

The Opening and Closing Sequences of the Battle of Jutland 1916 Re-examined: archaeological investigations of the wrecks of HMS *Indefatigable* and SMS *V4*

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This paper presents the findings from surveys carried out in 2016 of two wrecks sunk during the Battle of Jutland. The remains of HMS *Indefatigable* had previously only been partially understood. SMS *V4*, was found and surveyed for the first time. They represent the first and last ships sunk and allow the timings of the opening and closing of the battle to be established. In the case of HMS *Indefatigable*, the discovery that the ship broke in two, seemingly unnoticed, substantially revises the narrative of the opening minutes of the battle.

Key words: nautical archaeology, battlefield archaeology, conflict archaeology, Battle of Jutland, World War One, Royal Navy.

On 31 May 1916, the two most powerful battle-fleets in the world clashed off the coast of Denmark, in what in Britain has become known as the Battle of Jutland. In reality the battle was more of a skirmish from which the German High Seas Fleet, having accidentally run into the British Grand Fleet, was able to extricate itself and escape to base, leaving the British in control of the battlefield. However, in the 16 hours during which this drama played out, 25 ships were sunk, claiming more than 8500 lives. The Grand Fleet suffered 14 of the ships sunk and around 6000 of the lost sailors. More than 5000 of the British dead were lost on five ships that exploded, killing nearly every sailor aboard the ships. One such case was the first ship sunk in the battle, HMS *Indefatigable*, which sunk with all but two of its complement of 1019 (Harper, 1927: 117).

The battlefield, in which 24 of the ships were sunk—the 25th, HMS *Warrior* sunk while returning to Scotland—consists of two distinct groups of wrecks (Fig. 1). The northern group is made up of the 12 ships sunk during the opening daylight actions, the Battlecruiser Action, in which HMS *Indefatigable* was sunk, and the later Fleet Action, from which the Germans retired. The southern group comprises the 12 ships either sunk or scuttled as the High Seas Fleet returned to base during the Night Action, cutting across the rear of the Grand Fleet. SMS *V4* was the last ship sunk during this time. The positions shown on Figure 1 are derived from Harper (1927: 110), a record of the battle compiled by the captain of the Royal Navy's navigational school, and are the locations that were estimated by him in 1919 for where the ships were sunk. By surveying the entire battlefield in 2015, the author has shown that the Harper Record is a consistently accurate depiction of the battle (McCartney, 2016: 243–251).

On ten expeditions over the past 17 years the author has been instrumental in the discovery, recording, and interpretation of all of the wrecks sunk at Jutland. In 2015 the degree of knowledge about the wrecks was transformed by the application of swath bathymetry (multibeam) survey to each of the known wreck-sites (McCartney, 2016). This formed the basis on which future research at Jutland could be focused. A portion of fieldwork and research carried out in 2016 is the subject of this article. This was primarily aimed at resolving the last outstanding questions relating to the loss of two ships, the battlecruiser HMS *Indefatigable*, and the previously unfound German torpedo boat SMS *V4*.

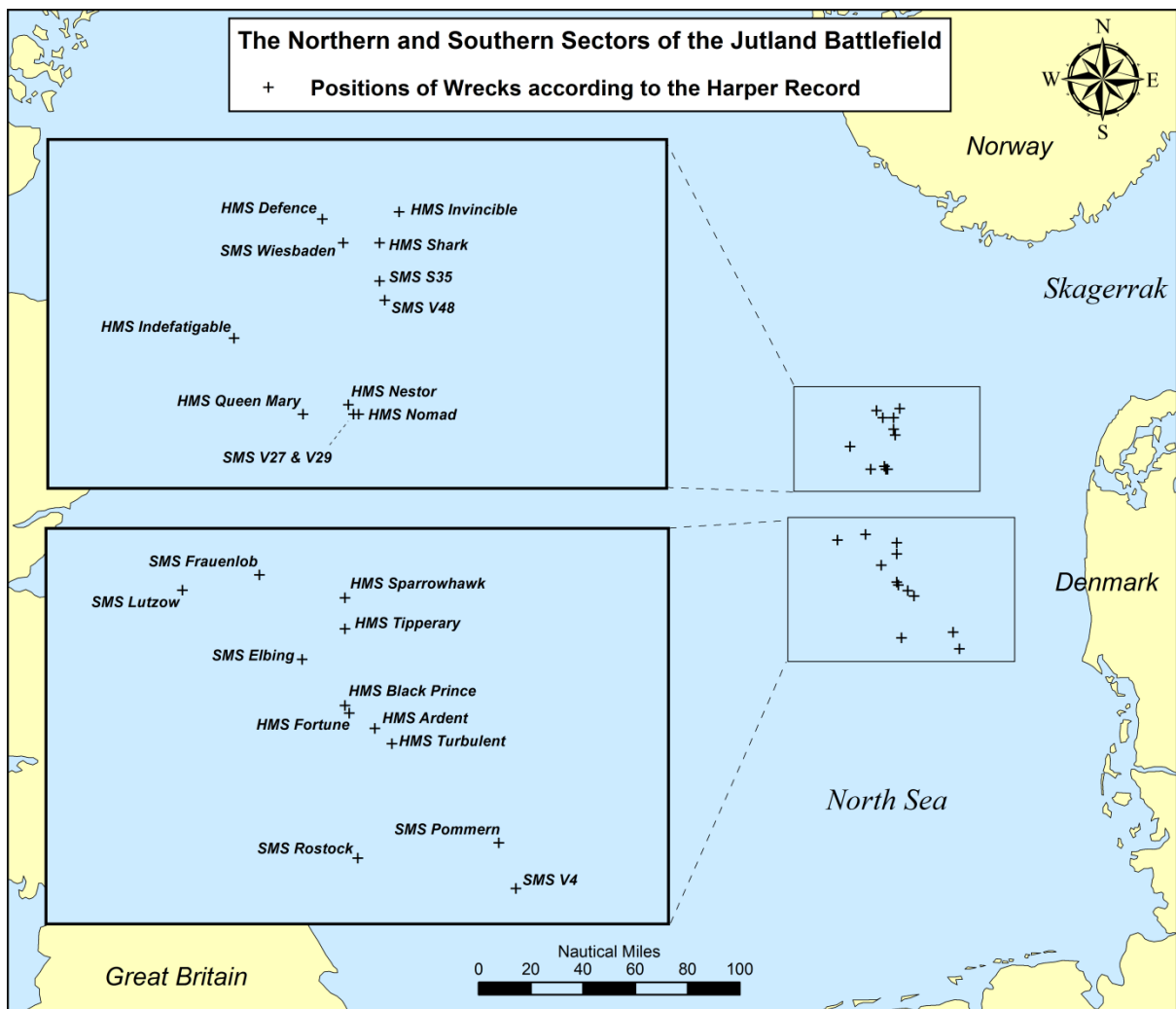


Figure 1. The Jutland battlefield showing the distribution of the ships sunk as depicted in Harper (1927: 110) (InnesMcCartney).

Reinvestigation of HMS *Indefatigable*

HMS *Indefatigable* was the lead ship of the class and represented a stretched version of the first generation of British battlecruisers, the *Invincible* Class (Fig. 2). The ship was constructed at Devonport and launched in 1909. After service in the Mediterranean, HMS *Indefatigable* joined Admiral Beatty's Battlecruiser Fleet (BCF) based in Rosyth in early 1915, from whence it sortied for the Battle of Jutland the following year. The BCF, operating as an independent reconnaissance force of the main British Fleet, encountered the German all-battlecruiser First Scouting Group (1SG) in the late afternoon on 31 May.

A running fight between both lines of ships, known as the 'Run to the South' soon followed, in which HMS *Indefatigable* was the last of the six ships in the BCF line. Fighting began at 15:45 with both lines of ships opening fire at the same time (Harper, 1927: 20). The action had been going on for around 17 minutes when, according to both Harper (1927: 21) and the official German historian Groos (TNA ADM 186/626: 41), HMS *Indefatigable* was sunk at around 16:02 when the ship was seen

to violently explode. The last ship in the 1SG line, SMS *Von der Tann*, had seemingly by prompt and accurate fire, rapidly destroyed a British battlecruiser.



Figure 2. HMS *Indefatigable*: Displacement: 18,500 tons, Length: 180m, eight 12-inch guns, sixteen 4-inch guns (with permission, World Ship Society collection).

The explosive nature of British cordite when ignited in confined spaces was certainly the cause of the loss of *Indefatigable*. Malpractice in the handling of cordite has long been understood by the Royal Navy as the primary cause that three British battlecruisers at Jutland blew up so readily. By overriding the safety features, such as anti-flash doors in turret structures, an uninterrupted path for naked flame was created from turret to magazine, so that a hit in the region of a turret would almost inevitably lead to a devastating explosion (Lambert, 1998).

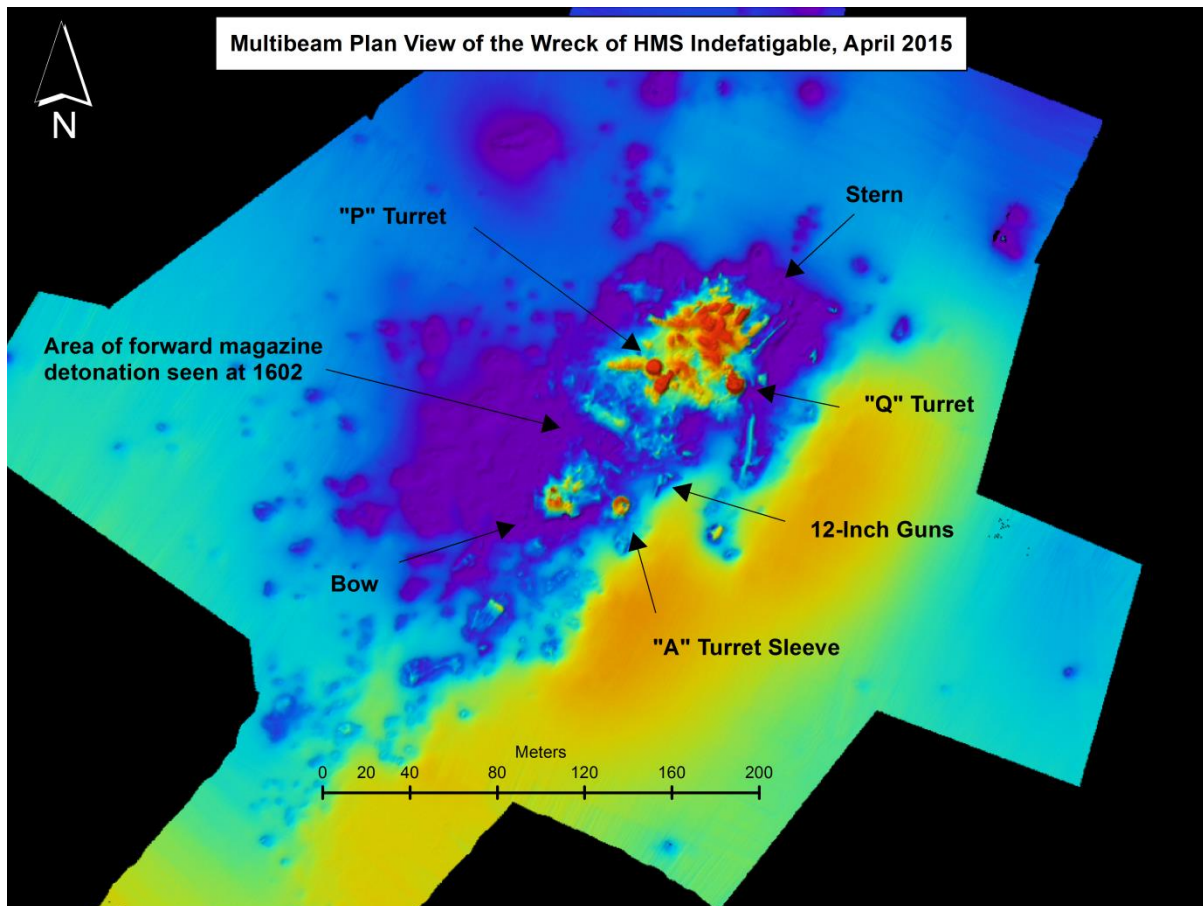


Figure 3. Multibeam plan view of the wreck of HMS *Indefatigable* as seen in April 2015 (Innes McCartney/JD-Contractor).

The wreck of HMS *Indefatigable* remained undiscovered until located and dived by the author in 2001 when the site was photographed and recorded on video (McCartney, 2016: 37–41). The wreck was seen to be very broken down and dispersed, possibly upside down. At the time there were no practical means by which an accurate map of the wreck-site could be derived, because it was too large and too deep (48m) to be measured using traditional diver-deployed techniques. What was needed was a geophysical survey. This finally occurred in 2015 when, in conjunction with underwater specialists JD-Contractor and its owner, Gert Normann Andersen, all the known wrecks of the Battle of Jutland, including HMS *Indefatigable*, were surveyed with high-grade swath bathymetry (multibeam) (Fig. 3).

The 2015 survey revealed that the wreck was violently dispersed over an even wider area than the 2001 dives had shown. An ROV was used to examine some of the outlying features uncovered by the multibeam and to confirm that the bow was pointing to the south-west. Three turrets were observed among the wreckage, with the fourth not identified. It was something of a revelation to see that craters made in the seabed by pieces of debris flying out of the ship when it exploded could still be seen 100 years after the event. The survey clearly demonstrated that, in accordance with the both Harper (1927: 20) and Groos (TNA ADM 186/626: 41), the fore part of the ship had exploded violently, seemingly leading to its destruction.

Unresolved archaeological questions

During the late summer of 2015, while the data from the Jutland survey was being processed and interpreted back in the UK, it became evident that the wreck-site was around 140m from bow to stern. This was odd because HMS *Indefatigable* was in fact 180m long (Roberts 1997, 29) So it seemed that up to 40m of wreckage could not easily be accounted for. Two possible reasons for why this was the case were promulgated (McCartney, 2016: 41–42). Either the wreck had concertinaed as it sank and then impacted with the seabed, or an undiscovered portion of the stern lay some distance from the wreck. There was no indication from historical sources, survivor and eyewitness accounts, however, that the ship had broken in two, shedding around 20% of its length.

In 2001, before this discrepancy had emerged from the geophysical data, the wreck of HMS *Indefatigable* had thrown up another mystery, which at the time had no plausible explanation. It was connected to the location in which the wreck had been found. The wreck of HMS *Indefatigable* is located some five miles to the north-east of the position recorded by Harper (1927: 110) (Fig.4, Line C). In 2001 the positional discrepancy of five miles did not raise any suspicion because of the accuracy of navigation in 1916, combined with the circumstances of being in a battle. Even still, it was noticeable by contrast just how close the wreck of the next ship sunk in the ‘Run to the South’ HMS *Queen Mary* was to Harper’s reckoning. Importantly, it was the distance between the wrecks of HMS *Indefatigable* and HMS *Queen Mary* that was difficult to explain.

The key question comes down to timing. It was known that the speed of the BCF at this time in the battle was limited to the maximum formatted speed of the battlecruiser HMS *New Zealand*—fifth in the BCF line and the slowest of all six ships—of 26 knots, and the line did not straggle (Gordon, 1996: 116). Harper states that HMS *Indefatigable* sunk at 16:02 and HMS *Queen Mary* at 16:26, 24 minutes later (Harper, 1927: 21–22). So by his calculations, he accurately plotted the distance between the two wrecks to be 10.82 nautical miles (Fig. 4, Line A), which equates to his calculating that the BCF was actually travelling at 27 knots, presumably pushing HMS *New Zealand* beyond normal performance.

This seems entirely logical until the distance between the wrecks of HMS *Indefatigable* and HMS *Queen Mary* was measured and found to be 12.26 nautical miles (Fig. 4, Line B). Using Harper’s calculated speed for the BCF of 27 knots, this distance means that the wrecks are actually over 27 minutes apart, not the recorded 24. This would require the BCF to have been making a suspiciously high 30 knots. The times recorded for the loss of these two ships is difficult to dispute because records from both sides agree. So what is the possible explanation? In 2001 none could be ascertained and it was described as simply the ‘fog of war’ (McCartney, 2001: 33–38).

Results of the 2016 survey

In early 2016 a working theory emerged that the timing question and the foreshortened nature of the wreck of HMS *Indefatigable* might be linked and have a common explanation. Was there a missing portion of the wreck? If there was, could it explain the outstanding question of timing? This led to the use of multibeam to resurvey the wreck of HMS *Indefatigable*. Scanning the ship’s known track in the minutes before it sunk became a priority during the fieldwork conducted on JD-Contractor’s MV *Vina* in March 2016.

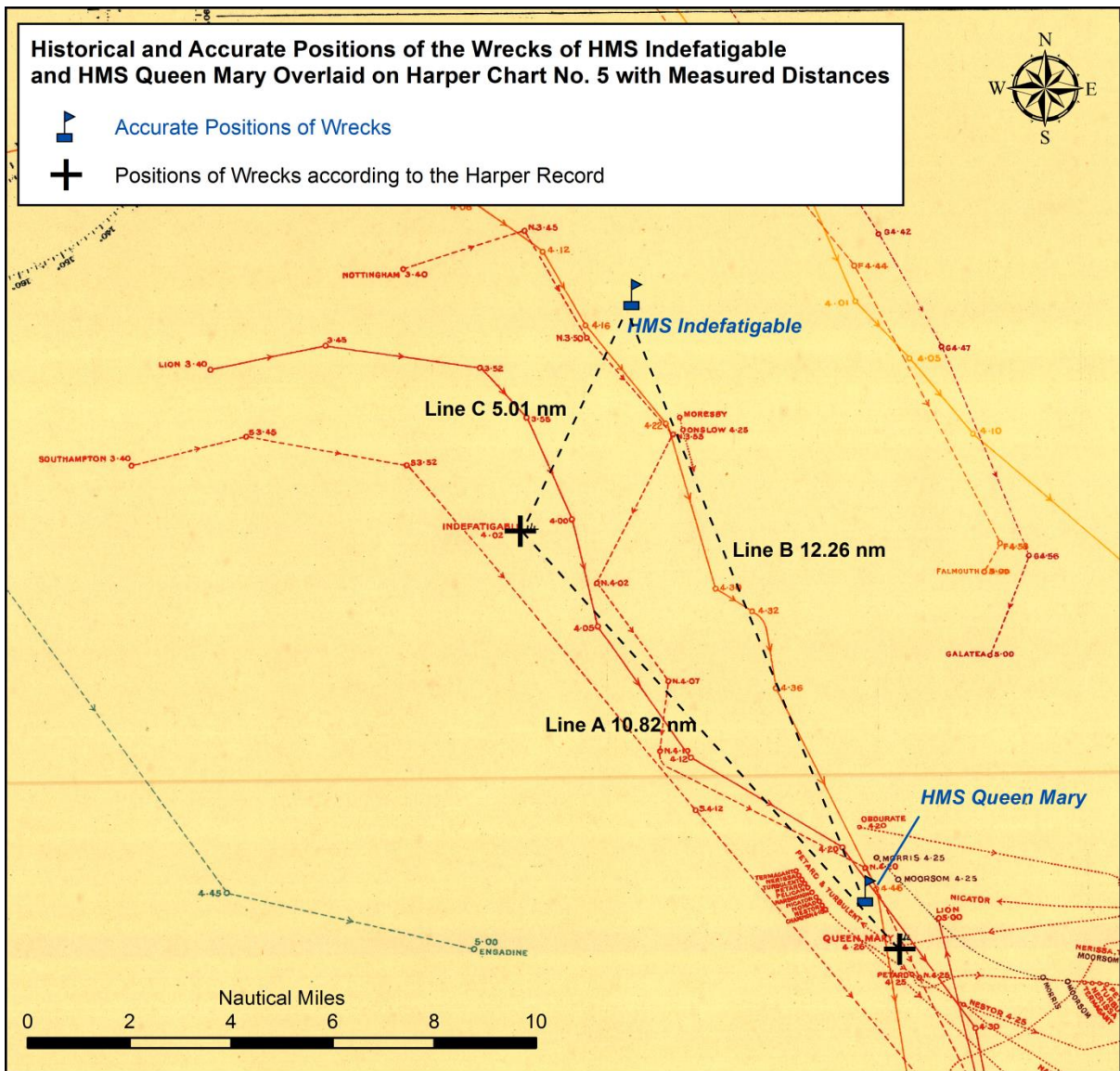


Figure 4. The Harper and actual positions of the wrecks of HMS *Indefatigable* and HMS *Queen Mary* marked on Harper Chart No. 5, showing measured distances between the wreck-sites (Innes McCartney).

On 15 March a wide-area survey using multibeam was conducted around the wreck-site and to the north of HMS *Indefatigable*. The multibeam scan took around three hours to complete and it was not until near the end that the remarkable image of what appeared to be HMS *Indefatigable*'s entire stern appeared on the monitors in *Vina*'s survey station. The results of the survey show the previously known main wreck-site and a large piece of new wreckage detected 500m to the north (Fig. 5). The new piece of wreckage was investigated by ROV and confirmed to be the stern of HMS *Indefatigable*, upside down on the seabed (Fig. 6). Visible features included: the upside-down base of the counter balance at the rear of 'X' turret, with the open escape hatch clearly visible (Fig. 7A); the upper side of 'X' turret's armoured barbette, which is upside down and orientated at a 45° angle (Fig. 7B); three of the ship's propellers (Fig. 7C); and the pair of rudders, completely vertical, as the uppermost point of the stern of the ship (Fig. 7D). The propellers looked as if they had been pulled

out of the wreckage as they lay some distance away from where they would have originally been situated. All these features clearly demonstrated that the stern of the ill-fated battlecruiser, as far forward as the after end of 'X' turret had been located, 500m from the main wreck-site.

The results of the 2015 and 2016 multibeam surveys, backed up by visual inspections of the wreck, clearly show that *Indefatigable* suffered two devastating explosions, significantly revising what is known of how the ship sunk. The stern portion was blown off along a line just aft of 'X' turret and must have been caused by a detonation of the cordite magazine under 'X' turret (Fig. 8). Similarly, the multibeam shows that the fore part of the ship was destroyed by a major explosive source that must have been the magazine under 'A' turret.

The first explosion, in 'X' magazine, effectively destroyed the ship. The later one, in 'A' magazine, reduced the fore part of the ship to small pieces and occurred as it was sinking and after it had ceased to have any fighting value. At the time it occurred, according to Brown (2003: 339–349), the crew were already dead as a supersonic shock wave caused by the 'X' magazine detonation would have devastated the interior of the ship, killing all inside its structure. This explains why there were so few survivors from the battlecruisers sunk at Jutland, and from HMS Hood sunk in 1941.

The Carne photograph re-examined

A photograph showing HMS *Indefatigable* sinking was re-examined in the light of the discovery of the stern section of the wreck (Fig. 9). The photograph was taken by Midshipman W. P. Carne from a position in the after torpedo control station on HMS *New Zealand*. It shows HMS *Indefatigable*, leaning very heavily to port and sinking by the stern. The notable absence of *New Zealand's* wake attests to several eyewitness accounts that *Indefatigable* hauled off to starboard, out of line, and on *New Zealand's* starboard quarter after it was hit aft. We now know the ship would have been completely out of control, having lost all means of steering and propulsion.

Multibeam Plan View of the Wide Area Survey of HMS *Indefatigable*, March 2016

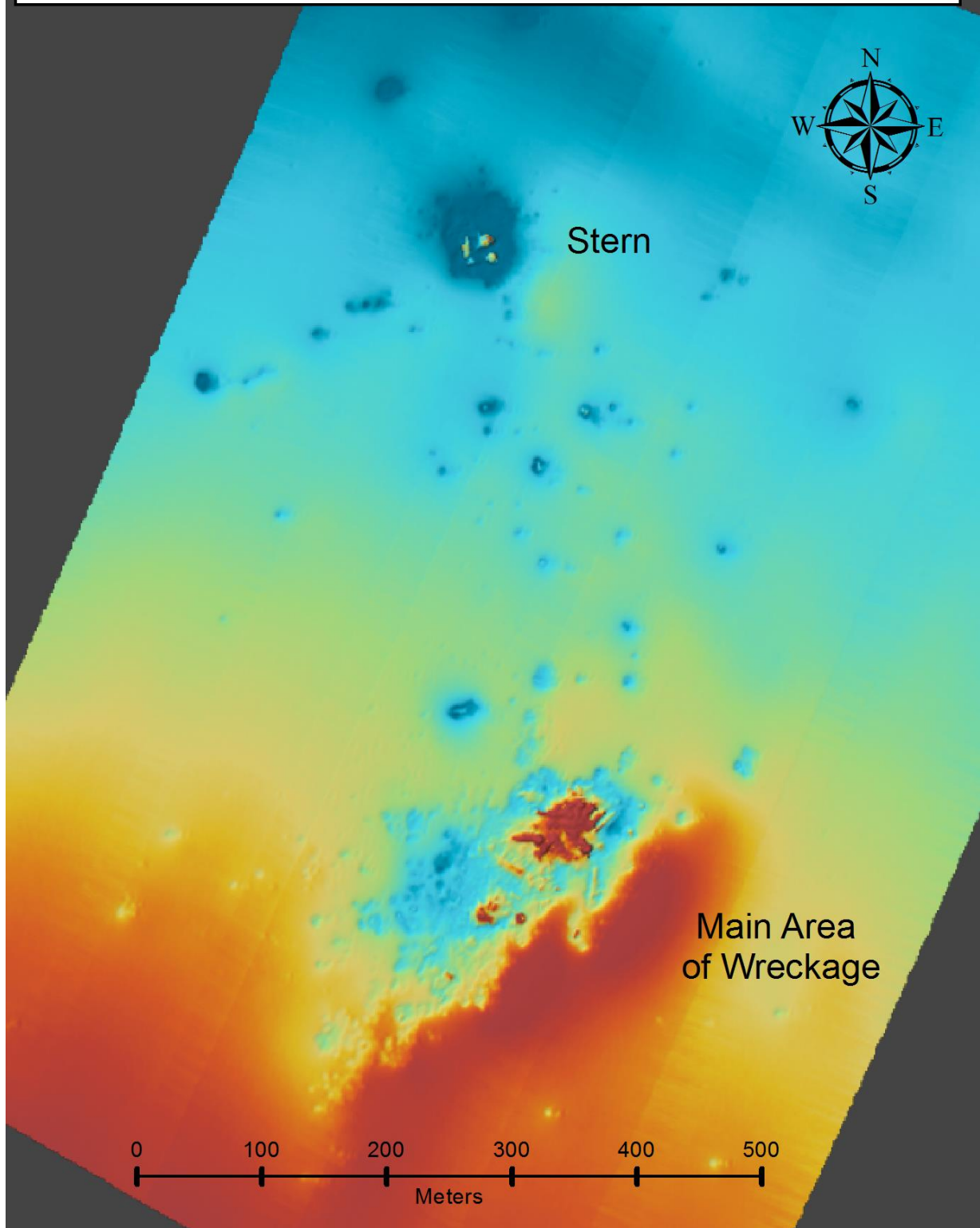


Figure 5. The results of the wide-area multibeam survey around the wreck of HMS *Indefatigable* (Innes McCartney/JD-Contractor).

The BCF's track was broadly to the south-east (Fig. 4). It has been known since the 2015 survey that the wreck points to the south-west (Fig. 3), but it is particularly interesting to note the dispersal of pieces of wreckage seen on the wide-area multibeam survey of the wreck taken in 2016 (Fig. 5). This seems to show the course of the fore part of the ship as it turned and rolled to starboard before sinking. It appears that it turned sharply at around the time it sunk.

In the light of the discovery of the stern of the ship in 2016, it seems the photograph held a previously unnoticed surprise: a pall of smoke clearly emanating from the surface of the sea, some distance aft of the sinking fore part of the ship. In all probability this represents the aftermath of the explosion of 'X' magazine; an innocuous detail of no significance until the stern was discovered. This one photograph seems then to capture the entire sinking process sometime between the two magazine explosions.

Comparisons to the eyewitness record

The discovery that HMS *Indefatigable* had broken in two is surprising because there is no reference to this happening in any text referring to the battle the author has so far found. The most detailed analysis of the fighting at Jutland makes no mention of it (Campbell, 1986: 60–61), and it must therefore be surmised that it was not evident to those looking at the ship at the time it occurred. Eyewitness accounts naturally do not always report events consistently, however, the most detailed accounts are worthy of closer examination.

The nearest witnesses were on the ship ahead, HMS *New Zealand*, and it was torpedo officer, Lt Cmdr Lovett-Cameron, stationed in the after conning tower, who has left us the most detailed account. Without opportunity to fire torpedoes he watched *Indefatigable* sink in detail through binoculars:

... she had been hit aft, apparently by the mainmast, and a good deal of smoke was coming from her superstructure aft, but there were no flames visible... We were altering course to port at the time and apparently her steering gear was damaged as she did not follow round in our wake, but held on until she was about 500 yards on our starboard quarter, in full view of the conning tower... she was [then] hit by two shells, one on the fo'c'sle and one on the fore turret. Both shells appeared to explode on impact. Then there was an interval of about 30 seconds, during which there was absolutely no fire or flame or smoke, except the little actually formed by the burst of the two shells, which was not considerable. At the end of the interval of about 30 seconds the ship completely blew up, apparently from forward. The main explosion started with sheets of flame, followed immediately afterwards by dense dark smoke which obscured the ship from view. (Fawcett and Hooper, 1921: 38)

Although detailed, it must be borne in mind that as the ship directly ahead of *Indefatigable*, HMS *New Zealand* was not well situated to see its stern, because it would have been obscured by the rest of the ship. Although Lovett-Cameron's account is detailed, he clearly only began to look at *Indefatigable* after it had been hit aft, and the stern was already on the seabed. He must have been situated next to Midshipman Carne who took the photograph, so that by the time *Indefatigable* turned, out of control, on to *New Zealand's* starboard quarter, it would have appeared as if the stern of the ship was under water. The question to be asked about this account is how long did the process described by Lovett-Cameron take to play out? In relation to this, and equally importantly, when during this process was the time of the destruction of the ship recorded?

Little extra can be garnered from the only account from the two survivors. Signaller C. Falmer and Able Seaman Elliot were seemingly in the foretop when the ship blew up. Falmer's later account states:

There was a terrific explosion aboard the ship—the magazines went. I saw the guns go up in the air just like matchsticks, bodies and everything. She was beginning to settle down. Within half a minute the ship turned right over and she was gone. I was 180 foot up and was thrown well clear of the ship. (Steel and Hart 2003: 95–96)

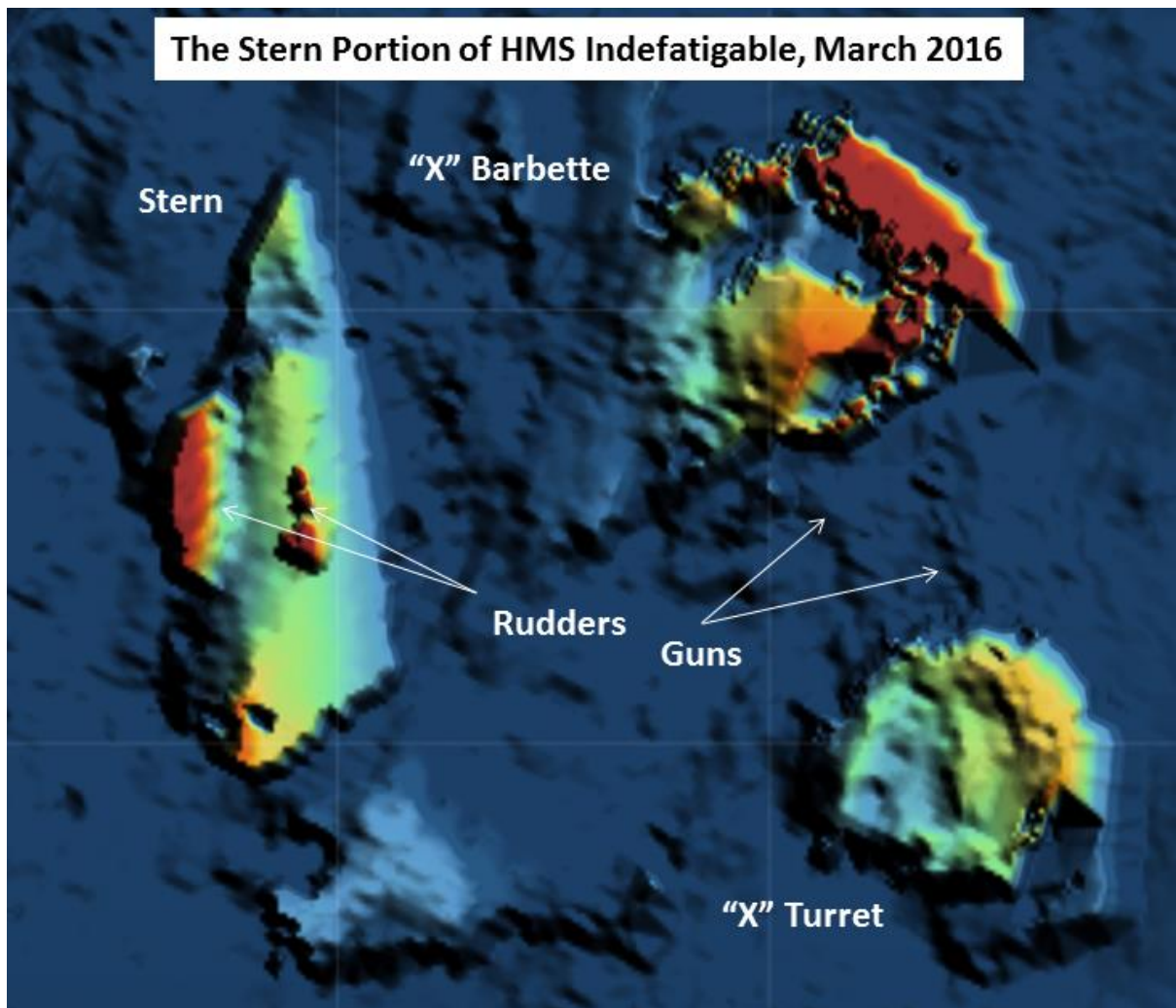


Figure 6. A close-up of the multibeam scan of the stern portion of HMS *Indefatigable* as discovered in March 2016 showing the upside-down stern with its twin rudders, the armoured barbette lying aft of the upside-down 'X' turret (Innes McCartney/JDContractor/MSP).

The evidence of how the ship sunk seems to point to the explosion referred to being the one in 'X' magazine. If this is so, then again the question is one of timing. How long did this account take to play out?

Perhaps the witnesses who saw the most detail were the German gunners on *Indefatigable's* nemesis, the battlecruiser SMS *Von der Tann*. It is known to have recorded opening fire at 15:49. An account by the Gunnery Officer, KK Mahrholz, states that:

The semi armoured piercing shell only exploded inside and therefore a hit result could only be seen when the interior was clearly destroyed. I guarded myself from observing hits, and adhered strictly to observing the fall of shot ... Meanwhile the fire from Von der Tann was extraordinarily successful, and the enemy disappeared completely sometimes in the surrounding columns of water ... Then 14 minutes after the opening of fire the enemy caught fatal wounds... I saw a giant explosion in the aft gun turret, a bright flash flame pushed out and ships debris was thrown in a wide arc in the air, seemingly it was the turret roof, which through pressure of the explosion inside had been thrown out. The next salvo gave the ship the rest, it hit further forward and had the result that soon after the impact a tremendous black smoke cloud climbed from the ship reaching double the mast height and the ship completely disappeared from sight. (Mahrholz, 1930)

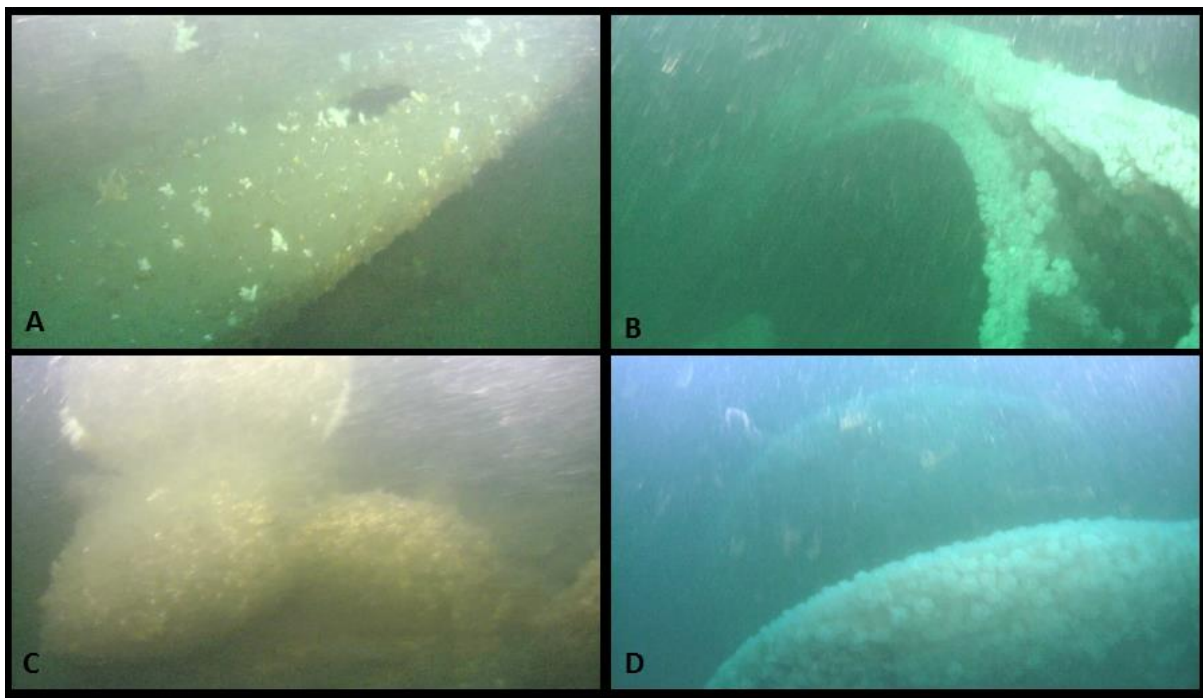


Figure 7. Images from the ROV survey of the newly discovered stern of HMS *Indefatigable*, March 2016: A) base of the counterbalance at the rear of the 'X' turret, with escape hatch; B) upper side of 'X' turret's armoured barrette; C) three of the ship's propellers; D) pair of rudders, (Innes McCartney/JD-Contractor).

It is clear in this account that Mahrholz witnessed the destruction of *Indefatigable* from an angle where the entire sequence of events was visible. It also offers some detail in terms of timing. Firstly, the explosions that sunk the ship were not immediately linked to hits but took an appreciable period of time to become apparent because they occurred inside *Indefatigable* and took time to build up and be visible from *Von der Tann*. Secondly, after the explosion of the stern, it seems it was the next salvo that created the explosion that ultimately created the black pall of smoke, also witnessed by Lovett-Cameron, but, again, there is a question of how long this took to play out.



Figure 9. HMS *Indefatigable* on its side and sinking by the stern, as seen from HMS *New Zealand*. The area circled in red seems to show a pall of smoke where the stern had already sunk to the seabed (Imperial War Museum Q64302).

Von der Tann reported firing 13 salvos at *Indefatigable* in 13 minutes, for an average of one salvo every 69 seconds. Even allowing for reports that the firing became more rapid towards the end (Mahrholz, 1930; Brooks, 2016: 198) it would seem that the next two known hits in one salvo occurred up to a minute after the 16:02 explosion. How long these took to develop into 'A' magazine detonation, if related, can be estimated based on Lovett-Cameron's account that it occurred at least 30 seconds later.

After this time the ship then took an appreciable period of time to sink, with this occurring behind a pall of smoke. One account written by sub-Lt. Stephen King-Hall (later Baron King-Hall of Headley) noted that it was possibly as late as 16:15 that the 200m-high (700ft) mushroom cloud that developed, denoting the spot where HMS *Indefatigable* finally sunk, was still fiery red at its base, suggesting a portion of the ship was still burning at that time (King-Hall, 1916).

Conclusion

Of the two outstanding questions related to the destruction of *Indefatigable* that had been posed by archaeological investigations of the wreck-site up to 2015, only one has been satisfactorily resolved. It was confirmed in 2016 that the ship broke into two distinct portions and that the cause was the hit aft reported by eyewitnesses, none of whom noticed it breaking at that time.

Far more problematic is the question of timing. The wreck of *Indefatigable* remains at a distance from the wreck *Queen Mary* that is difficult to immediately resolve from what we currently know. *Indefatigable* definitely blew up at 16:02. There are too many witnesses recording the time to comfortably suggest they got it wrong. Moreover, the ship may have then taken a few minutes to sink entirely. One possible explanation is that an early hit by *Von der Tann* took 2–3 minutes to develop into the 16:02 explosion but had the effect of slowing and turning the ship, but this is only a theory and far from certain. Alternatively, HMS *Queen Mary* may have sunk later than supposed or the speed of the BCF been underestimated for some reason. We may never know for certain. The discovery that the wreck is in two parts, however, does not on its own help resolve this question satisfactorily.

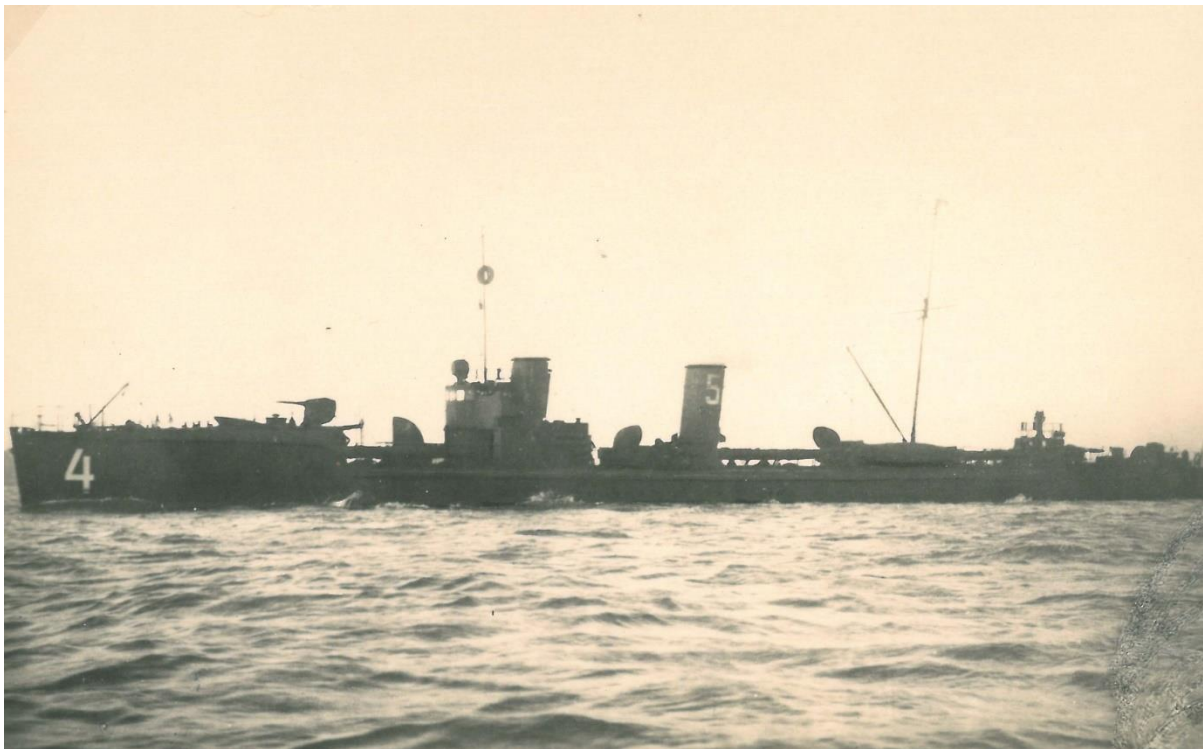


Figure 10. The torpedo boat SMS V4, length: 233ft, displacement: 689 tons, two 3.46-inch (88mm) guns of 30 calibre, one forward and one aft in single mounts, four 19.7-inch torpedo tubes with two mounted singly aft of the forecastle, one amidships on the centreline and one aft (Archiv Deutscher Marinebund).

SMS V4

SMS V4 was one of six torpedo boats built for the 1911–1912 construction programme by the Vulcan yard at Stettin, hence the 'V' prefix to the ship's name (Fig. 10). They were not considered to be a successful design, suffering from poor seakeeping, and by 1913 the German navy had adopted an alternative design (Gröner, 1990: 178). Nevertheless, one single flotilla, the 5th, was entirely of this class of vessel and was present at Jutland. The 5th Flotilla was made up of two half flotillas, the 10th and the 9th, in which SMS V4 was serving. During the close of the night phase of the battle the 5th Flotilla had been stationed towards the van of the German battle-fleet as it made its way back to Germany.

SMS *V4* became the last ship to sink in action at the Battle of Jutland. At 02:15 on 1 June, around five minutes after the pre-dreadnought battleship SMS *Pommern* had blown up after a British torpedo attack, the small torpedo boat seemingly suffered an underwater explosion. The bows were completely blown off, killing 17. The rest of the crew were picked up and the ship was finished off by gunfire and a torpedo from SMS *V6*. Why *V4* sunk has never been fully explained. Groos, the official German historian, concluded that either it had hit a drifting torpedo or mine, or had suffered an internal explosion by some unknown cause (TNA ADM 186/626: 203).

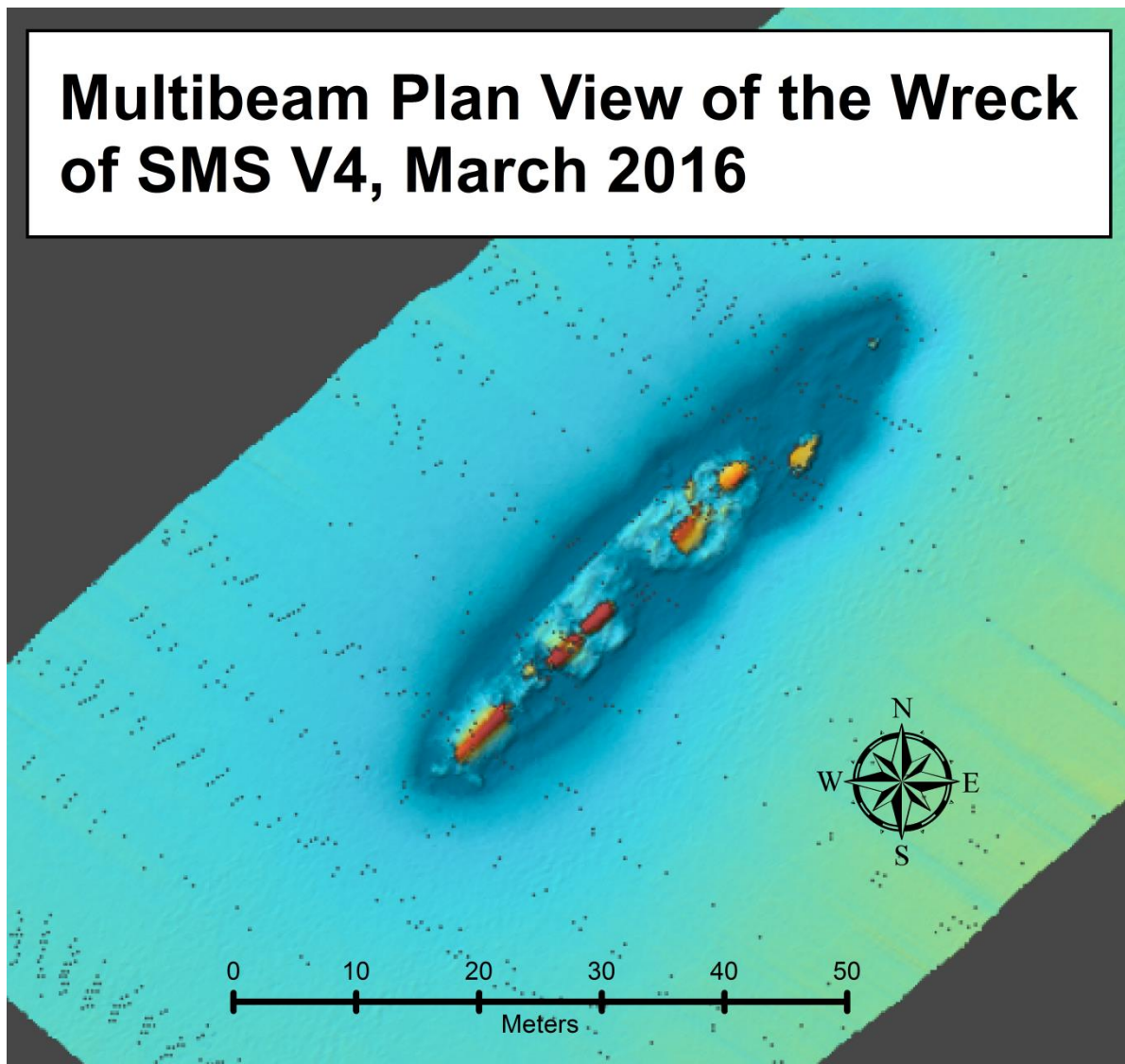
During the 2015 survey, this wreck-site was not a known target and, although we checked out some promising net snags in the vicinity of where it was reported sunk, the wreck was not found. By the time of the 2016 survey, things had changed. This was primarily because it had become evident from the results of the 2015 survey that Harper (1927) and its unpublished charts (Harper, 1919) represented in most cases a very accurate spatial portrayal of the battle. A re-examination of all data available for the time period shortly after SMS *Pommern* was sunk revealed that Harper's analysis was likely sound and that the wreck of SMS *V4* must lie very near his reported position.

A further examination of known fishing snags in the area revealed a very small snag that was close to Harper's position. On the morning of 14 March 2016 *Vina's* multibeam system surveyed this position and the unmistakable signature image of a small warship, as seen during surveys of 11 similar ships in the previous years, was revealed (Fig. 11). In nearly every case only the heavy machinery now remains. Time and the hostile marine environment of the North Sea have contributed to reducing these smaller wrecks to a broken-down state.

The site was inspected by ROV and also by *Vina's* divers, Toni Andersen and Denis Normann Andersen. All of the data gathered confirmed that this was the wreck of a Kaiserliche Marine torpedo boat. The highest feature showing on the wreck was at the extreme stern and is the ship's rudder post (Fig. 12A). It is not unusual for this feature to be seen on German torpedo boats of this era. They also featured twin engine rooms, each fitted with a single turbine and condenser. In this case the turbine can be seen, but the condenser is no longer present, leaving a rectangular void visible where it would have been fitted (Fig. 12B). The boilers present on the wreck were of the Thornycroft type extensively fitted to German vessels of this period (McCartney, 2016: 26). In this case the forward boiler was double length, the after end of which can be seen in Figure 12C. The two boilers in the centre of the ship faced each other, where they would be loaded with coal. The conjunction between these boilers was clearly visible (Fig. 12D).

It was recognized in the 2015 survey data that, in nearly every case, all that remains of the destroyers and torpedo boats sunk at Jutland is the heavy machinery and occasionally some dispersed wreckage on the seabed. So a useful tool was devised, using a typology based on the construction drawings of the holds of each class of small warship. Drawings were laid over the multibeam scans of the wrecks and were instrumental in identifying each wreck-site (McCartney, 2016: 25). For example, this methodology was used on the multibeam plan view of SMS *V4* and the main features of boilers and turbines line up very well (Fig. 13). SMS *V4* was the only torpedo boat of the 1911–1912 order to be sunk at Jutland. These facts likely prove that the wreck is SMS *V4*. Its proximity to the position calculated by Harper (1927) is additional proof of the accuracy of his records both in terms of time and place.

Figure 11. Multibeam plan view of the wreck of SMS V4 as found in March 2016 (Innes McCartney/JD-Contractor).



One interesting element of the survey of this site was that it revealed that the bows pointed around 90 degrees out of line with the known path the ship was taking. The wreck points to the south-west, whereas SMS V4 was heading south-east when the ship exploded. Perhaps the circumstances by which the crew were rescued from the floating remains of the ship had some bearing on how it is orientated. It is known that the sea state was rising (TNA ADM 186/626: 203) and the weather report from the nearest weather station, Blaavunds Huk, Denmark, shows the wind to be from the south (Metrological Office, 1916: 153), aiding which may have aided in swinging the floating portion of the ship around.



Figure 12. Images from the ROV survey of the wreck of SMS V4 on the day it was discovered: A) rudder post; B) turbine; C) Thorneycroft forward boiler; D) the two boilers. (Innes McCartney/JD-Contractor).

The Wreck of SMS V4, March 2016

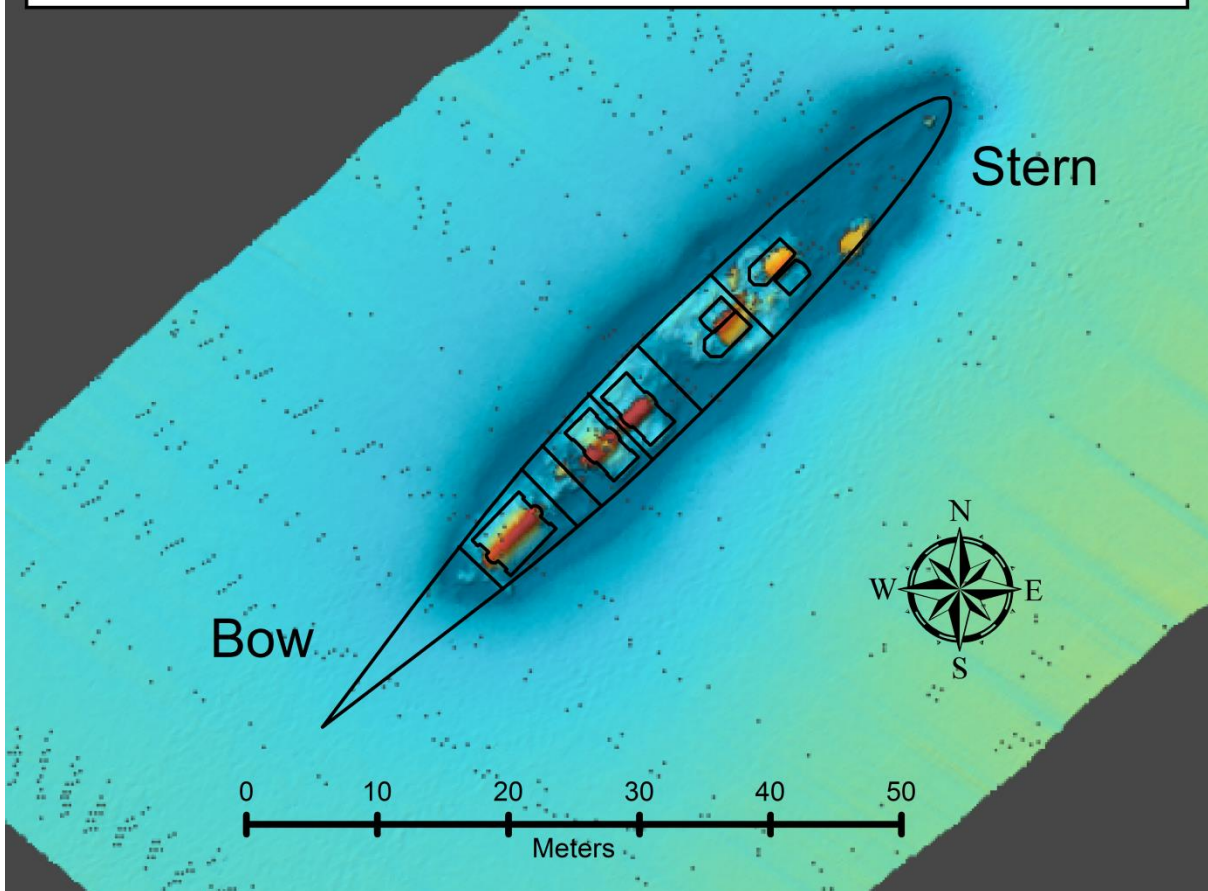


Figure 13. The hull form and machinery distribution plan for SMS V4 laid over the multibeam plan view (Innes McCartney/JD-Contractor).

Also of note was the fact that all of the larger bronze components and guns had been removed from the site at some point in the past. This was attested not only by visual inspection of the site by divers and ROV but also by the multibeam survey. The condensers, usually housed next to the turbines in V4's two engine rooms are absent from the multibeam scans, while the turbines remain (Fig. 13). The lack of condensers was seen on the at least six of the small warships both scanned with multibeam and visually inspected in 2015 (McCartney, 2016: 255). The commercial salvage of the bronze components from the smaller warships has been a recent activity at Jutland because, to the author's knowledge, these wrecks have only been located since around 2001.

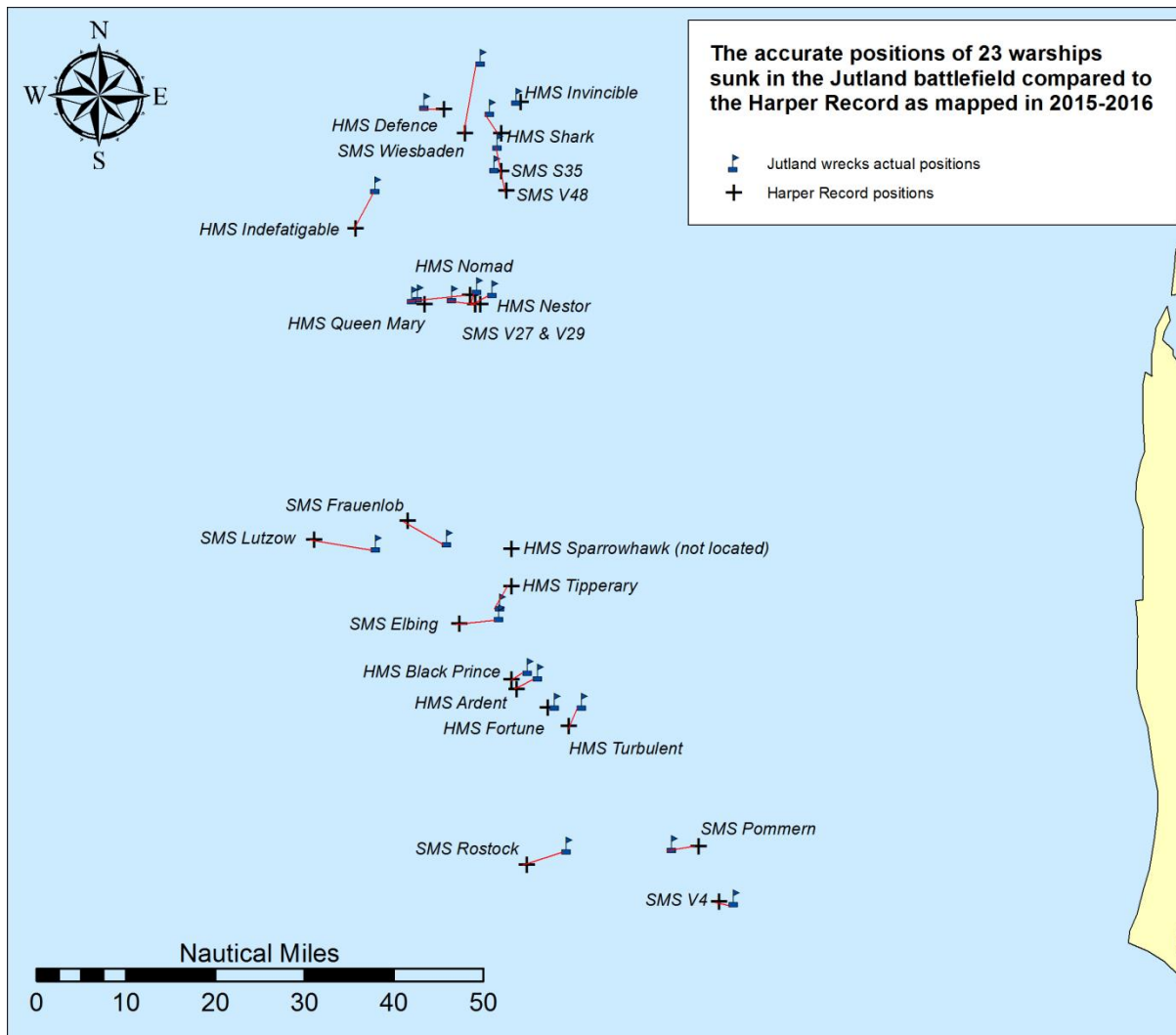


Figure 14. The Jutland battlefield as known in March 2016 showing the actual positions of each wreck-site compared the positions given in the Harper Record. The red lines show the difference between Harper’s estimations and the actual wrecks (Innes McCartney).

In summary

The March 2016 survey of the Jutland battlefield satisfactorily resolved two primary research questions. Firstly, was there a missing portion of HMS *Indefatigable*? Secondly, where was the wreck of SMS *V4*?

The location of the missing stern section of HMS *Indefatigable* on its own was not sufficient for the timeline of the battle to be redrawn with accuracy. However, its discovery revealed a strong example of how eyewitness record of events during the battle is being challenged by archaeological investigations of the wrecks. No one reported seeing the ship break in two.

In the case of *V4* it has been shown that its proximity to the position outlined by Harper (1927) confirms the timing and location where the last ship sunk in the battle. This supports the established premise that the Harper Record is a broadly correct chronology of the battle, with an average positional discrepancy of less than 3.5 miles (McCartney 2016, 244-245) (Fig 14).

Regrettably there is evidence on both wreck-sites that commercial salvage for profit has been carried out on them at some time in the past. At least one propeller has disappeared from the *Indefatigable* site and the condensers have been removed from *V4*. The two wrecks fall into the 65% of Jutland's wrecks where it is evident commercial salvage has taken place. It is sincerely hoped that the pending ratification of the 2001 UNESCO Convention on the Protection of Underwater Cultural Heritage by Denmark and Holland will help bring this unsavoury practice to a close before the wrecks lose much of their archaeological potential.

Acknowledgements

The author thanks the following for their various contributions to the production of this paper: Gert Normann Andersen, Mogens Dam, JD-Contractor, Sea War Museum Jutland, Dr Jann Witt, Gary Staff, National Maritime Museum, National Archives, Imperial War Museum, Terschelling Wreck Museum, Mallinson-Sadler Productions, the late David K. Brown, Dr Richard Osborne, Nick Jellicoe, Dr John Brooks and EIVA Marine Survey Solutions.

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