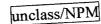
(040)

(544)

D/FOSM/X/5200/25



Flag Officer Submarines

Eastbury Park Northwood **MIDDLESEX** HA6 3HP

MOD: xxxxxxxxxxx BT: XXXXXXXXXXXX 

The President and Members of the Naval Board of Inquiry To Be Convened on 28 November 2000

21 November 2000

### **BOARD OF INQUIRY - INSTRUCTIONS**

#### References:

- QRRN Chapter 57. A.
- **ORRN** Chapter 45. В.
- The Yellow Guide. C.
- You are to assemble at 0830 on 28 November 2000 as a Board of Inquiry whereof 1. (538) circumstances surrounding the grounding of HMS TRIUMPH on 19 November 2000. The necessary recommendations.
- You are to call before you such witnesses as are necessary to enable you to conduct a full 2. inquiry. Recommendations should be put forward, if appropriate, which might prevent similar occurrences in the future. You are directed to investigate in detail all aspects of the submarine's navigation plan and all documents, including charts, that were in use. Your Inquiry should include, but by no means be limited to, a review of the following:
  - Extract of Fixing Log a.
  - Original Chart b.
  - Original Rough Chronological narrative
  - Big Brother Tape d.
  - Little Sister tape e.
  - SNAPS tape f.
  - Ship's Log g.
  - CO's/DCO's Orders

You are to ensure that all relevant matters that come to your attention during the course of your Inquiry are fully covered.

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(838) (640) (644)

- 4. The report of the Board is to be accompanied by minutes of the evidence taken. The questions in the minutes are to be numbered consecutively and the name and rank, rating or title of each witness are to appear at the head of each page of his evidence. The report and minutes are to be signed by the members of the Board and are to be in triplicate.
- 5. Recording/audio typing equipment and typing and secretarial support will be made available by the Captain Second Submarine Squadron to be used at the President's discretion.

24 NOV

Information:

CINCFLEET
Captain Second Submarine Squadron
The Commanding Officer HMS TRIUMPH

CONFIDENTIAL STAFF

unclass/NPM

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SM 520/03

Flag Officer Submarines Eastbury Park NORTHWOOD Middlesex HA6 3HP The Captain (SM)
First Submarine Squadron
Belmore House
HM Naval Base Clyde
HELENSBURGH
Dunbartonshire
G84 8HL

Fax: (XXXXXXXXXXXX

1 December 2000

Sir

#### BOARD OF INQUIRY - GROUNDING OF HMS TRIUMPH ON 19 NOVEMBER 2000

#### References:

- A. QRRN Chapters 8, 19, 23, 45 and 57.
- B. SGM Section 7 (Control Room Watchkeeping Officers)/para 0320 (SMCC Responsibilities).
- C. Guide to the Conduct of Boards of Inquiry (The Yellow Guide).
- D. D/FOSM/X/5200/25 dated 21 November 2000 (BOI Instructions).
- E. FOSM LAL 221130Z NOV 00 (BOI Records).
- F. The Submarine Navigation Manual (SMP 7).
- G. Command Tactical Guidance S&T Class (SMP 407).
- H. Trafalgar Class Ship's Standing Orders.
- I. BR 45(3).
- J. BR 8675(2) (SNAPS Operating Information).
- K. BR 8768(2) (NATO SINS Operator Instructions and Checks).
- L. HMS TRIUMPH LGH/WBF/WBB 211250Z OCT 00 (OPDEF X3/X6 Officers).
- 1. We have the honour to submit the report of our Inquiry into the grounding of HMS TRIUMPH on 19 November 2000.

#### INTRODUCTION

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She therefore sailed again for FOST running with the SMCC embarked on 7 Nov 00. Due to the compound effects of previous programme changes and the impact on her personnel, she landed some 30% of the Ship's Company, who were replaced by Trafalgar Class qualified personnel from other submarines.

1.14, 1.15

### NARRATIVE (ZULU time throughout)

3. On 19 Nov 00, TRIUMPH completed a SUBTACEX with USS TOLEDO in	(538)
the NFXAs and, from 0748, commenced a 22 knot transit towards the North Channel.	(540)
The submarine had last taken a navigational fix at 182332; this was a good GPS fix	(544) 1.19, Encl 6
which indicated that NATO SINS was accurate and which fell within 0.5nm of the	,
SNAPS CP(IC) position. Shortly after completion of the SUBTACEX, at around	
0830, XXX SMCC XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	1.4
CXXXXXXXXXXX Shortly after this, at around 0900, the Duty Commanding Officer	8.8
(DCO), xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	2.12
had changed at around 0700; officers of the oncoming Control Room watch were as	
follows:	

- a. OOW xxxxxxxxxxxxxxxx (newly AWC qualified, but at the time without BSO or TWS qualifications; joined TRIUMPH 16 Oct 00).

1.14

1.14, 4.9

- c. cxxxxxxxxxxxx Warfare Officer Part III trainee (loaned from HMS TURBULENT).
- d. xxxxxxxxxxxxx Supply Officer Part III trainee (stood down for most of the watch).

3.1

(538) (540) (544) 4.32, 4.43 8.9

Encl 2

Encl 2

8.12

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5. At around 0945, the xxxxand OOW discussed the approach to the shelf. Concern regarding the poor weather experienced over the previous few days led them	1.20, 2.14
to consider an approach which was deep and fast for as long as possible. This would	1.20
allow a more manageable SOA following surfacing, once over the shelf, for the inward transit to recover the towed array before proceeding to Faslane for Special (540)	,
Forces dry drills. Realising that this decision should also involve the xxxx the oncoming duty student, xxxxxxxxx was brought into the discussion. As a result of	
this discussion, the previous plan was amended to allow more time deep and fast; this	
altered the position of the depth change to 100m from the 400 fathom to the 300	2.20, 4.70
fathom line. Pencilled annotations on Chart F6817 were amended accordingly and	
previous instructions erased. On completion, both the XXX and XXXXX departed the	2.21, 4.35
Control Room until shortly after the grounding.	2.32
6. Both the xxxx and xxxxx believed their subsequent instructions to the OOW	
years along and had been understood. Whilst they had no reason to doubt navigational	10.15, 2.30
a source of their heliograd that the revised orders allowed ample scone for any	,
The same involved abanging death and slowing down in 1940	
two stages, calling the xxxxx, and running the 780 Echo Sounder continuously from	
some time before reaching the 200m contour. The xxxx also gave verbal instructions	
to take "regular" snap soundings both to check longitude and for training. Periodic	2.35
Orders permitted free use of the echo sounders. The OOW understood that the new	Encl 2
instructions permitted use of the echo sounders for snap soundings, replacing any	
requirement for continuous transmissions. The 200W, meanwhile, believed that	4.68
requirement for continuous transmissions.	( 12

On the chart table, the CP(IC) mode was selected on SNAPS and a manual EP 7. was generated in the DR position. Considerable uncertainty remains over the generation of DR and EP, compounded by confusion onboard over the SNAPS CP(IC) mode; both these aspects are discussed later. At 0953 an alteration to 054 538 was made to range a contact, before paralleling the planned track again. Although no (364(3)) records whatsoever were submitted to support any use of the echo sounders throughout the watch, the 200W, instructing XXXXXXXXX, took three snap soundings (544) on the 778, probably shortly after 1000. Thexxxx on hearing these soundings, rebuked the 200W for transmitting more than once, indicating that this was not good submarine practice. One sounding was achieved, reportedly somewhat shallower than expected. This was not used to update the navigational position and the 200W could not relate the sounding to an exact time. Meanwhile, the OOW remembers that he believed the sounding was inside the 1 nm PQE centred on the CP(IC) position. This sounding was not recorded or reported to the xxxx or xxx

continuous soundings were still required as previously directed and understood that

rather than solely for navigational purposes.

4.115, 6.106

7.50

Encl 1

Encl 4

6.43

Encl 14, 7.43

At about 1030, or shortly thereafter, verbal evidence revealed that the 780 8. echo sounder was run. No sounding was achieved, although heavy reverberations were apparent. It appears very likely that the 780 was on the wrong scale to display the echo trace, either through incorrect application of keel depth, incorrect evaluation of expected depth, or a combination of the two. At around the same time, the leading edge of the POE was apparently approaching the pencilled chart annotation for

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\_ INVESTIGATION **COVERING SECRET** 

order Ship Control to change depth. Neither the xxxxor xxxxx were consulted, nor were they in the Control Room during this period.	4.115	
9. At 1035, before the OOW ordered any change in depth, TRIUMPH grounded whilst proceeding at 22 knots and 200m. Indications of this grounding were noise, reported variously as rumbling and air-type sounds, together with a slight bow-up angle. The SCOOW xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	(538) (540) (544)	
suspected grounding and the OOW recalls ordering a shallow pitch angle. Within 20	4.115	
seconds of the initial indications of grounding, the XXX arrived in the Control Room and ordered Main Ballast to be blown in normal. XXXXXXXXX on arrival in the Control Room shortly afterwards, noted that the 780 echo sounder was running on the	1.62	
400-600m range scale. TRIUMPH surfaced in a safe, controlled fashion. A GPS fix taken after surfacing put TRIUMPH just under 3 nm to the East of the CP(IC) position, thus confirming the grounding.		

#### DISCUSSION - COMMAND AND MANAGEMENT

11.

10.	Command and Conduct.	It is considered that the procedures and	
responsibilities for Command, Conduct and Charge were well understood by all			
person	nnel and there was no confu	sion which could have contributed to the incident.	

fact that both X3 and X6 billets had been relieved by Officers who were not BSQ(T) qualified (Reference L). This cites "significantly reduced Control Room experience",

even before the decision was made to dilute the Ship's Company further.

coming shallow. The OOW stated that he felt concern at this stage and was about to

Ship's Company Dilution. In the Board's opinion, considerable risk was taken in diluting the Ship's Company in order to manage leave, appointing, drafting and morale in TRIUMPH. Whilst the xxx accepts full responsibility for this initiative and was not subject to direct pressure from any superior authority, this was clearly a 10.2, 10.3 questionable step, particularly in view of the demanding operations inherent in SMCC running. The initial period of FOST running was described as chaotic, until 1.15 teamwork had been established. Notwithstanding the risk mitigation in having (538) SMCC onboard to check that appropriate standards were being achieved and the (540) 10.5 xxxx insistence that all reliefs should be suitably qualified, the inexperience of the Control Room Watchkeeping Officers at the time of grounding must be viewed as a extremely high workload in preparing both pilotage and operational plans from scratch, whilst having little or no time to absorb his responsibilities or to become 6.131, 6.132 aware of the capabilities of navigation systems onboard. It is noted that TRIUMPH had already sent an OPDEF, before returning from her deployment, relating to the

Ref B

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# GOVERING SECRET unclass/NPM

12. Orders and Supervision. In the period leading up to the grounding, a variety of orders were given for precautions to be taken when approaching the continental shelf. In addition to periodic orders, which gave no indication of depth/speed changes and were somewhat ambiguous with respect to the use of the echo sounders, separate orders were given by the xxxx and two successive DCOs. These subsequent orders were not annotated in periodic orders, but were verbal and, as far as can be ascertained, written on the chart in use. Both the xxxx and xxxxxx during the relevant period, believed these were sufficient, but it is clear from evidence that at least some misunderstanding existed which would have been eradicated by the issue of new written orders. It also appears possible that some of the orders written as "clouds" on the chart were erased, perhaps during an alteration. Equally, neither the xxxxnor xxxxx supervised this potentially dangerous period by visiting the Control Room to check that orders were being carried out. This was particularly relevant given the inexperience of the Officers on watch.

(538) (54つ) Encl 2 (544)

Encl 8

(538) 1.62 (540)

5.10

1544

14. <u>Records</u>. The general standard and scope of records submitted to the Board was poor. No echo sounder traces could be produced, the navigation chart was confusing and appeared incomplete and the "Little Sister" tape only covered the period following the Emergency Stations pipe. Various records had to be sought subsequently by the Board. Confusion may have been caused by the list of required records signalled by FOSM (Reference E), whereas early reference to the table that already exists in SMP7 (Table 6-3) would have provided the Board with a better initial appreciation of events. There is, however, no suggestion that records were altered in any way after the grounding.

#### **DISCUSSION – NAVIGATION**

Refs F, J, K

Dependency on CP(IC) Positional Information. Throughout SMCC running, 15. TRIUMPH navigated with SNAPS running in the CP(IC) mode of operation. In this mode the averaged positional information from SINS A and SINS B is fed into SNAPS. CP(IC) is not a direct readout of this position but is a modified EP created by combining log speed (from an AGILOG input), gyro information (from the selected gyro source) and a stabilised navaid position, in this case NATO SINS IC position. The navaid position is stabilised by reference to a known fix position, the difference between the two positions is known as CP Drift and is applied to the IC position as an accuracy weighting factor or bias. Over a period of time (twelve hours) this weighting factor or bias will degrade until the CP(IC) position effectively becomes a straightforward EP. If the CP(IC) position is checked regularly, every four hours or so, against a fix, then the degradation of the position should not be significant. The greater the time period between the check fixes, then the greater the inaccuracy of the CP(IC) position. This was not understood onboard, with some believing that the position degraded to the NATO SINS IC position.

1.32

1.33, 4.90

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- 16. In addition to this unknown and unidentifiable bias, the CP(IC) position can also be significantly affected by a number of other factors. The extent and nature of the effects of these factors are currently unknown. Examples of these factors are:
  - a. The reference datums used by SINS, SNAPS,GPS and the chart.
  - b. The log error in use in SNAPS (default 5%).
  - c. The incorrect acceptance or injection of drift.
  - d. The incorrect injection of tidal stream.

. .

Because of the above potential error factors and the method of formulation of the CP(IC) position, with check fix periodicity greater than 4 hourly, its use as an accurate representation of the submarine's position must be questioned. The reliance on the SNAPS CP(IC) by all levels of the Command chain shows a basic misunderstanding of the information being displayed on the chart table. Each witness expressed dissatisfaction with the level and ambiguous nature of the guidance on SNAPS, views that are shared by the Board.

- 17. From examination of the data recorded onto the SNAPS magnetic recording tape, the system onboard TRIUMPH reverted from the CP(IC) mode to CP(EP) mode on several occasions prior to the incident. The printouts indicate that the system was reset each time to CP(IC). The positional printout gives CP(IC) positions, course, speed, depth and tidal information each minute; it is believed that the tidal information is misnamed and actually represents the range and bearing of the SNAPS derived EP position at that time. Reading the information would indicate that SNAPS was operating correctly by alarming and reverting to the EP mode each time the discrepancy exceeded the programmed limits. When the system was returned to the CP(IC) mode of operation, the differential between CP(IC) and EP was, as a matter of course, accepted. If the continual reversion of SNAPS to CP(EP) mode had been investigated by the Command team, then the positional discrepancy could have been discovered prior to the incident.
- 18. It was understood by the Command and the maintainers, but not by the OOW orxxxx that the AGILOG fitted to TRIUMPH under-read the submarine's true speed by approximately 10% at speeds above 10 knots. SNAPS should therefore have had the system log error manually amended from the default setting of 5% to 10% every time the submarine's increased above 10 knots.
- 19. On surfacing at 191042, the resultant error between the GPS position (5551.69N 009 13.07W datum unknown) and the displayed CP(IC) position (55 52.7N 009 17.8W datum unknown) was 290 degrees at 2.9 nm (when plotted with no datum shift applied on Chart F 6817). The accuracy of the NATO SINS IC position could not be verified at the same time due to the poor state of the records. Although the precise error within SNAPS, that led to the positional error experienced by TRIUMPH, can not be positively identified, the resultant discrepancy is not considered excessive, given the 10% log error for the 3 hour transit in excess of 10 knots and the other potential sources of error. It is also believed that SNAPS was operating correctly in that it repeatedly alarmed and defaulted to CP(EP) mode prior to the incident.

1.39, 1.40 2.5, 3.26 Encl 3

3.15

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- 20. <u>Pool of Errors</u>. Reference F Para 0750 states that each NATO SINS system should have a position keeping performance of better than 1.3 miles in 30 hours. Para 0752 states that the Pool of Errors (POE) should be estimated on equipment performance and history. The POE has been widely adopted as a 1nm circle around the IC position and it was this POE that the OOW and to the SNAPS CP(IC) position. As previously argued, the SNAPS CP(IC) position is not the NATO SINS IC position and the use of a static 1nm POE around this point was incorrect and failed to take into account the log and other errors inherent in the position.
- 21. <u>Use of Echo Sounders</u>. The correct use of echo sounders, as intended by the Command, as TRIUMPH approached the continental shelf would have alerted the cxxx and OOW to the proximity of the 200m contour. The running of either echo sounder would also have provided a check on the positional information being presented on the chart table. The failure to continually run either echo sounder was a major contributory factor to the incident.
- 22. <u>Chart Work</u>. The chart work was of a poor standard with records being insufficient for a true and precise record of the submarine's track to be reconstructed. The lack of any coherent DR and EP accounting for the easterly ocean current of ½ 1 knot, in accordance with the West Coast of Scotland Pilot (NP 66), was a contributing factor to the incident.

**CONCLUSIONS** 

#### 23. The Board conclude that:

a. HMS TRIUMPH ran aground in 200m of water at 1035 on 19 Nov 00, in the vicinity of 55 51.69N 009 13.07W, as indicated by a GPS fix taken 7 minutes later, after surfacing. The grounding was caused by poor navigation. Contributory factors included a widespread misunderstanding of SNAPS operation and poor chartwork.

Para 9, Para 15

b. Current Command guidance on navigation equipment, particularly SINS and SNAPS, is confusing and inadequate.

Para 16

- c. The Command Team was not aggressive enough in addressing known problems in Command Guidance on SNAPS and perceived AGILOG inaccuracy at high speed.
- e. On completion of the SUBTACEX at 190800, there appears to have been some Command relaxation in supervision of Control Room activities.

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f. The OOW paid insufficient attention to the safe navigation of the submarine.

Witness 4

- g. Insufficient use was made of echo sounders and the OOW failed to recognise the navigational contribution that their appropriate operation would have made. Earlier, continuous soundings would have facilitated the monitoring of the shelving seabed and, considering the high speed used, would not have posed any form of tactical constraint. Equally, clear direction on the use of snap soundings would have provided similar confidence checks.
- h. An approximate 30% change to the Ship's Company, immediately prior to sailing for SMCC running, generated a significant dilution of experience and teamwork within the Command Team. There is evidence that the supervision of very inexperienced Control Room Watchkeepers was, at times, inadequate.

Para 11

i. Verbal instructions and intentions from the Command to the OOW can be misunderstood or forgotten, whilst those annotated in pencil on the chart can be erased. Where ship safety is paramount, there is no substitute for clearly written Periodic Orders, formally amended and updated as required.

Para 12

24. The following personnel contributed significantly to the incident:

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The following officer contributed to the incident: 25.

### (538)

#### (844)

#### RECOMMENDATIONS

- 26. The Board recommends that:
  - Lessons learnt, drawn from the conclusions of this Board of Inquiry, should be given wide distribution within the Submarine Flotilla.
  - The Submarine Flotilla should be reminded of the requirement for b. clear, unambiguous written Command instructions to the OOW.
  - Submarines should be reminded of the importance of maintaining and collating comprehensive records in accordance with instructions laid down in operational documentation.

Para 23i

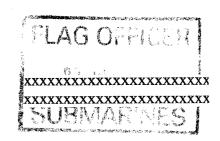
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d. The operational sections of navigational equipment publications and SMP7 should be reviewed to give clear guidance on the capabilities of SNAPS and its relationship with all variants of SINS.

Para 23ł

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



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Captain Royal Navy

#### Annexes:

- A. Index of Transcripts of Evidence from Witnesses.
- B. Transcript of Evidence from Witnesses.

#### **Enclosures:**

- 1. HMS TRIUMPH's 520 dated 23 Nov 00 (and enclosure thereto).
- 2. CO's Periodic Orders 181900z 191900z Nov 00.
- 3. WE Department Night Orders for 18 Nov 00.
- 4. Photocopy of Control Room log 18 and 19 Nov 00.
- 5. Photocopy of Fixing Log Sheets 159 166.
- 6. Photocopy of NATO SINS Fixing Log.
- 7. Tracing of chart F6817.
- 8. Chart F6817.
- 9. DCB Tape. Held in x legistry

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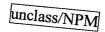
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- 10. SNAPS.
- 11. Wordsafe Tape.
- 12. Little Sister Tape...
- 13. Original narrative.
- 14. Lt Tabberer Initial Thoughts.
- 15. Machinery Order Log Sheet.
- 16. SNAPS Tape Positioning Information.
- 17. SNAPS Recording Log.

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#### RESTRICTED STAFF





D/FOSM/X5200/25



The Flag Officer Submarines Eastbury Park NORTHWOOD Middlesex HA6 3HP

Commander-in-Chief Fleet

1 Feb 01

#### HMS TRIUMPH GROUNDING - FINDINGS OF BOARD OF INQUIRY

#### Introduction

1. On 19 Nov 00 HMS TRIUMPH grounded in the vicinity of 55°51.69'N 009°13.03'W. A Board of Inquiry (BOI) was convened in Devonport on 28 Nov 00 and the report of its findings is enclosed.

#### Discussion

2. The grounding occurred because the submarine's true position was some 2.6nm further east than that plotted and when evidence that the navigational position was in error was obtained it was not acted upon. In addition, the execution of the plan was imperfect and the personnel on watch failed to follow properly the instructions that would have kept the submarine safe in the face of this navigational error.

#### Personnel

(53E)

(S44)

back .

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(538)

(540)

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(538)

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#### Conclusion

#### Recommendation

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Rear Admiral

#### Enclosure:

1. SM1,'s SM 520/03 dated 1 Dec 00 (BOI report). - PM RESTRICTED - STAFF