THE MERCHANT SHIPPING ACT 1894

m.f.v. Trident (ON PD111)

Report of Court No. S 497

Formal Investigation

LONDON
HER MAJESTY'S STATIONERY OFFICE

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m.f.v. TRIDENT

In the matter of a Formal Investigation held at the Sheriff Court House, Aberdeen on the 17th-20th, 23rd-27th and 30th days of June and 1st day of July 1975 before G S Gimson Q C, Sheriff, Principal of Grampian Highland and Islands assisted by Captain D J Hurst, Skipper D A Roberts and M Meek Esq, into the circumstances attending the loss of the British Motor Fishing Vessel *Trident* of Peterhead (Official Number PD III) which sank in a position about 10½ to 12 miles south east of Duncansby Head on 3 October 1974 with the loss of all seven men on board.

The Court having carefully inquired into the circumstances attending the above-mentioned shipping casualty, finds for the reasons stated in the Annex hereto, that it is probable that *Trident* took aboard a sea or succession of seas and foundered, the precise causes of the casualty being unascertainable. The Court considers it probable that deficient stability in her design contributed to her foundering.

Dated this twelfth day of September 1975

G S Gimson *Judge*

We concur in the above Report.

D J Hurst
D A Roberts *Assessors*
M Meek

Annex to the Report

1 The parties to this Inquiry were:

The Department of Trade represented by Mr K J Cameron, Q C and Mr K H Osborne, Advocate, instructed by Messrs Peterkin & Duncans, Advocates in Aberdeen (for Treasury Solicitor).

The White Fish Authority represented by Mr C E Jauncey, Q C and Mr J A Cameron, Advocate, instructed by Messrs Boyd, Jameson & Young, W S.

Mr David Tait, part owner of *Trident*, represented by Mr M S R Bruce, Advocate, instructed by Messrs Brander & Cruickshank, Advocates in Aberdeen.

The Personal Representatives of Alexander Ritchie, deceased, represented by Mr K W Ferguson of Messrs L MacKinnon & Son, Advocates in Aberdeen.

The Liquidator of Bute Slip Dock Company Ltd represented by Mr R E Henderson, Advocate, instructed by Messrs John Laing, Colquhoun & Co, Solicitors, Glasgow.

and also the following, who appeared by leave of the Court:

The Personal Representative of deceased Crew Members represented by Mr W L K Cowie, Q C and Mr A M Philip, Advocate, instructed by Messrs Masson & Glennie, Solicitors in Peterhead.

Mr Andrew Cumming represented by Mr J R Fiddes, Q C and Mr D K Bain, Advocate, instructed by Messrs Edmonds & Ledingham, Advocates in Aberdeen.

On behalf of the Post Office: Mr D M Burnside of Messrs Clark & Wallace, Advocates, Aberdeen.

2 *Trident* was a seine-net trawler of about 68 tons and 85 feet length overall. She was built at Middlesbrough in 1971-73 by Tees Marine Ltd to the design of Andrew Cumming of Bute Slip Dock Co Ltd of Ardmaleish, Bute, and fitted out by the latter firm. She was handed over to her joint owners, David Tait (her Skipper) and the late Alexander Ritchie (her Engineer) at Rothesay, Bute, on 31 March 1973. Although the specification for her building required that her stability should meet IMCO recommended standards and that she should undergo an inclining test on completion, no such test was carried out on her completion. From 31 March 1973 until her loss on 3 October 1974, *Trident* was engaged in group fishing, principally in the Minch, Clyde and Isle of Man fishing grounds and in all weathers.

3 On 3 October 1974, while on passage, light, from Troon, Ayrshire, to Peterhead, under her relief Skipper Robert C Cordiner, and while in company with (but 5 to 6 miles ahead of) M F V *Faithful II*, *Trident* disappeared without having given any form of distress signal or message. She would seem to have been lost almost immediately after 15.53 hours, at which time she was in contact with Wick Radio. At that time the weather was dull, with fine drizzle; wind NNE force 5 to 6; sea from NNE, fairly rough; tide ebbing northwards

at about 1.2 knots. Her course was about SSE, with the sea on her port quarter. A large oil slick about nine miles SSE of Duncansby Head, observed at about 10.45 on 4 October, indicated that she then lay near to that position, although the evidence from *Faithful II* would suggest that she had reached a point some one and a half to three miles further south before sinking. No trace has been found of any member of her crew, or of any wreckage. A quantity of fish boxes from her hold and a few other loose articles were found on 4 October and one of her lifebelts was found on the south coast of the Moray Firth in March 1975. All these circumstances point to the probability of *Trident* having foundered suddenly and without sufficient warning or premonition for any message or signal to be given or for any of her company to get out on deck. It is thought probable that her hatch-cover collapsed after she had foundered, releasing the fish boxes from her hold.

4 An exhaustive search of the whole sea area between Duncansby Head and Kinnaird Head, by sea and air, on 4 October and subsequently, disclosed only the oil slick and flotsam already mentioned. Between 12 and 19 November 1974 HMS *Bildeston* and HMS *Reclaim* carried out sonar searches in an attempt to locate the wreck of *Trident*, but without success.

5 A consensus of the evidence suggests that *Trident* probably shipped a sea (which is particularly liable to occur with a quartering sea) and before her freeing ports could have sufficient effect, she either foundered, or while still pinned down by the weight of water on her deck, shipped a second sea and foundered. The evidence indicated that as little as 12 tons of water trapped on deck could produce a significant angle of heel, involving danger, particularly if followed by a second sea either overwhelming her or lifting her stern so that the water on deck was trapped under the whaleback. In the opinion of the Court such a sequence of events is the most probable reconstruction of the disaster. It is consistent with lack of warning and with the absence of flotsam, the vessel foundering unexpectedly with all her equipment secure. It remains to consider whether the action of the sea on *Trident* should be regarded as the only factor likely to have contributed to the casualty.

6 All witnesses who were at sea in the vicinity and notably those on *Faithful II,* which followed the same course only half an hour after *Trident,* describe conditions as giving no cause for concern. It is of the greatest significance that *Faithful II* was able to heave-to with engines stopped from about 14.30 to 15.00 – within an hour of *Trident's* disappearance – without trouble or anxiety although she was only three to five miles from Duncansby Head in a position much closer to the notoriously disturbed area between that headland, Pentland Skerries and the shallow bank of Sandy Riddle. Moreover, she was able to proceed from there under automatic steering control. *Trident* was almost at the southern limit of the area in which freak waves (known locally as lumps of water) have been reported. Depth there is more than 30 fathoms, and the seabed is sandy with slight ridging. In that position and with winds of only force 5 to 6, despite some opposition between winds and the northward tidal flow, it appears to the Court that while it is possible it is extremely unlikely that *Trident* encountered a freak wave. Equally it is felt that while some conjunction of ordinary seas could explain her loss it is not likely and should not readily be accepted that that was the sole cause.

7 In the course of the evidence, a number of other factors were mentioned, as possibly causing or contributing to the disaster. These included:

(1) Collision with an explosive device or with a floating obstruction. There would seem to be no likelihood of either having occurred. The suddenness of the sinking and the absence of wreckage are contrary indications. The only known obstructions in the area, Radar Target Buoys Nos 2 and 3 and a drifting buoy were examined and found free of collision damage and no other obstructions were reported in the area prior to the casualty or during the intensive search of 4 - 6 October.

(2) Failure in the rudder stock assembly. The rudder stock was slightly under approved diameter, but the whole assembly had been renewed in April 1974 and it is unlikely that it failed within so short a period.

(3) Sudden unintended change of course. *Trident* was equipped with a Tenfjord secondary steering control operated by means of short levers mounted at convenient hand-height in each wing of the bridge. These allowed the vessel to be steered directly from a position giving a clear view alongside. This equipment did not operate when automatic steering was in use. When the equipment was in use, a short movement of either lever in a fore or aft direction produced rudder movement to port or starboard and the rudder remained at that setting until the lever was released. On two occasions while *Trident* was in service accidental contact with one of the levers had caused a fairly sharp change of course. Such an occurrence could bring *Trident* broadside on to the seas and into danger of swamping. While this could explain the casualty it was considered unlikely since it is probable that *Trident* was on automatic steering at the time of her loss.

(4) Neglect of good seamanship, as in failure to secure the hatch-cover, or to keep watertight doors closed or by allowing the freeing ports to be obstructed by nets or other gear. Human error is always a possibility, but there is nothing to lead the Court to suppose that the officers and crew of *Trident,* who were experienced and were familiar with her, would have neglected obvious precautions of this kind, particularly on a voyage involving passage through the Pentland Firth.

(5) Inadequate stability of *Trident.* The bulk of the evidence related to this subject.

It is impossible to assert categorically that *Trident* did or did not comply with the IMCO recommendations, to which it was intended that she should be built. As a result of the builders' failure to carry out an inclining test on *Trident,* the information which would have been obtained from such a test had to be supplied from other sources including the results of inclining tests on her hull before fitting out and on another trawler, *Silver Lining,* the hull of which was built to the same design. *Silver Lining* was tested in her completed state and the results adjusted for known differences in the superstructure and equipment of the two vessels. All the results are open to the risk of error. In addition, as must always be the case, the precise state of loading of *Trident* at the time of her loss, including the weight of fuel oil then in her bunkers, can only be estimated. It is significant that in the last radio contacts between *Trident* and *Faithful II,* members of *Trident's* crew are reported to have described her as having her decks 'sloshing with water' and (this within minutes of her loss) 'taking very heavy rolls'.

The best approximations that can be made of *Trident's* stability are set out in a production which is copied as an Appendix hereto. They show (A.2) that on the less favourable assumption that *Trident* had only five tons of fuel

remaining and using hydrostatics based on measurement of the hull of *Silver Lining* (in place of those deduced from the builders' lines plan) *Trident* failed to comply with IMCO minima in three respects: area 30 - 40°, maximum GZ position, and GZ at 30° (in the last case the deficiency was marginal). In the remaining three criteria, *Trident* was substantially in excess of IMCO recommendations. Conflicting views were expressed in evidence on the conclusion to be drawn from these results. Mr James Donaldson, Ship Surveyor in the Department of Trade's Marine Survey Office in Aberdeen, and a Fellow of the Royal Institution of Naval Architects, considered that *Trident's* stability (on these figures) complied 'substantially' with IMCO. A contrary opinion was expressed by Mr M J Napier, a Consultant Naval Architect with particular experience in the design of fishing vessels. Despite the very great weight which must be given to a witness of such high qualifications, experience and obvious ability as Mr Donaldson, the Court prefers Mr Napier's view on this matter. The IMCO standards are expressed as minima and it has recently been observed that they may require to be raised and that this has in fact been done in Poland and USSR (Holland-Martin Report on Trawler Safety 1974: Appx D para 11 p 139). Assuming that the conventional GZ (or righting-lever) curve is a valid measure of stability, the deficiency in *Trident* started to become significant at about the angle of heel at which her bulwark rail became submerged and was critical in the assumed situation at the time of the casualty. The Court is advised that the GZ curves drawn out from the available data indicate too rapid a decline in righting moment at this and greater angles of heel. It must be acknowledged that the data used in this study may be inaccurate – but any error may lie in either direction. The Court is further advised that the configuration of the curves as a whole is unsatisfactory: indicating that *Trident's* design fell below accepted standards of stability. The importance of this in the case of a trawler designed for the difficult waters of the Scottish fishing grounds is obvious. It does not appear to the Court or to the Assessors to be justifiable to 'set off' deficiencies in some respects against surpluses in other respects. The frequency with which a critical position is reached may be reduced: but that does not assist the vessel when such a position is reached.

In light of these considerations, some aspects of the design, building and operating record of both *Trident* and *Silver Lining* are felt to be of significance. It is an unusual feature of the case that when, during the Department's very thorough investigations, the hull of *Silver Lining* was measured and the measurements compared with the designer's lines plan, local divergences of up to five inches were noted. The differences are small, but the Court is advised that since stability is related to the *square* of beam, the effect of a comparatively small change in hull shape may be to produce a significant change in the KM factor. It is of course impossible to know whether *Trident* showed the same, or possibly other, divergences from the lines plan.

A full year after *Trident* was commissioned, the designer discovered that he had miscalculated the size of the fuel and fresh water tanks. Fuel capacity on both vessels was 22½ tons compared with an intended capacity of 13 tons: the fresh water tank was two tons under the intended capacity. During that year *Trident* when sailing with full bunkers (as is usual at the commencement of a voyage) would seem to have been at some risk. One incident from this period indicated sluggishness in recovering from a roll. In the case of *Silver Lining,* which carried more top-hamper, performance in the same respect appears to have been still more unsatisfactory. On discovering the errors the designer advised the owners to limit the amount of fuel carried, and in relation to the water tank advised the owner of *Silver Lining* to place two tons of

ballast in the void space in the forepeak. This last measure did not cause any apparent improvement and, in the opinion of Mr Napier, would have made the situation worse. The designer's advice thereafter appears to have borne no relation to the problem he was attempting to overcome. Without going in detail into the owner's complaints regarding *Silver Lining,* it must be noted that despite the addition of 8 tons of ballast, her stability is still in considerable doubt.

After an appropriate limit had been placed on *Trident's* bunker loading no incidents of abnormal behaviour were reported, although she tended to be a wet ship aft and to develop an induced roll when on automatic steering. In fact, she appeared to be a satisfactory and workmanlike vessel: and it must be noted in her designer's favour that she fished the Minch, Clyde and Isle of Man fishing grounds in all weathers. Had the period in service been longer, this would have been a factor of more significance.

During 1973 a failure of *Silver Lining's* steering led to the discovery that the rudder stock assembly on both vessels was wholly unsatisfactory and a re-designed assembly was fitted. There was no indication in evidence that the original unsatisfactory assembly had not been built as designed.

Reviewing the whole of this evidence, the Court has reached the conclusion that reliance cannot be placed on the soundness of the design of *Trident:* that she was probably of inadequate stability: that the last radio conversations with her indicated that in her then state of loading and in the prevailing weather conditions, her deficiencies were showing up markedly: that in all the circumstances it would be unrealistic to conclude that her loss was due solely to the action of the sea: and finally, that inadequate stability is the factor most likely to underlie her foundering in conditions which would not normally have overwhelmed a ship of her size.

8 In the course of the Inquiry, attempts were made to suggest that one or other of the parties should be held responsible for the loss of *Trident.* None of these cases was established. In particular, the Court is entirely satisfied that no case was made out against Mr Tait, part owner of the vessel. His experience of *Trident* at sea gave him no reason to suppose her at risk: and his decision not to follow the ambiguous advice concerning ballast given by the designer in a letter of 10 April 1974 was, in the view of the Court and the Assessors, entirely justified. He indicated that after learning of the very serious design error in the size of the fuel tanks, and of the experiences of the owner of *Silver Lining,* he was disinclined to rely too much on Mr Cumming. The Court considers that he was justified in adopting that attitude: which, indeed, the Court shares. An attack was also made on the White Fish Authority, but this was based on an erroneous view of their interest and function (no doubt encouraged by the terms of their letters). Lastly, the builders (of whom Mr Cumming was a director) were criticised for their failure to carry out an inclining test. While this undoubtedly led to great difficulty at the Inquiry in investigating the characteristics of *Trident,* no attempt was made in evidence to show that at the time in question it, or any aspect of the design of *Trident,* involved 'wrongful neglect'. The Court cannot embark on this subject without evidence.

9 The problem of standards of stability of trawlers generally is already under active consideration and it is understood that the design of *Trident* and *Silver Lining* will be the subject of detailed tests. This Inquiry can contribute nothing new to these studies. Only two other points seem to call for consideration:

(1) The liability of the secondary steering controls to accidental operation involves danger. Unless they are so placed as to eliminate the risk of accidental contact it would seem desirable that they should be fitted with a safety-catch, such as a trigger-grip.

(2) During the discussion of the effects of the stress of seas and the occurrence of freak waves, witnesses and the Court were reminded of other examples of losses of or damage to vessels in the same general sea area. It seems unfortunate that there is no collected record of either the circumstances or the findings in these cases. Such a record could be of considerable assistance in comparing conditions and circumstances in which casualties have occurred or exceptional seas have been reported.

10 Several parties moved for expenses. The calling as parties of Mr Tait and the representatives of the late Mr Ritchie and Mr Tait's attendance at this long Inquiry were necessary in the public interest, and in the somewhat unusual circumstances of the case it was reasonable that they both should also be represented. The proceedings were protracted by the need to investigate matters for which they could bear no responsibility, and in the circumstances it is appropriate that their expenses should be met in part. The Court directs that the Department of Trade should pay Mr Tait the sum of £500 and Mr Ritchie's representatives the sum of £150 towards their expenses. No other awards will be made.

11 In submitting this Report, the Court expresses its deep sympathy with the relatives of those who were lost with the *Trident*.

Questions and Answers

Q 1 By whom was the *Trident* owned at the time of her loss?

A David Tait and the late Alexander Ritchie.

Q 2 Where, when and by whom was the *Trident* built?

A Middlesbrough: September 1971 to May 1972, by Tees Marine Ltd. Completed at Isle of Bute by Bute Slip Dock Co Ltd. Commissioned 31 March 1973.

Q 3 How many officers and crew did the *Trident* carry on her last voyage?

A Two officers: five crew.

Q 4 Was the *Trident* in all respects seaworthy at the commencement of her last voyage?

A The Court is not satisfied that her intact stability was adequate for the intended voyage. Otherwise, so far as could be ascertained, she was seaworthy.

Q 5 (a) When and from where did the *Trident* sail on her last voyage?

(b) Where was she bound?

A (a) 01.00 hours, 3 October 1974: from Troon, Ayrshire.

(b) Peterhead.

Q 6 (a) What vessel was in company with the *Trident* on her last voyage?

(b) For what reason were the two vessels in company?

(c) Where and when did the two vessels rendezvous?

A (a) M F V *Faithful II.*

(b) At the request of the owner of *Faithfull II:* because that vessel had a defective gearbox.

(c) Off Pladda Island, early on 3 October 1974.

Q 7 (a) After the rendezvous did the vessel in company with the *Trident* have cause to stop?

(b) If so, where, when, and for what reason?

(c) Consequent upon these events what action did the *Trident* take?

A (a) Yes.

(b) At about 3 to 5 miles SE from Duncansby Head, at about 14.30 on 3 October, in order to repair a broken pipe to a sea-cock.

(c) *Trident* turned to come close alongside *Faithful II* and dropped two rolls of tape, with a buoy, for use in repairing the fractured pipe. *Trident* thereafter resumed passage to Peterhead.

Q 8 (a) What contacts by radio or radar were made between the two vessels after the rendezvous?

(b) Did the *Trident* after the rendezvous contact any other vessel by radio, if so what vessel, when, for what purpose and with what result?

A (a) Normal contact was maintained until about 15.50 on 3 October. After *Trident* separated from *Faithful II* (as noted in Answer 7(c)) contact was made as follows:

By radio

(1) Shortly after about 14.30 the Skipper of *Faithfull II* spoke to *Trident.*

(2) Probably at about 15.00, the Skipper of *Faithful II* spoke again to *Trident,* and asked that she keep her 'big' radio on, as *Faithful's* V H F was on reduced power.

(3) At a time estimated as between about 15.30 and 15.45, a deckhand on *Faithful II* had a conversation with a deckhand on *Trident.*

By radar

(1) At about 15.00, the Skipper of *Faithful II* saw an echo on radar, about 1 point off *Faithful's* starboard bow at a range of about 5 miles, which he considered to be from *Trident.*

(2) At about 15.20 and again at about 15.45 to 15.50, a deckhand on *Faithful II* saw an echo on radar, on *Faithful's* starboard bow at a range of about 5½ miles which he assumed to be from *Trident.* At this time there was much interference and the echo was only intermittently visible.

(b) Yes: M F V *Glenesk,* sheltering off Copinsay: at about 12.00 on 3 October: to ascertain the state of the tide and weather at the east end of the Pentland Firth. *Glenesk* told *Trident* that floodtide at Stroma Light would end at about 13.30 to 13.50.

Q 9 What contacts were made by Wick Radio with the *Trident,* when and with whom?

A *Trident* called Wick Radio on R/T at 14.19 and again, for the purpose of making a link call, at 15.36 to 15.40 on 3 October. She again called at 15.53 and was told to stand by to be called later. (At 16.44 and thereafter, calls by Wick Radio to *Trident* were not replied to).

Q 10 What was the last radio contact made by the *Trident*, when and with whom?

A Either with Wick Radio at 15.53 (see Answer 9) or very shortly thereafter with *Faithful II* (see Answer 8(a)) in the call estimated to have been made between 15.30 to 15.45.

Q 11 (a) What was the state of the weather, wind, sea and visibility at about the time referred to in Question 10?

(b) What happened to the weather thereafter?

A (a) Weather dull with fine drizzle: wind NNE force 5 to 6: sea from NNE fairly rough: visibility about 3 miles.

(b) No material change. *Faithful II* encountered rather worse conditions after reaching the Aberdeenshire coast after about 20.00.

Q 12 (a) When did Wick Radio first try to contact the *Trident* on 3 October without success?

(b) Who else tried to contact the *Trident* by radio on the afternoon of 3 October, when, and with what result?

(c) When was the *Trident* last seen on the radar screen of the vessel in company with her and what was the position of both vessels at that time?

A (a) At 16.44.

(b) *Faithful II* (Mr Wood, Skipper) at about 18.00: no response.

(c) At about 15.45 - 15.50, 3 October. *Faithful II* was then about 5 to 7 miles SE of Duncansby Head: *Trident* about 5½ miles ahead of *Faithful II* and 10½ to 12 miles SE of Duncansby Head.

Q 13 When was concern first expressed as to the safety of the *Trident*, and by whom was it expressed?

A 02.30, 4 October; by Davit Tait, part owner.

Q 14 (a) What search and rescue operations were organised, when and by whom?

(b) What were the results of such search and rescue operations?

A (a) Following requests for enquiries and expressions of concern by David Tait, Peterhead Coastguards endeavoured to obtain news of *Trident:* they then requested the issuing of a PAN broadcast by Wick Radio. This was put out at 03.03 on 4 October. Thereafter extensive and systematic searches were carried out in the sea area between Duncansby Head and Rattray Head. From 07.00 on 4 October an RAF Nimrod aircraft, and later 2 Shackleton aircraft and on 5 October an RAF Whirlwind helicopter searched the area. Also on 4 October, Wick lifeboat was launched at 10.03 and Macduff lifeboat at 10.30. At 13.00, Fishing Protection Vessel *Switha* commenced a search, in company with three M F Vs. On 5 and 6 October, F P V *Jura* also searched. Part owner David Tait arranged for his brother to search

the area over a period of a week: and also for a local Skipper Mr Norman Bremner to investigate the area in which an oil slick was reported.

(b) At 10.45 on 4 October, Wick lifeboat came upon a large oil slick northwards of Noss Head and about 9 miles SSE of Duncansby Head: and at position 58° 10′ N 02° 40′ W she sighted large numbers of fish boxes and baskets, some of which were picked up. On 6 October a wooden batten and two plastic pellets were picked up by F P V *Jura* at 58° 10′ N 02° 49′ W. Radar Target Buoys No 2 and 3 were inspected in the course of these searches and no indications of collision damage were found. Subsequently, on 14 March 1975, one of *Trident's* lifebelts was found by coastguards on the beach near Gardenstown.

Q 15 In approximately what position is it considered that the *Trident* was lost?

A About 10½ to 12 miles SSE of Duncansby Head.

Q 16 (a) What was the condition of loading of the *Trident* at the time she was considered to have been lost?

(b) In this condition of loading were the vessel's intact stability characteristics in substantial compliance with those recommended for fishing vessels by the Department of Trade?

A (a) As nearly as can be estimated, in one or other of the conditions indicated in the Appendix hereto.

(b) No certain answer can be given. Since no inclining test was carried out on *Trident* in her finished state and as her loading at the time of loss cannot be ascertained precisely, all data are subject to the possibility of significant error. On one of the available calculations (that based on the Lines Plan produced by the Napier Company) she fell below the recommended minima in three respects although above them in other respects. The Court is not satisfied that her stability characteristics were 'in substantial compliance' with the recommended standards.

Q 17 How many lives were lost in this casualty?

A Seven lives.

Q 18 What was the cause of the loss of the *Trident?*

A The cause(s) cannot be ascertained. So far as can be inferred from the circumstances, it is most probable that *Trident* took on board a sea or succession of seas and foundered. It is possible that her foundering was contributed to by her response to automatic steering (if in use) or accidental operation of her secondary steering apparatus. In all events it is probable that she was deficient in stability and that this contributed to her foundering.

Q 19 Was the loss of the *Trident* caused or contributed to by the wrongful act or default of any person or persons?

A No wrongful act or default was established in evidence.

G S Gimson *Judge*

D J Hurst
D A Roberts *Assessors*
M Meek

TRIDENT

ESTIMATED CONDITION AT TIME OF LOSS

(Condition 'A'1)

ITEM	TONS	VCG	VMT	LCG	F	A
'Lightship'	147.46	-	1485.19	-	-	496.19
Stores in Lower Focle	1.0	9.0	9.00	29.0'F	29.00	-
Stores in Upper Focle	1.5	16.0	24.00	36.0'F	54.00	-
Fresh Water	1.5	3.5	5.25	28.8'F	43.20	-
Hyd Oil Drum on Deck	0.18	15.0	2.70	26.0'F	4.68	-
Fish Boxes in Hold	3.32	7.5	24.90	17.5'F	58.10	-
Lub Oil Drums in ER	0.14	4.5	0.63	14.5'A	-	2.03
Nets	1.27	13.0	16.51	4.0'A	-	5.08
	0.92	14.0	12.88	37.5'A	-	34.50
	0.92	13.7	12.60	21.0'F	19.32	-
	0.15	13.7	2.06	21.0'F	3.15	-
	0.23	19.5	4.49	25.0'A	-	5.75
	0.11	13.5	1.49	38.0'A	-	4.18
Chain at After Gallows	0.27	12.5	3.38	28.5'A	-	7.70
Dog Rope	0.10	13.5	1.35	38.0'A	-	3.80
Stores	0.05	14.0	0.70	15.0'A	-	0.75
Crew and Effects	0.52	15.0	7.80	12.0'A	-	6.24
Oil Fuel	5.00	-	26.00	-	-	53.00
Tyres (6 OFF)	0.30	13.0	3.90	-	-	-
	164.94	9.97	1644.83	2.47 A	211.45	619.22 407.77

Deadweight = 17.48 tons

Draft at LCF = 7.604

TOK X

KM 12.344

GM 2.374

FS – 0.027

GM + 2.347

Free surface (IMCO)

As condition 'B' = $\frac{4.4}{164.94}$ = 0.027'

MLD drafts F = 5.60'

@ Perps A = 9.61' Trim = 4.01' by Stern

Full drafts F = 6.10'

@ Perps A = 10.11'

Hydrostatics based on Lines Plan supplied by Bute Slip Dock Company

TRIDENT

ESTIMATED CONDITION AT TIME OF LOSS

(Condition 'B'1)

ITEM	TONS	VCG	VMT	LCG	F	A
'Lightship'	147.46	-	1485.19	-	-	496.19
Stores in Lower Focle	1.0	9.0	9.00	29.0'F	29.00	-
Stores in Upper Focle	1.5	16.0	24.00	36.0'F	54.00	-
Fresh Water	1.5	3.5	5.25	28.8'F	43.20	-
Hyd Oil Drum on Deck	0.18	15.0	2.70	26.0'F	4.68	-
Fish Boxes in Hold	3.32	7.5	24.90	17.5'F	58.10	-
Lub Oil Drums in ER	0.14	4.5	0.63	14.5'A	-	2.03
Nets	1.27	13.0	16.51	4.0'A	-	5.08
	0.92	14.0	12.88	37.5'A	-	34.50
	0.92	13.7	12.60	21.0'F	19.32	-
	0.15	13.7	2.06	21.0'F	3.15	-
	0.23	19.5	4.49	25.0'A	-	5.75
	0.11	13.5	1.49	38.0'A	-	4.18
Chain at After Gallows	0.27	12.5	3.38	28.5'A	-	7.70
Dog Rope	0.10	13.5	1.35	38.0'A	-	3.80
Stores	0.05	14.0	0.70	15.0'A	-	0.75
Crew and Effects	0.52	15.0	7.80	12.0'A	-	6.24
Oil Fuel	8.00	-	45.00	-	-	75.00
Tyres (6 OFF)	0.30	13.0	3.90	-	-	-
	167.94	9.907	1663.83	2.56'A	211.45	641.22 429.77

Deadweight = 20.48 tons

Draft at LCF = 7.69'

TOK X

KM 12.372

GM 2.465

FS – 0.026

GM + 2.439

Free surface (IMCO)

Bunkers (P&S) 1.7

FW tank 2.5

DS tank 0.2

4.4 = 0.026

167.94

MLD drafts F = 5.60'

@ Perps A = 9.66'

Trim = 4.06' by Stern

Full drafts F = 6.10'

@ Perps A = 10.16'

Hydrostatics based on Lines Plan supplied by Bute Slip Dock Company

TRIDENT

ESTIMATED CONDITION AT TIME OF LOSS

(Condition 'A'2)

ITEM	TONS	VCG	VMT	LCG	F	A
'Lightship'	147.46	-	1546.42	-	-	519.74
Stores in Lower Focle	1.0	9.0	9.00	29.0'F	29.00	-
Stores in Upper Focle	1.5	16.0	24.00	36.0'F	54.00	-
Fresh Water	1.5	3.5	5.25	28.8'F	43.20	-
Hyd Oil Drum on Deck	0.18	15.0	2.70	26.0'F	4.68	-
Fish Boxes in Hold	3.32	7.5	24.90	17.5'F	58.10	-
Lub Oil Drums in ER	0.14	4.5	0.63	14.5'A	-	2.03
Nets	1.27	13.0	16.51	4.0'A	-	5.08
	0.92	14.0	12.88	37.5'A	-	34.50
	0.92	13.7	12.60	21.0'F	19.32	-
	0.15	13.7	2.06	21.0'F	3.15	-
	0.23	19.5	4.49	25.0'A	-	5.75
	0.11	13.5	1.49	38.0'A	-	4.18
Chain at After Gallows	0.27	12.5	3.38	28.5'A	-	7.70
Dog Rope	0.10	13.5	1.35	38.0'A	-	3.80
Stores	0.05	14.0	0.70	15.0'A	-	0.75
Crew and Effects	0.52	15.0	7.80	12.0'A	-	6.24
Oil Fuel	5.00	-	26.00	-	-	53.00
Tyres (6 OFF)	0.30	13.0	3.90	-	-	-
	164.94	10.344	1706.06	2.62'A	211.45	642.77 431.32

Deadweight = 17.48 tons

Draft at LCF = 7.641'

TOK ✕

KM 12.773

GM 2.429

FS – 0.027

GM + 2.402

Free surface (IMCO)

As condition 'B' = $\frac{4.4}{164.94}$ = 0.027'

MLD drafts F = 5.51'

@ Perps A = 9.77'

Trim = 4.26' by Stern

Full drafts F = 6.01'

@ Perps A = 10.27'

Hydrostatics based on lines plan prepared by Napier Company

TRIDENT

ESTIMATED CONDITION AT TIME OF LOSS

(Condition 'B'2)

ITEM	TONS	VCG	VMT	LCG	F	A
'Lightship'	147.46	-	1546.42	-	-	519.74
Stores in Lower Focle	1.0	9.0	9.00	29.0'F	29.00	-
Stores in Upper Focle	1.5	16.0	24.00	36.0'F	54.00	-
Fresh Water	1.5	3.5	5.25	28.8'F	43.20	-
Hyd Oil Drum on Deck	0.18	15.0	2.70	26.0'F	4.68	-
Fish Boxes in Hold	3.32	7.5	24.90	17.5'F	58.10	-
Lub Oil Drums in ER	0.14	4.5	0.63	14.5'A	-	2.03
Nets	1.27	13.0	16.51	4.0'A	-	5.08
	0.92	14.0	12.88	37.5'A	-	34.50
	0.92	13.7	12.60	21.0'F	19.32	-
	0.15	13.7	2.06	21.0'F	3.15	-
	0.23	19.5	4.49	25.0'A	-	5.75
	0.11	13.5	1.49	38.0'A	-	4.18
Chain at After Gallows	0.27	12.5	3.38	28.5'A	-	7.70
Dog Rope	0.10	13.5	1.35	38.0'A	-	3.80
Stores	0.05	14.0	0.70	15.0'A	-	0.75
Crew and Effects	0.52	15.0	7.80	12.0'A	-	6.24
Oil Fuel	8.00	-	45.00	-	-	75.00
Tyres (6 OFF)	0.30	13.0	3.90	-	-	-
	167.94	10.272	1725.06	2.70'A	211.45	664.77 453.32

Deadweight = 20.48 tons

Draft at LCF = 7.717'

TOK

KM 12.803

GM 2.531

FS – 0.026

GM + 2.505

Free surface (IMCO)

Bunkers (P&S) 1.7

FW tank 2.5

DS tank 0.2

4.4 = 0.026'

167.94

MLD drafts F = 5.57'

@ Perps A = 9.86' Trim = 4.29' by Stern

Full drafts F = 6.07'

@ Perps A = 10.36'

Hydrostatics based on lines plan prepared by Napier Company from measurements lifted from hull of Silver Lining

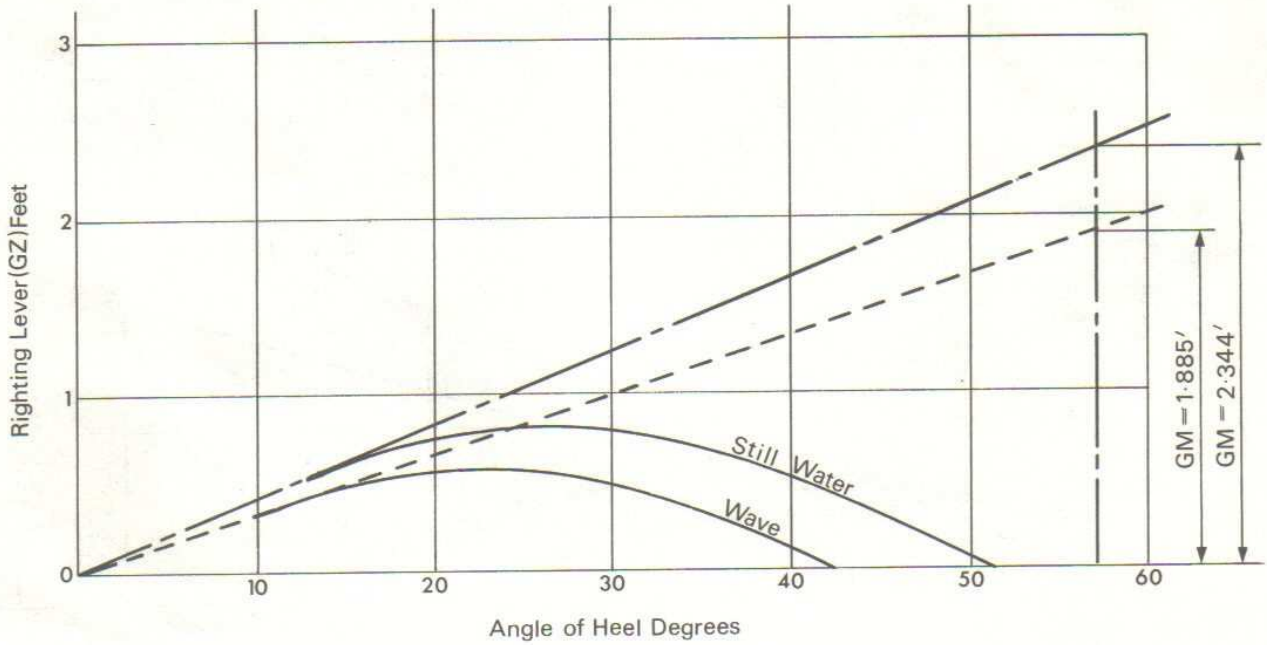
A1 Trident

Estimated condition at time of loss
5 tons fuel oil

	In Still Water	On Crest Of Wave
Area up to 30^0	15.88 ft. deg.	11.74 ft. deg.
Area up to 40^0	22.40 ft. deg.	14.83 ft. deg.
Area $30^0 - 40^0$	6.52 ft. deg.	3.09 ft. deg.
Max. GZ	0.818 ft. @ 25^0	0.574 ft. @ 22^0
GZ at 30^0	0.792 ft.	0.476 ft.

Hydrostatics based on lines plan prepared by Bute Slip Dock Company

Assumed wave height 13.0 ft. length 230 ft. of trochoidal form.



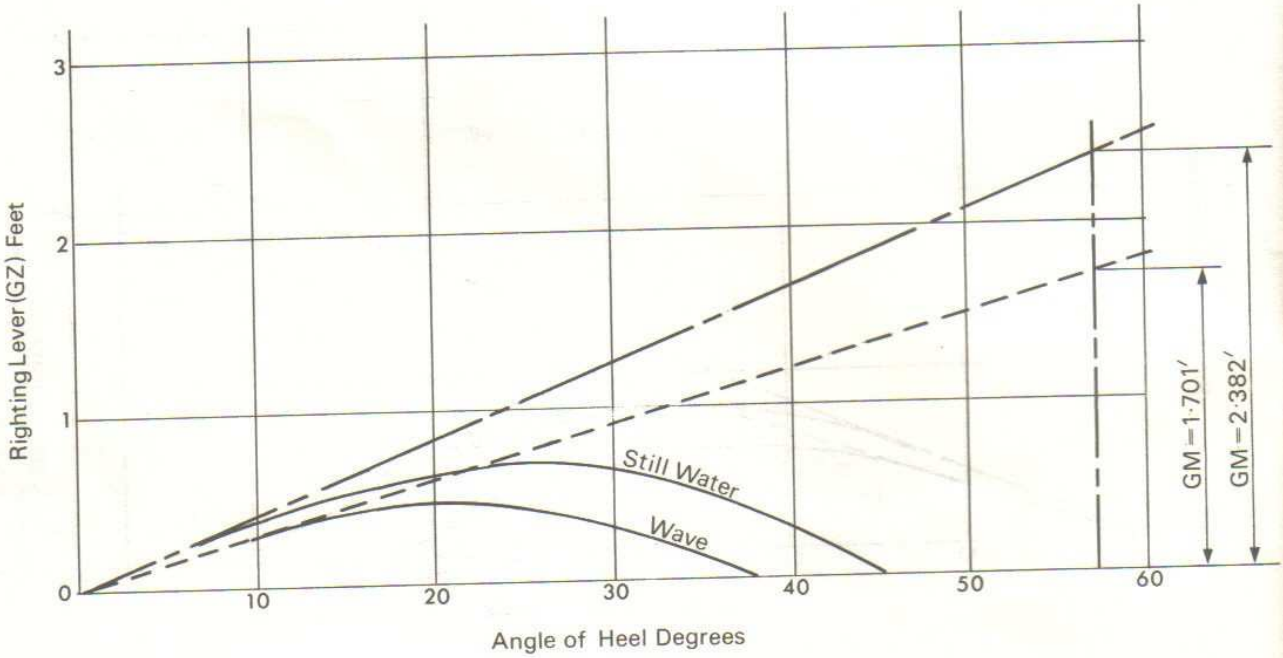
A2 Trident

Estimated condition at time of loss
5 tons fuel oil

	In Still Water	On Crest Of Wave
Area up to 30^0	14.09 ft. deg.	9.45 ft. deg.
Area up to 40^0 or vanishing angle whichever is lesser	19.02 ft. deg.	10.71 ft. deg.
Area $30^0 - 40^0$ or vanishing angle	4.93 ft. deg.	1.26 ft. deg.
Max. GZ	0.691 ft. @ 24^0	0.469 ft. @ 20^0
GZ at 30^0	0.643 ft.	0.29 ft.

Hydrostatics based on lines plan prepared by Napier Company from measurements lifted from hull of sister vessel *Silver Lining*

Assumed wave height 13.0 ft. length 230 ft. of trochoidal form.



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