The sinking of HMAS SYDNEY

16.1 The main hull of HMAS SYDNEY lies about 12 nautical miles from the wreckage of HSK KORMORAN, and her bow lies about 470 metres from the main hull. The footage from the remotely operated vehicle (ROV) allows it to be said with certainty that SYDNEY suffered severe damage from a torpedo hit on the forward section, about 20 metres from the bow on the port side, and that she suffered at least eighty-seven 15-centimetre shell hits on the port and starboard sides. It is also known that she was subjected to additional small-arms fire from a 3.7-centimetre gun and multiple 20-millimetre machine guns. Further, there were severe fires, and it can be assessed with confidence to the point of certainty that by the time the battle ceased there were many casualties—probably in the order of 70 per cent of SYDNEY’s complement.¹

16.2 Damage-control measures were probably restricted as a result of flooding, fire, smoke and difficulties with access. Nonetheless, it is probable that there were still some alive in SYDNEY as she sailed away from KORMORAN, although the numbers at the point immediately before she sank cannot be determined with precision. Those on board had no available life-saving measures that would allow them to leave the ship: the observed damage indicates to a high degree of probability that all boats and Carley floats that had not been blown overboard during the battle were unserviceable because of shell and fire damage. Those who were alive on board after the battle ceased died when she sank.

16.3 It is necessary to determine the manner in which SYDNEY sank. Some have suggested that she sank because while she was steaming her bow separated from the hull, causing uncontrolled flooding and sinking.

Structural integrity²

16.4 Experts from the Defence Science and Technology Organisation and the Australian Division of the Royal Institution of Naval Architects conducted an analysis to determine SYDNEY’s longitudinal structural strength in an undamaged state. The electronic model constructed for the purpose of that analysis then had removed from it the structural supports damaged by the torpedo hit. The amended model was again

¹ DSTO.003.0001 at 0278, para 7.6.1.1.2
² DSTO.003.0001 at 0290, para 7.7.1
tested to determine the longitudinal structural strength and whether, in that damaged state and when subjected to various loads consequent on different sea states, SYDNEY’s residual longitudinal strength was sufficient to retain the bow’s integrity as part of the hull. These analyses were conducted using a software program known as ULTSTR (Ultimate Strength).

The model was tested in various simulated sea conditions. The results showed that the bow would not separate from the hull as a result of the torpedo or other damage, even when the entire cross-section of the structural members where the torpedo hit was removed, it being known that only the port side members were in fact damaged.

The analysis leading to the conclusion that the bow stayed intact while SYDNEY was on the surface is consistent with other evidence. Doctor Cannon explained:

That [the conclusion that the bow stayed intact] must be taken in concert with the other evidence that was shown earlier. Firstly, the compactness of the debris field suggested that the bow remained intact. Secondly, the tearing of the hull plate around the side suggested that it was a more violent process and there was no compressive buckling occurring. Thirdly, the loads are suggesting that it wouldn’t break off. So there are three pieces of evidence there that come together to conclude that she would have remained intact in that particular environment.3

Further analysis suggested that the sinking of SYDNEY was caused by the failure of a watertight bulkhead, resulting in rapid, uncontrollable flooding.4

Two separate analyses were done to determine how long SYDNEY would be likely to have remained afloat in differing sea states, on different headings and with different assumptions of damage.

The heading and sea state are important because each affects the vessel’s roll motion. Having regard to penetrations of the hull, the height of the sea and the angle at which it strikes the hull are factors relevant to the intake of sea water through those penetrations, thus increasing the internal flooding, which in turn magnifies the rolling action.

The first analysis assumed only the damage caused by the torpedo and shell hits observable on the ROV images. The second analysis assumed that damage along with internal damage predicted as a result of

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3 TRAN.021.0001_R at 0082_R
4 TRAN.021.0001_R at 0083_R
internal explosions; it thus took into account the fact that many of SYDNEY’s watertight bulkheads had damage such as holes and cracks in the plating and stiffeners due to shrapnel, which increased local stresses. Each analysis assumed a speed of 5 knots.

The first analysis found that SYDNEY would remain afloat in sea state 3, regardless of the heading, for at least 12 hours—see Figure 16.1.

Although remaining afloat, the time history for the roll of the vessel sailing in beam seas shows that about four hours after the end of the battle the vessel might have been constantly rolling between about 15 and 40° to port. With these large roll angles, any attempt at damage control or evacuation would have been virtually impossible.

Figure 16.2 shows the time record for SYDNEY’s roll motion in sea state 3 at a speed of 5 knots. Figure 16.3 shows a visualisation of SYDNEY at a roll angle of about 40° to port in sea state 3.

Note: Analysis assumes flooding through hull and torpedo damage only.

Figure 16.1  Polar plot showing the time SYDNEY would remain afloat in sea state 3 at 5 knots

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5 DSTO.003.0001 at 0297; TRAN.021.0001_R at 0085_R to 0086_R
6 DSTO.003.0001 at 0304; Figure 270
7 DSTO.003.0001 at 0303, para 7.7.2.4.1
8 DSTO.003.0001 at 0304; Figure 270
Figure 16.2  Time record for roll motion of SYDNEY in sea state 3

Figure 16.3  Visualisation of SYDNEY at a roll angle of about 40° to port in sea state 3

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9 DSTO.003.0001 at 0304; Figure 271
10 DSTO.003.0001 at 0305; Figure 272
When KORMORAN launched her lifeboats, the sea state was about 3, increasing to sea state 4 and deteriorating. CAPT Detmers wrote that as darkness fell ‘The wind had risen and was now blowing at Force 5 or 6’.

Figure 16.4 shows how long SYDNEY would remain afloat in sea state 4 on the assumption of damage only to the hull as observed. It shows that the probability of SYDNEY remaining afloat depended on the heading at which she was sailing. A comparison of Figures 16.1 and 16.4 shows that the increasing sea state alone had a considerable impact on the prospect of SYDNEY remaining afloat.

The second analysis took into account predicted internal damage to the bulkheads. As noted, internal shrapnel damage causing holes or cracks in the plating and stiffeners affected the stress concentrations in the structure. This additional internal damage would allow progressive flooding to occur between adjacent compartments where there had been damage to the bulkheads, deck or deck-heads. That damage could be either entire panels missing or holes in the bulkhead through which

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11 CORR.007.0034 at 0135
12 DSTO.003.0001 at 0306; Figure 273
floodwater could move. Although the damage might have affected the integrity of watertight doors and hatches, the analysis was done on the basis that doors and hatches remained watertight and that internal bulkheads might have been affected by internal shrapnel damage.

Figures 16.5 and 16.6 show the consequences of that additional damage.

As Figure 16.5 shows, the prospect of SYDNEY surviving beyond four hours in sea state 3 depended on her heading. Figure 16.6, however, shows that once the sea reached sea state 4 the heading became irrelevant.

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13 DSTO.003.0001 at 0307; Figure 274
After the battle SYDNEY would have experienced considerable roll motion. Over time the amplitude of the roll would have increased as a result of increases in both the flooding and the sea state. As the roll increased, the vessel would have begun to experience deck-edge immersion, and additional flooding would have occurred through other openings, including those caused by shell penetration. Eventually SYDNEY would have rolled to an angle beyond which she could not recover, losing any remaining buoyancy and finally sinking. A further possibility is the collapse of watertight bulkheads: this would have affected the trim and stability of the vessel.

SYDNEY sank rapidly because of loss of buoyancy possibly combined with bulkhead collapse.

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\[14\] DSTO.003.0001 at 0307; Figure 275
\[15\] DSTO.003.0001 at 0308, para 7.7.2.5
Final foundering

SYDNEY’s final foundering could have occurred as a result of one of several mechanisms:

- She capsized and totally rolled over.
- She rolled over and additional flooding occurred through openings in the forecastle and upper deck, leading to sinking.
- She suffered a loss of buoyancy and plunged bow first.

If SYDNEY totally rolled over, once she was upside down many heavy items would have fallen off the ship. Most significant of those would be the gun turrets. The wreck of SYDNEY has all the guns in place. A considerable amount of deck fittings are also in place. It is thus probable that if SYDNEY capsized she did not totally roll over. The other two possibilities are more tenable.

As SYDNEY was sinking, some parts of the ship would still have been full of air. Among those parts would have been the relatively undamaged after part of the ship, from about Y turret to the stern; partly filled or empty tanks; watertight compartments such as those in the double-bottom spaces around the engine and boiler room; and other intact internal spaces. Although all spaces would have rapidly started to flood through ventilation trunks and air escapes, the ship would have been sinking so fast that the external water pressure would have caused the intact compartments to implode. The wreck provides extensive evidence of this. Most of the implosion damage would have occurred within about 30 metres of the surface. Figure 16.7 shows a section through SYDNEY as she lies on the sea floor with evidence of the implosion of her structure.

The sinking of a ship is a violent process. The force of water passing the sinking SYDNEY would have torn off the masts and rigging and dislodged loose items on the deck. Heavier items—such as the funnels, the top of the bridge and the director control tower—would have soon followed. Boats that were still secure in their cradles would have been torn off and could have been further damaged by striking the ship or other wreckage. Very close to the surface, the force of water entering the damaged bow would have twisted and torn the bow from the ship and in the process (aided by water rushing past the hull) parts of the side shell plating, decks and bulkheads would have twisted and broken

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16 DSTO.003.0001 at 0308, para 7.7.3
17 DSTO.003.0001 at 0308, para 7.7.3
18 DSTO.003.0001 at 0310, para 7.7.4

The Loss of HMAS SYDNEY II
away. The differing shapes of the various pieces of wreckage would mean they sank at a speed different from the speed at which the main hull sank, and they might have hit the ship, causing further damage. The rushing water would have lifted the torpedo tubes off the deck, adding them to the mass of wreckage scattered throughout the debris field.

The majority of this destruction would have occurred within the first 200 metres' depth. By then most of SYDNEY would have been full of water. As she continued her plunge she would have tended to level off, and she probably adopted a trim by the stern because the shape of the forward part of the ship offered more resistance to the passing water. SYDNEY probably hit the sea floor stern first, causing further damage to that already imploded area. The method of sinking is illustrated in Figure 16.8.

Figure 16.7  Section through SYDNEY as she lies on the sea floor, showing the implosion of her structure

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19 DSTO.003.0001 at 0311; Figure 277
16.9 There was no possibility at all of any crew alive in the hull of SYDNEY surviving such a sinking and an extremely low possibility of any crew member alive on her deck surviving.

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20 DSTO.003.0001 at 0312; Figure 278