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20080915_RS_FLEET_Legal_520/1/46

See Distribution

18 Sep 08

RECOMMENDATIONS FROM THE BOARD OF INQUIRY INTO THE GROUNDING OF HMS SUPERB

Reference:

A. QRRN Article 5701.

1. The Board of Inquiry into the grounding of HMS SUPERB on 25 May 08 during a submerged transit of the Red Sea reported to me in July and the Board's report has now been staffed. The Board concluded that HMS SUPERB grounded on a charted feature, in position xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxprincipally because a xxxxxx shoal, on the chart in use, was missed. Significantly, a number of factors contributed, including: the late decision to transit at xxxxxx a failure to consult all available multi source data in order to assess potential hazards, and a failure to check the chart when laying off a new track.

2. I have accepted the Board's conclusions and recommendations. The recommendations, which cover equipment, training and support issues, are forwarded at the Annex for the attention of addressees.

3. The BOI report, without supporting evidence, is forwarded at Enclosure 1. The report is still subject to the redaction process pending formal publication. While I am content to enclose the report in full (in order to give you the context necessary to take forward the required actions in an informed manner) I would ask you to treat the report as being sensitive, paying attention to its protective marking and disclosing no more detail then is necessary to fulfil your responsibilities, particularly to subordinates. Should you wish to access witness statements or other supporting evidence referred to at the Enclosure, you should contact Fleet Legal Operations.[1]

4. You will appreciate that my primary concern is to ensure that remedial action is completed as a matter of priority. This incident could have had far more serious consequences, mitigated significantly by the exemplary post incident response by SUPERB's Ship's Company. I look to all of you to ensure that effective measures are put

[1] Point of Contact: xxxxxxxxxxxxxxxxxx

ANNEX A TO
FLEET Legal 520/1/46
DATED 18 SEP 08

RECOMMENDATIONS AND ACTIONS

1. The principle recommendations of the Board are that:

a. COM(OPS) should signal all submarines highlighting the generic lessons identified from this incident. This signal has now been sent[2].

b. **Equipment:**

(1) **Fleet WEO SM** to investigate the formal transfer of the WECDIS RPT Laptop from a minor trial to acceptance into service as either a class modification (S, T and V) or alteration and addition (A&A) (paragraph 43).

(2) **Fleet WEO SM** to actively pursue connectivity of the WECDIS RPT to NSINS (paragraph 43).

(3) **Fleet WEO SM** to investigate feasibility of adding a depth alarm facility to all in service submarine echo sounders (paragraph 53).

(4) **Fleet Nav** to alert all submarine COs of the nascent capability of the WECDIS RPT laptop and develop the necessary standard operating procedures (SOPs) for its use in support of navigational safety, both surfaced and dived (paragraph 43).

(5) **Fleet Nav** should investigate the provision of a commercial off the shelf Voyage Data Recorder would represent a sensible investment for post event re-construction, particularly for a serious incident (SUBSUNK) (paragraph 48).

c. **Training:**

(1) **Fleet Nav and FOST (Shore)** to conduct a thorough review of all relevant SM courses to ensure that all aspects of dived navigation, planning preparation and execution, highlighted by this incident are adequately taught in FNO and the Basic and Intermediate Warfare Course (paragraph 33).

(2) **FOST (DN)** to develop an Emergency Operating Procedure for a collision at depth (paragraph 55).

(3) **FOST (DN)** to ensure that their training guarantees commonality in the execution of all navigational operations, in particular management of the plot and its associated records (paragraphs 44 & 47).

d. **Support**

(1) **Fleet Nav** to ensure that BR 45 is updated to reflect operating below MSD and to review and enhance the guidance contained therein. In particular, the

[2] Enclosure 19-CTF311 ADA/LGQ 231701Z JUN (Superb BOI).

proposal to include a further limiting danger line, in addition to those prescribed in BR45(4), for the submarine's max depth + BVSS be considered (paragraphs 34, 38 & 40).

(2) **Fleet Nav** to thoroughly review mechanism by which specialist products, compiled by UKHO SoS for dived navigation, are automatically supplied to all submarines. (paragraph 37).

(3) **Fleet Nav** and UKHO SoS to investigate the provision of 1:250,000 scale BC charts for this region (Red Sea) capable of being used for navigation (paragraph 39).

(4) **Fleet Nav** & Flotillas to ensure that submarine class standing orders are amended to include clear watch hand over routines. In addition, these orders are to include a robust routine for the hand over of the navigation plot (paragraph 50).

(5) **FLEET Nav** to issue guidance to the submarines to ensure that the Sea Order Book receives the attention that it deserves (paragraph 49).

(6) **Fleet Nav** are to mandate all submarine Navigation Officers to visit UKHO as part of the preparations for any deployment in accordance with FPN 60 (paragraph 27).

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Navy Command

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520/4

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7 July 2008

Sir

BOARD OF INQUIRY REPORT INTO THE CIRCUMSTANCES SURROUNDING THE GROUNDING OF HMS SUPERB ON 26 MAY 2008

Reference:

CINCFLEET's ABA/Z5A 031906Z JUN 08 (BOI Convening Signal).

We have the honour to submit our findings into the circumstances surrounding the above incident, as directed at the Reference.

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

Signed on Original

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
Lieutenant Commander, Royal Navy

Signed on Original

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Commander, Royal Navy

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Captain, Royal Navy

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in place to reduce the risk of a recurrence. Accordingly, I ask that you provide my office with reports on the initial progress towards achieving these recommendations by 3 Oct 08, and confirmation once they have been completed. If addressees feel that the recommendations are for whatever reason not achievable, I am to be informed immediately, along with full reasons.

Signed on Dii

xxxxxxxxxxxxxxxxxx
RAdm
COMOPS
Convening Authority

Annex:

A. Recommendations and action.

Enclosure:

1. Board of Inquiry Report.

Distribution:

Action:

FOST
Navy Cmd HQ for Fleet Nav and FLEET WEO SM

Information (without Enclosure):

CINC
DCINC
Command Secretary

520/4

7 Jul 08

BOARD OF INQUIRY REPORT INTO THE CIRCUMSTANCES SURROUNDING THE GROUNDING OF HMS SUPERB ON 26 MAY 2008

Reference:

Captain Faslane Flotilla's 5200/294 dated 5 Jun 08 (Flotilla Investigation).

Introduction

1. HMS SUPERB under the command of xxxxxxxxxxxxxxxxx sailed from the UK on 6 May 08[1] for an operational deployment East of Suez. All mandated unit training[2] had been successfully completed and the submarine was in a sound material state to undertake this deployment.

2. Having transited the Suez Canal on 25 May 08, whilst on passage in the Red Sea, the submarine grounded on a charted shoal whilst operating at a depth of xxxxx; there were no serious injuries attributable to this incident. The Flotilla and Ship's Investigation into the incident can be found at the Reference.

Narrative

3. **Passage Planning.** On the 20 May 08 SUPERB received SUBNOTE 032/08[3], whilst on passage from Gibraltar to Messina[4], requiring an xxxxx transit of the Red Sea.

4. Outline planning for this transit consisted of the Casing Officer (CASO), xxxxxxxxxxxx drawing up the dived chart as a training evolution, supervised by the Navigating Officer (NO), xxxxxxx xxxxx whilst crossing the Mediterranean. These charts were subsequently checked and signed for by the CASO and the Tactical Systems Officer (TSO), xxxxxxxxxxxx just prior to/during the Suez transit (25 May).

5. The navigational plan was subsequently checked and signed for by the Commanding Officer (CO) on the morning of 26 May 08, an hour and 25 minutes before the submarine dived[5]. He conducted this check by running a clear plastic ruler along the navigation track to scrutinise the allocated moving haven (MHN) for hazards. xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

6. Significantly, whilst aware that xxx bottom contour charts (BC) were available, having been advised by the NO that the British Admiralty (BA) surface charts were of a better scale and, based on previous experience, the decision was made to use the standard BA charts for the transit. No

[1] Enclosure1 - HMS SUPERB's LGA 140905Z JUN 08 (Summary of programme achieved).
[2] Force Generation Plan 83/07.
[3] CTF311 LGQ 200125Z MAY 08 (Subnote 32/08).
[4] Not alongside as reported in Flotilla Investigation, (Ref B).
[5] Whilst several statements place the event approximately 2 hours before diving the Board concluded that as the O Group took place at xxxx and information from this briefing was used in deciding the transit depth this event could only have taken place approximately an hour before diving at xxxx.
[6] Annex C – CO-21.

further reference or scrutiny of either the xxx BC chart, nor the UK Hydrographic Office (UKHO) produced variant of BA 159, xxxxxxxxxxxxxxxxxxxxxxxxxx, was made.

7. **Conduct.** Having exited the Gulf of Suez on the morning of the 26 May the boat dived at the northern end of the Red Sea, in accordance with its SUBNOTE, at xxxxxx The Tactical and Sonar Officer (TASO), xxxxxxxxxxxxxx conducted this evolution taking Charge[7] of the submarine at xxxxxx when he brought the OOW below. An overview of SUPERB's navigational plan is shown in Figure 1.

8. Once post diving checks were reported complete and correct at periscope depth (PD), the boat proceeded to xxxxxxxxxxxx. At xxxxx the submarine continued down to xxxxxx the selected depth for the dived transit.

9. xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxx This limited the submarine's maximum speed to no more than xxxxx and meant that achieving the required xxxx SOA was going to be difficult xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

10. At approximately xxxxxxx a 'close quarters drill'[11] was called, during which the navigation plot was formally handed to the Logistics Officer (LO), xxxxxxxxxxxx from the Charge Books Officer (CBO), xxxxxxxxxxx, who then set up and manned the Local Operations Plot (LOP). As it was assessed that the contact had already passed its closest point of approach (CPA) SUPERB did not manoeuvre.

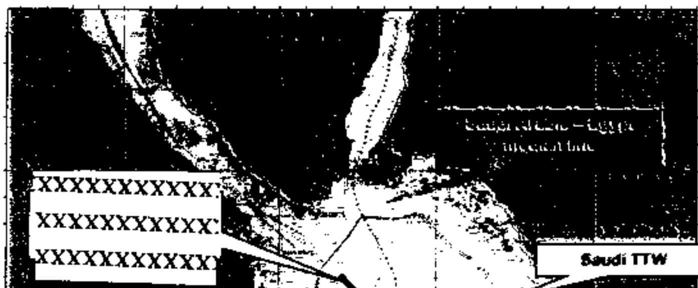

Figure 1 – Overview of HMS SUPERB's navigational plan.

11. At xxxxxx in order to assist with the SOA, TASO instructed the LO to shape the course to starboard, cutting the corner of the planned navtrack, iot reduce the distance to run, whilst at the

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[7] QRRN 0803 - 1. The safe conduct of the ship at sea is vested by the Commanding Officer in the Officer of the Watch, who alone can have 'charge of the ship'.

[8] Annex C – TASO-2 Statement xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxx xxxxxxxxxxx

[9] Enclosure 2 –Control Room Fixing Log.

[10] Annex C – LO - 3 'Approximately one hour later, at XXX the submarine went to close quarters…'.

[11] A close quarters drill, is a standing operating procedure, called in response to a surface contact, detected on sonar, which is going to pass close to, or over, the submarine. xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxx

same time allowing sufficient sea room xxxxxxxxxxxxxxxxxxxxxxxxx to manoeuvre within the MHN if required. The LO then plotted a course of xxxxxxx after the alteration, which was then cursorily checked by TASO[12]; this course ran directly over the xxxx shoal.

12. At this juncture, the on watch personnel, filling the key positions were as follows:

- Watch Leader, xxxxxxxxxxxxxxxx TASO (Charge).
- Plot Officer, xxxxxxxxxxxx LO [13].
- Ship Control OOW, xxxxxxxxxxxxxxx Coxn.

13. The other on watch Control Room officers, the NO and CBO, were both stood down. CBO was in the Wardroom studying for his Tactical Weapons Systems (TWS) Board and the NO was finalising that day's Sea Orders.

14. Navigationally the submarine's position was being plotted by the LO generating a dead reckoned (DR) and estimated position (EP) derived from NATO SINS A (NSINS) at 15 minute intervals, out to one hour ahead.

15. The CO transited the control room at approximately xxxxxx enroute to lunch in the Wardroom and glanced at the chart[14] noting that the plotted position, DR and EP, were within the MHN.

16. At xxxxxx the LO plotted the NSINS A latitude and longitude[15] and generated a further hours DR and EP, at 15 minute intervals and, 4 minutes later xxxxxxxx commenced his handover of the plot to the Torpedo Officer (TO), xxxxxxxxxxx

17. At xxxxx also in the control room, the NO commenced his handover to the CASO who was acting as the first watch Navigation Officer in the absence of the Signal Communications Officer (SCO) xxxxxxxxxxxx They did not sight the chart, nor did they subsequently inspect it as the concurrent plot handover between the LO and TO had become protracted[17]. On completion, the NO proceeded forward to the Ship's Office to make some minor amendments to Sea Orders. During this period the CO passed through the Control Room returning to his cabin from the Wardroom and noted that the handovers were taking place[18].

18. From post event examination of the 778 echo sounder trace, compared with timings from xxxxxxxxxxxxxxxxxxxx it appears that the soundings would have begun to rapidly shoal past xxxxx at xxxxxxxxx before the submarine grounded at xxxxxxxx whilst 778 was operating, it was not manned[19].

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[12] Annex C - TASO- 2 '...he (LO) laid that track off on the chart and I had a look at that track to just check that it was inside the MHN ... was where I wanted to go and where we were in the PIM.'

[13] QRRN 2323.5 makes no provision for the delegation of dived navigation below the watch navigator albeit, such delegation is common practice across the submarine flotilla.

[14] Annex C - CO-46,48 & 49 'I did not investigate the chart I glanced and realised where the 'spot' (SNAPS spot indicating the submarine's position) was. It was not somewhere where I was not expecting it'.

[15] Enclosure 3 (Copy of navigational Chart) BA159- Although the NSINS latitude and longitude were not routinely recorded in the Fixing Log.

[16] xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

[17] Annex C – LO-15, '...on reflection it was/ is probably inappropriate to have done a handover and a ship control debrief at the same time clearly at a busy time of watch handover'.

[18] Annex C: CO-84 "I went straight through the control room in the middle of the watch handover...I can't remember if I stopped to speak to anybody, but the handovers were going on ...I went straight back to my cabin'.

[19] Enclosure 6 - 'Sound Room Orders', provide comprehensive guidance wrt echo sounder manning when operating on the surface, but are far less specific when dived. That said, whilst it has no direct bearing on the incident, the trace had not been annotated iaw these instructions (4 figure time group every 6 minutes/fix), which would have allowed precise post-event reconstruction of events to take place.

19. **Grounding**. Post incident reconstruction of the chart by the Board indicates that the submarine grounded in position, xxxxxxxxxxxxxxxxxxxxxxxxx in the vicinity of a charted xxxxxx shoal, in international waters. A representative timeline of the events leading up to the grounding and re-construction of the chart are shown at Figures 2 and 3 respectively.

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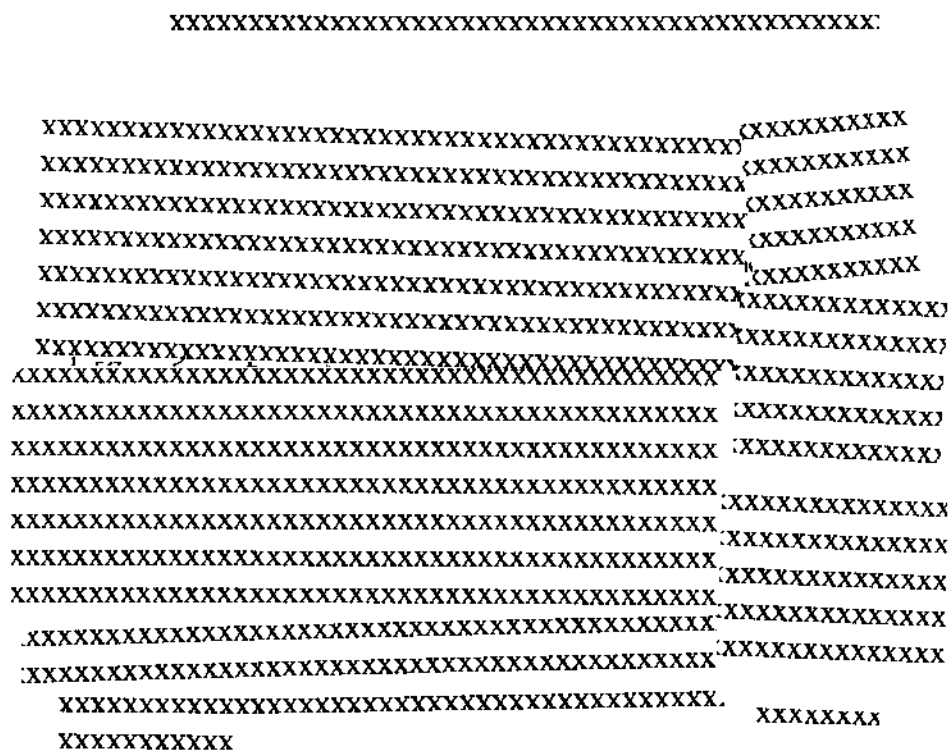
20. Post event analysis by the Board indicates that despite its daunting profile on the 778 trace the bottom was in fact shelving at approximately 20 degrees when the submarine struck the xxxxxx contour associated with the North West side of the xxxxxxxxx. Furthermore, evidence suggests that on grounding the bow was pushed initially to starboard and then to port which is consistent with the topography displayed on the chart and the more pronounced damage to the starboard bow.[20]

21. **Actions Post Grounding.** At this point the Coxswain (Coxn), xxxxxxxxxxx at the conclusion of his own handover to Deputy Weapons Engineering Officer (DWEO), xxxxxxxxxxxx reported that the submarine experienced 2 severe 'jolts' followed, after a short pause, by 2 more. Witnesses also report that the boat's log speed temporarily reduced to approximately xxxx The Coxn then took the submarine to emergency stations in response to a loud bang external to the submarine.

[20] Enclosure 7 – 2074 Broadband Trace. In its analysis of the grounding the Board concluded that, consistent with the greatest damage, the impact would have caused the bow to initially swing to starboard, before paying off to port as the submarine cleared the feature. This is consistent with the 2074 Broadband trace.



22. The Petty Officer Medical Assistant (POMA), who was supervising the trainee planesman, reported that he ordered to set 'full rise' on the planes and the watch leader, TASO, ordered 'full ahead'. Thereafter, those present state that the submarine's depth initially remained static at , for what seemed like a prolonged period (in reality probably only seconds), before a bow up angle was achieved and the boat began to rise. As this angle increased, a flood alarm aft caused the Coxn to implement EOP 13.1 (Flooding Dived). The transcripts indicate that the maximum pitch angle achieved was in the region of and, in the Coxn and TASO's opinion, was the cause of this float flood alarm[21]. Ship Control carried out the additional actions demanded of the Flood EOP 13.1, and specifically, ordered the blowing of main ballast tanks in normal and emergency by the Ship Control Console (SCC) operator.

23. During this process the CO arrived in the Control Room from his cabin and positioned himself behind Ship Control. The SCC operator stopped blowing at to institute the blow by the CO. As the submarine headed towards the surface, the CO established that the sound room had no contacts ahead and ordered the planesman to reduce the angle He also ordered the SCC operator to stop blowing at as a good ascent rate had been achieved. On surfacing, he went to the chart and, after the Garmin GPS fix had been plotted in position was heard to say 'I am sure it said whilst looking at the shoal; indicating that he had misidentified the charted sounding, earlier that morning, when he approved the dived passage plan.

24. Post incident, the EOOW and Marine Engineering Officer assessed the state of the reactor and confirmed that everything appeared normal. A secondary shield survey and core integrity check confirmed that the reactor plant had suffered no damage. Although no reference to this activity can be found in the Engineering OOW log, this report could be heard on

[21] High levels of bilge water in the engine room bilges are likely to have triggered the float flood alarm.

[22] 1600psi of air remained in the bottle groups at this point.

[23] Annex C CO-41 '...I can only summarise that I had seen it as a and at the time thought was what I had read' 261007Z 'I thought it said and later at 'I thought that was a

Discussion

25. In coming to its conclusions and recommendations and in order to answer the questions posed at Reference A, the Board has chosen to analyse the incident in 4 sections; preparations, planning, execution and actions after grounding.

Preparations

26. **Pre-deployment Briefings**. Prior to deployment, SUPERB's Command Team received a series of pre-deployment briefings. The first of these was the Intermediate Deployment Planning Meeting, chaired by Fleet 'Generate and Employ' at Northwood, on 21 Nov 07, which not only reviewed SUPERB's forthcoming deployment, but also included a 'wash up' of the lessons learnt during XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX Thereafter, the Main Deployment Brief took place on 22 Jan 08 at the Old War Office Building in London.

27. Using this information and the Submarine Deployment Manual (FPN 60) as a guide, SUPERB's Command Team produced an Action Grid[25] and Deployment Risk Register[26] for the deployment; standard practice for submarine deployments. Focused at the operational level, this comprehensive pre-deployment briefing package did not concentrate on either navigational or charting issues. However, the Board note that the Action Grid did task the NO to call on the Fleet Submarine Navigator and visit 'HYDROUK Taunton (MS6 Folio)'[27]; neither visit took place[28]. In the case of the latter the CO reports that post a phone call, the NO was advised that, as he had visited the UKHO within the year, a further visit was not required. The UKHO have no recollection of such a call. Nevertheless, had the NO conducted such a visit to the UKHO, in the Boards opinion, it is likely that he would have been aware of the full range of dived navigational products available for this area.

28. **Individual Training**. A summary of SUPERB's Warfare Officers qualifications and experience is at Annex A. In sum, all Warfare Officers involved in this incident were found to be STCW compliant. In addition, the LO, who was acting as Plot Officer in the lead up to the incident, had completed the required courses. Thus, in the opinion of the Board, the on watch team were sufficiently experienced to fulfil the roles and duties with which they had been tasked.

29. **Team/Unit Training**. The unit/team training process had begun last year with Submarine Safety Training Continuation (SSTC) 4-7Jul 07 and Directed Continuation Training (DCT) that followed 11-23 Jul 07, were both completed to a satisfactory standard.[29] This was followed by summer leave and a varied programme of operations and trials in UK waters, prior to a short deployment to the Mediterranean 27 Sep-8 Nov 07.

30. Post a pre-deployment maintenance period, Support Period (SP) 2, the submarine completed a further phase of Directed Capability Training (DCT) 21-23 Mar 08 achieving a 'satisfactory standard'.[30] This was followed by a final Fleet Operational Assurance visit conducted by XXXXXXXXX (Fleet DACOS UWB), 5-6 May, which concluded that the submarine was 'ready for deployment ...'.[31] **In the opinion of the Board SUPERB's preparations package was a**

[25] Enclosure 8 – HMS SUPERB Temporary Memorandum 84/07 dated 10 Dec 07 (Deployment Planning).
[26] Enclosure 9 – HMS SUPERB Deployment Risk Register.
[27] 'Marine Science Branch 6' became 'Submarine Operational Support' some time ago.
[28] Annex C- CO-91 Co reports that NO did phone Taunton, but as he had been there within the last year agreed that a specific pre-deployment visit was not required.
[29] FOST LGH/LGQ 240910Z JUL 07 (DCT Completion signal).
[30] Enclosure 10 -HMS SUPERB LGB/LGQ 290909Z APR 08 (HMS SUPERB DCT).
[31] Enclosure 11 - HMS SUPERB ADA/LGQ 060943Z MAY 08 (HMS SUPERB Operational Assurance Visit).

thorough and comprehensive process that saw the submarine successfully complete all mandated training and inspections prior to deployment.

Planning

31. **Navigation Planning** As described in the narrative, Subnote 032/08 was received by SUPERB on 20 May 08 and thereafter the charts appear to have been correctly prepared and inspected by CASO, NO and TSO. xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx . Once this was complete and, the minor shortfalls identified by the TSO rectified, the charts were signed by CASO and TSO, but not the NO, as detailed in Swiftsure Class Ship's Standing Orders (SCSSO)[34]. **Thus, at this stage, construction of the chart only ensured submarine safety provided it transited at safe depth.**

32. **Subnote Promulgation**. Comment was made in the Flotilla Investigation that CTF311 should vet SUBNOTES prior to transmission in order to ensure the navtrack avoids obvious navigational hazards. Given that the MHN, is designed to de-conflict sub-surface movements, it is invariably large enough (in this case 2000 square nm) and whilst on the one hand it will almost inevitably include areas that may be dangerous at certain depths, on the other it allows significant freedom of manoeuvre to the submarine. Therefore, the Board does not support this recommendation; the responsibility for navigational safety must remain solely with the Command.

33. **BR 45(4) Guidance & Training.** During the course of the Inquiry the Board have established that the focus of all dived navigation training is iaw the standard BR45(4) preparation described above. However, the BR does not reflect the common practice when operating below safe depth, of allowing xxxxxxxxxxxxxxxx (whichever is the greater) to provide a suitable bottom vertical safety separation (BVSS). Additionally, instructional specifications from the SM(n) and Submarine School powerpoint[35] were found to be equally lacking. That said, whilst acknowledging these shortfalls, in the opinion of the Board, had the shoal been sighted by any of the on watch personnel it would have been suitably marked by a no go line. Notwithstanding, these shortcomings in the documentation and training should be rectified.

34. **Checking of the Charts**. From interview, the Board concluded that the final check by the CO, was conducted on the day of the incident, approximately an hour and 25 minutes before the submarine dived and only 4 ½ hours before the incident. Furthermore, it is assessed that it was only when the NO briefed the CO on this leg of the passage that the transit depth of xxxxx was declared. This decision required a further limiting danger line to be drawn in addition to those required by BR45(4) and previously checked by CASO and TSO. Thus, although both NO and the CO state that they then thoroughly checked the navigation track and MHN, the xxxxx shoal, on which the submarine subsequently grounded, was not sighted. In the opinion of the Board, had a further limiting danger line, in addition to those prescribed in BR45(4), for the submarine's max depth + BVSS been drawn as part of the planning process, then it would have highlighted to the Command areas where depth of operation would become a consideration. If Fleet Nav support this initiative then this additional dived limiting danger lines should be incorporated into BR45(4) 0433 and current teaching.

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[32] BR45(4)-0433 Table 4.1 – Recommended Charted and Safe Depth Lines.
[33] The MHN is method by which submarine movements are de-conflicted. It is a sizable moving area centred on the promulgated navtrack, within which the submarine has complete freedom to manoeuvre as required.
[34] Swiftsure Class Ship's Standing Orders 1305.8 – 'Charts used for dived navigation are to be drawn up and checked by the NO. It is then to be further checked by a watch leader and finally authorised for dived navigation by either the CO or the XO. All 3 are to sign to say that they have done so. No chart is to be used for dived navigation unless so checked and authorised'.
[35] Enclosure 12 – RNSMS PPT for Basic Warfare Course. There appears to be no ISPEC for the navigational aspects of the submarine Basic Warfare Course.

[redacted]

35. The Board were struck that, despite early promulgation of the SUBNOTE and preparation by the team, the Command was content to accept a late briefing of this passage plan. As a result, the decision to transit at [redacted] was only made immediately prior to diving, which in turn resulted in only the CO and the on watch team, TASO, NO, CBO and LO, having the opportunity to scrutinise the chart; in addition to conducting their on watch duties. In the opinion of the Board, the lack of time between the Command decision to transit at [redacted] and the execution of the plan contributed to the failure of the team to spot the [redacted] shoal.

36. **Selection of Chart** [redacted]. The identification of the [redacted] shoal was made more difficult by the choice of chart used for planning and execution of the dived transit. In particular, had the [redacted] BC chart, [redacted], which was held onboard, been referred to by the Command (who was aware of its existence) or the NO, rather than being discarded due to its inferior scale to BA 159[37], it is unlikely that the hazard would have been missed. Extracts of both charts are shown below in Figures 4 and 5 and the [redacted] shoal can be clearly seen on the [redacted] chart in blue and surrounded by bottom contours,

[redacted]

37. In addition, the UKHO had produced special classified editions of the Red Sea charts BA 157, 158 and 159, [redacted]. Regrettably, updated copies of these charts had not been supplied to HMS SUPERB for this deployment. That said, whilst at Soudha, old editions of these classified charts were discovered onboard,[38] and had they also been consulted during the planning process, it is even more unlikely that the [redacted] shoal would have been missed. Investigation by the Board revealed that these charts are only provided to units on request. It is therefore strongly recommended that, in the future, they should be supplied automatically to all submarines deploying East of Suez, [redacted]

[redacted]

[37] Chart Scales - BA 159 1:750,000 (1 deg latitude = 6.1 inches) [redacted]

[38] Believed to have been issued for a previous deployment by SUPERB.

[redacted]

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38. Current teaching to both the Submarine Navigation course (SM(n)) and Intermediate Warfare Course advise that iaw BR45(4)[39] that standard charts can be used provided, the charts are drawn up correctly; have been compared to the BC chart and that the Source Data diagram has been consulted. Nevertheless both the course material and the BR should emphasise the guidance that in planning dived operations all available data must be considered, regardless of the chart that is ultimately used for navigation.

39. A further factor is the scale of the charts in use. In the opinion of the board neither xxxxxxx xxxxxxxxx products are at an adequate scale for conducting a dived transit of the Red Sea.

40. **In sum, whilst on the face of it the xxxxx shoal, as displayed on BA159, appears inconspicuous and easy to overlook, as indeed it was by 6 personnel onboard[40], had any of the BC charts been referred to in either the planning or execution phase of this passage then it is likely that the hazard would have been correctly identified and avoided. Furthermore, the provision of UKHO 1:250,000 scale bottom contour charts, should also be investigated to support future dived operations.**

41. **Employment of the Warship Electronic Chart Display Information System (WECDIS) Remote Planning Tool (RPT).** The WECDIS RPT laptop computer was embarked in Aug 2007 as part of a minor trial.[41] The aim of the trial was to allow submariners to gain experience operating this system, prior to the full WECDIS fit to all submarine platforms. Two members of SUPERB's warfare team had completed the WECDIS course prior to deployment, CASO and TO, and CASO, because of a natural affinity with IT equipment, had become the defacto expert onboard.

42. Used primarily as a navigational aid to improve unit safety whilst surfaced, taking a positional feed from the Garmin GPS, with no interface to NSINS, WECDIS RPT was perceived to have limited utility whilst dived. Onboard trials, post the incident, instigated by the CASO, revealed that the RPT could have been used to scan the planned navigational track for dangers during the planning phase. Figure 7, on the left, shows that when tasked to draw a 'No Go' line at xxxxx it immediately highlighted the xxxxx shoal. Regrettably, the Command Team, unaware of RPT's potential, did not exploit this capability. Furthermore, had this equipment been interfaced to NSINS

[39] BR 45(4). 0435.b. states 'Whether the 'Standard' Admiralty chart or the classified *BC* chart (if available) is used will depend on the circumstances. Some *BC* charts are sparse on depth information inside the 20m or 40m line (dependent on the chart) and do not show all of the coastal topography and fixing marks. Examination of the source data diagrams will determine whether the *BC* chart is good to the 20m or 40m contours.

[40] Those who inspected the chart post the decision to transit at xxxx were CO, NO, LO, TASO, CBO and possibly TO at the handover which was concurrent with the grounding.

[41] Enclosure 13 - D/DFLEET-N3/442/1/2007 dated 20 Aug 07 – Minor trial MTW 20/07 (Warship Electronic Chart and Display Information System) – Allocation to the SM Flotilla.

it would have been available when dived and would have alarmed automatically as soon as the hazard entered the system's anti-grounding cone.

[redacted]

43. **In the opinion of the Board, all submarine Command Teams should be made aware of the WECDIS RPT's nascent capability in its current minor trial[42] configuration. Thereafter, every effort should be made to develop some form of interface to NSINS to allow its capabilities to be exploited whilst dived and its status as a minor trial should be reviewed. The Board note that this recommendation was also made in a previous Board of Inquiry Report into a submarine grounding but acknowledge that the system is now beginning to enter service in submarines.[43]**

Execution

44. **Division of Responsibilities**. In the case of this incident the key responsibilities were held as follows:

a. **Command/Conduct**. Conduct remained with the CO throughout.

b. **Charge**. Having come on watch at approximately XXXXX that day, XXXXXXXXXX, the TASO and most experienced Watch Leader onboard, assumed duty as OOW[44] and took Charge[45] of the submarine when the boat dived at XXXXX that morning. He retained this responsibility until SUPERB grounded.[46]

c. **Plot Officer**. At the start of the watch, whilst on the surface, SUPERB's navigational plot was being manned by a Petty Officer of the Watch (POOW); just prior to diving, the watch navigator, in this case the NO, took over. Once dived and steady on depth, CBO assumed the role of Plot Officer, before in turn handing the duty over to the LO at

[42] Minor trial equipment is unsupported and intended for limited duration use. Full support is only achieved when equipment is accepted into service as a class modification or alteration and addition (A&A).
[43] Enclosure 14 - HMS MONTROSE 520/1 dated 12 Nov 2002 (BOI into the grounding of HMS TRAFALGAR on Fladda-Chuain on 6 Nov 02, para 34.
[44] QRRN 2321-2323 (The Officer of the Watch (Dived)).
[45] QRRN 0809.b. –'the authority delegated by the Commanding Officer or the officer to whom command or conduct have been delegated, to the Officer of the Watch for the safety of the ship at sea. This is further expanded in QRRN Chapter 30.
[46] QRRN 2323.5 – 'the OOW retains navigational responsibility for the vessel at all times...'

approximately xxxxx, who retained this responsibility until the grounding[47]. That said, whilst the NO and CBO were fully Bridge Warfare Qualified Warfare Officers the LO was not and had only received a limited amount of basic navigational training prior to taking up his appointment. Thus in the same manner as a second OOW on the surface, the LO should have warranted greater supervision by both the watch navigator (NO) and the Watch Leader (TASO), to ensure his chart work was correct.

45. **Decision to 'Cut the Corner'**. Post the close quarters drill, conscious of the need to maintain the xxxx SOA, TASO then ordered the Plot Officer, the LO, to chart a course to cut the corner whilst remaining within the MHN. Once the submarine had altered course the LO laid off the new navtrack which passed directly over the xxxxxshoal[48]. TASO stated that he cursorily[49] inspected the new track, but again he and the LO failed to note the hazard.

46. **Informing the CO**. Despite being required by SCSSOs [50] to inform the Captain 'if more than one mile off track'; it was common practice in SUPERB that the submarine could be manoeuvred as required within the MHN by the Watch Leader without recourse to the Command. Furthermore, the CO stated that he 'glanced at the chart'[51] enroute to lunch in the Wardroom at xxxxx and noted that the DR and EP placed the submarine within the MHN and must therefore have been aware that the alteration to xxx had taken place.

47. **Records**. So far as practicable all available records were examined by the Board and whilst it is assessed that an accurate reconstruction of the incident was possible, there were nevertheless a number of shortcomings. In particular, without NSINS fix data recorded in the Control Room Fixing Log it has proved impossible to use NSINS data as part of the reconstruction of the navigational track. In the Board's opinion the instructions in the front of the Control Room Fixing Log require revision to ensure, when dived, that the SINS position is recorded whenever it is plotted on the chart as an EP to enable reconstruction. It is also proposed that positions from NSINS A&B are recorded for comparison at least hourly[52].

48. xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx of limited value; the quality of data held was marginal, impossible to copy and could only be listened to onboard SUPERB[53]. In the opinion of the Board provision of a commercial off the shelf Voyage Data Recorder would represent a sensible investment for post event re-construction, particularly for a more serious incident such as SUBSUNK.

49. **Sea Orders**. CO's sea orders, in the standard submarine fashion, were loose leaf and produced on computer[54]. The original copy for the 26 May was lost during the grounding as the NO went forward to make a minor amendment in the ship's office. That said, apocryphally the CO's intentions note that '[shallow water patches of the Red Sea]...will provide us with no warning of danger and will require the highest accuracy and concentration from the right hand side'. The Board also noted that the Sea Order File did not contain an extract from SCSSOs of the occasions for calling the CO and NO and some pages from historic copies of the Sea Orders were missing although unsigned soft copies exist.

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[47] Enclosure 2 - None of the handovers between Plot Officers were recorded in the Fixing Log.
[48] Annex C, LO-5: '...As we came around I plotted theXXXtrack...' and later in response to 'Did you spot the XXX patch?', LO-6 'No, Sir'. Then 'Did TASO inspect the chart?' LO-8: ' Yes sir, at the time of the alteration, after I had laid on the new track.'
[49] Annex C ,TASO-2.
[50] SCSSO (Issue 2) -0107.8.b.(1).e– Informing the Captain.
[51] Annex C, CO- 47 'I looked at the chart whilst going for lunch...' CO-48 ' prior to luch, about xxxxx.
[52] Having compared SUPERB's Fixing Log to that of another submarine it was clearly below par.
[53] Having examined the recording in some detail only certain microphones were audible and it was only possible to listen to the various channels in SUPERB.
[54] Enclosure 15 – HMS SUPERB's Sea Orders dated 25/26 May 08.

50. **Watch Handover**. With no guidance within SCSSOs, it had been the practice in SUPERB for the watch handover routine to be specified for each leg of the deployment in a temporary memorandum issued by the Operations Officer (TSO). No such instruction had been issued for this passage. As a result, it appears that a number of key areas, SCOOW, Watch Navigators (who conducted their handover without sight of the chart) and Plot Officer, in particular, were being handed over concurrently at the time of the grounding. It is strongly recommended that Fleet wide submarine guidance is issued to cover this area. This should include the requirement for the Plot Officer/OOW to place a fix, or update the DR and EP on the chart, to confirm that the chart is correctly registered to SNAPS, on taking over the duty; they should then sign the Control Room Fixing Log.

51. **The evidence suggests that, when it came to the execution of the passage, TASO was informed by the NO of the plan to conduct the dived transit at a depth of xxxxx post the briefing of the CO, approximately one hour before the boat dived. Thereafter, he took the opportunity to scrutinise the navtrack for his watch but, like those before him, neither he nor his team identified the xxxxx shoal as a hazard within the MHN. Furthermore, the Command was not informed (iaw SCSSOs) of the decision to amend the navtrack that took SUPERB over the xxxxx shoal.**

52. **Equipment.** Despite problems prior to diving, NSINS A and B were operating within the designated accuracy limits xxxxxxxxxxxxxxxxxxxxx This was proven by comparing each unit's positional data to the GPS fix taken on surfacing. xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

53. The Flotilla Investigation, Reference B, recommended that an alarm should be fitted to submarine echo sounders and, whilst this recommendation is supported, in this instance had the alarm been set at say xxxxxxxxx the keel, from the 778 trace[55], it would have given insufficient warning of the impending grounding. Indeed, even if set at xxxxxxxxxx the keel it would have given less than one minute's warning. HMS SUPERB's navigational equipment was accurate, functioning correctly and in date for calibration and maintenance at the time of the incident, further details are at Annex B[56]. **There were no equipment issues that affected the outcome.**

Actions After Grounding

54. The board had no concerns with actions taken after grounding. POMA xxxxxx and the Coxn, xxxxxxxxx deserve recognition for their performance.

55. Additionally the Board note that despite the submarine service experiencing more than one grounding 'at depth' in the last decade, there is no emergency operating procedure (EOP) specifically for this scenario. At interview, all personnel state that the SCOOW used EOP 55.2 (Loud Bang External to the Submarine), which on its own doesn't exist; the term appears half way through EOP 55.2[57] which is more correctly entitled 'Collision Dived' and is an EOP to cover a potential collision while the submarine is operating at periscope depth. That the Coxn was able to do the right thing without recourse to more than momentary thought is a significant achievement. **The Board agree that a suitable EOP for a dived collision, below safe depth, needs to be created and incorporated into formal training as a matter of urgency.**

Conclusion

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[55] Enclosure 16 – 778 Trace.
[56] Enclosure 17-WE BOI requirement report.
[57] Enclosure 18 – Swiftsure Class SOPs

56. The Board concluded that HMS SUPERB grounded on a charted feature, in position xx xxxxxxxxxxxxxxxxxxxxxxx principally because a xxxxx shoal, on the chart in use, was missed. Significantly, a number of factors contributed: the late decision to transit at xxxxx, the failure to consult all available multi source data[58] to assess potential hazards within the MHN, and to check the chart when laying off the new track (paragraph 45). Furthermore:

a. There were 6 individuals who were involved in either the production of the dived chart for the xxxxx transit, or the subsequent conduct of the dived navigation thereon, all of whom could have spotted the xxxxx shoal. Of those 6, three were required by regulation to keep the submarine safe from navigational hazard. (paragraph 44).

(1) The NO, also Watch Navigator, until just prior to the grounding, had denied himself the use of the xxx Bottom Contour chart by focusing exclusively on the better scale of British Admiralty chart with no regard for the clarity of data displayed on the former. This led to the xxxxx shoal being difficult to identify and thus it was missed and wasn't hatched as a 'No Go' area within the moving haven, as it should have been (paragraphs 6 & 36).

(2) The evidence suggests that the Watch Leader's total reliance on the Plot Officer's control of navigating the submarine dived, without recourse to anything more than cursory oversight, was contrary to QRRN 2323.5 (paragraph 45).

(3) By his acceptance of a late brief, the Command unduly constrained its ability to scrutinise a vast amount of data on the dived chart; additionally, the relatively late decision to conduct the transit at a depth of xxxxx meant that any additional limiting danger lines were left to the on-watch team to construct. With the ultimate responsibility for submarine safety, the evidence is compelling that sufficient checks and balances were not present in the Command's onboard processes to prevent an incident of this nature occurring (paragraph 35).

b. Whilst it is assessed that an accurate reconstruction of the incident was possible, there were nevertheless a number of shortcomings with the compilation of the submarine's routine records (paragraphs 47 & 48).

c. The concurrent watch handovers restricted close scrutiny of the chart, just prior to the grounding, by members of the on coming watch which might, with a fresh set of eyes, have identified the hazard posed by the xxxxx shoal. (paragraph 50).

57. It was further concluded that:

a. All officers involved in this incident were found to be STCW compliant. In addition, the on watch team were sufficiently experienced to fulfil the roles and duties with which they had been tasked (paragraph 28).

b. The submarine had successfully completed all mandated training and inspections prior to deployment and the navigational equipment in use was accurate, functioning correctly and in date for calibration and maintenance, at the time of the incident (paragraph 30).

c. The Board had no concerns with actions taken after the grounding (paragraph 54).

[58] This includes both paper and electronic charting.

Recommendations

58. The principle recommendations of the Board are that:

a. COM(OPS) should signal all submarines highlighting the generic lessons identified from this incident. This signal has now been sent[59].

b. **Equipment:**

(1) Fleet WEO SM to investigate the formal transfer of the WECDIS RPT Laptop from a minor trial to acceptance into service as either a class modification (S, T and V) or alteration and addition (A&A) (paragraph 43).

(2) Fleet WEO SM to actively pursue connectivity of the WECDIS RPT to NSINS (paragraph 43).

(3) Fleet WEO SM to investigate feasibility of adding a depth alarm facility to all in service submarine echo sounders (paragraph 53).

(4) Fleet Nav to alert all submarine COs of the nascent capability of the WECDIS RPT laptop and develop the necessary standard operating procedures (SOPs) for its use in support of navigational safety, both surfaced and dived (paragraph 43).

(5) Fleet Nav should investigate the provision of a commercial off the shelf Voyage Data Recorder would represent a sensible investment for post event re-construction, particularly for a serious incident (SUBSUNK) (paragraph 48).

c. **Training:**

(1) Fleet Nav and FOST (Shore) to conduct a thorough review of all relevant SM courses to ensure that all aspects of dived navigation, planning preparation and execution, highlighted by this incident are adequately taught in FNO and the Basic and Intermediate Warfare Course (paragraph 33).

(2) FOST (DN) to develop an Emergency Operating Procedure for a collision at depth (paragraph 55).

(3) FOST (DN) to ensure that their training guarantees commonality in the execution of all navigational operations, in particular management of the plot and its associated records (paragraphs 44 & 47).

d. **Support**

(1) Fleet Nav to ensure that BR 45 is updated to reflect operating below MSD and to review and enhance the guidance contained therein. In particular, the proposal to include a further limiting danger line, in addition to those prescribed in

[59] Enclosure 19-CTF311 ADA/LGQ 231701Z JUN (Superb BOI).

BR45(4), for the submarine's max depth + BVSS be considered (paragraphs 34, 38 & 40).

(2) Fleet Nav to thoroughly review mechanism by which specialist products, compiled by UKHO SoS for dived navigation, are automatically supplied to all submarines. (paragraph 37).

(3) Fleet Nav and UKHO SoS to investigate the provision of 1:250,000 scale BC charts for this region (Red Sea) capable of being used for navigation (paragraph 39).

(4) Fleet Nav & Flotillas to ensure that submarine class standing orders are amended to include clear watch hand over routines. In addition, these orders are to include a robust routine for the hand over of the navigation plot (paragraph 50).

(5) FLEET Nav/FOST DN to issue guidance to the submarines to ensure that the Sea Order Book receives the attention that it deserves (paragraph 49).

(6) Fleet Nav are to mandate all submarine Navigation Officers to visit UKHO as part of the preparations for any deployment in accordance with FPN 60 (paragraph 27).

Annexes:

A. Summary of HMS SUPERB's Warfare Officers Qualifications and Experience.
B. Summary of Navigational Equipment Accuracy and Serviceability.
C. List of Witnesses and Interview Transcripts.

Enclosures:

[redacted]

Annex A to
CDF 520/4
Dated 7 Jul 08

SUMMARY OF HMS SUPERB'S WARFARE OFFICERS QUALIFICATIONS AND EXPERIENCE

[redacted]

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Annex B to
CDF 520/4
Dated 7 Jul 08

SUMMARY OF NAVIGATIONAL EQUIPMENT ACCURACY AND SERVICEABILITY

Equipment	Mode of Operation at Time of Incident	Last Accuracy Check	PMS Completed: (SP1 - Dec 06 - Feb 07) (SP2 - Nov 07 – Mar 08)(PMS Cycle 25)
AGILOG	Probe P1; Cal Curve C1	16 Apr 08 Measured Mile	SP2
778 E/S	Operating Continuously	780 comparison as per Pre-Seas 17 May 08 – Gibralter	SP2
NSINS	NSINS A in Navigate	260930C prior to diving.	SP2
SNAPS	IA	N/A	SP2
QYF	N/A	Last fix prior to diving taken 260628Z May 08 showed accy of 9m.	SP2

Annex C to
CDF 520/4
Dated 25 Jun 08

LIST OF PERSONNEL INTERVIEWED FOR BOI & STATEMENTS

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