduced the suction levels and were removed. They proved to be of no benefit.

MARINE ENGINEERING

27. Propulsive and electrical power and steering were maintained throughout the incident. Despite the heavy impact all plant continued to operate and none exhibited unusual vibration levels. As power isolations were made and flood water levels increased there were some control losses. These and other relevant observations are detailed below.

HIGH PRESSURE SALT WATER (HPSW) PUMPS

- 28. C" HPSW Pump. On impact all HPSW pumps were started. The pump located at 4/5C Sewage Treatment Plant quickly failed as the compartment rapidly flooded. Whilst the pump may have suffered impact damage it should have been able to function under water. It is noted that there was insufficient time to make the "Battle Override" switch.
- 29. "K" HPSW Pump. The pump "Battle Override" was operated at 072245L. The pump, which is also capable of running underwater, continued to operate underwater until 080030L at which point the water level in the Forward Engine Room was 18 feet.

TYNE ENGINE TROTTLE CONTROL

30. Shortly after the Starboard Tyne was started at 2205 speed control of the port and starboard engines was lost from the Machinery Control Room whilst pitch control was maintained from the Pitch Control Levers. The engines were immediately taken into local control in the After Engine Room and functioned normally. Control was lost due to the failure of the 50v and fuses at 4P Fs 5 and 4S Fs 5. It is not clear why failure occurred but it is possible that flooding in the Forward Engine Room caused earths when the water reached the Olympus Throttle Control which is supplied from the same fuse panel.

31. It was also noted that that the starboard Tyne NA Module which is the power supply for the control system had also failed. Again it was assumed that the failure was due to earths resulting from the FER flood. Full engine control was restored on 8 July.

LUBRICATING OIL CONTAMINATION

32. Gross Main Lubricating Oil contamination was suffered from water ingress from the floodwater in the FER migrating through the Olympus Torque tube covers and entering the Main Gearbox. The oil has been centrifuged and new stocks run down. Contamination levels are now within specification. Neither the main or Tyne primary gearboxes have been opened for examination.

TRANSFER OF FLOODWATER THROUGH DECK/BULKHEAD PENETRATIONS

33. Migration of Floodwater from the FER to the AER. Water was transferred through the poorly sealed Olympus torque tube cover soft patches. In addition the lack of remotely operated sullage bulkhead valves resulted in water transferring through the system to the AER centrifuge sullage tanks and into the AER bilge.

RECOMMENDATIONS

34. It is recommended that:

a. NBCD equipment allowances are reviewed with particular emphasis to:

- i. Shoring and tongue and groove timber.
- ii. Quick drying cement.
- iii. Portable eductors
- iv. Underwater sealants

b. The sullage system relating to the Main Machinery Spaces be reviewed to ensure that there are sufficient isolations to prevent back flooding.

c. The Naval Engineering Standards for deck penetrations especially for ventilation and cable glands be examined to ensure that are sufficiently robust to ensure compartment watertight integrity.

d. The feasibility of conducting post upkeep compartment pressure/vacuum testing in way of the Red Risk Zone is examined.

e. The sealing arrangements of the Olympus torque tube covers are examined to prevent water migration and contamination of the main lubrication oil system.

Enclosures:

- 1. Photographs of Shoring and Cement Box Arrangement.
- 2. Deck Plan Representation of Damage

M13

By CINC

1. I have considered the full BOI report, the summary of the BOI by COS (W) and the advice of the DCINC.
2. There is compelling evidence that the CO, XO, NO and OOW should be investigated further to ascertain whether their apparent negligence should be pursued through Court-Martial procedure.
3. I approve the recommendation that the DCINC should initiate a disciplinary investigation. This should be conducted as expeditiously as possible.
4. The officers should be informed of this course of action.
5. I note the actions put in hand by COS (W) with respect to assessment of navigational training, FOST continuation navigation training coverage, navigation equipment and command qualification et al. Specifically I would like reassurance with regard to all DD/FF XOs being CQ1.
6. I await further advice on the matter of possible commendations for members of the Ship's Company arising out of their actions post the grounding.

04 Sep 02

— J.B .