FROM INCIDENT TO SINKING - WHAT IS THE TYPICAL TIME? A LOOK AT THE DATA FROM WORLD WAR II

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ABSTRACT

This paper explores how quickly RN vessels have been lost at sea, timed from incident to sinking, its uses World War 2 historical data to give a large enough data field to enable statistical analysis. This has also been compared using more recent data from the Falklands conflict, Lloyd's Register World Casualty Statistics and MAIB data to show that there are no contradictions of the thesis that vessels tend to sink either quickly (typically less than 30 minutes for a large vessel) or slowly (typically greater than 2 hours for a large vessel) rather than, as vessels are currently designed with a SOLAS indicated design time of 45 minutes and makes recommendations as to the implications of this to Naval Ship design.

Introduction

Current modelling of evacuation times for vessels assumes that personnel should be able to evacuate in around the 45 minute time period. That time period though does not tie in with the time to sink of various well known recent disasters such as the *MV Derbyshire* (described as at catastrophic speed)[1], *Herald of Free Enterprise* (4 minutes)[2] and the recent *Explorer* in the Antarctic (72 hours). Nor does it tie in with the vessels lost by the RN in the Falklands conflict where *HMS Coventry* capsized in 23 to 26 minutes (although her hulk remained afloat until the following day) and the remaining 5 reasonably sized vessels which were all scuttled, once evacuated (*RFA Sir Galahad*) or at least a day later than the incident (*HMS Ardent, HMS Antelope, SS Atlantic Conveyor, HMS Sheffield*).

Aim

The author's knowledge and experience would lead him to the hypothesis that vessels tend to sink either quickly (generally less than 30 minutes) or slowly, and that the current modelling time demanded by SOLAS is not appropriate to warships. This paper will explore whether that assertion is valid.

[1] MIN 228 Bulk Carrier Safety Studies 1998-2004 (Loss of MV Derbyshire) MCA May 2006.

[2] Safety Management and its Maritime Application – Professor Chengi Kuo 2007.

Discussion on data

Examples can always be found to prove most theories so it was endeavoured to undertake a systematic statistical analysis to establish how long, typically, RN vessels would take to sink. As part of ensuring that any bias is removed from the selection of evidence the list of World War 2 RN vessels sunk was used.[3] In the majority of these the time taken to sink was recorded and all vessels of destroyer size upwards were used. This provided a database of 179 vessels, which could be analysed. Of these 30 vessels are either in the situation where the time of sinking is not known (NK in charts) or which were not at sea (i.e. in dry dock or tied to the pier) and are thus excluded from the statistical analysis below (NA in charts).

Twenty vessels are listed with the time unknown for sinking, in all cases these were destroyers and in most cases they simply disappeared. The most likely case for the majority of these is that they sank so quickly that no survivors got off and no message for assistance was raised thus they would probably further emphasise the results of this study by largely being with the less than 5 minutes category.

The information has been displayed using pie charts to try and give the best visual representation of the data. Those that are combined which are less than the valid time for current design work are in various shades of green. Those that are greater than the current design level are in various shades of blue, included in these are those which have sunk after being abandoned. We are designing currently just for the red area in each pie chart, with the amber area representing 31 to 40 minutes being close to the design time. All recorded times greater than 5 minutes were given as a whole number of minutes or hours.

Presentation of Key Findings

The time taken for all the vessels of destroyer size upward that sank can be seen in the pie chart below.

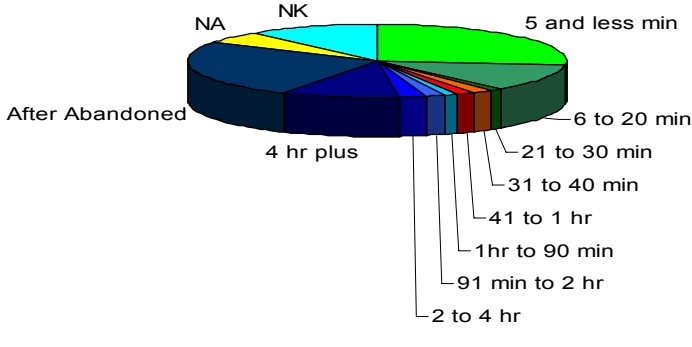

FIG.1 - SINKING TIMES IN WW2

As can be seen the design time assumed for current work of 40 minutes to 1 hour (the red area subset of the pie chart) is such that only 2 vessels (1.3%) fall into that

[3] All contained within CB4273 (now declassified).

timeframe. Even if the zone is expanded from 30 minutes to 1 hr 30 minutes it still only accounts for 8 vessels (which is less than 5%).

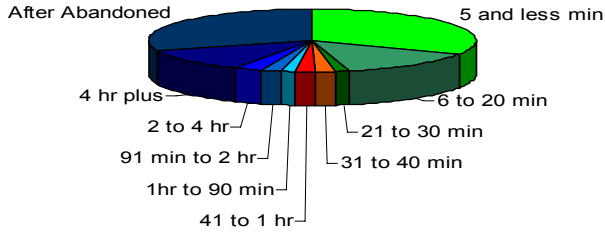

FIG.2 - VESSELS WITH KNOWN SINKING TIMES IN WW2

Since vessels have generally grown in size over the intervening period and this is to be used as applicable for T45 and CVF design justification and decisions then a more accurate subset of the data would be to use that of the larger vessels. These have been taken as the Cruisers and Armed Cruisers upwards thus from a smaller but better known database the figures would be as shown below.

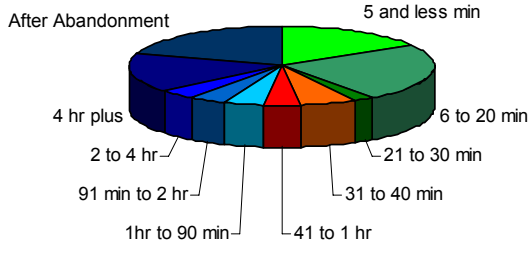

FIG.3 - LARGE VESSELS SINKING TIMES WW2

In this scenario just 2 vessels (3.7%) fall into the current design time of 40 minutes to 1 hour although 3 are within the slightly shorter time frame sinking between 30 and 39 minutes. If as before the zone is expanded to from 30 minutes to 1 hr 30 minutes it is 6 vessels (which are less than 12%). The corollary from this is that of the 123 destroyers sunk; just 2 sank in the time frame of 30 minutes to 90 minutes (1 on 50 minutes and 1 at 90 minutes).

The equivalent in damage to our most likely fatal attack on one of our vessels is the torpedo which these days has been replaced by the guided missile but equally likely a single major hit rather than repeated minor hits eventually breaking the vessel.

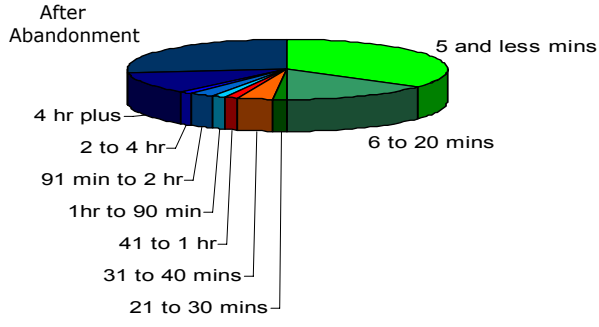

FIG.4 - VESSELS SUNK BY TORPEDO WW2

This chart also includes the 7 sunk by a mixture of shells, bombs and torpedoes, one sunk by a human torpedo (the destroyer *HMS Quorn*) and one which was both rammed and hit by torpedoes (the destroyer *HMS Hunter*). Again it can be seen that the vast majority are either less than 20 minutes (50%) or greater than 2 hours (40%) and with just one out of the 78 vessels sunk being within the current design time of 40 to 60 minutes (the armed merchant cruiser *Forfar* on 50 minutes).

If you look for the unexpected hits such that a vessel would be unprepared and perhaps in a less watertight condition. Then the most likely weapons scenario to give good data would be the mine hit, as these would have been generally unexpected state and thus are analogous to a peacetime incident within the current environment. Then there are 17 vessels sunk by mine, of these 7 sank in less than 15 minutes (6 in less than 5 minutes), 3 are not known as they are just recorded as capsized or hit a mine and sank, it is likely that these were quick as well. One further settled on the ground in a similar way to the Herald of Free Enterprise and the 3 remaining actually survived the hits and only after abandonment were then scuttled. This would indicate that in this situation a rapid sinking resulted every time where the damage was catastrophic.

Alternative Data Examined

A similar analysis was attempted for merchant vessels using the Lloyd's Register World Casualty Statistics[4], looking at those greater than 500 tonnes, as providing a large enough database to remove any bias from the selection process. However, after considerable effort to establish sinking times for the various vessels from various sources, a large number of unknown timings remained. Taking the 2006 Casualty List there were a total of 120 casualties resulting in sinking of which 57 were vessels of greater than 500 tonnes. For 40 of these it was not possible to establish how long they took to sink. Of the remaining 17, 5 sank in less than 15 minutes and the remaining 12 were all 2 hours or longer or after abandonment (with just 2 being in the 2 to 4 hour bracket). From this it can be seen that there is

[4] Lloyd's Register 2006 World Casualty Statistics.

nothing to indicate a different trend than that seen with RN vessels from World War 2 although the lack of known data makes any full validation impossible.

A similar question was asked under a Freedom of Information Request of the Marine Accident Investigation Branch (MAIB). Although they hold data from 1991 to current date as of May 2007 they were only able to supply sinking times for 27 vessels of greater than 100 grt. of which just 3 are greater than 500 grt. of these 2 were greater than 24 hours and the remaining one was 4 hours and 40 minutes. One of these 3 is the *Ece* which sunk in 2006 and features in both the MAIB and the Lloyds Register of World Casualty Statistics with the times quoted matching.

Discussion

What is quite noticeable from all the data presented in this paper is that the current region of design time for evacuation of 40 minutes to 1 hour does not tie in with when the majority of vessels are lost. Even with an expansion of that time to between 30 minutes and 90 minutes it is still a rare occurrence. Moving up size of vessel does increase the frequency slightly but not into a significant proportion to be justifiable as the design point. From these it can be seen that the current timings that are used for ship design following the IMO timescale are not in keeping with the likely scenarios that will cause such evacuation.

The IMO has actually recognised these phenomena in another area. It is interesting to note that the need for a rapid means of escape has been identified by studies for bulk carriers. An RCO was developed from the Norway/ICFTU FSA study on evacuation of bulk carriers of which the important feature was the free-fall capability, which provides the crew with a rapid means of escape that eliminates complex side-launching procedures. However, the IMO currently believe the technology for the float-free capability is not sufficiently developed that a mandatory legal requirement can be defined or enforced, although it was recognised that free fall lifeboats would generally float free in the event of a rapid sinking. In the meantime, SOLAS Chapter III Regulation 31 has been amended to require free-fall lifeboats for new bulk carriers until such time as technical specifications for float free arrangements can be defined. The amendment was adopted in December 2004 and came into force on 1 July 2006.

It is also important to take into account the thought process taught by the RN for its crews, whereby in a peace time scenario the Command Team are expected to react rapidly as an almost automatic response if the incident is felt to be beyond the scope of the Standing Sea Emergency Party to move to Emergency stations. This is likely to mean we move further from the design situation by not moving initially to abandon ship unless we are in a catastrophic disaster situation. It has been stated that in *HMS Coventry* the general order to abandon ship was not received by most of the ship's company but that the situation was so clear that independently they made that decision to abandon for themselves[5].

Work on changes to damage control since World War 2 is also likely to impact on any sinkings in the future, the robustness of RN damage control procedures was partly illustrated by the incident on *HMS Nottingham* in 2002. These damage

[5] Presentation by MEO HMS Coventry to MEO Designate Course 2002.

control procedures are not able to be brought into play in any catastrophic incident which results in rapid sinking but will impact on any event which gets past that initial stage, delaying the need (if not preventing) for abandoning ship.

Recommendations

It is the author's opinion that the RN ought to move to 2 scenarios for considering abandonment of the vessel.

a. A rapid sinking - this is likely to be from the action station or personnel directly at their place of work - this should work on providing as many means of escape as possible and continue with our current policies of life rafts being float free and life jackets being available near exits from the vessel or issued into battle bags (as is current practice for action stations). This scenario is likely to involve casualties, partly as the event, which, has caused it, will be catastrophic and traumatic.

b. A slow safe orderly evacuation which will take place from either action stations or emergency stations (clear lower deck position) and give time for an orderly plan to be put into place with probably early abandonment by various parties leaving others attempting to deal with the situation (or the internal battle). The likely time for this is to be greater than 2 hours and thus it will not mean personnel depart from their accommodation or normal work positions but from Emergency station positions or action stations.

The impact of this should then be worked into various RN procedures and training for example:

a. Practice putting on Once Only Survival Suit (OOSS) in an action station situation.

b. Practice both types of abandon ship (as required by SOLAS rules).

c. Conducting future EXODUS modelling from the appropriate situations i.e. including emergency stations rather than focus on from place of work or sleep.

Conclusion

The statistical analysis clearly backs up the author's assertion that vessels tend to sink quickly (less than 30 minutes) or slowly (greater than 90 minutes). This has been shown to be valid for:

a. All vessels of destroyer size and upwards in WW2.

b. Equally for cruisers and larger vessels.

c. Equally for those hit by torpedoes (the single or multiple large hit).

d. Without exception for those sunk by mines (those most likely to be not fully closed up).

and is not contradicted by any comparable data obtainable for equivalent civilian vessel sinkings.

It is hoped that this study will help inform debate and be given consideration as the RN develops it policies under the new Escape and Evacuation Naval Authority and starts to get involved in setting up an International military version of SOLAS, where perhaps more pertinent calculations and methodology more akin to that likely to be experienced in a war situation can be applied.