

**REPORT OF THE SERVICE INQUIRY INTO  
THE GROUNDING OF HMS ASTUTE ON 22 OCT 2010**

## NARRATIVE OF EVENTS

### Introduction

1. Whilst proceeding towards the RV for a boat transfer south of the Crowlin Islands on the morning of 22 October 2010, HMS ASTUTE continued on a heading of 130, towards the Isle of Skye bridge, for 4 NM until only minutes before grounding. The speed of the submarine was slowed from 13 kts to 2.5 kts but the OOW did not give any helm orders that would have turned the submarine away from the danger on ship's head. This was despite being instructed to on at least 3 occasions by the POOW and OOW Below. Astern revs (16) were applied, as was a turn to starboard, but these were not as a result of an appreciation of any immediate danger to the submarine by the OOW, rather to manoeuvre the submarine onto a favourable course for the boat transfer as instructed by the XO. During the turn to starboard the submarine grounded by the rudder. Early attempts to free the submarine by using ahead revs, MBT blows and de-ballasting failed and the submarine remained aground until shortly before the next high water at 1730Z. During the recovery some further damage was done to the submarine during a minor collision with the towing vessel ANGLIAN PRINCE.
2. The root causes of the grounding were non adherence to correct procedures for the planning and execution of the navigation combined with a significant lack of appreciation by the OOW of the proximity of danger. However, a number of additional causal factors were present, including some deficiencies with equipment. In conducting the Service Inquiry much reliance has been placed on written and spoken statements because of a paucity of recorded electronic data<sup>1</sup>.



**Figure 1 – HMS ASTUTE Aground**

<sup>1</sup> PMS Data has been made available by BAE Systems but No Big Brother (MIRRA), Little Sister or ASNAPs data was recorded.

**Chronology of Events (Including Recovery)**

3. Ephemeral data for the period of the incident is as follows:

High water 0602Z, 4.9m, 1812Z 5.1m  
Low water 1232Z, 1.1m  
69% Springs (3 days before Springs)  
Height of tide at time of grounding 4.8m  
Tidal Stream 0.4-0.6kts SE  
Morning civil twilight 0631Z  
Moonset 0644Z (98% of the face of the moon illuminated)  
Sunrise 0711Z

4. Whilst undertaking Contractor Sea Trials HMS ASTUTE had been conducting Underway Noise Ranging overnight on the Rona Noise Range<sup>2</sup>. These started the previous evening at approximately 1700Z (21 Oct 2010). The trials completed early morning and the submarine surfaced at 220449Z Oct 10<sup>3</sup>, to commence a surface transit towards the Kyle, remain in Patrol Routine and conduct a boat transfer at 0630Z. Due to the large number of riders required and the limited capacity of the submarine, a number of boat transfers were required to ensure that the personnel required for each trial were on the submarine. This would be the 7<sup>th</sup> boat transfer conducted at Kyle during this period at sea<sup>4</sup>.

5. The TASO (Lt Cdr █) surfaced the submarine and the CBO (Lt █), as the surfacing OOW, proceeded to the bridge, initially taking the look and then the submarine once established with the minimum equipment that he needed<sup>5</sup>.

6. Completion of noise ranging had over run and the submarine was slightly behind schedule for the 0630Z boat transfer. The OOW (Lt █) was instructed to make best speed to the boat transfer position and trimmed down on 4MBT and proceeded at 13kts. TASO (Lt Cdr █) acted as the OOW Below, keeping oversight of the OOW (Lt █) who was not Platform Endorsed (PE)<sup>6</sup>. The submarine was navigating on chart 2480, which was on the plot, steering a course of 168, speed 13 kts.

7. Problems with the integrated communications system, resulted in the OOW (Lt █) directing that the audio panel on the bridge be replaced<sup>7</sup>. The remaining items on the bridge were being rigged, including the █ secondary radar, due to problems with radar 1009<sup>8</sup>.

<sup>2</sup> NO (Lt █) Interview Transcript Page 4.

<sup>3</sup> Surfacing is recorded within the Ship's Log (Exhibit 5), but not the surfacing position. The first surfaced fix in the Fixing Log (Exhibit 7) is at 220452Z Oct 10.

<sup>4</sup> CO (Cdr █) Interview Transcript Page 5.

<sup>5</sup> Pelorus and 2 lines of communications. Helm line and Command Group via Audio Panel, Voice Pipe and WIFCOM were all available in this case.

<sup>6</sup> CBO (Lt █) Interview Transcript Page 35. XO (Lt Cdr █) Interview Transcript Page 27.

<sup>7</sup> CBO (Lt █) Interview Transcript Page 20.

<sup>8</sup> CBO (Lt █) Interview Transcript Page 11.

8. At approximately 0600Z, the submarine took a course of 151<sup>9</sup>, cutting the corner of the planned NavTrack<sup>10</sup> to make up lost time. The time of this course change is not annotated in the fixing log<sup>11</sup>.

9. At 0545Z the watch handover commenced. Over the next 20 minutes the team in the Control Room changed with the helmsman (PO [REDACTED]), SCOOW (WO2 [REDACTED]), Plot (LS(SSM) [REDACTED]) and OOW Below (Lt [REDACTED]) completing their respective handovers by 0605Z<sup>12</sup>.

10. The submarine moved onto the area covered by chart 2498<sup>13</sup>. The planned change chart position was marked on the navigational track at the 57 22N line of latitude. The submarine reached this line at approximately 0553Z. Indications on the chart are that the chart was changed at 0606Z<sup>14</sup>, although this is not recorded in the fixing log or annotated correctly on the chart. This was some 12 minutes later than the planned change chart position and was 1.4 nm from the western edge of the boat transfer grid where the boat transfer was to take place.

11. Between 0600Z and 0605Z the TSO (Lt Cdr [REDACTED]) made his way to the bridge to relieve the OOW (CBO Lt [REDACTED]), having conducted the preparations for his handover in the Control Room. He had briefly examined chart 2480 (the chart on the plot), and checked the submarine's status with the SCOOW (WO2 [REDACTED]) and OOW Below (Lt [REDACTED])<sup>15</sup>. He did not put a fix on the chart<sup>16</sup>, nor did he question the chart that was in use. To ease the reporting of position, a grid had been drawn on chart 2498 by the Navigating Officer (Lt [REDACTED]). Chart 2480 did not cover this area. Arriving on the bridge he commenced his handover.

12. At sometime shortly before the 0611Z fix, ASTUTE had completed the shortcut to regain time and at the request of the plot, the OOW altered to a new course of 130, remaining at 13 kts. This course alteration is not recorded in the fixing log. ASTUTE entered the boat transfer grid (Figure 2) at 13 kts at 0612Z and continued to propel on a course of 130.

13. The bridge was still being rigged<sup>17</sup>, with the [REDACTED] secondary radar yet to be switched on and some items still to be brought up. On his departure from the bridge the CBO (Lt [REDACTED]) took the OOW binoculars with him, realising this when he reached the Control Room. The OOW (Lt Cdr [REDACTED]) noted the lack of a handheld VHF radio or chart, and requested that these items were brought up from the Control Room with the binoculars.

<sup>9</sup> POOW (LS [REDACTED]) Interview Transcript Page 3.

<sup>10</sup> Exhibit 6a.

<sup>11</sup> Exhibit 7.

<sup>12</sup> LO (Lt [REDACTED]) Interview Transcript Page 2, CBO (Lt [REDACTED]) Interview Transcript Page 28.

<sup>13</sup> Exhibit 6a.

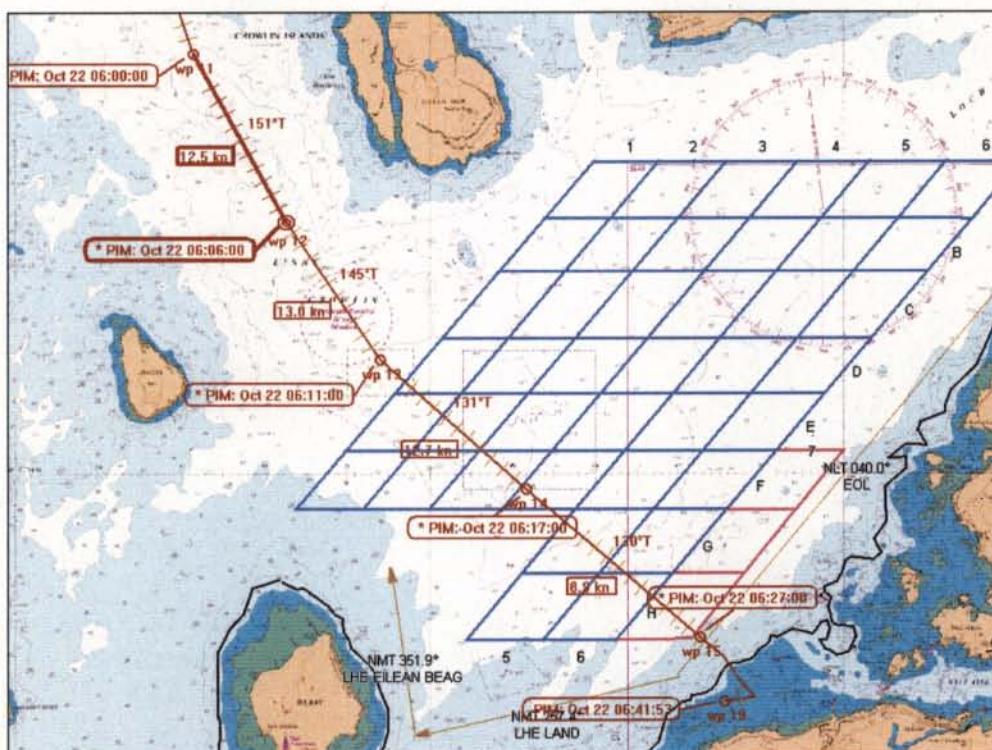
<sup>14</sup> This is also supported by POOW (LS [REDACTED]) Interview Transcript Page 26 and Lt [REDACTED] Interview Transcript Page 14.

<sup>15</sup> TSO (Lt Cdr [REDACTED]) Interview Transcript Pages 1-5.

<sup>16</sup> In the fixing log (Exhibit 7) there is no record of a fix, nor any signature from the TSO (Lt Cdr [REDACTED]).

<sup>17</sup> CBO (Lt [REDACTED]) Interview Transcript Page 10, TSO (Lt Cdr [REDACTED]) Interview Transcript Page 15.

14. At 0619Z, the POOW (LS █) reported the next fix (recorded as 0618Z in the log and marked as 0617Z on the chart) and using the grid system on his chart (See Figure 2) reported the submarine position as box F3. The fix shown on the chart puts the submarine in box F4, at a speed of 13 kts. The POOW (LS █) requested that the OOW (Lt Cdr █) slowed to 4kts and turned to port to a new course of North<sup>18</sup>. The OOW (Lt Cdr █) acknowledged the report<sup>19</sup>. He had no chart and could not therefore reference the position, did not ask for clarification and chose not alter course due to the presence of MV OMAGH at R30, range 1.5-2kx, 40P<sup>20</sup>. The OOW (Lt Cdr █) had no handheld VHF radio to inform OMAGH that he wished to turn however, the submarine's VHF communications system was fully functional. There was no impediment to a retiring turn to Stbd. At 0621Z the submarine reduced speed to 4 kts, having advanced a further 1600 yards from the fix position and entered box G6. The POOW below became concerned when he noticed the submarine had not altered to North. He came and asked the Helmsman what course had been ordered and was told that the submarine had slowed to 16 revs and was still steering 130<sup>21</sup>.



**Figure 2 – Reconstruction of Navigational Track and Boat Transfer Grid**

15. At 0620Z the XO (Lt Cdr █) passed the CO (Cdr █), who had just returned to his cabin from the Wardroom shower on 2 deck, and reported that he was on his way to the Secondary Navigation Position (SNP) to direct the boat transfer. Glancing at the chart he noted the submarine's position in the boat transfer grid and proceeded into the fin. Briefing the boat transfer team, he proceeded to the SNP. The SNP flaps were still shut,

<sup>18</sup> POOW (LS █) Interview Transcript Page 9.

<sup>19</sup> TSO (Lt Cdr █) Interview Transcript Page 25.

<sup>20</sup> This contact was not reported to the CO.

<sup>21</sup> POOW (LS █) Interview Transcript Page 11. PO █ Interview Transcript Page 5.

clipped and moused (tie wrapped), from noise ranging the previous night<sup>22</sup>. Using white torches the XO (Lt Cdr [REDACTED]) and a member of the casing party, cut the tie wraps and unclipped and lowered the SNP flaps. This took approximately 5 minutes.

16. At 0624Z AB [REDACTED] arrived at the bridge with chart 2498<sup>23</sup> and one minute later at 0625Z the XO (Lt Cdr [REDACTED]) emerged into the SNP with virtually no night vision. At the same time (0625Z) the POOW (LS [REDACTED]) reported that there was 4 cables of safe water on ship's head by EP. The OOW Below (Lt [REDACTED]) also bleeped the OOW on the bridge line stanaphone line and informed him he was leaving the box and needed to come to the North immediately<sup>24</sup>. The XO (Lt Cdr [REDACTED]) took the safe water to be to the edge of the marked grid, having no reference point with diminished night vision, and not expecting to be so close to land<sup>25</sup>. Querying the position with the OOW (Lt Cdr [REDACTED]), who repeated that he had 4 cables of safe water, the XO (Lt Cdr [REDACTED]) questioned why the submarine was still trimmed down on 4MBT and directed that it should be made fully buoyant. Looking over the side of the fin and estimating that the submarine was still doing between 5 and 6 knots, he also directed that way should be taken off the submarine in preparation for the boat transfer<sup>26</sup>.

17. At 0626Z a blow was put into 4MBT. This was followed by an order on the helm line of 'Slow Astern, revolutions 30' which was not acknowledged. The helm line appeared not to be working so the OOW (Lt Cdr [REDACTED]) used his fallback communications – WIFCOM. This order was repeated on WIFCOM, again with no acknowledgement. WIFCOM [REDACTED] was also being used by the XO (Lt Cdr [REDACTED]) and casing party, and the next report was one from the casing. The OOW (Lt Cdr [REDACTED]) ordered on WIFCOM, 'Hold all reports, Slow Astern, revolutions 30'. This ambiguous<sup>27</sup> order was acknowledged and the telegraphs put to Slow Astern at 0628Z<sup>28</sup>. Lt Cdr [REDACTED] stated in his interview that he intended to order 'Slow Astern' and should not have included the revolution order<sup>29</sup>. The SCOOW (WO2 [REDACTED]) did not question the anomaly. The XO (Lt Cdr [REDACTED]) questioned the order, but it was not corrected by the OOW (Lt Cdr [REDACTED]).

18. The POOW (LS [REDACTED]) was content<sup>30</sup> that the boat transfer could take place close to Kyle and believed that the CO (Cdr [REDACTED]) was prepared to undertake the evolution outside the South Eastern edge of the inked in boat transfer grid. LS [REDACTED] had pencil amended the chart to provide additional reference grid boxes to the South Eastern side to facilitate this<sup>31</sup>. The CO (Cdr [REDACTED]), when questioned, stated that these grid boxes were only to provide additional reference positions to the OOW should the submarine drift into these areas during the boat transfer<sup>32</sup>. These additional areas were not marked on the

<sup>22</sup> XO (Lt Cdr [REDACTED]) Supplementary Interview Transcript Page 2.

<sup>23</sup> TSO (Lt Cdr [REDACTED]) Interview Transcript Page 23, LO (Lt [REDACTED]) Interview Transcript Page 4.

<sup>24</sup> LO (Lt [REDACTED]) Interview Transcript Page 12-13.

<sup>25</sup> XO (Lt Cdr [REDACTED]) Interview Transcript Page 12.

<sup>26</sup> XO (Lt Cdr [REDACTED]) Interview Transcript Page 11.

<sup>27</sup> [REDACTED] Revolution orders are only used with Half Ahead in surface telegraphs.

<sup>28</sup> Exhibit 33 and 33a PMS Data.

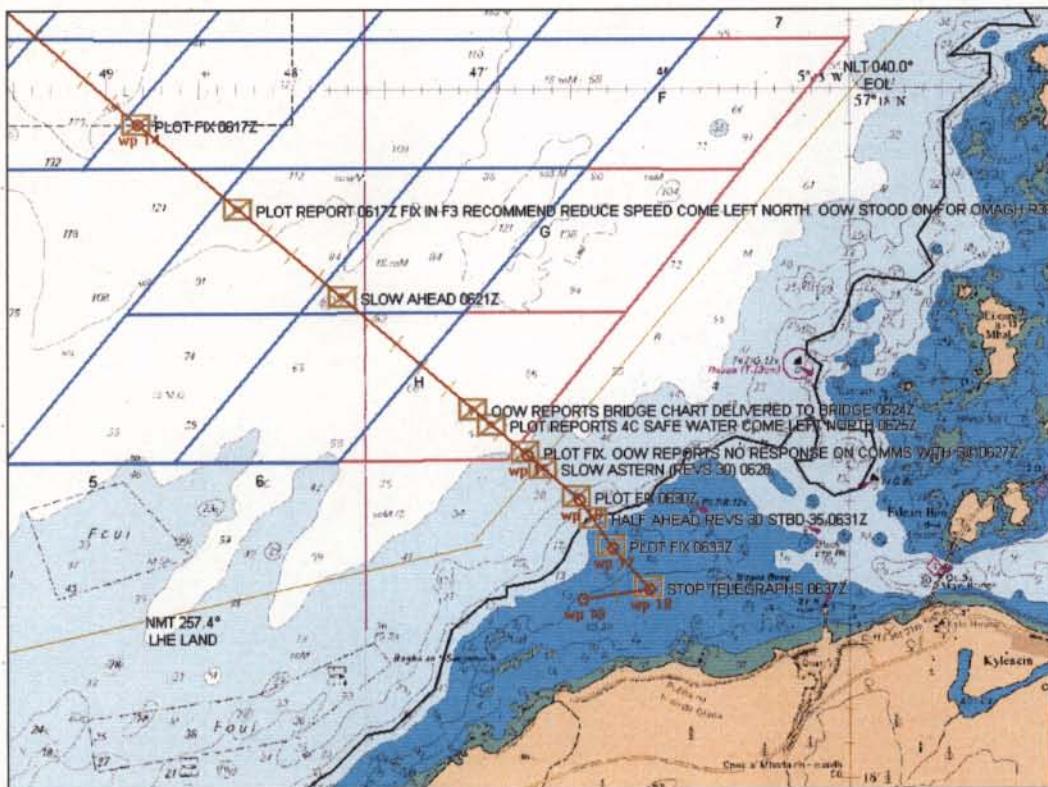
<sup>29</sup> TSO (Lt Cdr [REDACTED]) Interview Transcript Page 27.

<sup>30</sup> POOW (LS [REDACTED]) Interview Transcript Page 7.

<sup>31</sup> Marked in red on Figure 1 and Figure 2.

<sup>32</sup> CO (Cdr [REDACTED]) Interview Transcript Page 4.

bridge chart<sup>33</sup>. Missing the 0624Z fix which was near to his interpretation of the boat transfer position by EP, the POOW (LS [REDACTED]) took the next fix at 0627Z. This fix put the submarine outside the inked grid by 1000 yds and now 1100 yds short of the grounding position. He reported the fix and for the second time requested the OOW (Lt Cdr [REDACTED]) turn to North<sup>34</sup>.



**Figure 3 – Geo-referenced Narrative of Events Prior to Grounding**

19. The OOW (Lt Cdr [REDACTED]) was now concerned about fishing floats 150-200 yds on the port bow and not wishing to snag the floats in the turn, he stood on<sup>35</sup>. Again, there was no impediment to a retiring turn to Stbd.
20. The POOW (LS [REDACTED]) noted that the turn had not commenced and brought this to the attention of the OOW Below (Lt [REDACTED]). The OOW below (Lt [REDACTED]) called the OOW (Lt Cdr [REDACTED]) by stanaphone and informed him the submarine was leaving the box and he needed to alter course to the North immediately<sup>36</sup>. Despite considerable doubt over the safe navigation of the submarine the CO (Cdr [REDACTED]) was not called as he should be by ASTUTE SOs<sup>37</sup>.
21. The XO, who could now see from the SNP, observed MV OMAGH on the Stbd quarter and told the OOW to alter course to starboard using Stbd 35 and increase to Half

<sup>33</sup> Exhibit 6b.

<sup>34</sup> POOW (LS [REDACTED]) Interview Transcript Page 13.

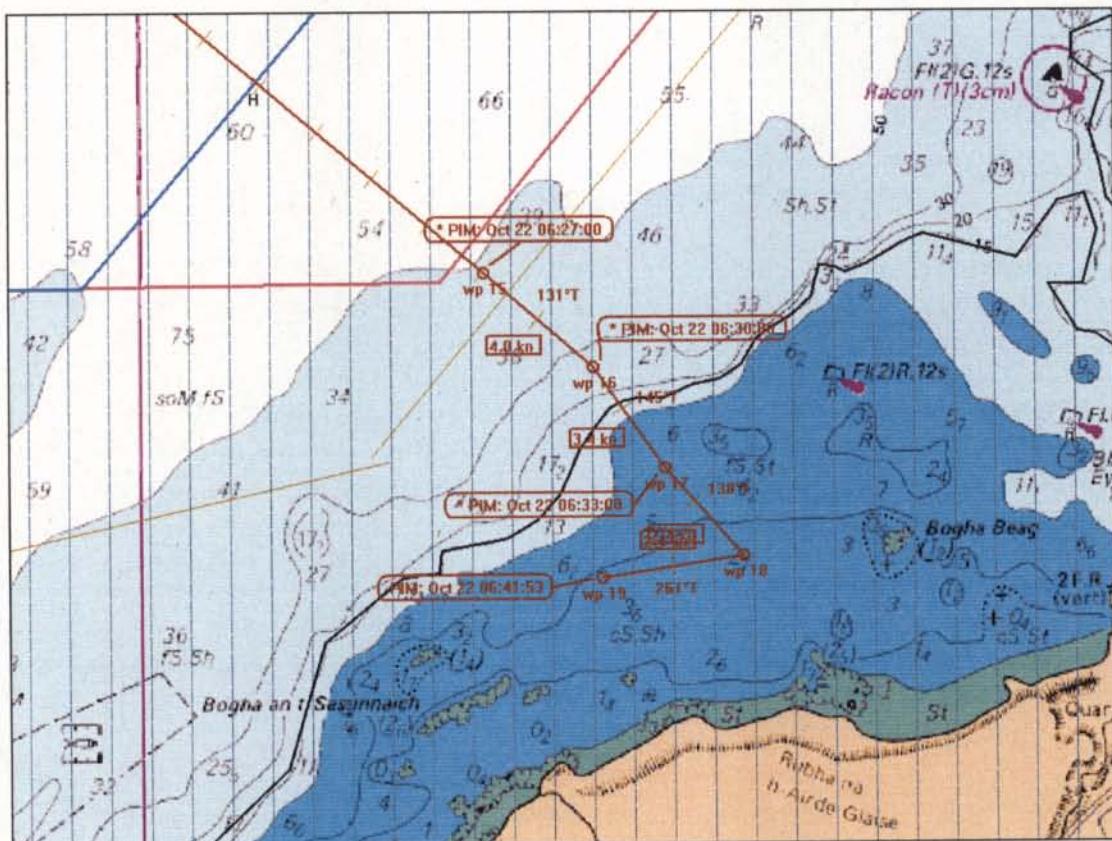
<sup>35</sup> TSO (Lt Cdr [REDACTED]) Interview Transcript Page 37.

<sup>36</sup> LO (Lt [REDACTED]) Interview Transcript Page 12.

<sup>37</sup> Exhibit 26. Section 8 – 0181.

Ahead [REDACTED]<sup>38</sup>. The OOW carried out this instruction at 0631Z. It was at this point that the XO now became quickly concerned with what he could see. He stated the submarine was very close to land, the Kyle Channel Buoys and Skye Bridge were not where he expected them to be<sup>39</sup>. The order to propel ahead increased the submarine's speed from [REDACTED]<sup>40</sup>.

22. As he realised the position of the submarine and the proximity of land the XO (Lt Cdr [REDACTED]) ordered the OOW (Lt Cdr [REDACTED]) to report the safe water. The OOW (Lt Cdr [REDACTED]) contacted the plot, who reported that there was 2 cables of safe water on ship's head. The XO (Lt Cdr [REDACTED]) directed that the CO (Cdr [REDACTED]) be called to the Control Room immediately to look at the chart. The boat had commenced the turn and the XO (Lt Cdr [REDACTED]) decided, with the limited information available, to continue the turn<sup>41</sup>. ASTUTE was at 4.8 kts when it ran aground at 0635Z (Figure 4), slowly decelerating to zero speed<sup>42</sup> and remaining with ship's head at 220. It is the view of the SI Team that the 0637Z fix is incorrectly recorded in the fixing log and therefore it is assessed that the submarine did not pass through waypoint 18 (Figure 4). This effect of grounding, however, was not felt within the submarine and the submarine was not brought to Emergency Stations.



23. Realising that the submarine was now very likely aground and without any navigational information in the SNP, the XO (Lt Cdr [REDACTED]) ordered the telegraphs to stop and went below to look at the chart. Arriving in the Control Room at 0637Z he encountered the CO (Cdr [REDACTED]) who had arrived just before him. Both CO (Cdr [REDACTED]) and XO (Lt Cdr [REDACTED]) observed the submarine position on the chart, which was over the LDL and in a charted depth of 5m. ASTUTE's rudder draws 10.64 metres in a normal surfaced trim. The height of tide was calculated to be 4.8 metres at 0635Z<sup>43</sup>.

24. The CO (Cdr [REDACTED]) instigated a series of helm and propulsion orders, in an attempt to free the submarine<sup>44</sup>. The bow was free to move and the submarine was held aground by the rudder and whilst the ship's head could be moved, no discernable change in position was observed. The SCOOW (WO2 [REDACTED]) was ordered to de-ballast the submarine and the CO (Cdr [REDACTED]) proceeded to the casing.

25. At 0645Z, from the casing the CO (Cdr [REDACTED]) ordered further helm and propulsion orders and MBT blows without success. OMAGH was requested to support ASTUTE and a line passed between the two vessels. The line from No 1 bollards, through the bull ring to OMAGH, was used to pull the bow towards deep water on a heading of 315. WARDEN, with a greater bollard pull, was asked to close<sup>45</sup>.

26. WARDEN arrived at 0740Z, and a line was passed through the bull ring to No1 bollards. As WARDEN took the weight and started to pull, the line parted and the bow drifted to port. A berthing hawser was immediately used to replace this line and at 0750Z a second pull was initiated with ASTUTE at 50 revolutions and MBTs being blown. The hawser parted and the ship's head payed off to port due to the wind. Whilst de-ballasting the submarine had reduced the draught (20-30 cms), the tide was ebbing and had fallen by approximately 50 cm.

27. With three range vessels (WARDEN, MOORHEN, SARA MATJEE) and the ship's head at 251, a lateral pull was attempted at 0816Z. The submarine listed to stbd, the aft line parted and no discernable movement was detected. To prevent damage to the submarine, safeguard essential systems and noting the ebbing tide the CO (Cdr [REDACTED]) ceased any further attempts to move the submarine. Compensating Tanks Os and Ms were flooded to correct the list and slowly settle the submarine's hull on the bottom. Os and Ms were filled to capacity [REDACTED]

28. The WEO (Lt Cdr [REDACTED]) had ordered DCHQ closed up at 0730Z. All personnel had been shaken and compartment rounds carried out. At 0837Z the CO (Cdr [REDACTED]) ordered the SCOOW (WO2 [REDACTED]) to conduct further WTI checks. At 0851Z the diesels were prepared for running [REDACTED]

[REDACTED] The AC DG came on line at 1025Z and at 1045Z approval was given by the CO (Cdr [REDACTED]) [REDACTED]. With one DG defective (DCDG) and therefore only one running (ACDG), electrical load reductions were implemented to leave only vital systems, [REDACTED]

<sup>43</sup> By Admiralty Total Tide programme.

<sup>44</sup> Exhibit 9 OOW Below Narrative, Exhibit 16 Ship's Narrative.

<sup>45</sup> Exhibit 9 (OOB Below Narrative), Exhibit 5 (Ships Log) and Exhibit 32 (CO Notes) all corroborate the events 220640Z – 222342Z OCT 10.

The second DG (DCDG) was not repaired until 1300Z, when it was successfully run and connected to the electrical distribution system.

29. At 1230Z divers started an assessment of the condition of the hull and sea bed, reporting at 1330Z that the seabed consisted of soft sand and shale, with no rock. The hull was lying on the seabed with the rudder embedded in the sand and shale by 1-1.2m (Figure 5). At the request of the CO (Cdr [REDACTED]) and CSALMO Representative (Mr [REDACTED]) the divers then used the rib to conduct soundings and determine the best route to deeper water.



**Figure 5 – Rudder Skeg Embedded in the Sand and Shale**

30. Pumping out water from trim tanks, Os and Ms was estimated to take 2½ hours and commenced at 1400Z in preparation for the float off. Formal approval for the float off by signal was given by CTF311 at 1549Z. The bow was seen and felt to move at 1600Z as it floated. The aft trim tanks were dry and water was transferred to the fwd trims to lift the stern. At 1640Z, whilst checking the draught marks on the rudder, it was noticed by CSALMO Representative ([REDACTED]) that the rudder was moving. WARDEN was attached aft and the ANGLIAN PRINCE forward using the submarine's rip tow. Ship's head was pulled to the planned course of 350 for the recovery. A 2 second blow into 3&4 MBT lifted the rudder clear and the stern was observed to move.

31. As the ANGLIAN PRINCE pulled forward, a further blow was put into the MBTs and ASTUTE moved slowly forward. After briefly stalling, the boat lost bottom suction and floated off. A blow was put into 1&2 MBTs to restore full buoyancy and the rudder and EPM tested to prove steerage way, both essential to controlling the submarine behind the tug. At 1730Z as ANGLIAN PRINCE pulled ASTUTE away, WARDEN closed in at the stern but the submarine's headway resulted in tension on the line and it parted.

32. The submarine was towed to the BUTEC range. At 1945Z ANGLIAN PRINCE slowed to a stop and allowed ASTUTE to drift. Directed not to use propulsion<sup>46</sup>, ASTUTE did not check the headway and drifted until ANGLIAN PRINCE was abeam ASTUTE's fwd casing. As ANGLIAN PRINCE propelled ahead so that OMAGH could conduct a boat transfer with the submarine, ANGLIAN PRINCE veered to port and struck the sbtd bow damaging the Stbd foreplane, tiling and torpedo tube faring plate. The rip tow had been severed in the incident and EPM drive was used to check all submarine movement. In accordance with the EOP for a Collision, the submarine was brought to Emergency Stations and Damage Control checks conducted.

33. Once AYTON CROSS arrived a line was passed to the submarine at 2342Z and both remained in position overnight on the BUTEC Range.

<sup>46</sup> Exhibit 10 CINCFLEET'S LGE H2G 221755Z OCT 10.

## ANALYSIS OF EVENTS

### Contributory Factors

34. **Planning.** There was no dedicated plan or specific briefing for the boat transfer scheduled for 0630Z on the morning of 22 Oct 2010. The submarine had conducted a number of transfers in this area on the previous 6 days, both afternoon and morning. Conduct of boat transfers was therefore reliant on personnel repeating the actions of earlier transfers. A general brief was conducted some days earlier to cover the conduct of noise ranging on the Rona Range and this included some instruction on boat transfers. Specifically the CO authorised that boat transfers would be conducted on the watch at Patrol Routine<sup>47</sup>. The watch would be supplemented by the XO going to the fin and directing the boat transfer from the SNP at the rear of the fin (approx 8 metres from the OOW position, Figure 6). The CO would be in the Control Room to meet and greet departing/arriving riders.

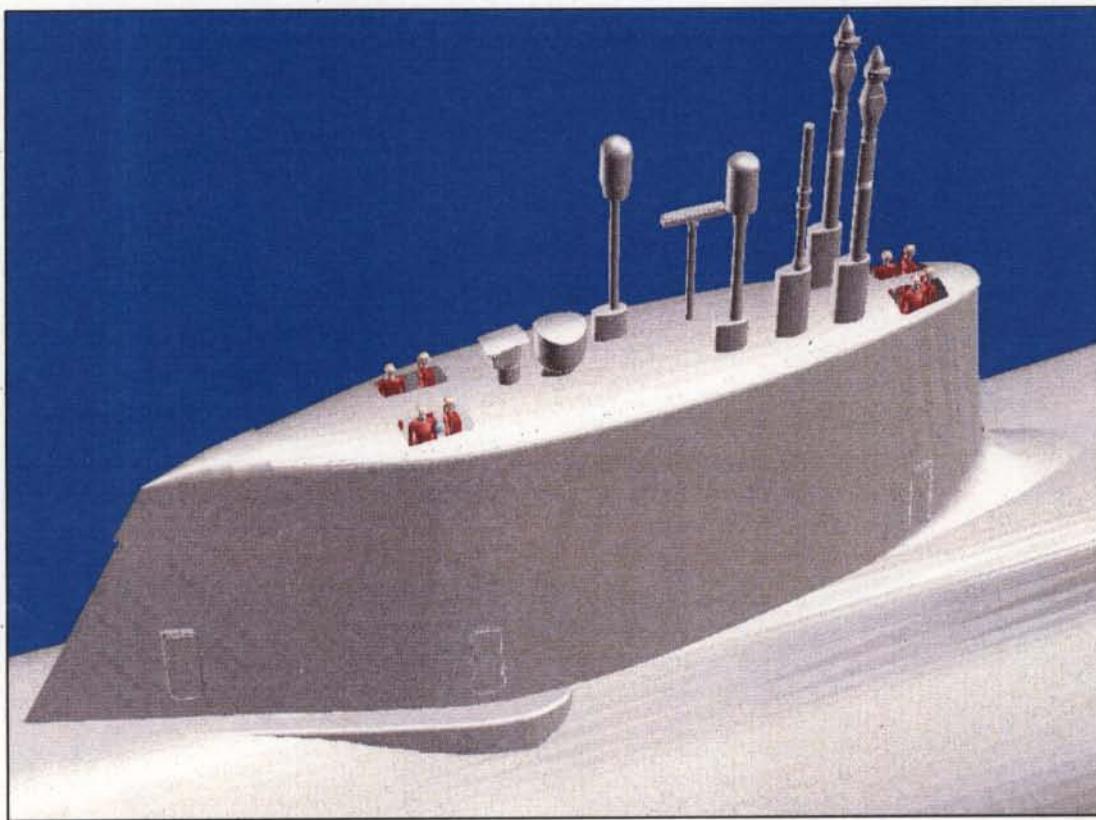


Figure 6 – Layout of ASTUTE Class Fin

35. **Navigation.** The Navigating Officer's workbook did not indicate any prior planning for the boat transfer<sup>48</sup>. The chart<sup>49</sup> lacked any clear position for the transfer and did not provide any instruction on when to slow down, or when to allow the casing party access to the casing. Additionally there were no instructions on when to call the CO or XO. The

<sup>47</sup> CO (Cdr [REDACTED]) Interview Transcript Page 5.

<sup>48</sup> Exhibit 20.

<sup>49</sup> Exhibit 6a.

plan assumed good visibility (min 3 nm visibility) to allow for a clearing bearing on Pabay Island. It was decided that the TSO (Lt Cdr [REDACTED]) would be on the bridge and the Navigating Officer (Lt [REDACTED] would go to the casing<sup>50</sup>. The 3<sup>rd</sup> BWQ Seaman Officer of First Watch was landed from the submarine to undertake the duty of Fishing Vessel Liaison Officer (FVLO) at the Rona Range Terminal Building. The implications of this were not fully considered in any plan. In the absence of the 3<sup>rd</sup> BWQ Officer, it is the view of the SI team that the most appropriate manning for this boat transfer should have the Navigating Officer (Lt [REDACTED]) on the Bridge, the Second Coxswain on the Casing and the TSO (Lt Cdr [REDACTED]) as the OOW Below.

36. Lt Cdr [REDACTED] stated to the SI team that he had never been south of the Crowlin Islands on the bridge in the dark before<sup>51</sup>; the CO (Cdr [REDACTED]) was unaware of this fact<sup>52</sup>. In contrast, the Navigating Officer had completed a number of transfers in this area in the dark. It is the view of the SI team that the Navigating Officer should have been on the bridge for this boat transfer. The CO's Sea Orders<sup>53</sup> provided no additional instructions on the conduct of the boat transfer other than the time at which it was to commence. It is the view of the SI Team that insufficient guidance and direction was provided in Sea Orders for this event.

37. **Bridge Preparations.** On the morning of the incident the submarine surfaced on the watch at 0449Z and commenced a surfaced passage to the boat transfer area. The CO was not present in the CR for the surfacing. The submarine was surfaced by the TASO (Lt Cdr [REDACTED]), who remained as the OOW Below. The surfacing OOW was the CBO (Lt [REDACTED]). Lt [REDACTED] took Charge of the submarine however, he is not Platform Endorsed (PE) and therefore Lt Cdr [REDACTED] remained in the CR to supervise him. The minimum qualifications for OOW Surface are STCW NWC, Platform Endorsement (PE) and CO's authorisation<sup>54</sup> and it is the view of the SI Team that this requirement should be adhered to. Rigging of the bridge commenced shortly after surfacing and was not complete until just minutes before the grounding. At approx 0610Z, when the CBO (Lt [REDACTED] handed over to the TSO (Lt Cdr [REDACTED]) a number of significant items were still not on the bridge and the Secondary Navigation Position (SNP) flaps were still shut, clipped and moused (tie wrapped). The items absent from the bridge were the hand held VHF radio and the bridge chart, and the Secondary Radar [REDACTED] was not yet operational<sup>55</sup>. It is the view of the SI Team that the lack of these items all contributed to the grounding.

38. **Use of Radar.** The submarine's primary radar, Radar 1009, was not used after surfacing . During the previous 24 hrs it was emitting noise and a command decision was made to limit its use and to preserve it to support dived operations iaw FPN 95. The radar defect was discussed at the O Group conducted on 21 Oct<sup>56</sup>. Lt Cdr [REDACTED] was not present at this O'Group but he stated in his evidence that he had been briefed that he could use the radar any time he required it. At no stage did anyone request its use. To mitigate for this the Secondary Radar [REDACTED] was to be rigged. It is a

<sup>50</sup> NO (Lt [REDACTED] Interview Transcript Page 9.

<sup>51</sup> TSO (Lt Cdr [REDACTED] Interview Transcript Page 8.

<sup>52</sup> CO (Cdr [REDACTED] Interview Transcript Page 15.

<sup>53</sup> Exhibit 13.

<sup>54</sup> ASTUTE SSOs 0181 Para 6a(1). The reference to STCW BWC is incorrect and should refer to STCW NWC.

<sup>55</sup> CBO (Lt [REDACTED] Interview Transcript Page 13-15.

<sup>56</sup> Exhibit ?? O Group 21 Oct 10 Power Point slides.

cumbersome task to rig it and something the crew are not over familiar with<sup>57</sup>. On this occasion it was not available until too late. The OOW remembers seeing the picture on the [REDACTED] shortly after he gave the order to come to starboard at 0631Z, only minutes before the grounding<sup>58</sup>. It is the view of the SI Team that the [REDACTED] Radar is inferior to Rader 1009, but would have supported the navigation requirements, if used, on the morning of 22 Oct 10.

39. **Bridge Chart.** The absence of the bridge chart until 0624Z also played a significant role in the grounding<sup>59</sup>. The POOW was reporting the submarine's position to the OOW following each fix by cross referencing it to a boat transfer grid box. The absence of the bridge chart meant the OOW was unable to determine his position relative to danger. By his own admission he had not established any tripwires to mitigate against impending danger<sup>60</sup>. Although the chart did finally make it to the bridge this was deemed too late and from his evidence it is concluded that the OOW did not have any meaningful time to refer to it as events unfolded around him.

40. **VHF Radio.** The absence of the VHF radio meant that the OOW could not communicate directly to MV OMAGH from the bridge<sup>61</sup>. At no stage was the CR or WT Office directed to communicate with OMAGH using the CR VHF Radio [REDACTED] or the WT Office set. Early communication with MV OMAGH would have allowed the OOW to request OMAGH to adjust its course and provide him the option to turn to port into safe water at an earlier position. There was no restriction on him turning to starboard at any time<sup>62</sup>. By the OOW not considering the option of an earlier turn to Stbd, it is the view of the SI Team that the lack of early communications with OMAGH contributed to the grounding.

41. **The Secondary Navigation Position (SNP).** The SNP flaps were still shut and clipped when the XO arrived in the back of the fin at 0621Z. It took him a finite time (approx 5 Minutes) to remove the tie wraps and unclip the 8 clips per flap before he was in position. It was a further 2-3 minutes before he gained his night vision and for him to recognise that the submarine was much closer to land than he had ever seen it for a boat transfer. It is the view of the SI Teams that this delay prevented any command supervision of the OOW until it was too late. The reason the flaps were not lowered was explained by the XO in his evidence<sup>63</sup>. The submarine had been noise ranging and it was important that the fin was 'tight' and rattle free, hence all 8 clips were shut and moused. During previous boat transfers the flaps were already lowered but they were overlooked on the morning of the incident.

42. **Bridge Repeat.** HMS ASTUTE is fitted with a permanently rigged Bridge Repeat which displays helm, log speed and engine revolutions. A fault in the display prevented the engine revolutions from being read<sup>64</sup>. Whilst this would have given the OOW

<sup>57</sup> XO (Lt Cdr [REDACTED] Interview Transcript Page 39.

<sup>58</sup> TSO (Lt Cdr [REDACTED] Interview Transcript Page 16.

<sup>59</sup> TSO (Lt Cdr [REDACTED] Interview Transcript Page 30.

<sup>60</sup> TSO (Lt Cdr [REDACTED] Interview Transcript Page 23.

<sup>61</sup> TSO (Lt Cdr [REDACTED] Interview Transcript Page 23.

<sup>62</sup> TSO (Lt Cdr [REDACTED] Interview Transcript Page 35.

<sup>63</sup> XO (Lt Cdr [REDACTED] Supplementary Interview Transcript Page 2.

<sup>64</sup> CBO (Lt [REDACTED] Interview Transcript Page 17.

confirmation that engine orders were being implemented, it did not contribute to the grounding.

**43. Bridge Communications.** The surfacing OOW, CBO (Lt [REDACTED]), was experiencing some bridge communication difficulties and asked for the ICS audio panel box to be changed<sup>65</sup>. The original watertight unit had leaked and been replaced by a standard unit which also had a fault. The OOW (Lt [REDACTED]) directed that the original watertight unit, which had been dried out, should be used, which required replacement of the fitted unit. Fitting the watertight unit added considerable delay to the rigging of the bridge and it still exhibited faults. Faults in the Internal Communications System had resulted in the SCOOW Team dialling up a conference call to enable the required personnel to communicate. This was a convoluted process and was one of the delays in the restoration of communication between the Bridge and Control Room. This work-around solution did not include the CO's cabin and prevented him from monitoring the net. The SI Team questioned the use of the voicepipe as a secondary communications path. It was stated by the OOW Below that it was totally ineffective<sup>66</sup> and as a result was never used. It is the view of the SI Team that the defects and shortcomings of the Internal Communications System were a causal factor in the grounding.

**44. Actions by the OOW.** Prior to going to the bridge Lt Cdr [REDACTED] looked at the chart. He was informed that the submarine was running approx 5 minutes late for the boat transfer RV. He did not put a fix on the chart and he provided no instructions to the POOW as to how he intended to manoeuvre or position the submarine for the transfer<sup>67</sup>. He did not provide any instructions to the POOW on how he wished the submarine to be fixed, nor did he provide instruction on the use of the Stbd Optronics mast for fixing or monitoring of clearing bearings. Furthermore, he did not question why the echo sounder (paper trace) was not running. ASTUTE Class SOs (Draft) states that the echo sounder should have been running as the submarine was within one mile of land<sup>68</sup>. The handover was not conducted in accordance with SOPs<sup>69</sup> and it is the view of the SI Team that this resulted in the OOW proceeding to the bridge without sufficient SA or an understanding of the plan; this is assessed to be a causal factor to the grounding.

**45.** The Navigating Officer informed the SI team that as a general rule the 'generic plan' for boat transfers was to enter the inked in boat transfer grid and reduce speed to [REDACTED] conduct a turn (port or starboard), put the wind at Red 90 and then stop and await the arrival of the Transfer Vessel (MV OMAGH). The preferred method of transfer was for ASTUTE to place the wind on the port beam and conduct the transfer on the submarine's starboard side<sup>70</sup>. Had this plan been followed, it is the view of the SI Team that the grounding would have been avoided.

**46.** When ASTUTE entered the boat transfer grid at 0612Z, no direction was given to reduce speed until the fix report at 0619Z. At this point the OOW was requested by the POOW to reduce speed and alter course to North. The OOW stated that he could not turn

<sup>65</sup> WEO (Lt Cdr [REDACTED]) Interview Transcript Page 2, CBO (Lt [REDACTED]) Interview Transcript Page 20.

<sup>66</sup> LO (Lt [REDACTED]) Interview Transcript Page 23.

<sup>67</sup> TSO (Lt Cdr [REDACTED]) Interview Transcript Pages 1-10.

<sup>68</sup> Exhibit 26.

<sup>69</sup> Exhibit 26.

<sup>70</sup> NO (Lt [REDACTED]) Interview Transcript Page 5-8.

to Port at this time because of the position of MV OMAGH and did not consider the option of turning to Stbd. It is not clear whether OMAGH was underway or stopped. With no bridge VHF radio, the OOW could not liaise with OMAGH to resolve the situation, however, the CR and WT office VHF radios were available for this purpose. It is the view of the SI Team that any Situation Awareness (SA) Lt Cdr [REDACTED] had when he arrived on the bridge was now rapidly deserting him due to the lack of either radar, a chart or previous experience in this area. His decision not to alter course to North when first directed by the POOW or at the earliest opportunity thereafter, or to seek an alternative means to communicate with OMAGH to resolve the situation was now critical to the final outcome. It is the view of the SI Team that, as the submarine entered box G6, at the edge of the boat transfer grid, either the OOW Below (Lt [REDACTED]) or the POOW (LS [REDACTED]) should have called the CO<sup>71</sup>. There was now considerable 'doubt' about the intentions of the OOW and his awareness of the submarine's proximity to danger on ship's head. The submarine was propelling ahead at [REDACTED] still steering course 130 and heading directly towards the 15 metre Limiting Danger Line (LDL).

47. At 0632Z the submarine speed was [REDACTED] by PMS. From reconstruction by the SI team, the submarine had 3 cables of safe water in front at 0627Z. The OOW stated he was concerned about snagging some fishing floats 150-200 yds fine on his port bow and did not turn<sup>72</sup> to the North. It was the CO's assessment, based on his knowledge of the handling characteristics of ASTUTE, that bold astern revs (50 RPM) at this time, or an immediate turn using full rudder would have kept the submarine safe. The SI team are of the view that the OOW (Lt Cdr [REDACTED]) had a weak knowledge of the surface handling characteristics of ASTUTE and by this stage still had no appreciation of the proximity to danger.

48. At 0628Z the submarine commenced propelling slow astern ([REDACTED]<sup>73</sup>. The submarine speed at this time was [REDACTED]. Lt Cdr [REDACTED] states he ordered Slow Astern 30 Revs. The submarine was obeying telegraphs in surfaced mode and the order that was actually executed was Slow Astern [REDACTED]. This was the OOW's (Lt Cdr [REDACTED]) intention<sup>74</sup>. If he had wanted to achieve 30 Revs Astern, the correct order he should have given was to order Half Astern Revolutions 30. Neither the SCOOW (WO2 [REDACTED]) or the Helmsman (PO [REDACTED]) requested clarification whether the OOW required Slow or Half Astern. Under interview neither could actually recall any Astern order. An examination of PMS data shows that only [REDACTED] were ever applied at 0628Z. It is the view of the SI that given the proximity of danger had the TSO (Lt Cdr [REDACTED]) given the order 'Half Astern Revolutions 30' the grounding would have been avoided.

49. It was at this time that a failure in the communications system occurred between the OOW and Ship Control which resulted in a delay of approximately 2 minutes in passing this order. The order was eventually passed by WIFCOM and required the OOW to order all stations to hold reports. The lack of any recoverable data from Big Brother prevents the SI team from determining when and what orders were actually given. The OOW Below (Lt [REDACTED]) stated in his evidence that he spoke to the OOW on the stanaphone and

<sup>71</sup> ASTUTE SOs (Draft) Section 8 Art 0181 para 8(b)(1)(o) informing the CO when surfaced.

<sup>72</sup> TSO (Lt Cdr [REDACTED]) Interview Transcript Page 28.

<sup>73</sup> Exhibit 33 and 33a.

<sup>74</sup> TSO (Lt Cdr [REDACTED]) Interview Transcript Page 27.

informed him that the Control Room were having difficulties in understanding his orders<sup>75</sup>. It is the view of the SI Team that the failure of the communications system compounded the problem and delayed the execution of the Slow Astern order.

50. At 0628Z the Echo Sounder trace was turned on<sup>76</sup>. Up to the grounding it shows a rapidly shoaling trace from 45 metres to 1 metre before becoming blacked out. The blacking out would have been when the CO switched from the forward transducers to the after ones. The after transducer is in the base of the rudder which supports the assessment that the rudder was the first part of the hull to ground. The SI team have been unable to identify who switched the echo sounder trace on. Although the Digital Depth Recorder element was running and displaying on the helmsman's panel neither the helmsman (PO [REDACTED]) or SCOOW (WO2 [REDACTED]) noticed the sounding or it reducing until after the grounding. The Echo Sounder trace should be run in confined waters at Patrol Routine<sup>77</sup> but was not on this occasion. The responsibility to run it rests with the OOW. It is the view of the SI Team that throughout the build up to the grounding at no time did the OOW (Lt Cdr [REDACTED]) take any action to turn away from the most dangerous course which was taking him directly towards land. When he gave reasons for not altering to port, he always had the option, at any time in the inked in boat transfer grid, of turning to starboard. It is the view of the SI team that his lack of SA (no radar or chart), no previous experience of operating in this area in the dark and his incomplete preparations before proceeding to the bridge were the major causal factor in the grounding. He, as OOW, was responsible for the safe navigation of the submarine<sup>78</sup>.

51. **Post Grounding Actions.** The submarine grounded (speed Zero) at 0635Z<sup>79</sup>. It was finally concluded that the submarine had grounded after several more minutes (0637Z). The XO came down from the bridge to inform the CO of his thoughts. They met in the CR. Because of the gentle nature of the grounding it did not give any cause for immediate concern and as such no one in any position of responsibility felt there was any immediate threat to the submarine<sup>80</sup>. As a consequence there was no automatic reaction to take the submarine to Emergency Stations. The SI understands why this might be but and believes it to be a regrettable oversight, but one that by itself did not further endanger the submarine. A number of those interviewed stated that Emergency Stations should have been ordered to get the entire crew up and conducting Phase 1 checks. It was admitted by a number of key personnel that the EOP for Grounding could not be readily found due to the fact that it is included as part of the Collision EOP<sup>81</sup>. The WEO took charge of initiating a full set of rounds of the submarine to ensure the submarine was watertight. Phase 1 damage checks were not ordered but in the absence of any reports within the first few minutes they were assumed to be complete by de-fault. At this point the CO was attempting to use blows and ahead and astern propulsion to drive the submarine free.

<sup>75</sup> LO (Lt [REDACTED]) Interview Transcript Page 14.

<sup>76</sup> Exhibit 1.

<sup>77</sup> ASTUTE Class SOs Art 0181.9p(1). E/S is to be run continuously whenever the submarine is coastal waters, in passage or patrol routine when within 1nm of land.

<sup>78</sup> QRNN 1922.

<sup>79</sup> Exhibit 33 and 33a.

<sup>80</sup> WEO (Lt Cdr [REDACTED]) Interview Transcript Page 45. XO (Lt Cdr [REDACTED]) Interview Transcript Page 35.

<sup>81</sup> WEO (Lt Cdr [REDACTED]) Interview Transcript Page 46. CBO (Lt [REDACTED]) Interview Transcript Page 32.

## Detailed Analysis of The Navigational Plan

52. Navigational intentions for the Boat Transfer were not clearly defined in Night orders and the specific conduct of this transfer was not discussed between the CO and NO. There was no evidence of any planning in the NO's workbook or notebook. Understanding of the plan differed between key players; the CO, XO and NO understood that the submarine should, on reaching the grid, reduce speed to [REDACTED] and manoeuvre as required within the box for the boat transfer, optimising for the prevailing conditions. The POOW view was that the submarine was to proceed to the south eastern boxes within the grid, as this had been conducted previously, in order to reduce transfer times. The OOW believed that he could conduct the transfer anywhere within the boat transfer grid provided that it was a good location for wind and had enough sea room in order to complete the transfer<sup>82</sup>.

53. Both charts were checked against the NP133B<sup>83</sup> and found to be up to date for chart corrections. It was found that the chart correction page which includes the correction state for chart 2498 in folio 5 was missing. However, the duplicate chart in the local folio was viewed and both charts were at the same correction state.

54. Both the plot and bridge charts had an inked in LDL at the 15m contour. No visual or radar safety was annotated on the plot chart whatsoever<sup>84</sup>. Some clearing bearings were sighted on the bridge chart, covering the coastline in the vicinity of the grounding but not to the north of the boat transfer grid. These visual clearing bearings were based on edges of land and islands which would have little utility at night in all but the best conditions, or by day in reduced visibility. The bridge chart presented as evidence to the SI Team also detailed a pilotage plan to the buoy in Broadford Bay. Clearing bearings, wheel over points and distances to wheel over were clearly marked, as this was a proposed plan for the submarine once she had been refloated. The SI team have some reservations as to whether the clearing bearings displayed on the chart were actually displayed prior to the incident, and were not in fact annotated as part of the planning for the Broadford Bay pilotage. No evidence of a NO GO sounding was displayed on the chart.

55. The plot chart displayed an inked in boat transfer grid. This had additional boxes pencil amended to the south east of the box (F7, G7, H7). The boat transfer grid on the bridge chart differed from that on the plot chart in that the pencil amended boxes and the inked in boxes G5, G6, H5 and H6 were omitted.

56. The plot chart displayed a navtrack which entered the boat transfer grid at box D1 on a course of 130 and finished on the eastern edge of G5/western edge of G6. Distances to run on this navtrack were wrong, as admitted by the NO when questioned<sup>85</sup>. This navtrack was not annotated on the bridge chart, although a track from the RONA range to the buoy in Broadford Bay was marked on the bridge chart, as part of the subsequent plan once the submarine had been re-floated. Bubble times were not annotated on the plot chart, nor

<sup>82</sup> TSO (Lt Cdr [REDACTED]) Interview Transcript Page 6.

<sup>83</sup> Exhibit 18.

<sup>84</sup> Exhibit 6a (Plot) and 6b (Bridge).

<sup>85</sup> NO (Lt [REDACTED] Interview Transcript Page 44.

any clear chart notes and instructions as to when to reduce speed and prepare for the boat transfer. Tidal Diamonds had not been marked up for the transfer on either chart.

57. It is the view of the SI Team that the Navigational Plan falls short of the requirements laid down in BR45 Vol 1 and is a contributing factor to the grounding.

### Detailed Analysis of Execution of the Navigation

58. In the execution of the navigation, the fixing routine was being conducted by the POOW (LS [REDACTED]). GPS was being used as the only method of fixing the Ship, bar one 3 point visual fix at 0600Z. Soundings were not being tied in, as evidenced by the fact that the echo sounder trace was started at 0628Z<sup>86</sup> and there were no record of soundings recorded in the fixing log, which is in contravention of ASTUTE Class Standing Orders<sup>87</sup>. No recourse was made to the use of the Starboard Optronics mast to tie in visual bearings. 1009 Radar, although available was not being used.

59. The OOW, Lt Cdr [REDACTED] had taken Charge of the Ship and therefore had responsibility for the execution of the navigational plan. As evidenced in the fixing log, the correct navigational responsibilities before taking the watch were not conducted in accordance with ASTUTE SOs, in that he did not put a fix on a chart, make notes on the navigational plan to take to the bridge and did not provide the POOW with any direction on navigational intentions. There is no record of the responsibility for the execution of the navigation being passed to another officer. Without an operational radar or bridge chart, the ability of the OOW to execute the navigation from the bridge was significantly degraded. There is also no evidence to suggest the fixing routine and navigation was being robustly managed by the OOW from the bridge. By his own omission, the OOW Below (Lt [REDACTED]) did not provide thorough supervision of the plot and the fixing routine, stating in his interview that he had only 10-15 hours experience as the surfaced OOW Below<sup>88</sup> and less navigational experience than the POOW. The NO was nominated as the Casing Officer and was not able to offer any navigational advice and direction, nor take the navigation from the OOW. It is the view of the SI Team that the responsibility for the execution of the navigation was in effect resting with the POOW (LS [REDACTED]), who was the only person with an understanding of the submarine's position. If his recommendations to the OOW, had been enacted in a timely manner, they would have prevented the submarine from grounding.

### Records

60. Records taken complied with the minimum expected at Patrol Routine. The paucity of records and the fact that 3 out of 4 electronic records contain no usable data has hindered, but not prevented, the SI Team in reconstructing the incident. A number of recording systems unique to ASTUTE have required BAE Systems Specialists to extract the data or prove the absence of data. This delayed the SI team in finalising their report. The SI Team make the following observations:

<sup>86</sup> Exhibit 24.

<sup>87</sup> Exhibit 26 ASTUTE Class Standing Orders (Draft) Section 8 Art 0181 para 9(p)(1).

<sup>88</sup> LO (Lt [REDACTED]) Interview Transcript Page 4.

- a. **Control Room Fixing Log.** The CR Fixing Log was not maintained in accordance with standard procedures, eg, no record of fix by the oncoming OOW, no chart changes recorded, no course alterations annotated and no sounding data<sup>89</sup>.
- b. **Ship's Log.** The Ships Log lacked all relevant detail. In particular it did not contain a surfacing position, no reports of major hull openings and no report of the grounding<sup>90</sup>.
- c. **Little Sister.** Little Sister was started after the grounding and has only provided limited information for the SI team<sup>91</sup>.
- d. **Narrative.** The Narrative was started after the grounding<sup>92</sup>.
- e. **A SNAPS.** No data has been recovered from the ASNAPS system. It is believed that a defect has prevented it recording any navigational data<sup>93</sup>.
- f. **Echo Sounder.** The echo sounder trace was started at 0628Z and records only 7 minutes of data until the grounding<sup>94</sup>.
- g. **Platform Management System.** Platform Management Date (PMS) provided by BAE Systems has been an important source of data to enable a full reconstruction of events and corroborate witness evidence<sup>95</sup>. EOTs (Engine Order Telegraphs) was not being recorded by PMS, forcing the reconstruction to be done from shaft revolutions and direction.
- h. **Big Brother (MIRRA).** The configuration of Big Brother has prevented any data from being provided to this SI<sup>96</sup>.

## Equipment

- 61. Two significant equipment deficiencies have been identified. These are Radar 1009 and a fragile Internal Communications System. It is the view of the SI team that radar was fundamental for the safe execution of this boat transfer. The noise defect did not affect the serviceability of the radar but despite him knowing that it was available, the OOW did not use it.
- 62. Communications between the bridge and ship control failed at a critical moment in the incident (0626Z). Restoration took approximately 2 minutes and undoubtedly resulted in a delay in passing an engine order (Astern Revs). It is the view of the SI Team that the

<sup>89</sup> Exhibit 7.

<sup>90</sup> Exhibit 5.

<sup>91</sup> Exhibit 2.

<sup>92</sup> Exhibit 16.

<sup>93</sup> Exhibit 4.

<sup>94</sup> Exhibit 1.

<sup>95</sup> Exhibit 33 and 33a.

<sup>96</sup> Exhibit 3.

Internal Communications System requires further attention to ensure that it can support safe operation of ASTUTE Class submarines.

### Damage

63. An inspection by the Northern Diving Group of the submarine whilst aground indicates the entire hull was resting neatly on the soft seabed. The rudder was seen to be embedded in the silt and slight damage to the leading edge of the rudder skeg was observed. The photographs of the damage caused by the grounding (Figures 7 and 8) show that there is no structural damage to the rudder. Damage is principally limited to the GRP Skeg which has been split and requires replacement and the BUTEC Pinger. Estimates of repair costs have yet to be completed but unit cost of the GRP Skeg and Pinger is estimated at £81K<sup>97</sup>. The rip tow was also deployed and will need replacement.

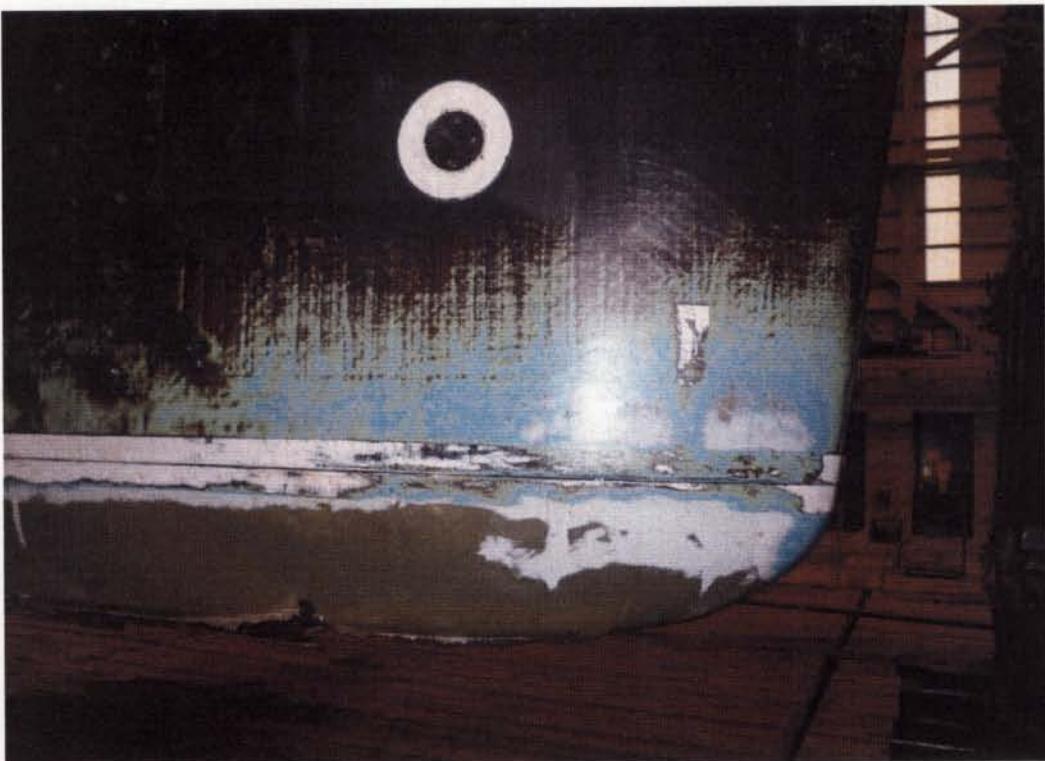




Figure 8 – Internal Damage to GRP Rudder Skeg.

#### First of Class Issues

64. **WECDIS.** WECDIS is not fitted in ASTUTE and, as such, navigation is being conducted using traditional paper chart procedures. Whilst the observance of correct navigational planning and execution procedures would have avoided this incident occurring, a WECDIS system would have greatly improved the navigational SA afforded to the plot and OOW. A WECDIS repeat on the bridge, slaved to the plot would have allowed the OOW immediate real time reference of the ship's position and would have mitigated the lack of radar and chart. It would have also removed any discrepancies in the bridge and plot chart which were observed in this incident. HMS ASTUTE does not hold a 'Safe Navigator' laptop.

65. **Big Brother (MIRRA).** The SI teams attempts to extract any voice recorded data from Big Brother (MIRRA) proved problematic. Detailed diagnostics by BAE Staff identified that the over-write security setting were incorrect which resulted in the voice data disks being wiped of any voice data. This shortcoming has been taken by the company for follow up action on ASTUTE and follow on boats.

66. **Internal Communications.** During the Service Investigation a number of witnesses stated that the ICS fitted to ASTUTE is both problematical and unreliable. It is the view of the SI team that the ICS needs further development to ensure reliable communications to support safe operation of ASTUTE Class submarines. This should consider improvements to the voice pipe.

**FINDINGS**

67. Preparations for, and conduct of the watch by the OOW (Lt Cdr [REDACTED]) fell short of the standards required to maintain submarine safety.
68. The planning for the boat transfer was insufficient to ensure safe completion and lacked appropriate command oversight.
69. The boat transfer was planned to be conducted at Patrol Routine and not River Routine. River Routine would have ensured that Echo Sounder trace was running and manned, and would have also resulted in conscious decision on whether to operate the 1009 radar. River routine would also have also required the OOW Below to have been a Seaman Officer vice the Logistics Officer<sup>98</sup>. That fact that the boat was not in River Routine is highly unusual in the opinion of the SI Team. There would not appear to be any legitimate reason, for what is standard practice in other submarines, not to have been adopted on this occasion.
70. The navigation plan for the boat transfer was not briefed to any of the personnel responsible for its execution nor was it briefed to the CO.
71. The execution of the plan lacked command oversight and the imposition of the normal control measures that may have prevented it (eg. Briefing, Routine and times to be called).
72. The requirement to open the SNP flaps delayed the XO getting into position in the fin until 10 minutes before the grounding and prevented early Command oversight of the evolution.
73. The implications of landing the 3rd Seaman Officer from 1st Watch to perform the duties of FVLO on bridge and casing manning were not properly considered. The OOW had no previous experience of operating in this area in the dark. The NO was more experienced at conducting boat transfers and should have been acting as OOW rather than being the officer on the casing. The SI Team considers that the most appropriate manning for this boat transfer should have been: Navigating Officer (Lt [REDACTED]) on the Bridge, the Second Coxswain on the Casing and the TSO (Lt Cdr [REDACTED]) as the OOW Below.
74. By taking charge of the submarine the TSO had assumed responsibility for the execution of the navigation. There was no bridge chart on the bridge at a critical time. The lack of a bridge chart, radar and insufficient SA by the OOW, combined with ineffective supervision by the OOW Below, effectively resulted in the control of navigation resting with a Leading Seaman.
75. Radar 1009 was available if required, but was never used. A requirement to change the bridge ICS audio unit delayed the rigging of the secondary radar, which resulted in it not being available for use until too late.

<sup>98</sup> Exhibit 28 ASTUTE Class SOs (Draft)

76. Fragile bridge communications delayed the passing of an Engine Telegraph Order. The hiatus this caused may have caused the OOW to give a conning order in an incorrect format. The CO was not in the Control Room and was unable to hear any communications between the bridge, the navigation plot or ship control.

77. There was no hand held VHF radio on the bridge which prevented the OOW from communicating with MV OMAGH at a critical time. However, VHF was available in the Control Room and WT Office throughout but never considered.

78. The Grounding EOP is not in the index of EOPs and was not immediately apparent to the Ship Control Team.

79. It was the view of the SI team that the time taken to rig the bridge for surface running takes longer in ASTUTE than on a TRAFALGAR Class. Certainly on the morning of 22 October this was the case as the bridge was not fully rigged until approximately 3 minutes prior to grounding<sup>99</sup>. This was 1 hour 38 minutes after surfacing.

80. The paucity of electronic records has hindered reconstruction of the incident. Configuration of the Big Brother (MIRRA) Voice Recording system meant that all data was wiped on replay. ASNAPS data card was blank due to a system defect and Little Sister was not used until after the event. Data provided from PMS proved vital in reconstructing events.

81. It is the opinion of the Panel that whilst there were a number of individual and collective failings within the Navigation and Command Team onboard HMS ASTUTE, and that these were compounded by a number of contributory factors, the failings observed are not indicative of wider failings within the Submarine Service as a whole. It is the view of the Panel that this grounding was caused by failures specific to HMS ASTUTE.

<sup>99</sup> XO (Lt Cdr [REDACTED]) Interview Transcript Page .

**RECOMMENDATIONS**

82. The following recommendations are made:

- a. It is recommended that COMOPS reviews this report with a view to taking administrative or disciplinary action as required.
- b. The Commanding Officer needs reminding of his responsibilities for safety of the submarine and personnel law QRRN Chapter 8. In particular the need to provide clear and comprehensive direction and guidance, and the need to ensure appropriate levels of command oversight.
- c. All Surfaced OOWs need reminding of their responsibilities for safe and accurate execution of navigation.
- d. All OOWs Below need reminding of their responsibilities for the appropriate supervision of personnel.
- e. The Grounding EOP should be revised and included as a separate EOP and not part of the Collision EOP.
- f. Clear guidance on the adoption of River Routine needs to be stipulated in ASTUTE Class SOs.
- g. Before undertaking any further sea trials HMS ASTUTE should be provided with a surfaced navigation training package to cover manning, routines, navigational planning, briefing and execution.
- h. The fragility and limitations of the Internal Communications system needs addressing. Most important is the need for 2 reliable and dedicated lines of communications between the bridge and ship control. Any solution must ensure that the CO can select and monitor these direct communication lines from his cabin.
- i. It is recommended that WECDIS is fitted to all ASTUTE Class SSNs at the earliest opportunity. Until WECDIS can be fitted ASTUTE should be provided with a 'Safe Navigator' laptop.
- j. Shortcomings noted in the operation of the Big Brother (MIRRA) system need to be rectified at the earliest opportunity. A full brief of data capture and play back procedures needs to be provided to ship's staff