6. SS RICHARD MONTGOMERY

6.1 INTRODUCTION

The purpose of this chapter is to describe the assessment of the extent to which the construction and operation of a new hub airport in the inner Thames Estuary could impact upon the overall stability of the SS Richard Montgomery wreck.

The chapter does not seek to collect further data on the current state of the SS Richard Montgomery and its cargoes or its likely future state, rather to explore the risks posed by the development of an airport in the vicinity of the vessel and the courses of action that might be required. The opinions and conclusions expressed in this report are based upon the opinions and conclusions stated in the referenced studies.

The section begins with a description of the history of the wreck and its current state (Sections 6.2 and 6.3) before discussing the various risks associated with the wreck (Sections 6.4), the implications for construction and operation of an airport (Sections 6.5 and 6.6), possible mitigation (Section 6.7) and presenting summary conclusions (Section 6.8).

6.2 HISTORY

The SS Richard Montgomery is a US Liberty Ship, built in 1943 in Florida. The vessel was carrying a cargo of munitions to support the war effort, travelling from the USA to Cherbourg, France via the UK in August 1944 when it sank off the coast of Sheerness. The vessel was at anchor when it drifted on to a sandbank running east of the Isle of Grain, approximately 250m north of the approach to the River Medway, and suffered major structural damage causing it to take on water.

At the time the vessel ran aground, it is understood to have been carrying between 6,000 and 7,000 tons of munitions. A salvage operation was launched a few days later and continued for a month but was abandoned before all the cargo had been recovered. The vessel subsequently broke into two parts. Around 1,400 tons (Net Explosive Quantity) of munitions is understood to remain on board.

The wreck remains on the sandbank where she sank and her masts are visible above the water level at all states of the tide. Figure 19 and Figure 20 show the location of the wreck in relation to the Isle of Grain.

Figure 18: SS Richard Montgomery soon after running aground

Figure 19: Location of SS Richard Montgomery

Figure 20: Location of SS Richard Montgomery in relation to the Isle of Grain

6.3 CURRENT STATE

The SS Richard Montgomery is administered by the Receiver of Wreck, a department of the Maritime & Coastguard Agency (MCA), an executive agency of the Department for Transport which has overall responsibility for the vessel.

The wreck is designated under Section 2 of the Protection of Wrecks Act 1973 due to its munitions cargo

and is subject to an exclusion zone which is marked and guarded by Medway Ports. The wreck and its
exclusion zone are marked on nautical charts. Large vessels in any case avoid the area of the wreck because it is in shallow water.
The Maritime & Coastguard Agency undertakes annual surveys of the SS Richard Montgomery to monitor
the condition of the wreck and the seabed. MOD divers assess the hull every ten years. Various technological advances have enabled more detailed analyses to be conducted in recent years, including

sonar surveys and hull thickness measurement using ultrasound. The results of the multibeam sonar survey in 2002, shown in Figure 21, illustrate the features of the sea bed around the wreck; deeper water
is shown in blue.

Figure 21: Multibeam sonar image of the SS Richard Montgomery in 2002

Figure 22: Multibeam sonar image of the SS Richard Montgomery in 2012

The most recent published survey was undertaken by NetSurvey Limited in October 2012 and encompassed a sonar survey of the area within a 400m radius of the wreck. Successive recent surveys
have observed gradual changes in the condition of the wreck.

Figure 23: SS Richard Montgomery, masts visible above the waterline

The vessel list and orientation have been found not to have changed in the past three surveys, the erosion of the sea bed (scour) having already taken place over many years to the extent that the vessel is
now believed to rest on a London Clay bedrock, most probably with no significant quantity of sand beneath it. Some erosion of the sea bed continues to occur and a particular feature located 40m from the
wreck is observed to be moving closer by around 1m each year.
The surveys in recent years have been conducted remotely using equipment that assesses the condition
of the hull but technology has not allowed further sonar beam penetration to assess the condition of the
munitions. The munitions are understood to comprise fused cluster bombs, standard unfused TNT bombs
and smoke bombs. Any fuses that remain on board may no longer be functional, but it is believed that the
munitions would retain their explosive power and the phosphorous contained in the smoke bombs would
be capable of spontaneous ignition if exposed to air.

Excerpts from the MCA survey in 2012

_ The crack on the port side of hold 2 shows a vertical increase of approximately 16cm since 2011. The horizontal measurement remains unchanged.
_ The deck plating at hold 2 has dropped by 30cm since 2010 (2011 survey data could not be accurately measured in this area, although a small drop in deck plating was noted in the 2011 report).
_ No change noted in the aperture in the bulkhead at hold 3.

_ Buckling of the hull plating on the port side of hold 2 remains in a similar condition to that found in 2011.
_ One of the two stays on the forward mast is now detached at deck level but remains suspended from the masthead.
_ Scour on the port (west) side of the wreck has shown a gradual increase in size.
_ The orientation, list and pitch of the wreck remain unchanged.

_ Over much of the wreck, no changes were noted.
_ As recommended in 2011, a smaller survey vessel was used to survey the wreck and this has resulted in much improved data.
_ The seabed survey re-located all 38 seabed features that have previously been identified.

6.4 RISKS ASSOCIATED WITH THE WRECK

As stated in the Maritime & Coastguard Agency's 1998 report, there are three broad areas of risk associated with the SS Richard Montgomery:

_ Collision
_ Capsize
_ Breaking up

Collision with the wreck is considered a remote possibility, though collision with the masts rather than the main part of the vessel would be more of a possibility. While larger vessels would naturally keep away because of the shallow waters, recreational vessels do pose a threat. However, the area is clearly marked with navigational buoys and other markers and no near misses have been recorded to date. Were a collision to occur, the conditions may be produced for an explosion.

If the wreck were to capsize, perhaps because of sea bed erosion, mass detonation could result or munitions could escape and be dispersed by the tide. Similarly, if the wreck were to break up as the structure continues to disintegrate then either mass detonation, partial detonation or dispersal of individual munitions could result.

The effect of mass detonation has been the subject of much press speculation, but very little data exists from which the scale of impact could be confidently derived. Based on the MCA's 1998 survey report, which cites some work carried out by the Defence Evaluation and Research Agency (DERA; now the Defence Science and Technology Laboratory), it is reasonable to assume that local property and population would be put at risk if mass detonation were to occur.

The dispersal of munitions would be likely to result in some washing ashore. Once ashore, they would dry out which would render some more volatile and those containing phosphorous to spontaneously combust.

6.5 RISKS RESULTING FROM AIRPORT CONSTRUCTION AND OPERATION

Limited detail on the proposed construction methods for an inner Thames Estuary airport is available at present. However, it can be reasonably assumed that construction will involve extensive pile driving into the London Clay and chalk estuary and sea bed and that considerable volume of infill material will need to

be transported to the site and deposited.
Tunnelling (proposed by Metrotidal Tunnel and Thames Reach Airport Ltd) and pile driving for the construction of the airport will cause local vibration; however it is considered somewhat unlikely that
vibrations of any significance would reach the location of the wreck.
Construction may involve large amounts of material being transported by ship. The Thames and Medway
Estuaries are already very busy shipping routes and therefore it is unlikely that the additional traffic would have a material impact on the wreck.
The airport is expected to have an impact on the tidal flows of the Thames Estuary and possibly the Medway Estuary. The scale of the impact is not comprehensively understood at present but small

changes to the movement of water around the wreck and the resulting scour and movement of sands
cannot be ruled out.
Once the airport is in operation, aircraft on westerly approaches (i.e. the majority of the time) would pass
over the site of the wreck at a height of over 1,000ft, possibly much more depending on the precise location of the runways.
While the wreck has been subjected to the forces of nature, including tidal flows, storm surges, and high
winds, to which the wreck has been subjected for nearly seventy years, the construction and presence of
the airport could lead to certain vibrations and changes in tidal flows and the sea bed which could potentially affect the stability of the decaying wreck.
Overall, any authority would need to give careful consideration to the risk that construction and operation of the airport may change the likelihood of the SS Richard Montgomery's munitions detonating
or being dispersed.

6.6 RISK POSED TO THE AIRPORT

The SS Richard Montgomery, if left in its current state, poses three main risks to an inner Thames Estuary
airport:
_ Unplanned mass explosion
_ Munitions washing up on shore
_ Disruption during planned disposal
Depending on the selected location for the inner Thames Estuary airport, the SS Richard Montgomery
could lie within as little as 5km of the airport perimeter. The airport and its associated infrastructure could therefore be within the range at which an unplanned mass explosion of the munitions would likely
cause damage to people and property. The events that might lead to an unplanned explosion are described above.
There are very few recorded, relevant comparative examples upon which to assess the impact. One example is the Kielce, a munitions ship which sank in 90ft of water around 4 miles off the coast of Folkestone in 1946. In 1967, efforts to clear the wreck resulted in an explosion with an equivalent yield of
2,000 tons of TNT. The majority of the energy was carried seismically, rather than acoustically, with vibrations felt nearly 5,000 miles away, though the blast was reportedly heard 7 miles away. Some minor

damage to property was reported. Differences between the SS Richard Montgomery and the Kielce make
it difficult to draw comparisons. The SS Richard Montgomery is believed to carry a smaller quantity of
munitions (equivalent to 1,500 tons of TNT rather than 2,000 tons); the design and construction of the
ships is different; the SS Richard Montgomery is one or two kilometres closer to shore; and the Kielce was
lying in much deeper water than the SS Richard Montgomery. Given these factors, it is reasonable to assume that an unplanned explosion could result in sufficient release of seismic and acoustic energy to
cause damage to airport infrastructure and potentially cause harm to people within the radius of a few
kilometres.

Munitions washing up on shore have the potential to cause disruption to airport operations even in the
absence of detonation. It may be necessary to curtail airport operations while the munitions are examined and disposed of, and while searches are made for any other munitions that might be dispersed
in the area. The extent to which small quantities of munitions might cause risk of harm to people and
damage to airport infrastructure cannot be assessed at present.

Therefore, while the construction and operation of the airport are unlikely to increase the likelihood of
the SS Richard Montgomery exploding, the presence of an airport would introduce several thousand people within the potential range of a mass explosion. The impact of the explosion would therefore be
much greater and so the overall risk profile is raised.

6.7 POSSIBLE RESPONSES

The Maritime & Coastguard Agency's 1998 report presents a range of possible responses to the risks posed by the SS Richard Montgomery:

_ Do nothing
_ Monitor
_ Containment
_ Entombment
_ Removal

The 'Do nothing' option was ruled out by the report since the wreck is continuing to degrade and the risk
of capsize, significant movement and dispersal of munitions increases with time.

Monitoring, which involves routine surveys of the wreck to examine any changes that would suggest a
change to the level of risk, was identified as the safest option and has been adopted as the policy to date.

Containment would involve placing a carefully designed bund around the wreck with the aim of preventing dispersal of munitions and possibly supporting the structure. Surveys to determine the appropriate construction and location would be necessary with respect to the sea bed and tides. Monitoring would need to be continued to examine the condition of the bund and the wreck itself.

Entombment would involve placing a rigid structure around and over the wreck to completely enclose it.

Both entombment and containment are thought to carry a certain amount of risk during the construction phase. They cannot be considered permanent solutions since the structures would need to be monitored, maintained and at some stage replaced. Replacement could be a particularly hazardous exercise. Removal would entail either complete removal of the wreck or just its munitions, with the former bringing to the end entirely the risks and costs associated with the wreck. At the time of the report, in 1998, the removal option was considered unfeasible as the technology did not exist to carry out the work safely.

Planned disposal of the wreck, or indeed planned containment or entombment, would probably involve extensive disruption to operations if an airport were located in the inner Thames Estuary. The findings of the report prepared by DERA in 1998 suggested that entombment or disposal would elevate the risk of detonation while the works were taking place. If the wreck were to be disposed of, consideration would need to be given to an evacuation zone with a radius of several kilometres to be implemented for the duration of the disposal works, which could take weeks or months. It is therefore feasible that during this time, at least part of the airport would fall within the evacuation zone and in any case over-flight of the zone would likely be prohibited, requiring substantial curtailment of operations or even full closure. If this were to occur during the construction phase, the schedule for delivery of the airport could be put at risk and costs could significantly increase.

Disposal would carry immense safety risk for those working on the wreck. In recent years, the safety risks of undertaking a detailed physical inspection of the munitions and the storage areas have been assessed to outweigh the benefits of doing so. Disposal of underwater explosives is extremely hazardous and it is reasonable to assume that the risk to human life could be substantial.

Given the safety risks, the lack of detailed information on the state of the wreck's holds and of the munitions held within them, and with few if any comparable reference points nationally or internationally, it is not possible to assess costs at this stage. However, any cost estimate would also need to account for the disruption to the areas evacuated. Costs could be much higher during construction and once the airport opens because of the potential disruption to operations resulting from any requirement for an evacuation zone.

6.8 CONCLUSION

The SS Richard Montgomery poses a low risk to people and property today, as it has done for nearly seventy years. The approach adopted by the Maritime & Coastguard Agency has been to continue to

monitor the wreck for any changes; the safest option in the meantime being to leave the wreck undisturbed.

The construction and operation of the airport itself is not thought to increase the risk to the SS Richard Montgomery significantly, particularly given the elements and forces of nature to which it is continually exposed. However, an airport would introduce several thousand people who would be within the potential range of a mass explosion; thus the impact of an explosion would be much greater.

While the change in stability of the munitions is not fully understood, i.e. whether they pose more or less of a risk of explosion now than before, the structural condition of the wreck can only continue to worsen.

It is almost inevitable that the time will come for the wreck to be conclusively treated, perhaps through containment or disposal. It may be that technological advances, coupled with sufficient data collection and analysis, will allow the munitions to be safely neutralised, removed or contained so as to eliminate the risk of explosion. Even then, some period of elevated risk can be foreseen while works are being carried out.

The greatest risk to the airport is therefore that the time will eventually come for the wreck to be treated and that the treatment itself may require construction work to be halted or, if the airport is already open, requires full or partial closure or some other curtailment to operations for an extended period of time.

Therefore, because the costs and operational disruption of interventions to eliminate the risk posed by the SS Richard Montgomery could be prohibitive once the airport is being built or is operational, it would seem necessary for full treatment and/or removal and disposal of the munitions to be undertaken prior to construction of the Estuary airport.