



Ministry
of Defence



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WORK IN A TEAM TO DESIGN AND PROPOSE A SOLUTION TO A PROVIDED TARGET SET

Abstract

The intent of this report is to demonstrate how the team worked together and functioned to explore and design a solution to the set brief. The report details the teamwork, communication and organisational strategies used to achieve the systems engineering result. The scope of this report is solely to that of how the team operated and does not include all details of the work conducted. It should be noted that large sections of this work were done in collaboration with the group and the group spreadsheet can be made available on request. [1]

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2. Introduction

The initial brief set by the customer was to design a solution that could “Neutralise the communications centre whilst causing minimal collateral damage to the rest of the building structure or potential occupants” with a stretch target to “immobilise / disorientate occupants rather than eliminating them”. Further detail was provided for the structure, layout and construction of the target building. [2]

The result of this project saw the selection of a Shoulder Launched Rocket System and two further sublevels of critical component being identified and selected. The broad system architecture is shown in Figure 1, Figure 2 and Figure 3.

The chosen system can be broken down into a series of component parts and subsystems. At the weapon level the system is made of 3 core components; Command and Launch Unit (CLU), Telescopic Missile Tube (TMT) and Missile shown in Figure 1 respectively. the assembled system is shown in Figure 2. Of the three core components the Missile is deemed to be the most critical component and where the future development and focus is placed.



Figure 1 - CLU, TMT, Missile

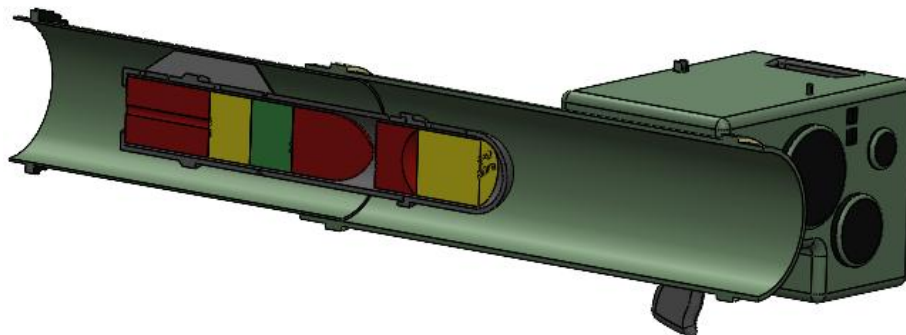


Figure 2 - Weapon System Assembled

Breaking down the Missile into its core components it is made up from a Case, Rocket Motor, Weapon Controller, Safety and Arming Unit, Lethal Package and Guidance Control Unit. Using a QFD 2 the Safety and Arming Unit (SAU) was determined to be the most critical component within the missile. lastly in the SAU the initiating device used to translate electrical signal to detonative shockwave was identified the critical component at this level, this is the Exploding Bridge Wire (EBW).

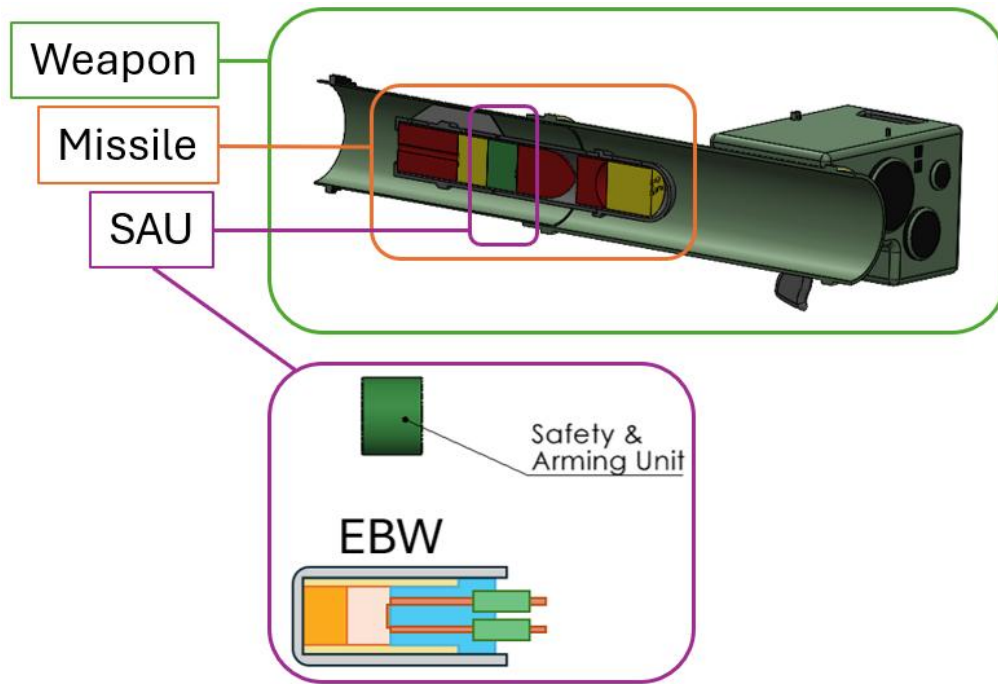


Figure 3 - Critical Component System Architecture

3. Team structure and Roles

Initially the team was selected by the lecturer as the task was presented to the course. The team consisted of the 6 team members of which the author is team member C. At the project outset only the key engineering roles were identified. It should be noted that all the identified roles consisted of engineering. This would not be the case in a real design project. There would also be key Project Management, Commercial, Finance and Logistical roles that would have a key influence and support in any design process.

Upon initial meeting the team identified and aligned with the individuals' strengths and experiences with the broad engineering roles. The role of the author was the Test and Evaluation Engineer who is responsible for all aspects of Testing, Performance evaluation and regulatory compliance. The full group breakdown can be seen in Table 1. After a few meetings and discussions team member B also requested to take the role of a project manager to no verbal objections.

Student Number	Initials	Member Order	Role
2217522	GJ	A	Research and Development
2222538	LJ	B	System Safety
2207149	CH	C	Test and Evaluation
2219350	DG	D	Manufacturing
2223157	RM	E	Process Safety
2224230	LG	F	Disposal

Table 1 - Group Breakdown

As the test and evaluation engineer the author was responsible for producing sufficient work to demonstrate how a test and evaluations process could be used in this project. As with other aspects of this project the critical component chosen was the Safety and Arming unit. A full trials programme was generated for the SAU as per AOP-15 [3]. This is available through the teams Excel Systems Engineering workbook that is available on

request. Traditionally a T&E Engineer is responsible for generating the initial testing requirements and then iteratively resending new requirements as the design direction is finalised. Once this has taken place, they will inform the testing criteria and add further performance requirements. To enable a success often part testing is performed before final design completion. For example, a rocket motors performance may be tested in a Sled Trial before its final integration into the missile. After the final design has been achieved the T&E Engineer will be responsible for testing the system to allow for qualification and assurance of Safe and Suitable for Service (S3) before acceptance by the customer. Any discrepancies at this stage could ultimately lead to costly and time-consuming design changes that can often be avoided with sufficient input at the requirements stage.

4. Design project management

The project management aspect of any programme is a critical pillar that supports and organises the other functions. A good project management function will enable and enhance the overall output of the project and lead it to a successful and timely outcome.

All systems engineering is often based around a cyclical process that flows down through the various stages of the project in an iterative style. This method is often referred to in project management as a mix between waterfall and agile. [4]

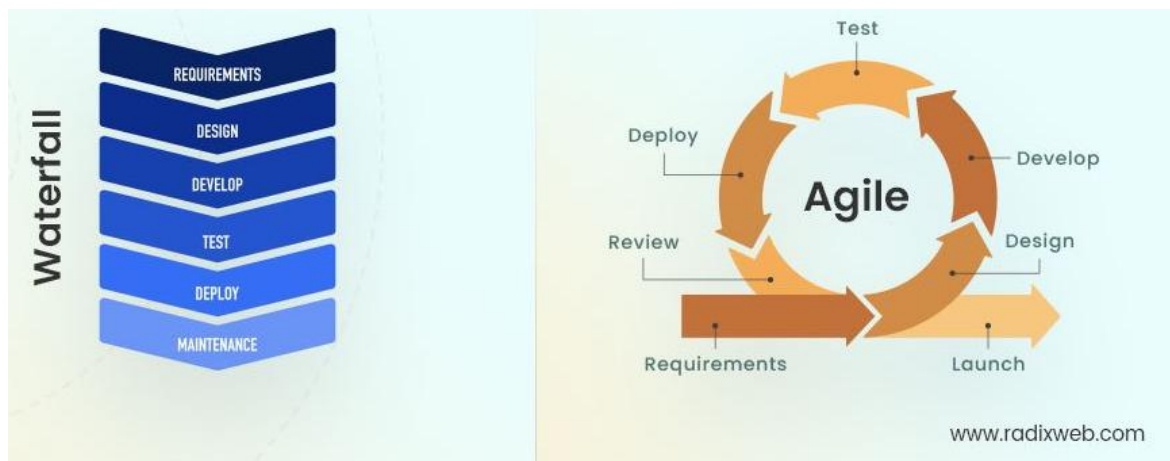


Figure 4 - Agile Vs waterfall [5]

By modifying the usual agile development method and incorporating the systems engineering approach the team effectively generated a new approach. We did this by breaking down the waterfall steps in to the system levels and incorporating a cyclical loop for each level. This involved start to define and evaluate requirements, develop functions and concepts before identifying the critical component. From here the same process will repeat for the identified critical component. This process would repeat for every component until sufficient detail is captured but due to time constraints for this project this was deemed excessive. Figure 5 shows the systems engineering cycle and Figure 6 shows the levels of the waterfall

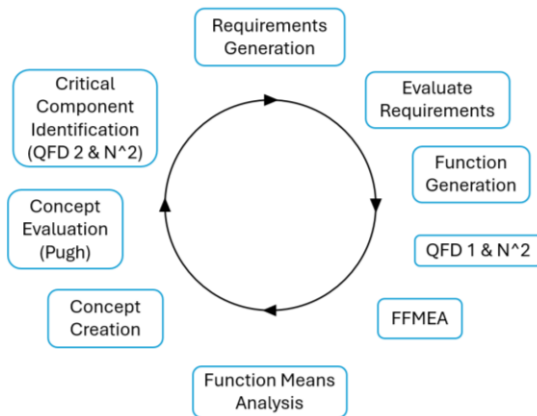


Figure 5 - Systems Process

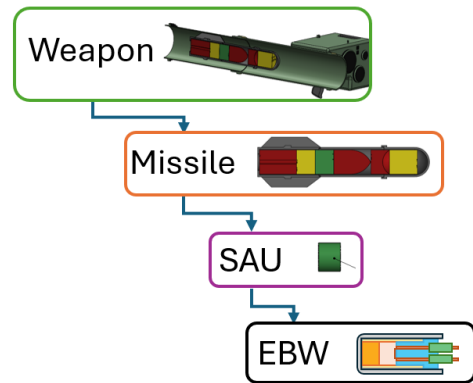


Figure 6 - Waterfall Levels

To support the generation of key artefacts and to come up with a broad plan for the completion of the project team member B created the below plan that split the work down into achievable tiles with an initial daily standup that then moved to weekly once we relocated out of Swansea.

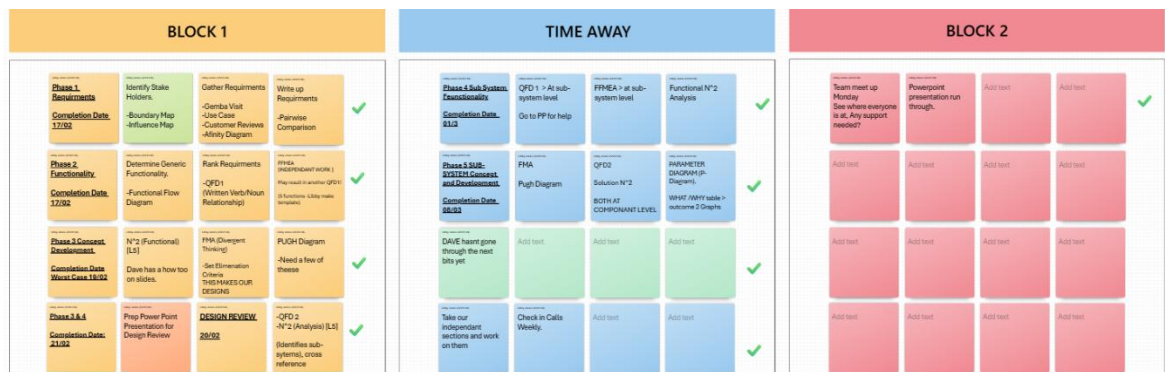


Figure 7 - Artefact Generation Plan

5. Teamwork and Communication

At the project outset the author initially created a MS TEAMS Area and associated file storage area and file structure. This allowed the team to then collaborate on shared documents, private meetings and record the work completed. In addition to this a WhatsApp group was created to allow for the seamless communication away from a computer.

Whilst the individual roles were identified initially, they were broadly ignored and the entire team worked collaboratively to complete the work share. This allowed the free flowing of information amongst the team and for quick progression. The team found that extended group sessions working to solve the problem or create a piece of work was the fastest way to achieve the extensive amount of work required within the short time frame.

Initially communication between the team was challenging as few of the group has worked together previously. In addition, certain preconceptions and personalities had to work themselves out as the work was being conducted. Due to the short timeframe there were times where communication was heated, and a measured approach was required. Fortunately for our team, this was quickly overcome through meaningful discussions and the problems were solved. Upon later review it was discussed and concluded that how the members were communicating was the problem at hand,

leading to initial misunderstanding. Through asking of the right questions and learning others talking styles we mostly managed to eliminate these initial issues.

During the time where the team could not meet in person, we utilised a standard weekly TEAMS meeting on a Friday. This was decided by the team to be the most amenable time allowing for personal and work commitments. In the end this effort was of little use as at no point was the whole team available for the meeting and when the meetings were conducted most had higher priorities outside of this project.

6. Initial and Final Presentations

As the requirement for an initial and final presentation was made clear from the project outset Team member B created a presentation template that could record the broad summary of the design stages and later detail the individual responsibilities that were required of the individual role's aspect.

At the end of the first block of work on the 20th February 2025 the team met with the customer to evaluate current progress and conclude a direction from the three presented initial designs. The design process steps and 3 recommendations were made to the customer and it was then requested that they choose a final option for progression. This initial meeting allowed for a conformation of direction and design.

After the 4 week intermission between being at university a significant proportion of effort was required to catch up on the planned work and prepare the design for the final presentation due 11 days later.

The final presentation was delivered on 4th April 2025 and the final slides presented are available at Annex A

After the final design presentation, the "Customer" presented the feedback below.

8. Feedback from presentation.

After the final design presentation, the “Customer” / lecturer presented the feedback below on the 14th April 2025.

Charles Hadley	Team 1
Team feedback / Questions	
Q to team.....Alternatives to EBW? Were these considered? simple slides with clear layout. Images are a good size, easy to view. Good contrast between text and background. Theme consistent throughout different sections to give a nice cohesive team feeling. Referring to other people’s sections showed good collaboration. Some overlap in safety content, could give the impression of lacking communication between the two. Clear introduction to set out order of events. Would have benefitted from having a distinct conclusion, even one slide summarising the key points. References stated as available on request; it would have been better to include the references slide in the presentation for the sake of transparency. Some misinterpretation of stretch goal between group members?	
Feedback / Comments Dave	
Specifications and sources of legislation understood How do you ensure that subsystems are tested to the right level Systems logic may have slipped to the SAU very quickly How would the go / no go values, for the tests be cascaded down Actions taken to qualify subcomponents?? Smart certification?? What do you need for this??	
Feedback / Comments Jenni	
good volume, quite a fast-paced delivery which could make it difficult for someone to follow if they are not familiar with the area. Good interaction with the audience, open body language. Minimal reading from slides/screen. Confident delivery throughout.	

Figure 8 - Presentation Feedback [6]

The answers to the non-technical questions and statements posed are below the remaining questions have been evaluated in the Systems Engineering report.

S: “Some overlap in safety content, could give the impression of lacking communication between the two”

A: The author completely agrees on this statement. The duplication in safety regulation requirements was identified to the two safety roles but was chosen to be included from the perspective of both parties regardless. With hindsight a broader breakdown of the stages taken to achieve the final design result presented would have benefitted the presentation over having individual sections.

S: “Would have benefitted from having a distinct conclusion, even one slide summarising the key points”

A: Yes, the author agrees and had made note for a summary slide in future long presentations.

Q: Some misinterpretation of stretch goal between group members?

A: whilst there was opportunity for miss interpretation, this is not the case for the stretch target. The wording of the requirements is generally backwards as the overall aim is to neutralise the target. With the stretch target not to eliminate the enemy combatants. A non-lethal option would be easily achievable whereas a lethal option would pose further collateral damage risk that would be unacceptable. This effectively made the ‘stretch’

target easier to achieve and where the team were aiming. There was no confusion within the team but it may have been presented this way.

S: "quite a fast-paced delivery which could make it difficult for someone to follow if they are not familiar with the area"

A: the 'customer' was treated as an intelligent customer acting as Defence Equipment and Support (DE&S) or another MOD based organisation would. MOD organisations have sufficient knowledge and experience for this type of presentation and form technical experts in their fields, hence the fast paced delivery was adequate for the 'customer' it was theoretically pitched too.

9. Design Review Results

After this initial round of design, requirements generation and subsystem level exploration this project would benefit from a fresh start where new and novel methods were considered to complete the objective and neutralise the target. Only the obvious method of 'neutralisation' was considered and in fact using other non-user related method could have been applicable. For example, deploying a signal jammer or destroying the signal/ satellite communications capability would have also neutralised the target. A restart of the programme would allow for quick lessons to be learnt whilst incorporating the current work for progression. This restart may equate to the same or similar design choices being made but would be further reinforced by the new comparisons that would be made. Without this fresh start there is no evidence or requirements to make any further design changes.

10. Reflections

Upon reflection on the performance of the team the overall work and output would have benefitted by two additional clear roles. A team lead and an active Project Manager (PM). Whilst team member B did volunteer for the PM role they could not devote sufficient time to this role alongside their priority of safety. They produced one simple tracking sheet that did not form a part of a plan but more of a record of what was done. Where the team to have a dedicated PM that could have initially generated a plan, organised meetings, taskings and aims the remaining group members would have been able to focus more closely on the work at hand rather than what need to be done next.

An official team lead would have smoothed some of the decision making as the democratic process used was burdensome. Although a democratic approach to decisions is effective it was also time consuming as coming to a consensus regularly quickly became tiresome which didn't help when team members were overworked to complete aspects for the upcoming deadlines.

Lastly some greater time and focus on 'out of the box' thinking would have benefitted the project as without realising the team set its down a design path subconsciously. This eliminated design options from the start that could have changed the final result.

11. Conclusion

In conclusion the team came together, worked effectively and quickly to achieve a significant goal in a short timeframe. Whilst there are significant areas for improvement throughout the process the team collectively learnt, developed and progressed to deliver a viable product given the broad engineering scope and project constraints.

12. References

- [1] UWTSD WBGD Team 1, *Team 1 Design Book*, Swansea: UWTSD, 2025.
- [2] UWTSD Lecturer, "L5 - Systems Engineering & Work-Based Group Project (ACDA5021&ACDA5022)," [Online]. Available: <https://moodle.uwtsd.ac.uk/mod/resource/view.php?id=650673>. [Accessed 25 05 18].
- [3] DOSR, "DSA 03-OME Part 1 (JSP 520)- Defence," Defence Safety Authority, NA, 2020.
- [4] C. Hadley, "20250505 - 2207149 Systems Engineering Final Report," UWTSD , Swansea, 2025.
- [5] P. Palkhiwala, "Waterfall vs Agile: What to Know Before Choosing Your Development Method," 2023 08 25. [Online]. Available: <https://radixweb.com/blog/waterfall-vs-agile>. [Accessed 26 05 2025].
- [6] U. Lecturers, *Charles Hadley WBGD Feedback for June*, Swansea: UWTSD, 2025.
- [7] Rockwell Automation, "Functional failure mode and effects analysis (FFMEA)," FIIX, [Online]. Available: <https://fiixsoftware.com/glossary/ffmea/>. [Accessed 05 01 2024].
- [8] D. S. Burge, "Pugh Matrix (PM)," in *The Systems Engineering Tool Box*, Rugby, Burge Hughes Walsh, 2009, pp. 1-15.
- [9] UWTSD, "L5 - Systems Engineering & Work-Based Group Project (ACDA5021&ACDA5022)," [Online]. Available: <https://moodle.uwtsd.ac.uk/course/view.php?id=12137>. [Accessed 04 04 2025].

13. Annex A – Final Presentation

Note the name in the top left-hand corner of the slide denote the individual that delivered that slide. The general theme of the slide pack was created by team member E.



Team 1 Final Presentation

Presented By:
 Gareth James (2217522)
 Rachel McColm (2223157)
 Libby Jones (2222538)
 Charles Hadley (2207149)
 Dan Garton (2219350)
 Lewis Gray (2224230)

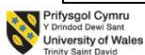
For Group Based Project
 ACDA5022



Charles Hadley

Meet The Team

Gareth James	Charles Hadley	Daniel Garton
Research & Development Engineer	Test & Trials Engineer	Manufacturing Engineer
Libby Jones	Rachel McColm	Lewis Gray
Design Safety Engineer & Project Manager	Process Safety Engineer	Disposal Engineer



Charles Hadley

Housekeeping & Amenities

- Introduction
- Emergency Exit
- Fire Alarms
- Eating and Drinking
- Questions?



Charles Hadley

Agenda

Research & Development

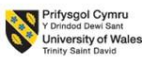
Design Safety

Test & Evaluation

Manufacture

Process Safety

Disposal



Gareth James

Mission Objective:

1. Neutralise the communications centre.
2. Minimise collateral damage to the rest of the building structure or potential occupants
3. Immobilise / disorientate occupants rather than eliminating them.



Gareth James

Requirements:

Contributing Factors:

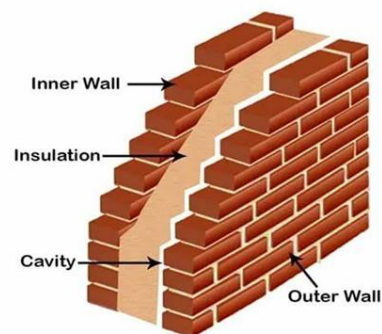
Target specifications:

- External rendered filled cavity block construction – Approx 300-350mm thick.
- Room Dimensions 10m x 8m x 4m Room.

Limiting Factors:

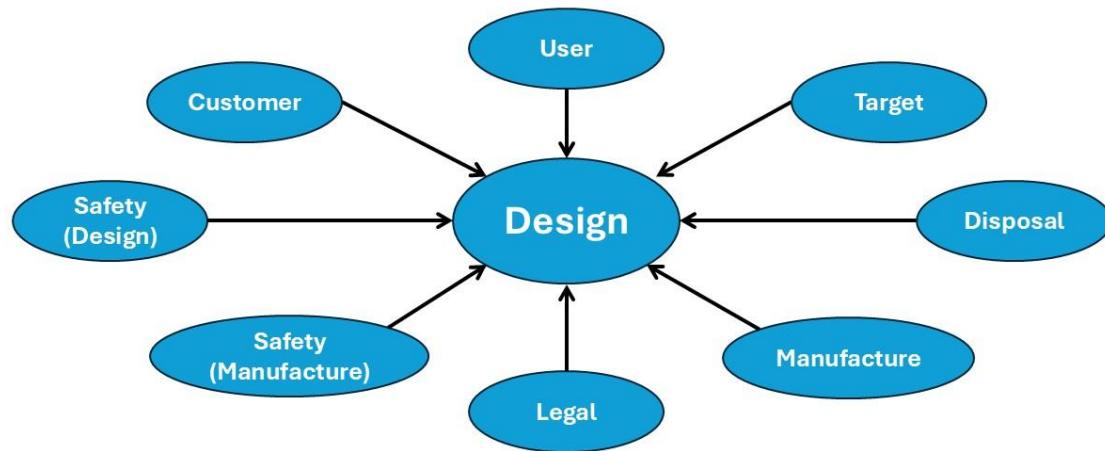
Factors which directly impact design:

- Reduction of collateral damage
- Blast must also not impact the structure



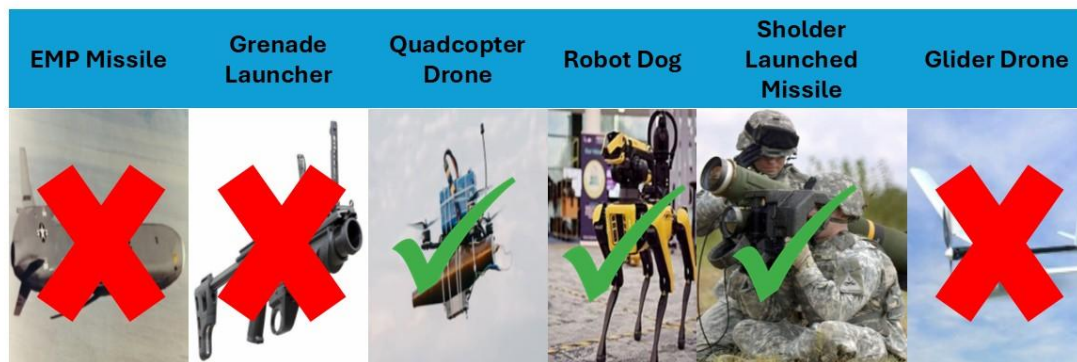
Gareth James

Requirements



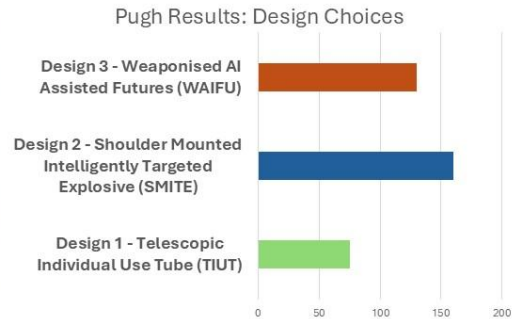
Gareth James

Design Phase Summary



Gareth James

Solution:



Gareth James

System Design Overview

Telescopic Tube

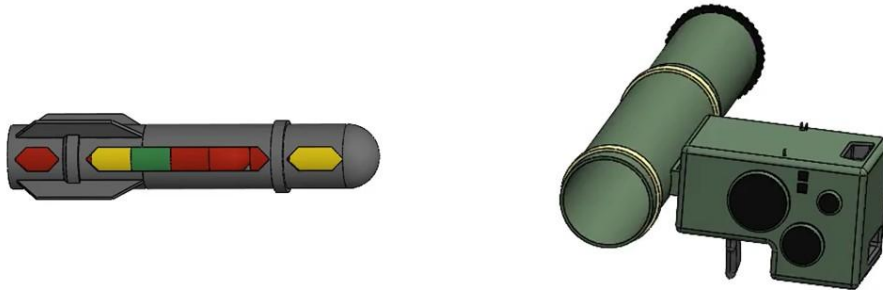


Command and Launch Unit
(C.L.U.)



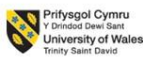
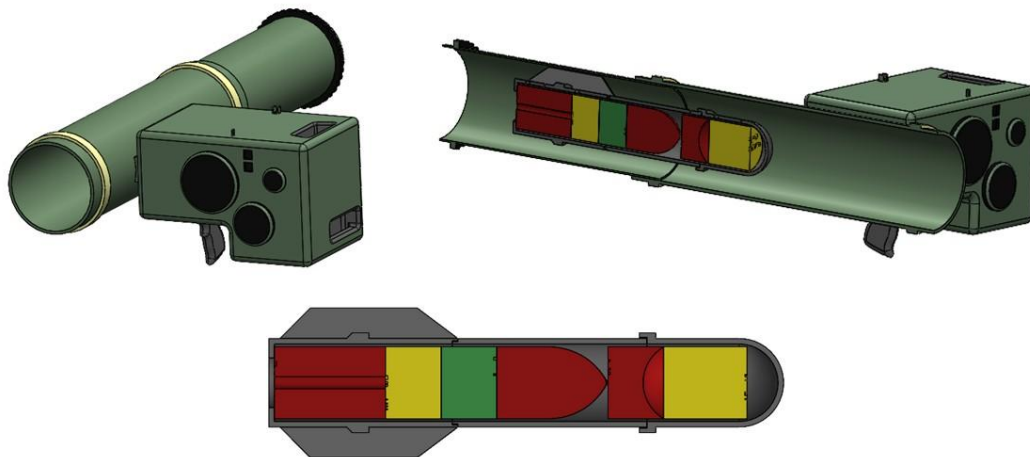
Gareth James

System Design Overview



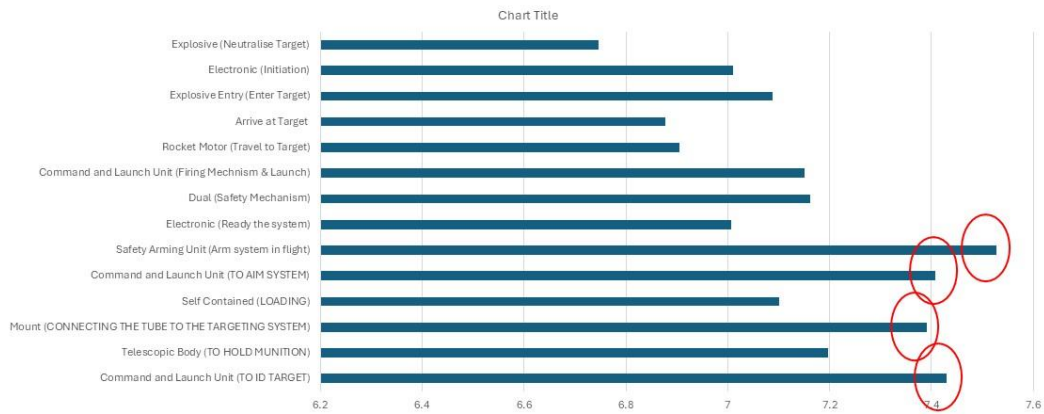
Gareth James

Shoulder Launched Missile



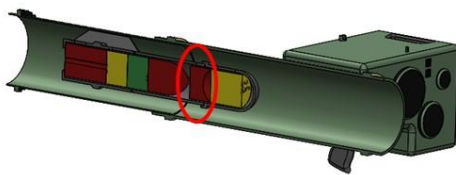
Gareth James

System Design Overview



Gareth James

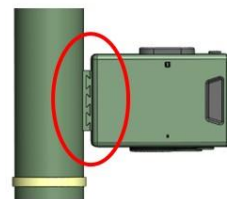
Key Design Features:



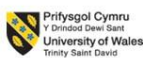
The Safety and Arming Unit



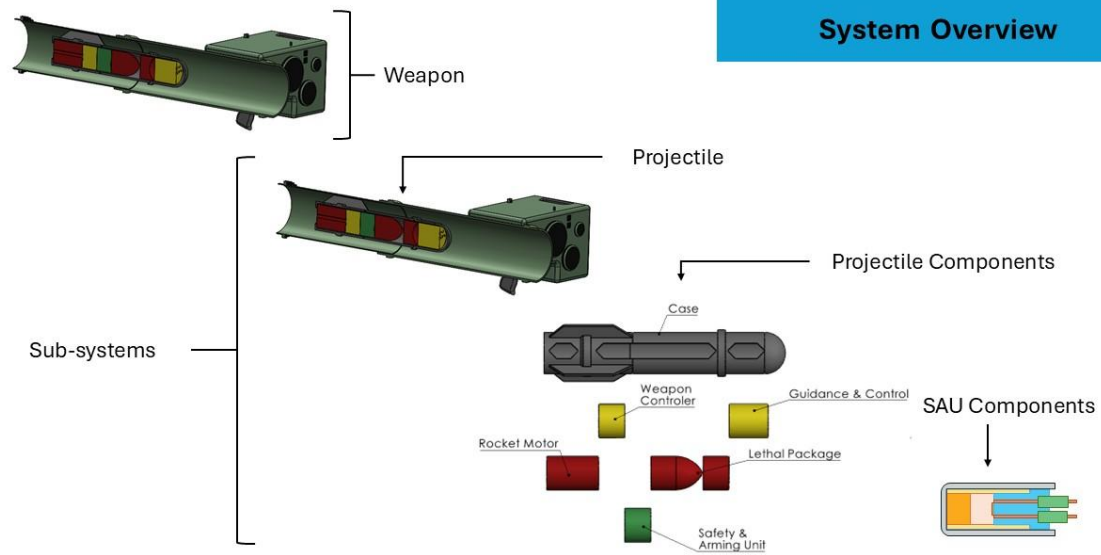
The Command and Launch Unit



The Mount



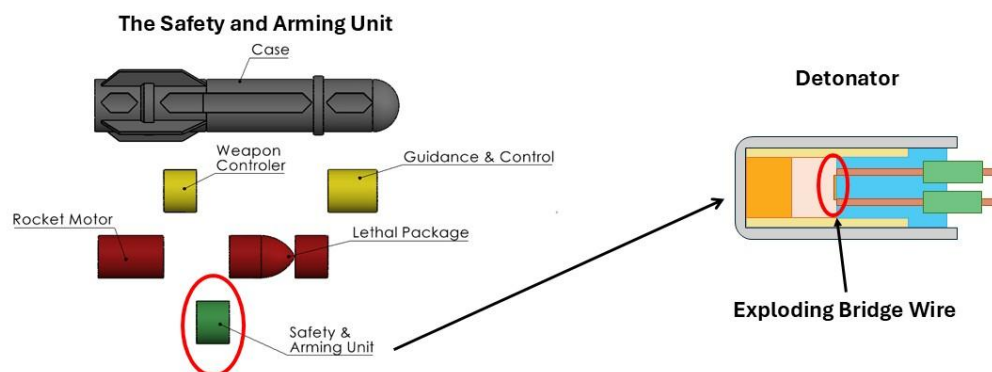
Gareth James



Prifysgol Cymru
Y Ddrnod Dewi Sant
University of Wales
Trinity Saint David

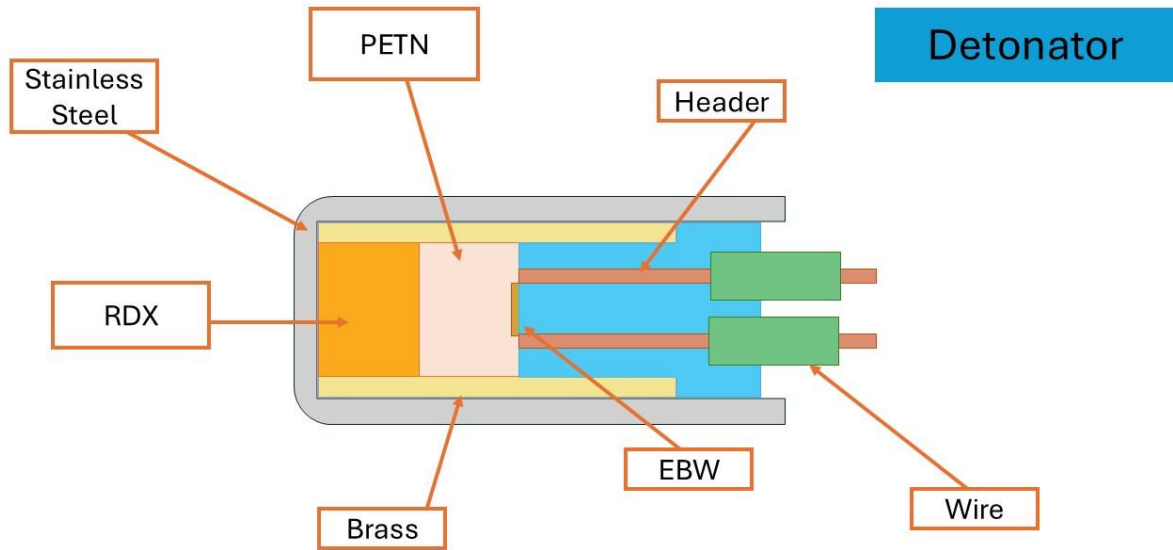
Gareth James

Critical Sub-Systems



Prifysgol Cymru
Y Ddrnod Dewi Sant
University of Wales
Trinity Saint David

Gareth James



R&D Questions?

Libby Jones



Safety Compliance



The Health &
Safety Work Act
1974



The Explosives
Regulations 2014



DSA 02.OME: Defence
Ordnance, Munitions
Explosives Regulations



Libby Jones

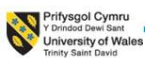


Safety Compliance



The Explosives
Regulations 2014

- Prevent an unplanned fire or explosion
- Limit the extent of an unplanned fire or explosion
- Protect people from the effects of a fire or explosion



Libby Jones



Stakeholder Requirements

- The system must be designed as such it is safe to operate
- The system must be designed as such it is safe to handle
- The system must be designed as such it is safe to function



Libby Jones

Push to Fit Mount



- Design Failure Mode Effects Analysis was utilised to identify the ways the system could fail.
 - Over
 - Under
 - No
 - Intermittent
 - Un-intended
- What was the risk ?
- Can we mitigate that?

Libby Jones

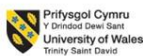
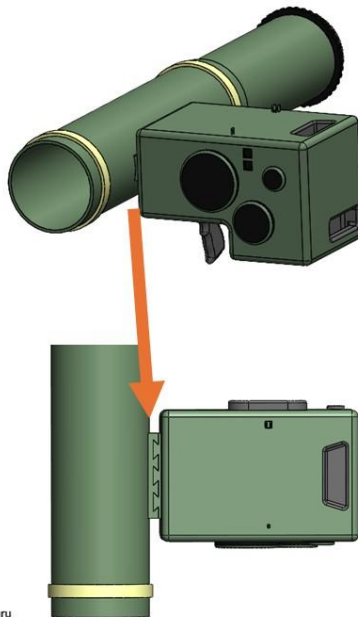


Eliminate

Hierarchy of Controls

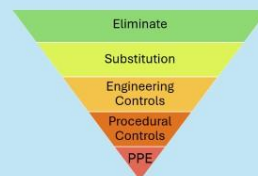


Libby Jones



Dove Tail Mount

- Lower RPN Value when compare with a Press fit on a DFMEA
- Mechanical Interlock, provides consistent, secure attachment, reducing the “Human Element”.
- Ergonomically shaped to withstand vibration during launch.

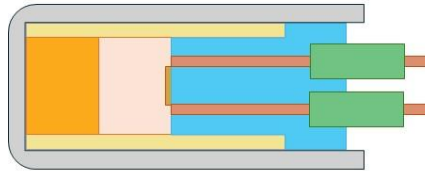


Libby Jones

HAZARD: Unintended Functioning of the EBW System

How this can occur:

- Functioning of the explosive elements in the EBW.
- A presence of a current in the system due to the fusing / arming functioning when unintended.



Libby Jones

HAZARD: Unintended Functioning of the EBW System**Sensitive materials in the EBW i.e. Explosives****Eliminate**

- No, the Booster Composition is required to detonate Main charge

**Substitute**

- Could look into Substitution of PETN & RDX

**Engineering Controls**

- Not really, we can control the critical diameter and density of the composition

**Procedural**

- Depending on sensitivity of composition, safe handling procedures

**PPE**

- Not at this stage



Libby Jones

HAZARD: Unintended Functioning of the EBW System

EBW as a whole

Eliminate

- Yes, but you can't function your main charge

Substitute

- Yes, could initiate with percussion as an example

Engineering Controls

- Yes, could incorporate SAU, to ensure current to EBW is intended

Procedural

- Safe handling procedures

PPE

- Not at this stage

Safety



Deliver Effect



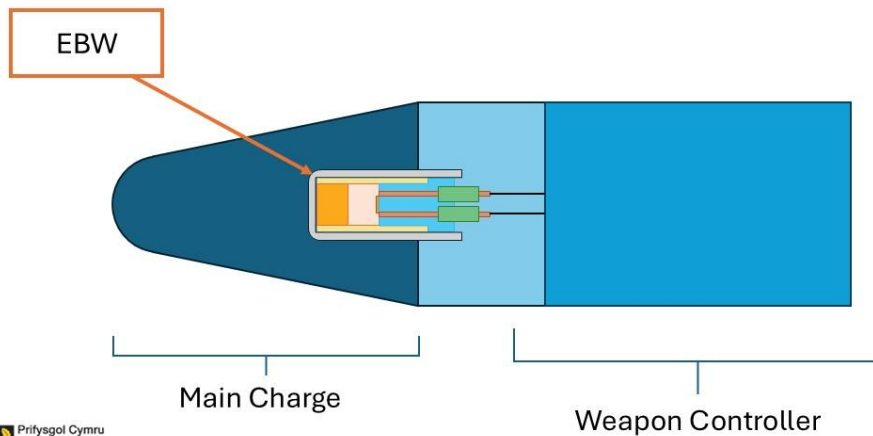
Deliver Effect



Safety

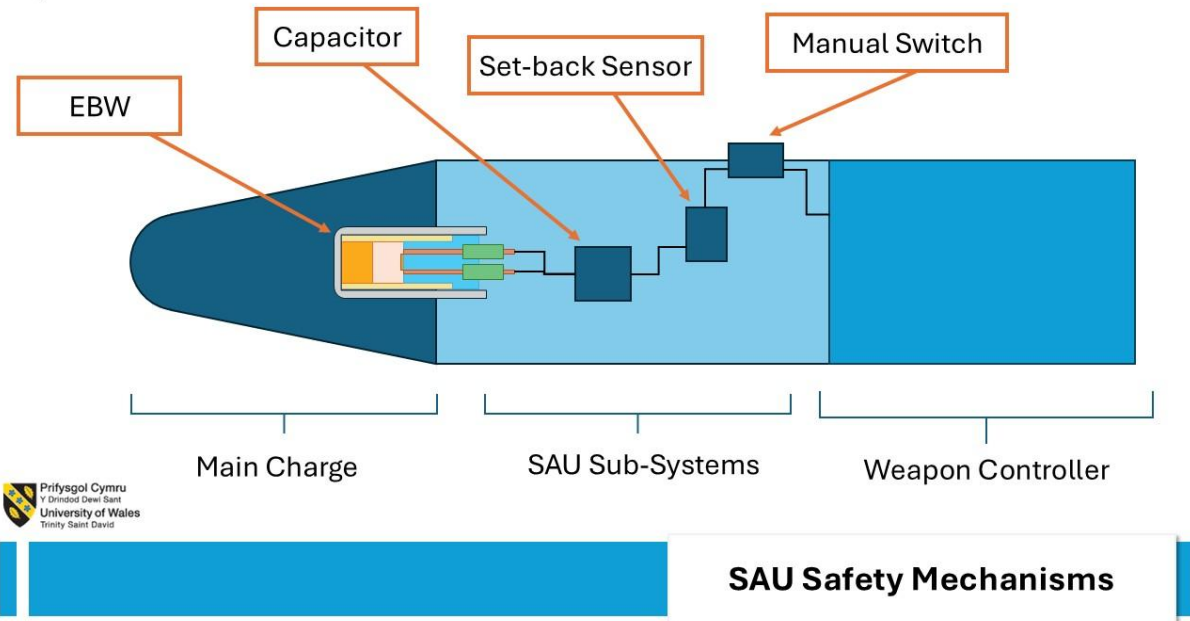


Libby Jones



SAU Safety Mechanisms

Libby Jones



Design Safety Questions?

Test and Evaluation (T&E)

Charles Hadley



Requirements



Approach



Design Feedback



Analysis and Performance

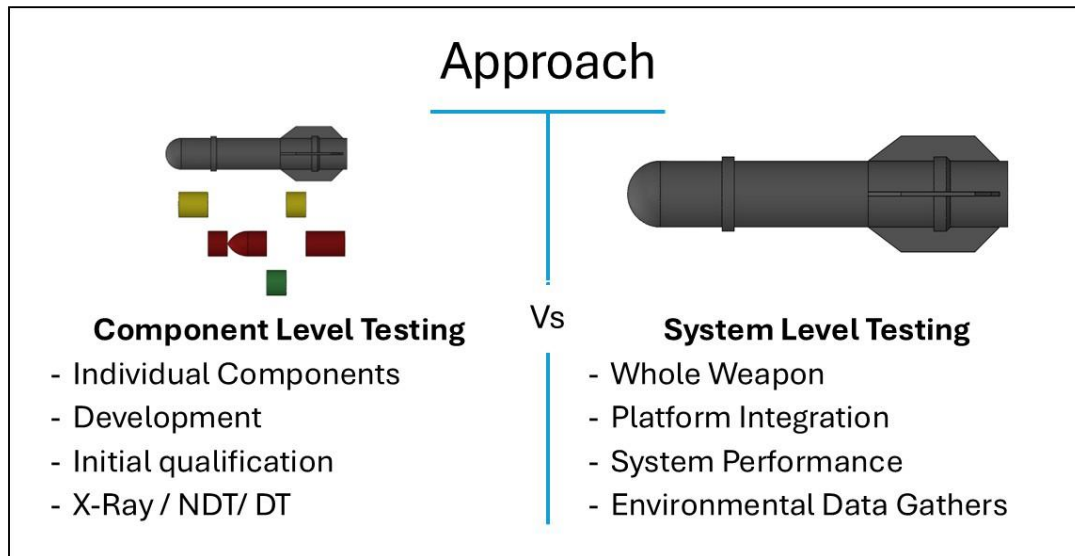


Results

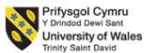
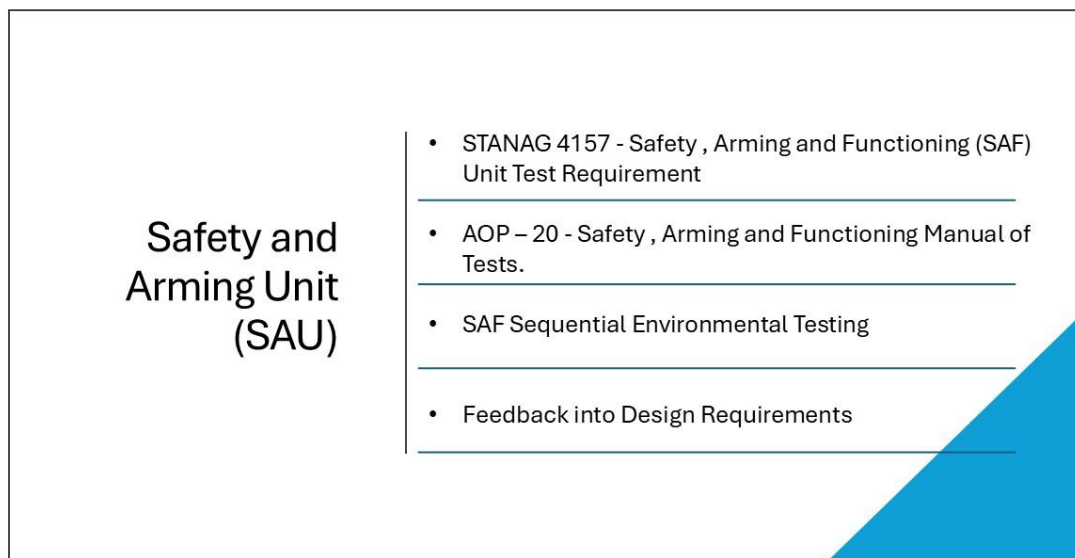
T&E – System Requirements

- Safe and Suitable for Service (S3)
- DSA02 OME 101,107,108,109,110,113
- Defstan 00-035 – Sequential Environmental Testing
- AOP-15 – The process for determining S3 for munitions

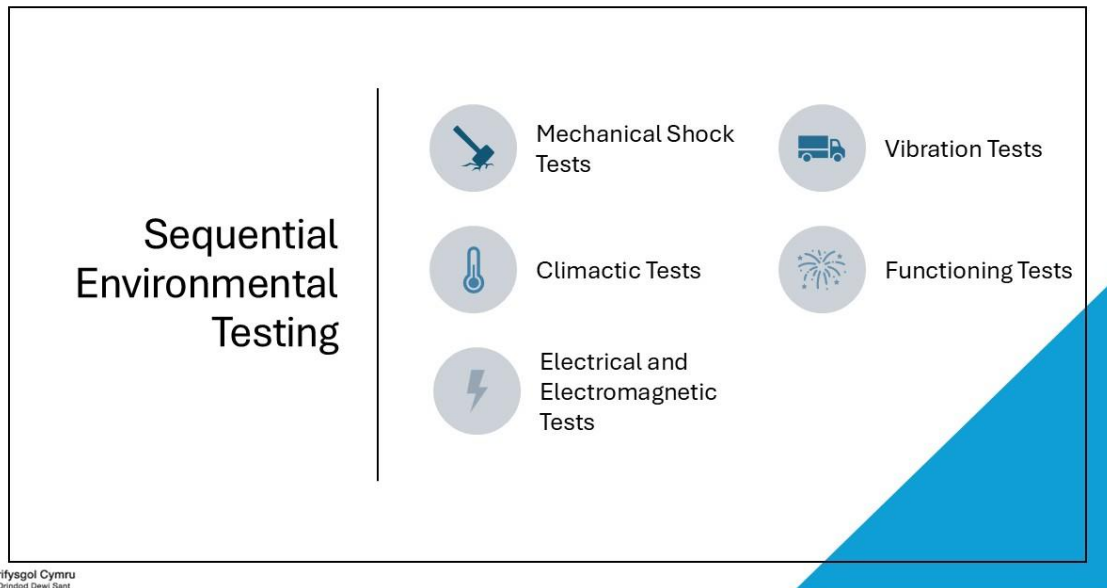
Charles Hadley



Charles Hadley



Charles Hadley



Charles Hadley

Testing Plan

Group	Test	Criteria for Passing Test	Munition	Packaged	Minimum Assets Required	Tailoring	Tailoring Reason
Mechanical Shock	A1 Jolt	Safe for use 1	None	No	1	In	
Mechanical Shock	A2 1 Jumble	Safe for use 1	None	No	1	In	
Mechanical Shock	A3 12m Drop	Safe for disposal	None, I, L	Both	4	In	
Mechanical Shock	A4 1.5m Drop	Safe for use 4	None, I, L	No	2	In	
Mechanical Shock	A5 Transportation Handling	Operable	None, I, L	Yes	2	In	
Vibration	B1 1 Transportation Vibration	Operable	None	Both	2	In	
Vibration	B3 Tactical Vibration	Operable	None	No	1	In	
Climatic	C1 Temperature & Humidity	Operable	None	No	1	In	
Climatic	C2 Vacuum/Steam/Pressure	Operable	None	No	1	In	
Climatic	C3 Salt Fog	Operable 5	None	No	1	In	
Climatic	C4 Waterproofness	Operable 6	None	No	1	In	
Climatic	C5 Fungus	Operable	None	No	1	In	
Climatic	C6 Extreme Temperature	Operable	None	No	1	In	
Climatic	C7 Thermal Shock	Operable	None	No	1	In	
Climatic	C8 Leak Detection	7	None	No	1	In	
Climatic	C9 Dust	Operable 8	None	No	1	In	
Climatic	C10 Solar Radiation	Operable	None, I	Both	2	In	
Safety, Arming & Functioning	D1 Primary Explosive Component Safety	9	None	No	1	In	
Safety, Arming & Functioning	D2 Projectile Fuse Arming Distance	7	I, L	No	1	Out	Out for component testing - in for System
Safety, Arming & Functioning	D3 Time to Air Burst	7	I, L	No	1	Out	Out for component testing - in for System
Safety, Arming & Functioning	D4 Explosive Component Output	7	None	No	1	In	
Safety, Arming & Functioning	D5 Rain Impact	10	I	No	1	In	
Safety, Arming & Functioning	D6 Brush Impact Non-Fire Test	Safe, Operable	I	No	1	In	
Safety, Arming & Functioning	D7 Mortar Ammunition Fuse Double Loading Test	1	None	No	1	Out	Not a Mortar
Safety, Arming & Functioning	D8 Progressive Arming Test	1	None	No	1	In	
Safety, Arming & Functioning	D9 Explosive Train Transfer Reliability Testing	7	None	No	1	In	
Aircraft Munition	E1 Jetison	Safe for disposal 11	L	No	1	Out	Non Aircraft Munition
Aircraft Munition	E2 Low Altitude Accidental Release	Safe for disposal 11	L	No	1	Out	Non Aircraft Munition
Aircraft Munition	E3 Arrested Landing Munition Pull-off	Safe for disposal 11	L	No	1	Out	Non Aircraft Munition
Aircraft Munition	E4 Catapult And Arrested Landing Forces	Operable	I	No	1	Out	Non Aircraft Munition
Aircraft Munition	E5 Simulated Parachute Air Delivery	Operable 12	None, I	Yes	1	Out	Out for component testing - in for system
Electric & Magnetic Influence	F1 1 Electrostatic Discharge	Safe for use 13	None	Both	2	In	
Electric & Magnetic Influence	F2 1 High-Altitude Electromagnetic Pulse	Operable 7	I	No	1	In	
Electric & Magnetic Influence	F3 1 EMR Hazards (ELMR)	Operable	None	Both	2	In	
Electric & Magnetic Influence	F4 1 EMR Operational (EMRO)	Operable	None	No	1	In	
Electric & Magnetic Influence	F5 Lightning	Operable	I	No	1	In	
Electric & Magnetic Influence	F6 Electrical Stress Test (EST)	Operable	None	No	1	In	

6

Categories

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Tests

8

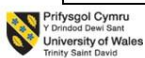
Tailored Out

29

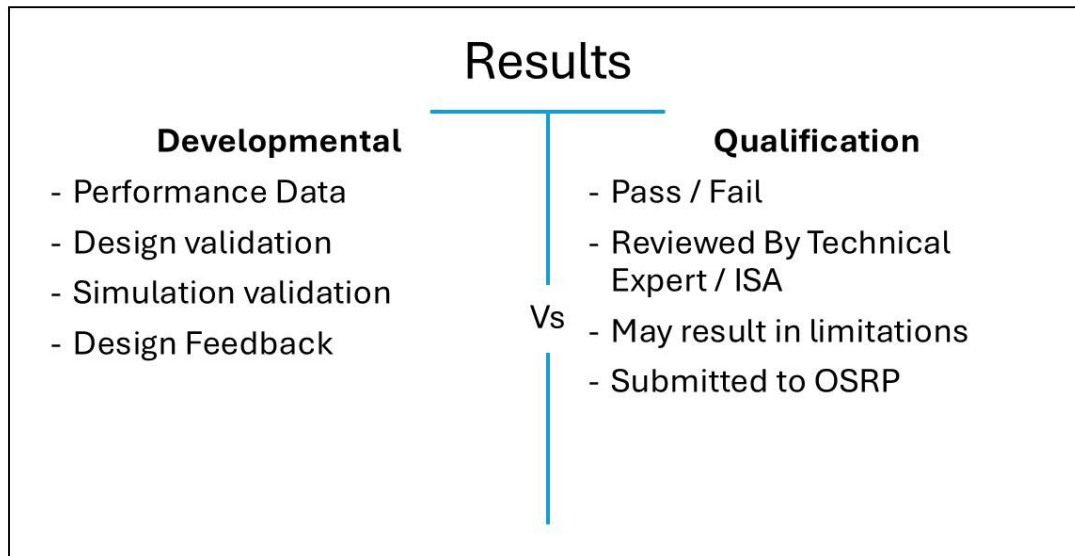
Tailored In

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Assets Required



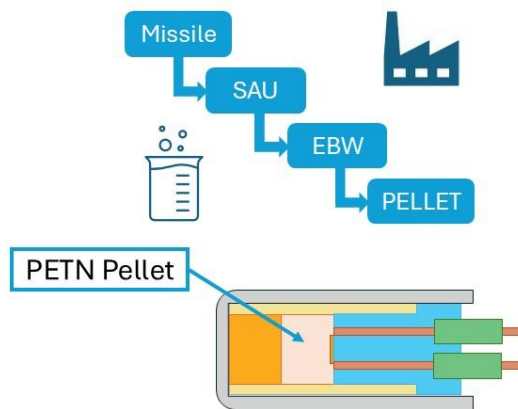
Charles Hadley



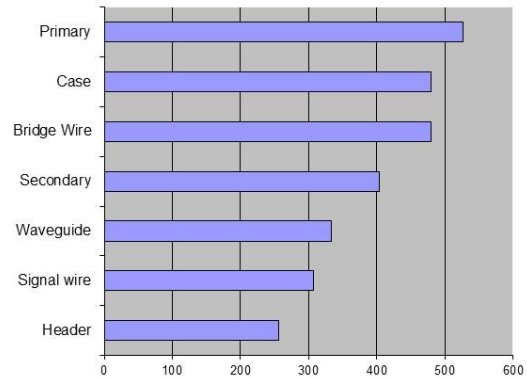
T&E Questions?

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Manufacturing



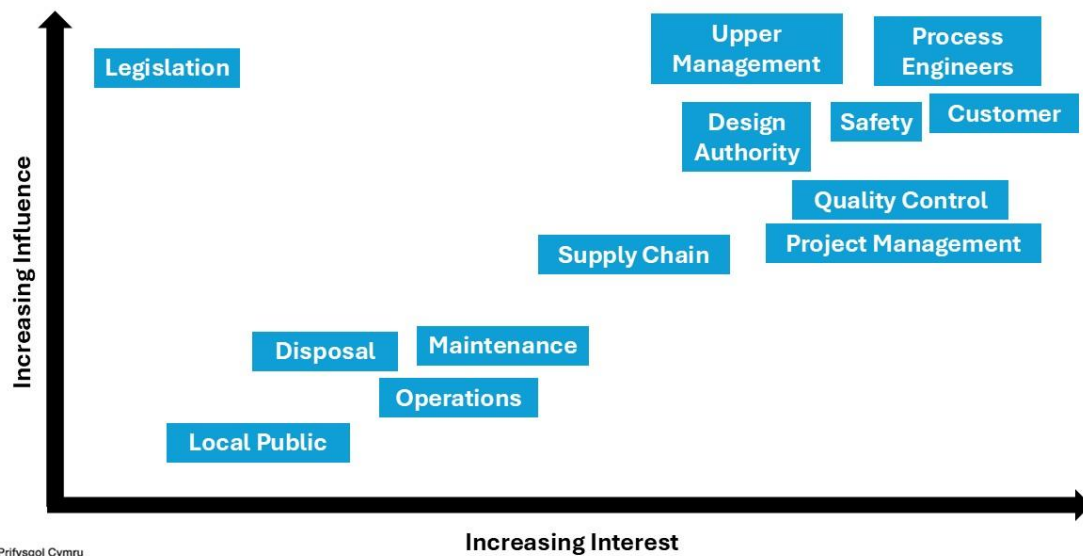
Process Importances Chart



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Manufacturing Stakeholder Map



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Manufacture stakeholder requirements

- ✦ **Operations** → Simple to Follow
- ✦ **Engineers** → Minimal Human Factors and Noise Factors
- ✦ **Safety** → Safe at all point
- ✦ **Supply Chain** → Alignment with Supply Chain
- ✦ **Project Management** → Contract Timelines
- ✦ **Design Authority** → Product Made to Specification
- ✦ **Maintenance** → Easy PM, Training available
- ✦ **Legislation** → Regulatory Compliance
- ✦ **Disposal** → Easy Disposal, Available Disposal Routes
- ✦ **Customer** → Functional & Reliable Product
- ✦ **Upper Management** → Cost-Effective, Time-Effective, High-Yield, Space-Efficient
- ✦ **Local Public** → Minimal Interference (Noise pollution, Light pollution, Road congestion)
- ✦ **Quality Control** → Product Meets Specifications



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Available Processes

Mix and Cast



- Increased Process steps
- Needs casing/moulds
- Voids risk
- Shrinkage casting
- + Proven

RAM



- Expensive
- Not proven
- Needs casing/moulds
- + Increased solid loading

Press

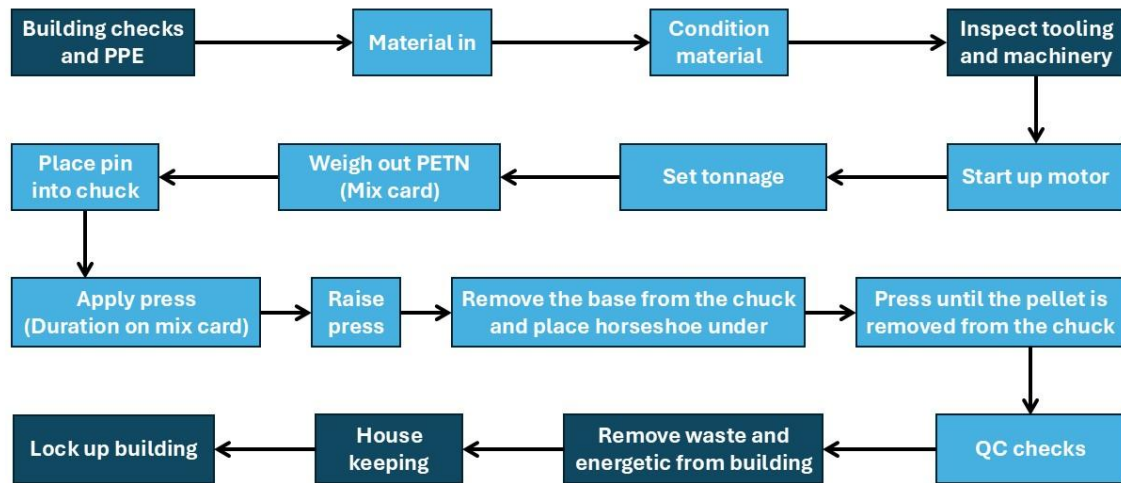


- Specific materials
- + Inexpensive
- + Proven
- + No casing
- + Less heat created
- + Precise shape



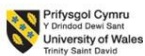
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Top level flow



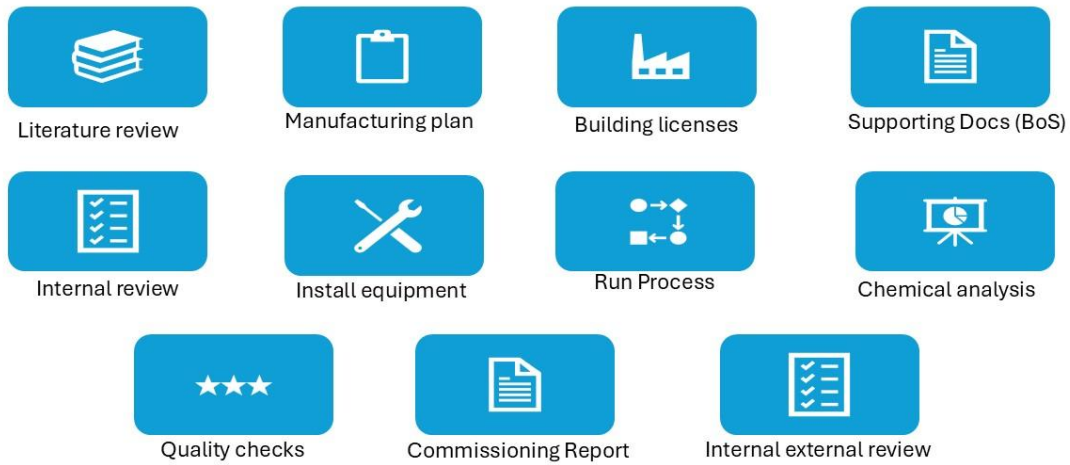
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Work Package Deliverables



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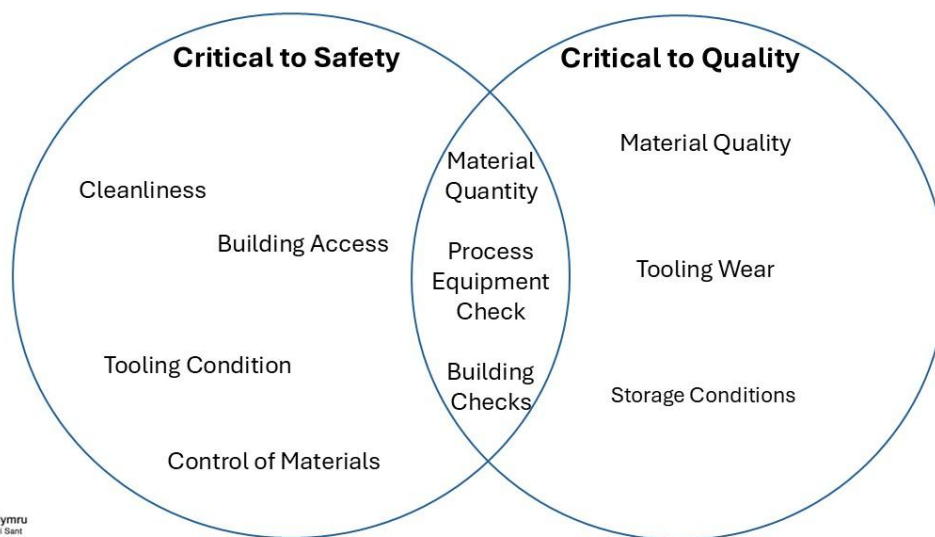
Work Package Deliverables



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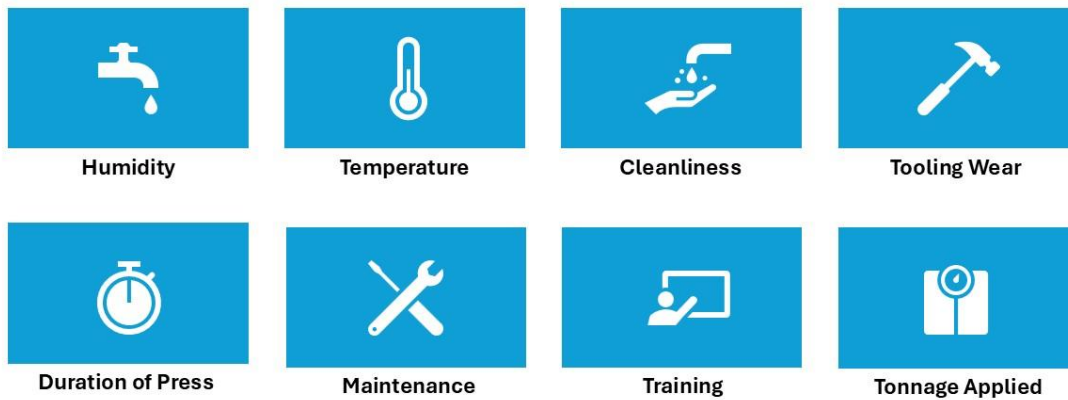
Critical Process steps



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Process Control Plan (PCP)/QFD4



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Validation plan

Blast modelling

Human factors analysis

Shift condition running

Various QC checks through the process

Commissioning report

Manufacturing Questions?

Rachel McColm



Legislation and Regulation



The Explosives
Regulations 2014



The Health &
Safety Work Act
1974



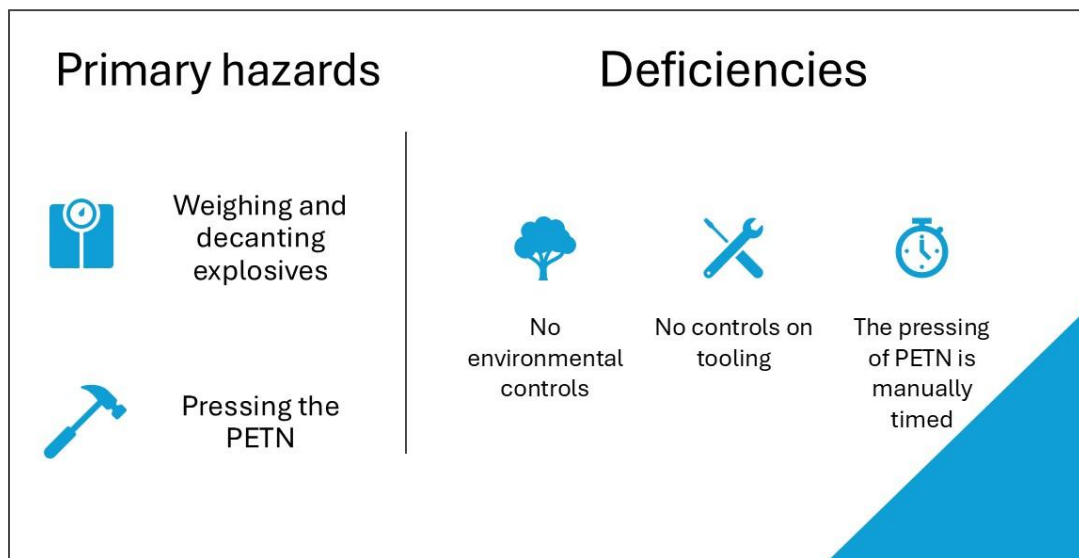
DSA 02.OME: Defence
Ordnance, Munitions
and Explosives (OME)
regulations

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Risk Classification

	Negligible	Minor	Moderate	Significant	Severe
Very Likely	Low Med	Medium	Med High	High	High
Likely	Low Med	Low Med	Medium	Med High	High
Probable	Low	Low Med	Medium	Med High	Med High
Unlikely	Low	Low Med	Low Med	Medium	Med High
Very Unlikely	Low	Low	Low Med	Medium	Medium

Risk Class	A	B	C	D	E
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Mitigations



Tooling Controls



Environmental Controls



Automation



Rachel McColm



Post Controls Risk Classification

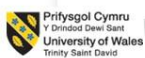
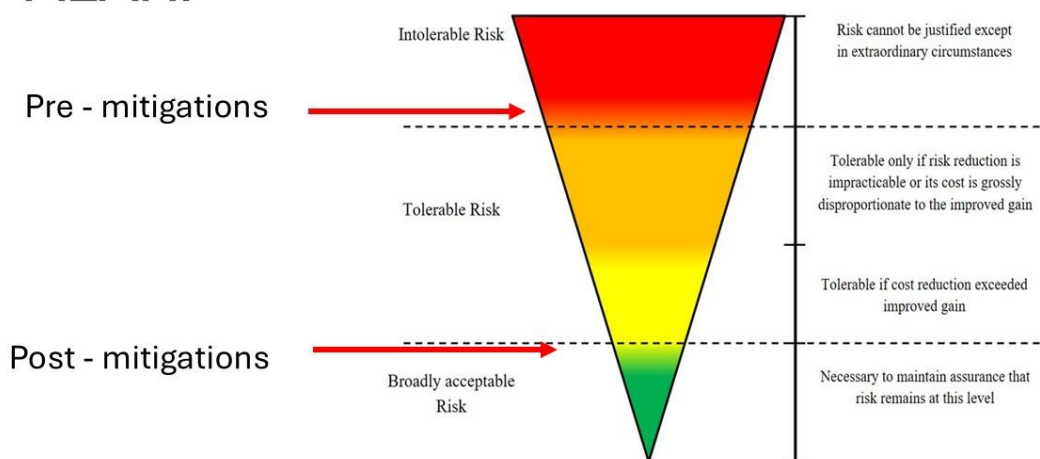
	Negligible	Minor	Moderate	Significant	Severe
Very Likely	Low Med	Medium	Med High	High	High
Likely	Low Med	Low Med	Medium	Med High	High
Probable	Low	Low Med	Medium	Med High	Med High
Unlikely	Low	Low Med	Low Med	Medium	Med High
Very Unlikely	Low	Low	Low Med	Medium	Medium

Risk Class	A	B	C	D	E
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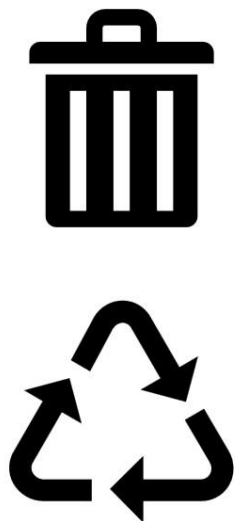


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ALARP



Process Safety Questions?



Disposal

Lewis Gray

Lewis Gray

Requirements



Safe



Effective



Reliable



Minimal Environmental Impact



Lewis Gray

Input from Design

- Munition must be recoverable from Launch Tube Assembly
- Subcomponents must be recoverable from missile
- Toxic materials kept to a minimum.



Lewis Gray

Inert Components	Energetic Components
Telescopic Launch Tube	Safety and Arming Unit
Command Launch Unit (CLU)	Rocket Motor
Guidance & Control Unit	Follow Through Bomb
Weapon Controller	Precursor Charge
Storage Case	Blip Motor
Missile Frame	

Components to be Disposed of

Lewis Gray

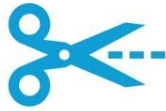
Methods Evaluated



Lewis Gray

Methods Selected

Shredding



- **Non-Energetics**
- Inert Components
- + Cheap
- + Effective
- + Established
- Shredding waste to be recycled by third party



Incineration

- **Energetics**
- Contaminated Components
- + Safe
- + Effective
- + Reliable
- + Established
- Incineration waste to be disposed of by contractors.

Lewis Gray

Waste Management Plan

- Waste generation identified at all levels of manufacture.
- Energetic waste to be disposed of with end-of-life energetic components.
- Inert waste to be shredded.

Disposal / Final Questions?

References available on request