



Ordinance, Munitions and Explosives

HNC Level 4

Academic Year 2025 - 2026

Jack Burden

Group Project Assignment

Role: Project Manager/Transport Expert

This thesis is submitted in partial fulfilment of the requirements for
the HNC of OME

(NB. Remove if the degree award is based solely on examination of the thesis)

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- the thesis submitted has been written by me alone.
- the thesis submitted has not been previously submitted to this university or any other.
- that all content, including primary and/or secondary data, is true to the best of my knowledge.
- that all quotations and references have been duly acknowledged according to the requirements of academic research.

I understand that to knowingly submit work in violation of the above statement will be considered by examiners as academic misconduct.

Abstract

This assignment reflects on the shallow water removal/disposal team's experiences. Written from the perspective of the Project Manager. It covers Team management, research, project solution and presentation. Questions that were posed by the University are addressed in the presentation section and the conclusion.

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Acronyms:

OME – Ordinance, Munitions and Explosives

FFE – Free from Explosives

CFFE – Certified Free from Explosives

FFEH – Free from Explosive Hazard

CFFEH - Certified Free from Explosive Hazard

EOD – Explosive Ordinance Disposal

UXO – Un-Exploded Ordinance

ADR – Accord Dangereux Routier

HSE – Health and Safety Executive

UK – United Kingdom of Great Britain and Northern Ireland

NEQ – Net Explosive Quantity

Pyro – Pyrotechnics

TNT – Trinitrotoluene

MOD – Ministry of Defence

1.1 – Dangerous goods class 1, hazard division 1 (Mass Explosion Hazard)

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1 Introduction

In research and project development, the process of reaching a solution is just as important as the final solution itself. This assignment looks into the steps involved in researching the shallow water recovery of dumped munitions in Swiss lakes. These include, obtaining and analysing data, and transforming the data into a practical solution. This will be done by looking at the procedures from trustworthy sources and evaluating the results. The difficulties faced and the tactics that worked will be evaluated extensively. This reflection shows how production and research are linked, and how each step helped create a solution that is both practical and cost efficient. This assignment has been written with the assumption that the reader was present during the presentation. Some aspects of the presentation have been left out due to this.

2 Team Management and my role

When the team first started the project, we didn't officially designate any roles. We focused on research. During the research process, team roles naturally became clear. Each member of the team gravitated towards a specific aspect of the project, mostly the parts they see day-to-day with their job roles. With this, we had: Jack Burden – Transport expert and removal, Tom Greenwood – Munitions expert and breakdown, Jamie Hodges – Locating OME and Environmental expert, Hayden Taylor – Disposal expert and Lake Locations.

Jack emerged as the Project Manager as he organised the email chain, group chat, SharePoint and weekly meetings. Each weekly meeting was documented on the SharePoint on a master document of Meeting Minutes (Figure 1).

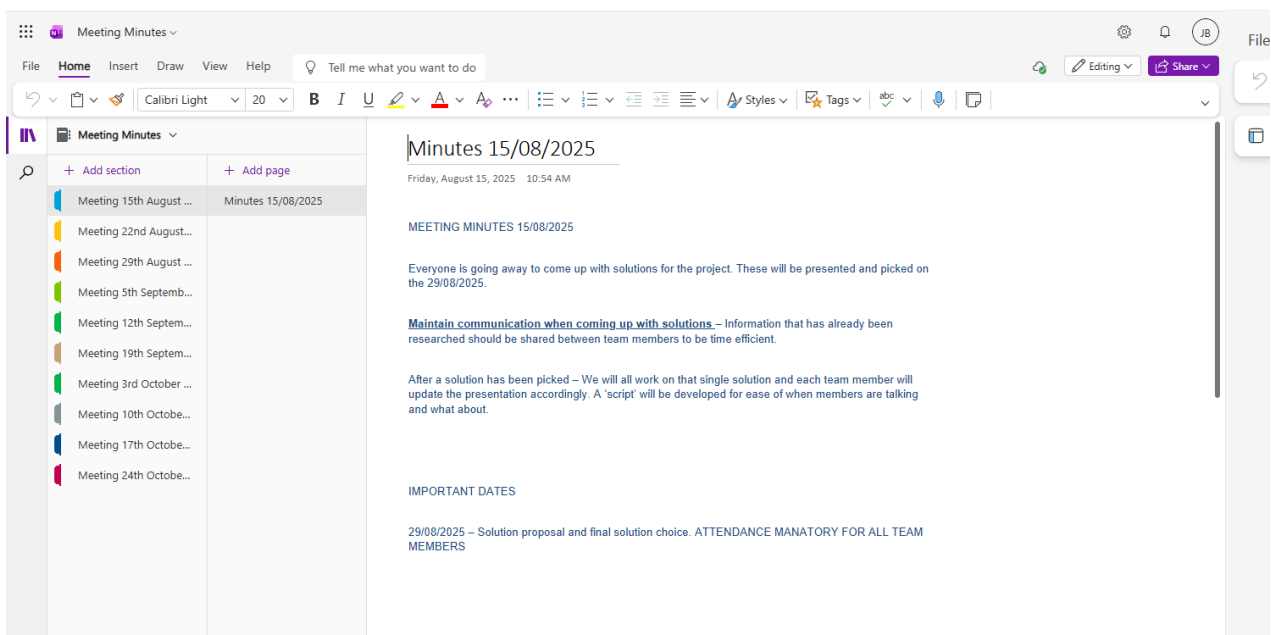


Figure 1 - Meeting Minutes

On top of this master document, each week, the meeting minutes would be sent out via email to all team members to allow those who were unable to attend to stay in the loop. For example, as seen in figure 1, the team was set a task to each go and research a possible solution to the project. Each solution would be

presented to the rest of the team on the 29th August. The team would vote on which solution they thought would be the best.

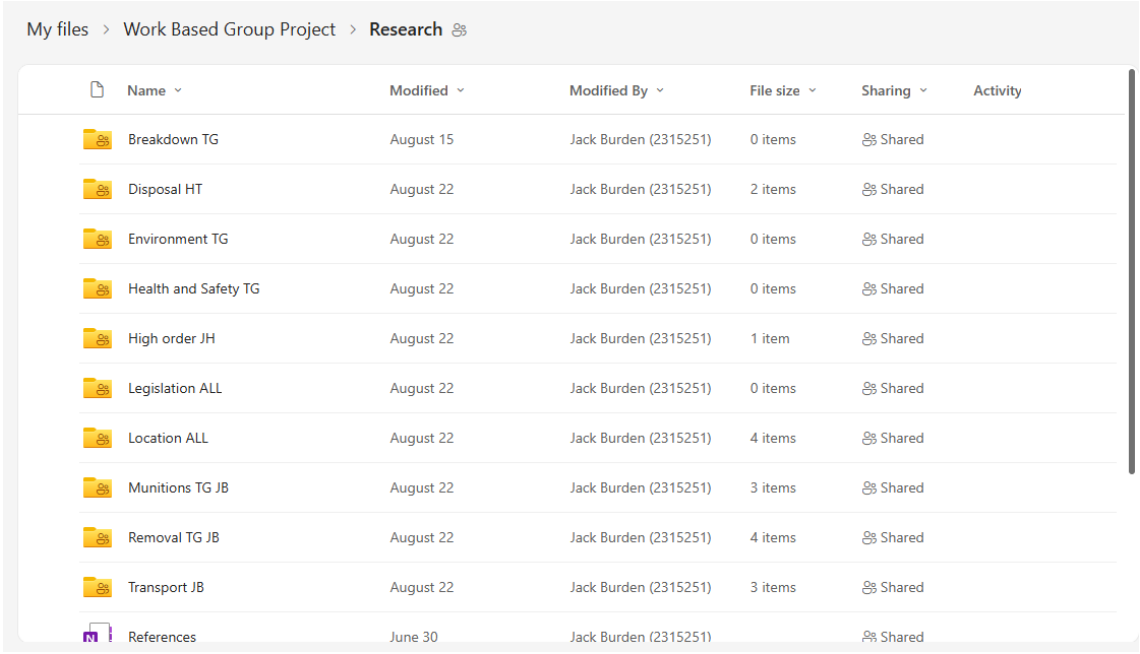
The Project Manager found that a relaxed management style fit the team the best. They saw throughout the process that the team were all pulling their weight.

It was also found that the team worked better in person when compared to working virtually. At the beginning of the project, it was logistically difficult to meet in person over the summer as all of the team were based across England. It was difficult to balance work and research without having an opportunity to completely focus on the project, like the team could in the first block of University Year 3. But the team made it work. To ensure that the team stayed on top of the research, the Project Manager set research goals throughout the summer.

The role of transport expert was simple as it coincides with the Project Manager's job role. Any questions the transport expert had, they could easily ask a coworker to ensure all information was present and correct for the project.

3 Research

It was important to ensure that, during the research process, the team kept track of all the research and references. All pieces of research that were acquired (that may have been used) were organised into an extensive SharePoint that was accessible to the team at any time. Research pieces were also referenced in a master references document.



The screenshot shows a SharePoint interface for a folder named 'Research'. The breadcrumb path is 'My files > Work Based Group Project > Research'. Below the path is a table listing the contents of the folder. The table has columns for Name, Modified, Modified By, File size, Sharing, and Activity. The contents include several subfolders (Breakdown TG, Disposal HT, Environment TG, Health and Safety TG, High order JH, Legislation ALL, Location ALL, Munitions TG JB, Removal TG JB, Transport JB) and a 'References' document. Each item is marked as 'Shared'.

Name	Modified	Modified By	File size	Sharing	Activity
Breakdown TG	August 15	Jack Burden (2315251)	0 items	Shared	
Disposal HT	August 22	Jack Burden (2315251)	2 items	Shared	
Environment TG	August 22	Jack Burden (2315251)	0 items	Shared	
Health and Safety TG	August 22	Jack Burden (2315251)	0 items	Shared	
High order JH	August 22	Jack Burden (2315251)	1 item	Shared	
Legislation ALL	August 22	Jack Burden (2315251)	0 items	Shared	
Location ALL	August 22	Jack Burden (2315251)	4 items	Shared	
Munitions TG JB	August 22	Jack Burden (2315251)	3 items	Shared	
Removal TG JB	August 22	Jack Burden (2315251)	4 items	Shared	
Transport JB	August 22	Jack Burden (2315251)	3 items	Shared	
References	June 30	Jack Burden (2315251)		Shared	

Figure 2 - Research Folder

As seen in Figure 2, the research was organised extensively. Each aspect of the project was divided up and allocated to the relevant team member (their initials can be seen next to their respective areas of research). The team agreed that it was essential to know as much information as possible. The train of thought was that, with all information present, we could plan the best solutions. The team spent the majority of the first 3 months on research alone.

To ensure that every aspect of research was extensively examined, each folder contained further information divided into subfolders. Please see below Figures 3 and 4 as an example.

My files > Work Based Group Project > Research > Munitions TG JB

Name	Modified	Modified By	File size	Sharing	Activity
1000lb Bomb	July 18	Jack Burden (2315251)	9 items	Shared	
3kg Practice Bomb	July 18	Jack Burden (2315251)	11 items	Shared	
BL 755 Cluster Bomb	July 18	Jack Burden (2315251)	4 items	Shared	

Drag files and folders here to upload.

Figure 3 - Munitions Folder

My files > Work Based Group Project > Research > Munitions TG JB > 1000lb Bomb

Name	Modified	Modified By	File size	Sharing	Activity
Nose or Tail pistols	July 18	Jack Burden (2315251)	2 items	Shared	
Nose pistols	July 18	Jack Burden (2315251)	4 items	Shared	
Tail pistols	July 18	Jack Burden (2315251)	12 items	Shared	
1000lb GP data sheet REF 4.png	August 15	Jack Burden (2315251)	65.0 KB	Shared	
1000lb GP REF 4.png	August 15	Jack Burden (2315251)	172 KB	Shared	
1000lb GP sectioned diagram REF 4...	August 15	Jack Burden (2315251)	368 KB	Shared	
1000lb MC data sheet REF 4.png	August 15	Jack Burden (2315251)	47.0 KB	Shared	
1000lb MC REF 4.png	August 15	Jack Burden (2315251)	179 KB	Shared	
1000lb MC sectioned diagram REF ...	August 15	Jack Burden (2315251)	353 KB	Shared	

Figure 4 - 1000lb Bomb Folder

As seen in Figure 4, each research item has a REF number in the file name. This was done so the team could keep track of which piece of research came from which reference. Each reference was compiled into a master References document.

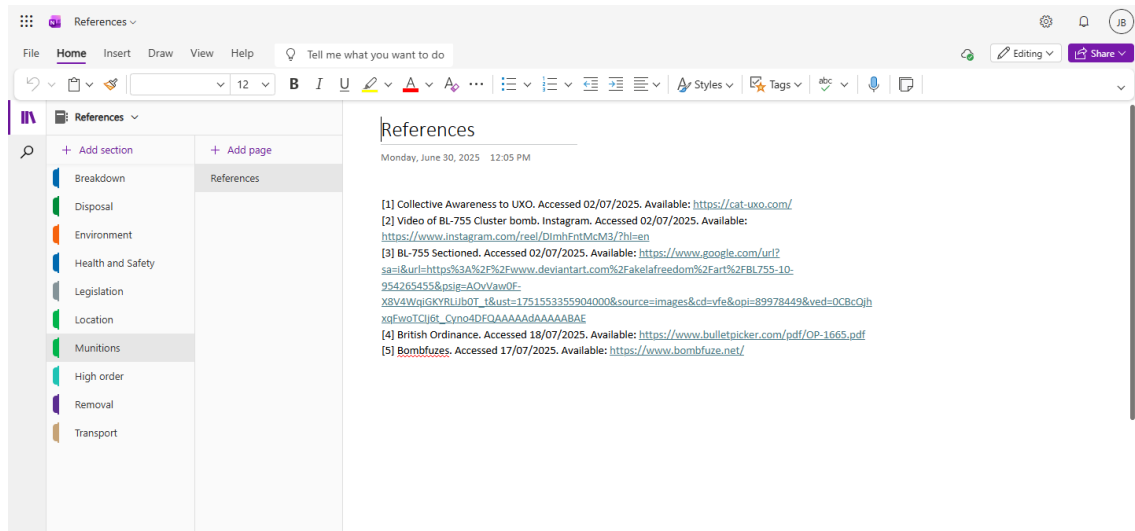


Figure 5 - References

The References master document is as extensive as the research itself. The document is divided into each research area. Each area then has its own references list. This was done to keep track of research for the assignment.

The Project Manager's areas of research were transportation, removal and munitions. He assisted the munitions expert with research as he sees serviceable and unserviceable munitions every day due to his job role. Transportation did not require much external research. Transportation of dangerous goods by land is conducted frequently due to the Project Manager's job role. Removal required extensive external research. The Project Manager found a brochure from a salvage company that has assisted the United States Navy in removal of OME [1]. This is where the idea for the salvage lift bags was discovered. Research on each munition had to be thorough.

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UAE • UK • INDIA • ZERBAJAN

SY-UNDERWATER LIFT BAGS

ENCLOSED SHALLOW WATER FLOTATION BAGS

When you need to float an object in extremely shallow water use SUBSALVE's shallow water "pillow" shaped Enclosed Flotation Bags (also referred to as boulder bags). Utilize them in any position - upright or flat, outside or inside of structures—for vessel salvage, auto recovery, pipeline and cable installation and emergency flotation for ships, aircraft, submersibles and ROVs.



Adaptive

- Configure with a multitude of rigging combinations.
- Use with a single or multiple attachment points around the perimeter of the bag.



Fabric

- Urethane-coated nylon—high-strength and heavy-duty
- Superior abrasion resistance
- Resistant to most petro-chemicals
- UV-resistant
- Low maintenance requirements and easy to clean
- RF welded seams



Lifting Harness

- Heavy nylon lift harness built into the body of the lift bag
- Safe working ratio of 6:1

Safe and easy to use

- Equipped with all necessary hardware—ready for immediate use
- 3/4" NPT inflation/deflation port equipped with ball valve
- Stainless steel quick disconnect for inflation
- Pressure relief valves: set to release at 2.5 psi above ambient pressure
- Enough pressure relief valves are installed in each bag to allow expanding to vent should a free ascent occur.

Figure 6 - Subsalue Catalog [1]

If the team did not understand the hazards posed by the ordinance, then they could not effectively propose a safe solution for removal and disposal. For the 1000lb bomb, a book published by Britain at the end of World War 2 was found during research [2]. This contained sectioned drawings of the munition and went into extensive detail on design of the munition and different fuzes.

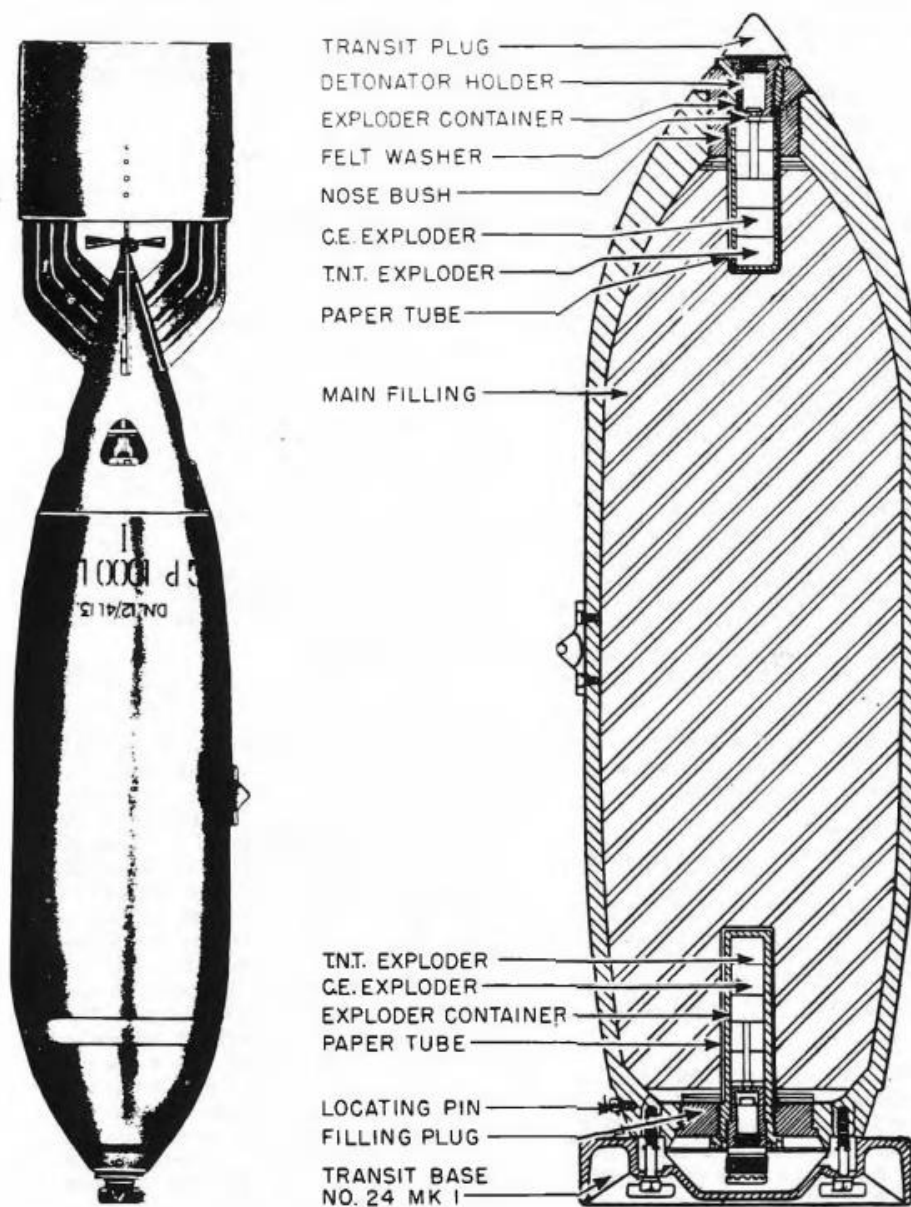


Figure 12—G.P. 1,000-lb. Bomb Mk I

Figure 7 - GP 1000lb Bomb Sectioned [2]

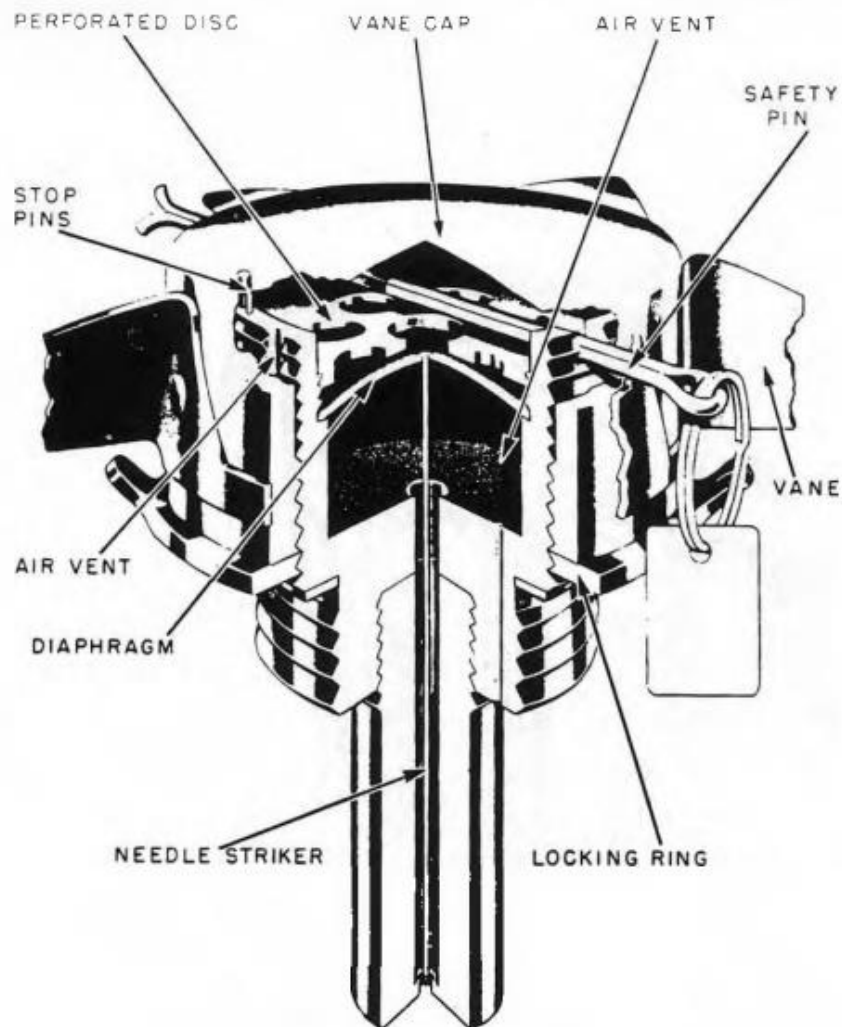


Figure 135—Nose Pistol No. 44 Mk II

Figure 8 - No. 44 Nose Pistol Sectioned [2]

Once the team was happy with the amount of research accumulated, we moved onto producing possible solutions to the project.

4 Project Solution

On 15th August, the team was sent away from the weekly meeting, tasked with coming up with possible solutions for the project. These solutions were proposed to the whole team on 29th August. The team would choose the best solution. The team then move forward with the project and the creation of the presentation.

The solution proposed by the Project Manager consisted of the use of a Diving Bell (Figures 9, 10) to examine and x-ray the munition. This would've been done to determine what state the energetic materials, within the explosive train, were in. The team mutually agreed that this was too risky for a number of reasons. The Diving Bell pushes the water away from the chamber as it is lowered into the water. It was believed that this action may disturb the energetic materials and could cause premature High Order. This was a worry for the BL-755, due to the submunition's arming mechanism (Figure 11). The submunition's arm once their springs are no longer under tension. It was thought that the Diving Bell's chamber pushing the water away towards the BL-755 may cause some submunitions to become dislodged from their housing within the main casing (Figure 12). Once armed, the submunitions detonate upon impact with an object or the ground. At the time, it was unknown whether the density of water would affect their sensitivity to impact. As a result, a solution involving the Diving Bell was not chosen.



Figure 9 - Diving Bell Ship [3]



Figure 10 - Diving Bell Chamber [4]



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Description

This is the British BL-755 Mk 1, a High-Explosive-Dual-Purpose (HEDP), Anti-Vehicle (AV) and Anti-Personnel (AP) submunition, dispensed from the 272kg (600lb) BL-755 cluster-bomb, containing 147 x Mk 1 submunitions, packed in 7 sections of 21 x submunitions each.

Following separation from the aircraft, the BL-755 cluster-bomb outer casing covers are jettisoned by a gas ejector at 1 of 4 pre-set times.

The BL-755 Mk 1 submunitions are then ejected sideways, as much as 18m (60ft) from the dispenser at pre-set intervals.

Each of the ejected submunitions is then orientated by the deployment of a stabilising coronet while a spring-mounted base-plate is activated to give the correct stand-off for the Shaped-Charge (SC).

The submunition warhead is designed to explode on Impact (IMP), being triggered by a piezo-electric fuze which is located under the base-plate.

Upon detonation, the SC produces an Explosively-Formed-Jet (EFJ) which can punch through up to 250mm of armour.

In addition, the release of 2000 pieces of fragmentation produces a secondary AP effect.

Figure 11 - BL-755 Submunition [5]

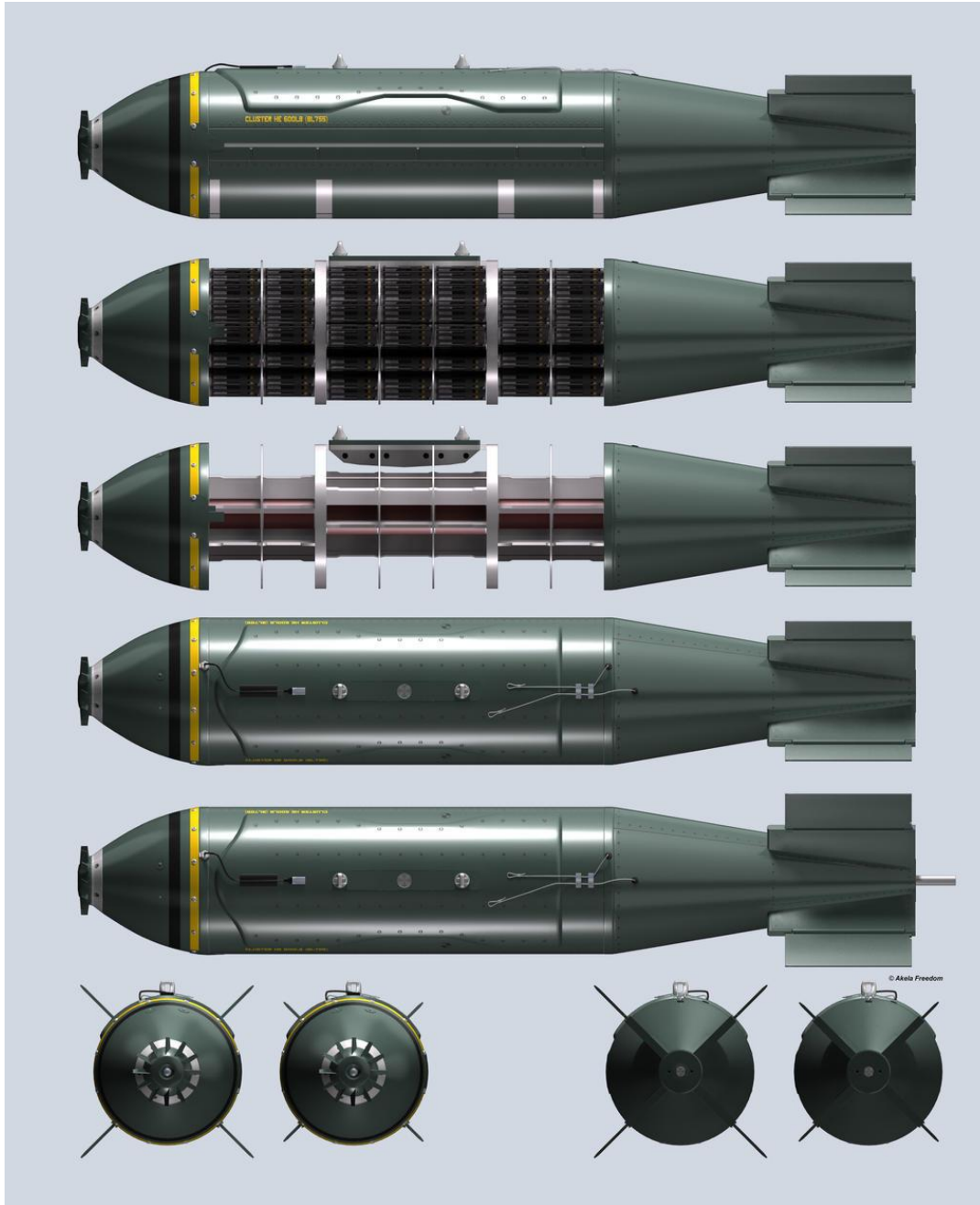


Figure 12 - BL-755 Main Casing [6]

After extensive discussion, the team agreed on the solution proposed during the presentation. This consisted of: locating the shallow lakes, locating the OME, taking a water survey, considering the environment, removal of OME using salvage lift bags, low order of the 1000lb bomb and the 3kg practice bomb on the shore, high order BL-755 where it stands and removing all waste.

5 Presentation

Once the team finalised a final solution for the removal or disposal of the dumped OME, presentation skills became the priority. When developing the presentation, the general consensus from the team was that the information on the slides should be concise and visibly appealing to the audience. This was done to allow the audience to focus on what we were saying during the presentation and not becoming distracted by an overload of information. Each member of the team created and designed their own slides. All members were willing to assist others when required. Once a basic version of the full presentation was completed, the group started run throughs.

The team focused on ensuring that all members were confident in their respective areas of research and could answer any questions proposed after presenting with knowledge and ease. Run throughs of the presentation were timed and potential questions for each section were posed to all members after each run.

The teams first run through of the presentation finished at roughly 30 minutes, which was 10 minutes off from the target time of 40 minutes. The munitions expert was absent during this run so the team was confident that the extra 10 minutes could easily be achieved. After this, it was decided mutually that extra slides were required to ensure that the presentation flowed correctly and accurately portrayed the team's thought process throughout. A slide on area control (Figure 13) and a slide on the post disposal process (Figure 14) were added.

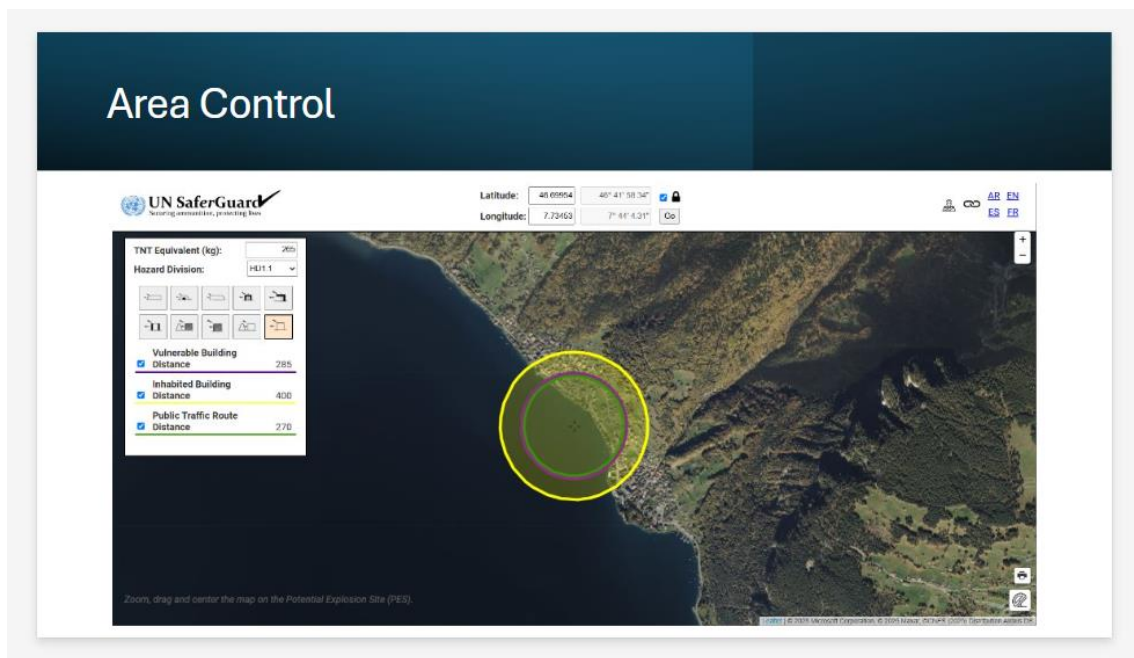


Figure 13 - Area Control Slide

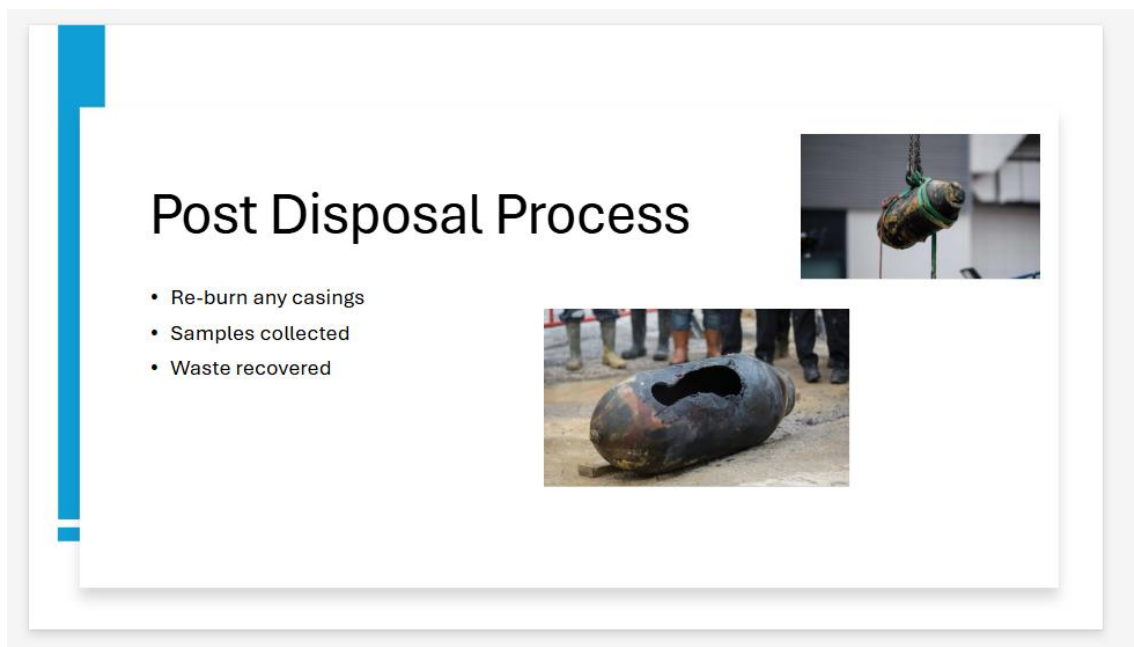


Figure 14 - Post Disposal Process Slide

Coming up to the day of the presentation, the team was happy with the presentation, the flow and presenting. The team started doing multiple run throughs of the presentation to ensure that nothing had been missed or anything major needed to be adjusted prior to presenting.

On the day of the presentation, the team was happy with how everything went and the project manager was very happy with how the team performed on the day. All questions were answered and the audience seemed happy with the presentation and the answers provided.

Each member of the team received personal feedback on how they performed during the presentation. The project manager will address the feedback he received from Dave Holley and Jenni Steen:

Dave's feedback 1: "Overall, I'd like to have seen a little more on the decision-making process and the selection logic and a look at other disposal methods."

Project manager's response: "As a team we did briefly touch on the decision-making process and selection logic at the end with Slides 25 and 26 (Flow Charts) but our main aim for the presentation was to portray our final solution clearly and in an easily digestible way. Our disposal expert looked into other disposal methods during research but it was decided that they should be left out to ensure that the visual aspect of his slides were consistent with the simplistic theme throughout the presentation."

Dave's feedback 2: "Safety area excluded. Look at the hazard area...how area calculated."

Project manager's response: "When working on a range, the hazard area is determined by the maximum amount of 1.1 explosive allowed out on range (this is dictated by its HSE license). In the real world, other aspects also play a role in day-to-day activities, for example, acoustic levels. With regards to the hazard area on the shore of Lake Neuchatel, this would have been calculated using the worst possible scenario (High order of all OME at once). Hazards from this would

include: Fragmentation, primary, secondary and tertiary injuries to personnel, TNT contamination in the lake and sediment, possibility of windows/structures within the hazard area blowing out from the shock wave.”

Dave’s feedback 3: “High order full BL 755 (What is the major hazard?)”

Project manager’s response: “As a BL 755 is class 1, hazard division 1, the major hazard posed is mass explosion.”

Dave’s feedback 4: “How is pyro initiated.”

Project manager’s response: “The only Pyrotechnic article was the 3kg Practice Bomb. In a serviceable condition, it can only be initiated if it experiences the correct amount of inertia when being dropped from an aircraft. During the presentation, we said that we would make the bomb function as designed to burn out the pyro. Technically, this is incorrect as we would have to exert it to the correct amount of inertia to start off the explosive train. As it is not in a serviceable condition, we would have to find another way to initiate the explosive train within the bomb. This could be done through shock, percussion/stab, heat and flash. This would all be done to the fuze to initiate the explosive train which, in turn, would allow the bomb to function as designed.”

Dave’s feedback 5: “Clarify UK regs. How do they influence the European situation.” (with regards to transportation)

Project manager’s response: “Transportation regulations across all of Europe are the same, they all follow the guidance of ADR (for transportation of dangerous goods on land). In the UK, this is slightly different. We have to abide by ADR and also the UK road Derogations (these are unique to transport of dangerous goods by land within the UK only). The UK regulations have not influenced the European regulations in any way. It is the other way round, the European regulations (ADR) influenced the creation of the UK road Derogations. Some differences include: the minimum amount of 1.1 that can be transported in the UK and requires ‘plating up’ is 20kg NEQ, whereas, in Europe the minimum is 50kg NEQ. ”

Dave's feedback 6: "How does this fit into the disposal process at the end?"

Project manager's response: "Transportation is a key part of the disposal process that must be addressed. EOD arisings uncertified refers to items like the burned-out half's of the 1000lb bomb after the cut and burn technique is conducted. They can't just be left on the shore, they need to be transported to a suitable disposal site after the fact. Any FFEH and explosive waste, after the on shore disposal process has been carried out, will also need to be transported to a suitable disposal site. Any samples taken for future research will also have to be transported to a safe and secure site that holds the correct license for storage and testing of OME. An example of a suitable site for all of these items would be QinetiQ MOD Shoeburyness. This will all be done in accordance with ADR and the European regulations for transportation of dangerous goods."

6 Conclusion

The team conducted themselves very professionally throughout the process. For future projects, an ideal situation would give the team more time for research however, the project manager understands that this is a luxury, especially in real world situations.

The proposed solution is not perfect. There are areas where failure could potentially occur. For example: when using the salvage bags to float the munition up to the surface, the bag could split if the outer casings of the munition are sharp. When deflating and inflating the lift bags and the pontoons respectively, ready for towing to the shore, if these actions are not completed in perfect sync, there is a risk that the munition could fall back to the seabed. This could potentially risk a mass explosion hazard if the impact with the seabed exerts enough force onto the energetic materials to initiate the explosive train. Another example of a likely failure would be the cables of the high tensile net snapping during movement of the munition from the water to the shore. Alternatively, the crane may place the munition on the shore with too much force, possibly initiating the explosive train.

An alternative method of disposal for the 1000lb bomb nose fuze was proposed by Gareth Collett. Could it be possible to deflagrate the sensitive fuze underwater? Yes and no, tail/nose pistols are essentially a timed striker mechanism for a detonator which is built into the weapon system. If the pistol was dearmed and removed (like we did during our presentation) it would leave an exposed detonator. The detonator could be removed, theoretically but in reality, it is unknown how the water has affected the detonator over time, it could be more sensitive or less sensitive. It could be possible to expose the primary explosive fill within the detonator and deflagrate but due to the confined space the energetic materials are in, it could cause a build-up of pressure and heat. This would lead to detonation.

Overall, future research is required to discover the safest, most efficient method for removal of dumped OME underwater.

References

This section has been split into two, the references used in this assignment and the sources used during research. Any overlaps have NOT been referenced twice.

Assignment

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Research

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