SS Richard Montgomery (U)

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1.0	21 July 1997	Initial issue

Executive summary

A review was carried out of the information available at DERA Chorley on the wreck of the Richard Montgomery and the munitions thought to be present. The types of ammunition and their probable location in the wreck is described and an assessment made of their condition following the extended period of immersion. A summary is also given on the information available on the effects of a contrived or accidental initiation of the munitions resulting in a mass explosion.

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1 Introduction

The United States Liberty Ship, SS Richard Montgomery, ran aground on East Nore Sands in the Thames estuary in August 1944. The vessel had on board nearly 9000 tonnes of munitions of which approximately one half were salvaged at the time and the rest are still in the wreck.

The wreck is one and a half miles from Sheerness and the Isle of Grain and 600 feet from the Medway Channel Fairway. The masts and derricks are visible at all states of the tide and the decks are always covered even at low tide [1].

There have been regular reviews of the situation with the wreck and a number of proposals for salvaging the remainder of the cargo but the decision has always been that it was better not to disturb it [2,3,4]. Following the most recent review, held on 25 November 1996, DERA were requested to provide a short written comment on the probable condition of the munitions and explosives and the possible effects on the area of a mass explosion [5].

2 Review of available information

2.1 Munitions remaining in the wreck

2.1.1 There are a number of discrepancies between the information in the sailing draft [6] and that in the salvage reports [7] but the information at Table 2-1 is probably a reasonable estimate of the numbers and types of munitions remaining in the various parts of the wreck.

2.1.2 The munitions that have been the principle cause of concern, and whose presence has probably most influenced the decisions not to attempt recovery of the rest of the cargo, are the cluster fragmentation bombs located "between decks" in hold no 2. These are believed to be of two types and some of them are understood to be fuzed. Details of the two types are given below.

2.1.3 Cluster fragmentation bomb. AN M1A1 100lb size

2.1.3.1 These bombs are packed in a cluster of six 20lb bombs type M41 each fitted with a fuze type AN-M11A1. This fuze contains an in line M13 detonator which contains both lead azide and a gilding metal detonator cup. There was initially considerable concern over the possibility of the formation of copper azide on the copper or copper alloy components. This was considered hazardous, as copper azide is more sensitive than lead azide, and was likely to be formed in potentially hazardous parts of the safety and arming mechanisms. The fuze is a vane armed, direct action, impact design and the detonator and striker are in line. The sequence of events required to accidentally actuate the detonator are considered extremely unlikely to occur, particularly after an extended period of submersion.

2.1.4 Cluster fragmentation bomb AN M4A1

2.1.4.1 These bombs are packed in a cluster of 3 type M40, 23lb TNT, unfuzed fragmentation bombs. Three fuzes type AN-M120 A1, each in a sealed metal can, are also packed in the case. The fuze is a mechanical, delay arming impact fuze. In the unarmed state the M19AZ detonator is out of line with the striker and booster charge. Even if the detonator was to function, with this design of fuze, the explosion would not propagate to the primer.

2.1.4.2 There was considerable correspondence between the UK and USA authorities regarding the risk of accidental functioning of these fuzes and the probable effects of their prolonged submersion. A reappraisal of the hazards was carried out by PERME, Waltham Abbey in 1980 [8]. The conclusions were that the fuzes would have become flooded within a short time after the sinking and are now either completely non functional or no more sensitive than in the normal state.

	Hold No 1	Explosive weights (tonnes)
Deep tanks		
Aft	79 cases signals	3 (pyrotechnics)
	1429 cases wp 100lb smoke bombs	65 (white phosphorus)
Forward	30 boxes boosters	31 (pyrotechnics)
	786 boxes signals	
Lower holds/between decks		
	1407 500lb bombs TNT AN M64A1	167
	850 1000lb bombs TNT AN M65	208
	1500 250lb bombs TNT AN M57	84
	Hold No 2	
Lower holds	1068 1000lb SAP bombs TNT AW-M59	140
	574 500lb SAP bombs AN M58	41
	286 2000lb GP TNT AN-M66	144
	588 1000lb AN M65	140
Between decks	521 580 B260 lb fragmentation bombs AN M81	9
	2297 cases of fragmentation bomb clusters	9
	AN M1A1 (6 x 20lb fuzed)	
	and/or AN M4A1 (3 x 23lb unfuzed)	
	and/or AN-M81 B260lb	
	Hold No 3	
Lower decks/between decks	1170 SAP 1000lb bombs	163
	406 GP 1000lb bombs	99
	1351 SAP 500lb bombs	97
	Total	1400 tonnes

Table 2-1; remaining munitions

2.1.4.3 It may be of interest to note that an investigation carried out around 1973 by D F Cotgrove of Southend Chamber of Trade concluded that all of the fuzed bombs had been cleared away during the original salvage operation and that all the remaining bombs were unfuzed [8]. The conclusions were based on a study of the records of the weights of the individual cases and interviews with the salvage crew. His view was given limited support by Major Theodore C Chart, [10] who is an expert on American munitions and the author of a book on the subject.

2.1.4.4 The overall conclusion from the reports available is that any fuzes present in the wreck will have deteriorated to the extent that they are no longer functional and would not constitute a hazard to handling the munitions by normal EOD handling providing an aqueous environment is maintained.

2.1.5 Other munitions present

2.1.5.1 The remainder of the cargo consists of unfuzed high explosive bombs, pyrotechnic stores and 100lb smoke bombs.

2.1.5.2 The main high explosive filling for the bombs is understood to be TNT or RDX. These materials are chemically very stable and would be expected to remain in good condition within the bomb cases. The TNT would be relatively unaffected by leakage of water into the bomb case but explosives containing RDX or ammonium nitrate would be affected as they are partially or completely soluble in water. Unless there has been significant leaking of the soluble components of the explosive there is likely to be little or no changes in the sensitivity or explosive power of the explosives as a result of the extended submersion.

2.1.5.3 The records show that a quantity of 100lb white phosphorus smoke bombs are stored in the aft deep tank below no 1 hatch. The bombs are in individual wooden boxes and do not contain fuzes or booster charges. White phosphorus is quite stable when stored under water but can ignite spontaneously in air. CBDE Porton Down has extensive experience of this material and can advise on the special hazards that would be involved in a recovery operation or explosion involving stores of this type.

2.2 Kielce Incident

2.2.1 One of the factors which probably influenced the decision to leave the wreck untouched was the incident with the Kielce in 1967 [11].

2.2.2 The Kielce was a Polish vessel which sank in deep water 3 miles off Folkstone with a cargo of bombs similar to those on the Richard Montgomery. An attempt was made to recover the bombs and a small explosive charge was placed adjacent to a bulkhead to free the bombs. The explosion propagated to the rest of the cargo and the blast caused considerable damage over a wide area. The blast occurred at about the time that proposals to recover the munitions from the Montgomery were being considered

2.3 Effects of a mass detonation

2.3.1 There have been a number of studies of the likely effects of a mass detonation of the munitions remaining in the wreck (equivalent to 1500 tonnes of TNT) either as the consequence of an accident or as the result of a planned disposal operation [12, 13]. Whilst there is not a lot of data available that can be directly related to the particular situation with the Richard Montgomery, it has always been accepted that a mass explosion would put property and the local population at risk.

2.3.2 Damage could arise from a number of effects of the explosion but the principle cause would be from the resulting air blast. The extent of damage would be very dependent on the weather and tidal conditions at the time but could cause damage to windows at a distance of 18,000 feet and extensive damage to houses at 1650 feet. Because of the location of the wreck there would probably be little question of direct injury to people by air blast but there could be injury by secondary effects, mainly from flying glass. For a planned explosion, evacuation would be necessary for a distance of 10,000 feet from the wreck.

2.3.3 The damage from seismic shock could occur to a maximum of 14,000 feet but only minor damage would be expected at distances greater than 5,500 feet. Structural damage could occur in well maintained properties at distances less than 3,500 feet. It is considered unlikely that wave action would be significant outside the immediate area of the water course unless the event occurred at the top of a high tide.

2.3.4 The distance at which ships would be affected would be very dependent on the design of the individual ship but the area would probably need to be cleared to a distance of at least 1000 feet in the event of a planned explosion. Missile effects could be produced up to about 13,000 feet and at a distance of 5000 feet an intensity of the order of 1 missile to every 250,000 square feet could be anticipated (1 missile for every 30 houses).

2.3.5 The figures are not claimed as accurate but probably give some idea of the magnitude and effects of a mass explosion of the wreck.

3 Conclusions

3.1 The bulk of munitions are high explosive bombs. The main fillings are probably still in serviceable condition and, with suitable initiation, capable of a mass high order detonation.

3.2 Any fuzes present are likely to have been completely flooded for some time and are either non functional or no more sensitive than in their normal state.

3.3 The white phosphorus smoke bombs would present a special hazard in the event of a recovery operation or explosion.

3.4 The condition of the explosives would probably permit handling by normal EOD procedures providing a aqueous environment was maintained [8].

3.5 It would be extremely dangerous to use explosives in the vicinity of the wreck.

3.6 The reports which estimated the effects of a mass explosion of the remaining cargo were both written some time ago. As there have been significant developments in computer programs capable of modelling events of this type, it may now be possible to obtain a better assessment of the effects of a mass explosion under a variety of different wind and tidal conditions than was previously available. The Explosives Effects Sub Committee of the Explosive Storage and Transport Committee may be prepared to carry out this assessment.

4 References

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13. TATE, F E G, *The Richard Montgomery problem*, XB 243/1/3. 4 December 1975.