

George Atkins Major Project Proposal

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Suitability of Pendine Firing Shelters

Research Proposal

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1. Introduction

Firing shelters are used at MoD Pendine to protect trials staff from fragments or ricocheting bullets during trials activities. Currently, Pendine blocks are placed in front of firing shelters (shown in Figure 1) as the business is unsure if the firing shelters are sufficiently robust to protect staff within.

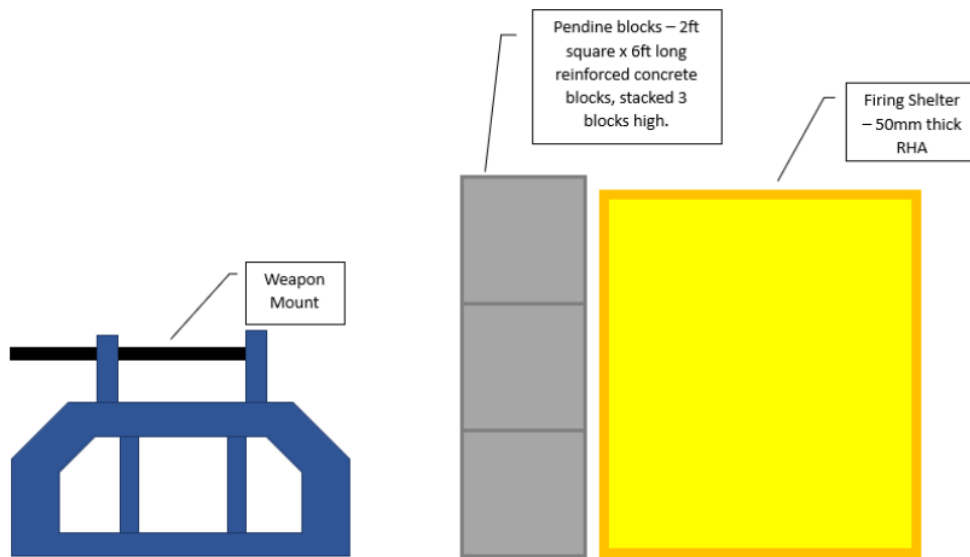


Figure 1 – Current Set up of firing shelters

It will save time, effort and eliminate the hazardous activity of placing these 1500kg blocks if the shelter is found to be sufficiently robust. The purpose of this research is to assure QinetiQ leadership that the firing shelters are sufficient to protect staff without the need of Pendine blocks.

2. Background to the Proposed Research

A literature review has been conducted to ascertain if similar testing has been conducted. There are several examples of research conducted using ballistic testing methods which shall be used for this research, including: Material Behaviour during Ballistic Testing [1], Ballistic testing of surface-treated alumina and silicon carbide with improved adhesive bond strength [2], Ballistic testing of transparent armour ceramics [3]. Another article regarding the Standardisation in testing ballistic protection systems [4] confirms the proposed test methods are suitable for testing armours effectiveness.

similar to what?

Similar testing has been conducted extensively at Pendine, although not on the RHA firing shelters, but rather on customer supplied targets of various materials and thicknesses. The procedures and data capture requirements for ballistic testing and how to conduct it safely are well understood.

3. Aims & Objectives

3.1 Aims

To determine if the firing shelters in use at MoD Pendine are sufficient protection for staff without the addition of Pendine Blocks.

3.2 Objectives



To conduct testing in the spirit of AEP-55 [5] to determine the effectiveness of firing shelters. This includes:

- Charge adjustment of ammunition to achieve different strike velocities.
- Measurement of Muzzle and Strike Velocities.
- Measurement of target plate temperature.
- High Speed Digital Video (HSDV) footage of bullet interaction with target plate.
- Being able to hit the target point within 1 calibre of the aim point.

4. Experimental Design

4.1 Outline of Experimental Procedure

The trial shall be set up as per figure 2 & 3.

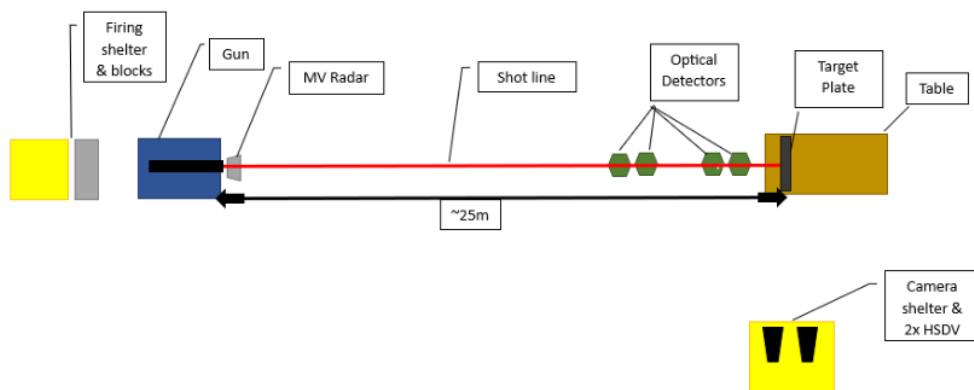


Figure 2 – Range layout plan view

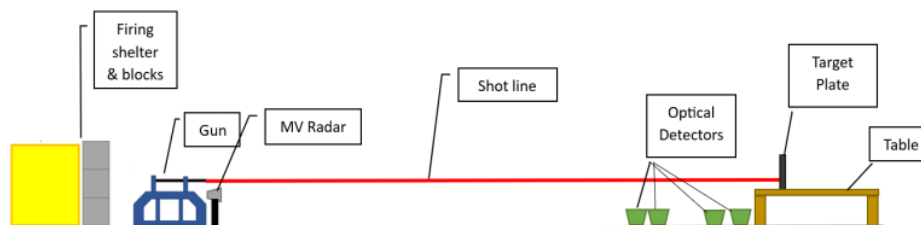


Figure 3 – Range layout side view

For the threat type the shelters will be most likely exposed to (ball rounds) AEP-55 states 22 rounds with no complete penetration must be achieved to give a 90% confidence level in the armour.



4.2 Data Collection

For each round fired the data required and capture methods are tabulated below in table 1.

Table 1 – Data Capture Requirements

Data Required	Capture Method
Muzzle Velocity	Weibel Doppler MV Radar
Strike Velocity	Weibel Doppler MV Radar, Optical Detectors, HSDV cameras
Interaction of round with target plate	HSDV cameras
Meteorological Data	Met Station
Shot Position	Tape measure
Penetration result	HSDV camera and witness screen
Charge weight	Scales

what are you going to demonstrate with these results?

4.3 Data Evaluation

Data capture at Pendine is in accordance with ISO/IEC 17025 UKAS [6] and the site holds accreditation so data is reliable. Data will be reviewed by the Principal Researcher to identify the threat level the firing shelters are proof against.

you say nothing how these data will be evaluated. what analytical approach will you take? is there any statistical analysis involved?

4.4 Risks & Limitations

A generic trials risk assessment for small arms activities at Pendine [7] exists and will be supplemented by a trials specific risk assessment. No university assets or personnel will be exposed to any risk. *what are these risks for which the risk assessment was produced?*

4.5 Ethical Issues

An ethics form has been completed [8] and submitted. There are no ethical issues with the conduct of this activity. *it's not a literature source!*

5. Resources & Planning

5.1 Physical Resources

Table 2 tabulates the resources required for this research, note the list is not exhaustive and covers the main elements.

Table 2 - Physical Resources

Item	Quantity
Target plates	4
Table	1
Weapon	1
Mount	1
Firing shelter	1
Camera shelter	1
Pendine blocks	As required <i>how many are required?</i>
MV Radar	1
Optical detectors	4
HSDV cameras	2
Met station	1
Mobile Ammunition Process Facility	1
Telehandler	1

5.2 Human Resources

Table 3 tabulates the staff required to undertake this research, note this list is for range staff only and doesn't include the plethora of background staff that enable trials to occur.

Table 3 - Human Resources

Job Title	Role	Quantity
Trials Manager	Responsible for trial delivery	1
Trials Conducting Officer	Weapon operation	1
Range Worker	Range construction and target movements	2
Instrumentation	Data capture	2
Photographer	HSDV operation and stills	1
Magazines Worker	Charge adjustment	1

6. Gantt Chart

See figures 4 to 6 for the planned dates activities will take place.

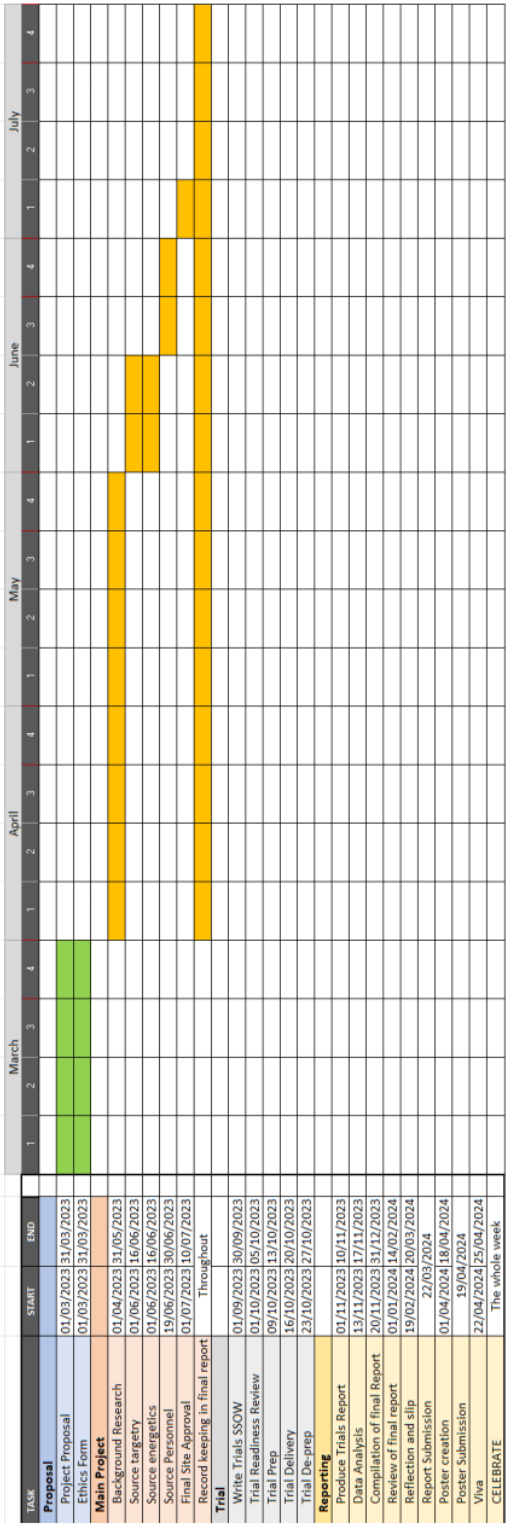


Figure 4 - Gantt Chart March '23 - July '23

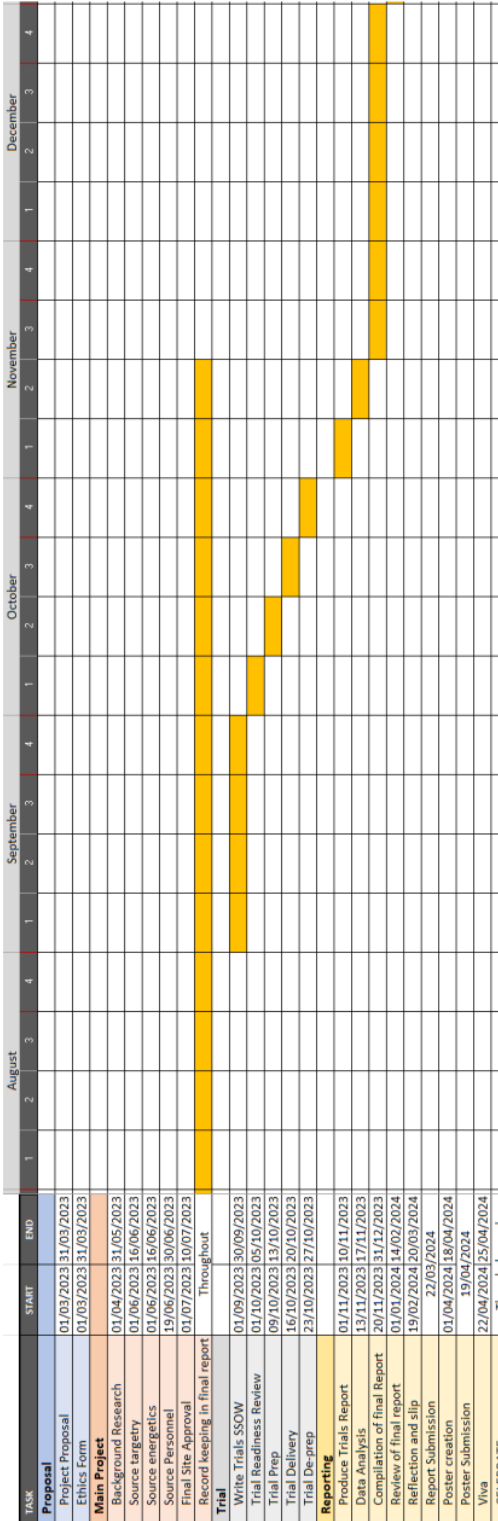


Figure 5 - Gantt Chart August '23 - December '23

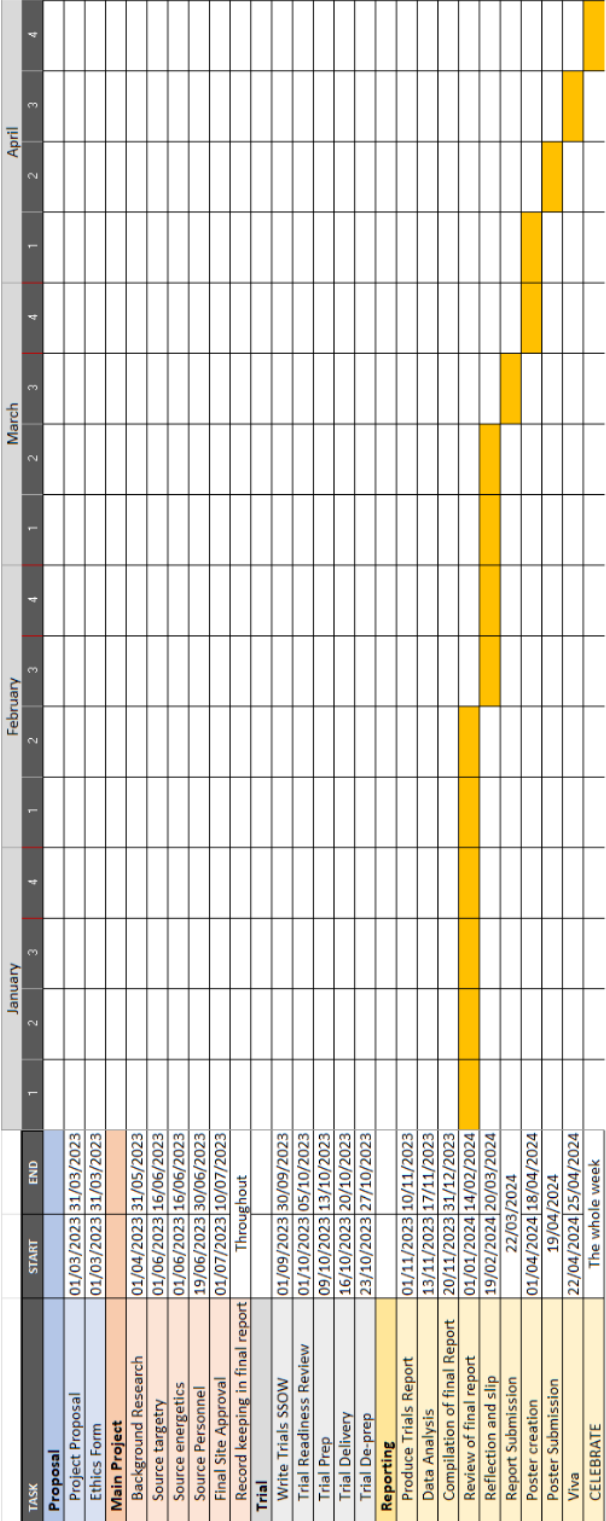


Figure 6 - Gantt Chart January '24 - April '24

7. References

- [1] I. Szachogłuchowicz, B. Fikus, K. Grzelak, . J. Kluczynski, J. Torzewski and J. Łuszczek, "Selective Laser Melted M300 Maraging Steel—Material Behaviour during Ballistic Testing," *Materials*, vol. 14, no. 2681, 2021.
- [2] A. Harris, B. Vaughan, J. Yeomans, P. Smith and S. Burnage, "Ballistic testing of surface-treated alumina and silicon carbide with improved adhesive bond strength," *Applied Ceramics Technology*, vol. 14, pp. 323-330, 2017.
- [3] E. Straßburger, "Ballistic testing of transparent armour ceramics," *Journal of the European Ceramic Society*, vol. 29, pp. 267-273, 2009.
- [4] G. G. Ojoc, C. pirvu, S. Sandu and L. Deleanu, "Standardization in testing ballistic protection systems," *IOP Conf. Series: Materials Science and Engineering*, vol. 724, 2020.
- [5] NATO, *Procedures for evaluating the protection level of armoured vehicles - Kinetic Energy and Artillery Threat*, NATO Standardization Agency, 2014.
- [6] "UKAS," [Online]. Available: <https://www.ukas.com/accreditation/standards/laboratory-accreditation/>*/i am not sure what is the relevance of this source*
- [7] G. Atkins, H. Walters, S. Bowen, A. Evans, G. Williams, J. Ashley-Jones, J. Gottwaltz, L. Hender and Y. Jackson, *Pendine Small Arms and Cannon Trials HARA*, Pendine: QinetiQ, 2022.
- [8] G. Atkins, *Application for ethical approval*, Swansea, 2023.

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GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

40/100

Intro / Aim & Objectives (150 words) 98 + 86 Project		
<i>Project title. Identification of a specific problem to be investigated. Well-defined aims and SMART objectives.</i>		
<i>Explaining why this project is worth doing. Discussion of what the project needs to do to be a success.</i>		
<i>Description of any deliverables that will be produced at the end of the project</i>		
The project title is too general. Can you specify the 'suitability' for what? 'Safety assessment of Pendine firing shelters'	20	7
The problem to be investigated is roughly stated. It lacks critical details to support its importance. Make it stronger.		
The aim is too general. Objectives are not SMART.		
Supporting details are missing. Explain the importance; why is this project worth doing		
There is no discussion of what the project needs to do to be a success.		
deliverables are not described		
Background to the Project / Literature Review (450 words) 126		
<i>Description of how the work to be done in the project relates to the</i>	20	6

<i>work identified in the literature review. Discussion of any ethical issues raised by the project Identifying what has already been done within the field. Topic familiarity. Brief literature review using appropriate sources – 6-8 journal papers and book chapters rather than just websites. Selection of relevant models & concepts.</i> Four sources are mentioned as relevant but this relevance is not explained. You claim that the ballistic testing methods used in the other papers would be useful in your research but you do not name any of them. No discussion of any ethical issues. I am convinced that you know this topic, but it is not very straightforward from the proposal. There is no analysis, synthesis, or evaluation of the concepts. No arguments are developed that would lead to logical conclusions Engagement with a limited range of relevant literature and credible sources (only 4 instead 6-8). Application for ethical approval is not a literature source.		
Project Design (200 words) ~200		
<i>Clear statement of which development methods are to be used and why they are appropriate.</i> <i>A clear statement of which tools are to be used and why they are appropriate.</i>	30	13

<i>A clear description of how data collected will be analysed</i> The methods to collect data are clearly stated but there is no explanation of what these data will demonstrate. You say nothing about how these data will be evaluated. what analytical approach will you take? is there any statistical analysis involved? what are the risks for which the risk assessment was produced?		
Resources / Planning (200 words) 144		
<i>List of any deliverables. Clear diagram showing both timing and resource use. Completed ethics form.</i> <i>Limited and relevant appendices</i> Deliverables not listed Very good Gantt charts The Ethics Form contains more relevant information in a more coherent form than the project proposal	15	8
Document Presentation		
Correct spelling. Grammar and punctuation. The flow of narrative/fluency. Coherence. Word processed. Correct use of referencing with	15	6

bibliography. Strict word limit for main text – 1000 words. Excellent spelling and punctuation. Some sentences difficult to understand Not very fluent Nor coherent Properly word-processed Referencing shows minor omission ([REF 6] no access date but IEEE format applied throughout Below the word limit. The background to the project /Literature review should be more extensive. The project plan is professionally structured and includes a title page with the title and student's name, a table of content corresponding to numbered sections, and subsections in the text. Page numbers are included and correspond to the numbers in the main body. Add the titles: Table of Figures and Table of Tables. There is no 'Conclusions' section nor 'Expected results' Low level of similarity Abbreviations must be explained when used first time in the text (e.g. RHA – rolled homogenous armor)		
TOTAL	100	40

Text Comment. List of Figures

Text Comment. List of Tables



Comment 1

this sentence is not very clear

Text Comment. grammar

Text Comment. explain



Comment 2

what are 'these 1500kg blocks'? develop this more

Text Comment. repetition



Comment 3

word 'conducted' repeated three times in two sentences. rephrase!

Text Comment. what are these methods?

Text Comment. explain

Text Comment. similar to what?



Comment 4

main concepts/findings of each of these publications should be described, analysed, critically assessed



Comment 5

what are the results of test at Pendine? what methods were used?



Comment 6

these procedures and data capture requirements should be described here



Comment 7

protection from what? Explain what are the potential risks.

PAGE 4



Comment 8

How this applies to buildings?



Comment 9

These two figures show exactly the same thing. Choose only one.



Comment 10

this sentence is not clear. you are trying to combine too many concepts in just one phrase.

PAGE 5

Text Comment. what are you going to demonstrate with these results?

Text Comment. you say nothing how these data will be evaluated. what analytical approach will you take? is there any statistical analysis involved?

Text Comment. what are these risks for which the risk assessment was produced?

Text Comment. it's not a literature source!

Text Comment. how many are required?

PAGE 6

PAGE 7

PAGE 8

PAGE 9

PAGE 10

Text Comment. i am not sure what is the relevance of this source