

Major_Project_Proposal_Planar _Wave_Generator_1906968

by Thomas Harwood

Submission date: 26-Mar-2023 10:38AM (UTC+0100)

Submission ID: 200531795

File name:

18042_Thomas_Harwood_Major_Project_Proposal_Planar_Wave_Generator_1906968_487262_2059744784.docx
(707.42K)

Word count: 4549

Character count: 23465

Major Project Proposal 2023/24

Design and Fabrication of an Explosive Plane Wave Generator for use in explosive
formulation testing.

L6 - OME Major Project (Year 4 - Sept 2019 Cohort) (ACDA6017)

Thomas A Harwood (1906968)

University of Wales Trinity Saint David

DSTL/PUB147961

UK UNCLASSIFIED

Introduction

Project Title.  1

Design and Fabrication of an Explosive Plane Wave Generator for use in explosive formulation testing.

Project Brief

To carry out explosive testing, a high precision planar detonation wave is required. The Commercial Off The Shelf (COTS) solution is very expensive and doesn't fit the dimensions of the test item, so a proprietary solution is required this will also feed in to future capability development.  2

Aims and Objectives.

 3 Design a proprietary Single Point Initiated Planar Wave Generator (SPIPWG) based on past research.

- The proof of concept and design of the SPIPWG must prove to be more cost effective than the COTS Solution and must be completed by the start of July 2023*.

Model the design of the Planar Wave Generator (PWG) to inform design changes and the manufacture process.

- The modelling of the design must provide tangible data that supports the proof of concept by the start of August 2023*.

Manufacture the proprietary PWG in a way that enables modifications and optimisation during the trial.

- The fabrication of the PWG must be completed to the test specification and be completed prior the start of the full scale trial.

Test the PWG in a full scale trial to evaluate the PWG using appropriate instrumentation to characterise the detonation wave.

- The completion of the full scale trial and thus the production of high speed video and fibre probe data must be completed prior to the end of October 2023*.

Analyse the results produced from the full scale trial to inform design optimisation if required, and to record lessons learnt to direct future formulation trials.

- The analysis of the results and the final trials report must be review and completed by the end of the 2023 calendar year*.

*All dates mentioned In the Aims and Objectives listed above are initial deadlines and may change depending on the projects forecasting after the start of the next financial year.  4

Project Outputs

A proprietary PWG would enable the cost effective testing of energetic formulations to generate fundamental equation of state data to feed into high fidelity computational modelling. This will increase the accuracy and predictive power of the computational models increasing quality and cost effectiveness of energetic research tasks. To ensure this project is a success it needs to produce a cost effective and reproducible planar detonation wave.  5

Project Deliverables

- Presentation of the Design and Modelling solution of the PWG
- Risk Assessment and Trials Plan for an evaluation trial of the manufactured PWG
- Authoring a trials report which collates and analyses the outcomes and conclusions of the evaluation trial and any recommendations for further work.

Project Background



This project requires the design, development and testing of a PWG, in order to complete this task a planar wave generating method must be ^{developed} utilising the knowledge of the techniques from the literature review to produce the proprietary system.



Ethical Issues



There are minimal ethical issues with this project, due to this project not including any living subject involvement. Therefore there is no requirement to acquire informed consent, protect confidentiality and respect the right to withdraw. This project will not include any form of deceptive behaviour or exaggeration.

Literature Review

Single point initiated detonations usually result in a curved detonation waves, however it is desirable to achieve a straight line detonation wave for research purposes [1]. A method of achieving this planar wave front from single point initiations ^{is} by using a COTS wedge test set-up [2]. A Comparison between a COTS Rowanex 1100 Wedge Test and a modular test set-up illustrate comparative results [3], suggesting that a more cost effective proprietary system is achievable. Introducing an air-metal barrier into a test set-up is a possible solution to create that single point initiated planar wave [4]. Alternatively, manufacturing isosceles triangular sheets of explosives with a specific perforation pattern can also create a similar planar wave front [1]. The effects of a PWG can be modelled using a computational modelling package with the outputs being used to inform any improvements to the design [5].



Models & Concepts

Rankine-Huguenot Conditions - The point at which a sound wave transitions to a shock wave while travelling through and explosive material. [6]

Planar Wave form - The blast wave of a detonation event which appears flat in all dimensions. [7]

Equation of State (EoS) - An equation which predicts the relationship between a materials density, pressure, temperature and volume. [8]

Jones-Wilkin-Lee (JWL) - a Type of EoS Which defines a materials expansion during a detonation reaction. [9]

Project Design

Development Methods

The development methods used to ensure the success of this project are Analysis and Design, Engineering and Pre-Fabrication Testing. These development methods are appropriate to this style of project as they are used in collaboration to ensure the production of a successful SPIPWG which will supply fundamental information for future projects.

Project Tools

The success of this projects depends on the design of the SPIPWG and the production of the planar wave. Impetus modelling software will be used to ensure the proposed design achieves these goals prior to the manufacturer a full scale trial, this tool will enable the optimisation of the design prior to the physical test.

Data Collection

High Speed Video and Fibre Probes will detect the break out point of the detonation wave along the surface of the PWG and this will be plotted in a 3 axis graph to illustrate how planar the detonation wave is.

Resources and Planning

List of Deliverables

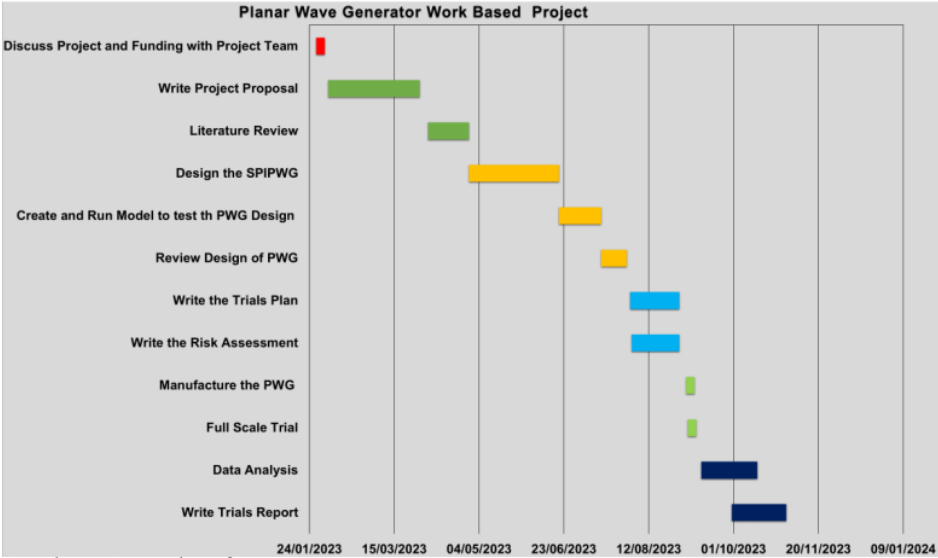
- 1. Design and Modelling Presentation
- 2. Risk Assessment
- 3. Trials Plan
- 4. Trial Report

Time and Resources

Planar Wave Generator Final Year Project	Start (Date)	End (Date)	Duration (Days)**
Discuss Project and Funding with Project Team	28/01/2023	02/02/2023	5
Write Project Proposal	04/02/2023	30/03/2023	54
Literature Review	04/04/2023	28/04/2023	24
Design the SPIPWG	28/04/2023	20/06/2023	53
Create and Run Model to test th PWG Design	20/06/2023	15/07/2023	25
Review Design of PWG	15/07/2023	30/07/2023	15
Write the Trials Plan	01/08/2023	30/08/2023	29
Write the Risk Assessment	02/08/2023	30/08/2023	28
Manufacture the PWG	03/09/2023	08/09/2023	5
Full Scale Trial	04/09/2023	09/09/2023	5
Data Analysis	12/09/2023	15/10/2023	33
Write Trials Report	30/09/2023	01/11/2023	32
Write Dissertation	01/10/2023	09/03/2024	160

** Days suggested in this Column are estimations and should not be counted as full days

Table 1 – Timing plan for Major Project



Graph 1 – Gantt chart for project timings

FOR ETHICAL APPROVAL

In order for research to result in benefit and minimise risk of harm, it must be conducted ethically.

The University follows the OECD Frascati manual definition of **research activity**: “creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications”. As such this covers activities undertaken by members of staff, postgraduate research students, and both taught postgraduate and undergraduate students working on dissertations/projects.

The individual undertaking the research activity is known as the “principal researcher”.

This form must be completed and approved prior to undertaking any research activity.

SECTION A: About You (Principal Researcher)

1	Full Name:	Thomas Harwood
2	Student Number:	1906968
3	Email address:	1906968@student.uwtsd.ac.uk tharwood@dstl.co.uk
4	Programme of Study:	BSc (Hons) Ordnance, Munitions & Explosives (Technical Research & Development)
5	Director of Studies/Supervisor:	Gareth Collett

SECTION B: Internal and External Ethical Guidance Materials

	Please list the core ethical guidance documents that have been referred to during the completion of this form (including any discipline-specific codes of research ethics, location-specific codes of research ethics, and also any specific ethical guidance relating to the proposed methodology). Please tick to confirm that your research proposal adheres to these codes and guidelines. You may add rows to this table if needed.	
1	UWTSD Research Ethics & Integrity Code of Practice	☒
2	UWTSD Research Data Management Policy	☒
3		☐

SECTION C: Details of Research Activity

1	Indicative title:	Design and Fabrication of an Explosive Plane Wave Generator for use in explosive formulation testing.		
2	Proposed start date:	April 2023	Proposed end date:	February 2024
Introduction to the Research (maximum 300 words in each section) Ensure that you write for a <u>Non-Specialist Audience</u> when outlining your response to the three points below: • <i>Purpose of Research Activity</i> • <i>Proposed Research Question</i> • <i>Aims of Research Activity</i> • <i>Objectives of Research Activity</i> Demonstrate, briefly, how Existing Research has informed the proposed activity and explain • <i>What the research activity will add to the body of knowledge</i>				

	How it addresses an area of importance.
3	Purpose of Research Activity To carry out explosive testing, a high precision planar detonation wave is required. The Commercial Off The Shelf (COTS) solution is very expensive and doesn't fit the dimensions of the test item, so a proprietary solution is required this will also feed in to future capability development. (this box should expand as you type)
4	Research Question Design and Fabrication of an Explosive Plane Wave Generator for use in explosive formulation testing. (this box should expand as you type)
5	Aims of Research Activity Design a proprietary Single Point Initiated Planar Wave Generator (SPIPWG) based on past research. Model the design of the Planar Wave Generator (PWG) to inform design changes and the manufacture process. Manufacture the proprietary PWG in a way that enables modifications and optimisation during the trial. Test the PWG in a full scale trial to evaluate the PWG using appropriate instrumentation to characterise the detonation wave. Analyse the results produced from the full scale trial to inform design optimisation if required, and to record lessons learnt to direct future formulation trials. (this box should expand as you type)
6	Objectives of Research Activity The proof of concept and design of the SPIPWG must prove to be more cost effective than the COTS Solution and must be completed by the start of July 2023*. The modelling of the design must provide tangible data that supports the proof of concept by the start of August 2023*. The fabrication of the PWG must be completed to the test specification and be completed prior the start of the full scale trial. The completion of the full scale trial and thus the production of high speed video and fibre probe data must be completed prior to the end of October 2023*. The analysis of the results and the final trials report must be review and completed by the end of the 2023 calendar year*. *All dates mentioned In the Aims and Objectives listed above are initial deadlines and may change depending on the projects forecasting after the start of the next financial year. (this box should expand as you type)
Proposed data collection methods (maximum 600 words)	

	Provide a brief summary of all the methods that may be used in the research activity to collect data, making it clear what specific techniques may be used. If methods other than those listed in this section are deemed appropriate later, additional ethical approval for those methods will be needed. You do not need to justify the methods here, but should instead describe how you intend to collect the data necessary for you to complete your project.
7	High Speed Video and Fibre Probes will detect the break out point of the detonation wave along the surface of the PWG and this will be plotted in a 3 axis graph to illustrate how planar the detonation wave is. (this box should expand as you type)

SECTION D: Scope of Research Activity

	Will the research activity include:	YES	NO
1	Use of a questionnaire or similar research instrument?	☐	☒
2	Use of interviews?	☐	☒
3	Use of focus groups?	☐	☒
4	Use of participant diaries?	☐	☒
5	Use of video or audio recording?	☐	☒
6	Use of computer-generated log files?	☐	☒
7	Participant observation with their knowledge?	☐	☒
8	Participant observation without their knowledge?	☐	☒
9	Access to personal or confidential information without the participants' specific consent?	☐	☒
10	Administration of any questions, test stimuli, presentation that may be experienced as physically, mentally or emotionally harmful / offensive?	☐	☒
11	Performance of any acts which may cause embarrassment or affect self-esteem?	☐	☒
12	Investigation of participants involved in illegal activities?	☐	☒
13	Use of procedures that involve deception?	☐	☒
14	Administration of any substance, agent or placebo?	☐	☒
15	Working with live vertebrate animals?	☐	☒
16	Procedures that may have a negative impact on the environment?	☐	☒
17	Other primary data collection methods. Please indicate the type of data collection method(s) below.		
	Details of any other primary data collection method: (this box should expand as you type)	☐	☒

If you have ticked NO to every question then the research activity is (ethically) low risk and you may skip section E and continue to section F.

If YES to any question, then no research activity should be undertaken until full ethical approval has been obtained.

SECTION E: Intended Participants

Who are the intended participants:		
------------------------------------	--	--

		YES	NO
1	Students or staff at the University?	☐	☐
2	Adults (over the age of 18 and competent to give consent)?	☐	☐
3	Vulnerable adults?	☐	☐
4	Children and Young People under the age of 18? (Consent from Parent, Carer or Guardian will be required)	☐	☐
5	Prisoners?	☐	☐
6	Young offenders?	☐	☐
7	Those who could be considered to have a particularly dependent relationship with the investigator or a gatekeeper?	☐	☐
8	People engaged in illegal activities?	☐	☐
9	Others. Please indicate the participants below, and specifically any group who may be unable to give consent.	☐	☐
	Details of any other participant groups: Complete this only if your participants cannot give consent. This includes animals (this box should expand as you type)		

	Participant numbers and source Provide an estimate of the expected number of participants. How will you identify participants and how will they be recruited?	
10	How many participants are expected?	0 (this box should expand as you type)
11	Who will the participants be?	 (this box should expand as you type)
12	How will you identify the participants?	 (this box should expand as you type)

	Information for participants:	YES	NO	N/A
13	Will you describe the main research procedures to participants in advance, so that they are informed about what to expect?	☐	☐	☐
14	Will you tell participants that their participation is voluntary?	☐	☐	☐
15	Will you obtain written consent for participation?	☐	☐	☐
16	Will you explain to participants that refusal to participate in the research will not affect their treatment or education (if relevant)?	☐	☐	☐
17	If the research is observational, will you ask participants for their consent to being observed?	☐	☐	☐
18	Will you tell participants that they may withdraw from the research at any time and for any reason?	☐	☐	☐
19	With questionnaires, will you give participants the option of omitting questions they do not want to answer?	☐	☐	☐
20	Will you tell participants that their data will be treated with full confidentiality and that, if published, it will not be identifiable as theirs?	☐	☐	☐
21	Will you debrief participants at the end of their participation, in a way appropriate to the type of research undertaken?	☐	☐	☐
22	If NO to any of above questions, please give an explanation			
	(this box should expand as you type)			

	Information for participants:	YES	NO	N/A
24	Will participants be paid?	☐	☐	☐
25	Is specialist electrical or other equipment to be used with participants?	☐	☐	☐
26	Are there any financial or other interests to the investigator or University arising from this study?	☐	☐	☐
27	Will the research activity involve deliberately misleading participants in any way, or the partial or full concealment of the specific study aims?	☐	☐	☐
28	If YES to any question, please provide full details			
	<i>(this box should expand as you type)</i>			

SECTION F: Anticipated Risks

	Outline any anticipated risks that may adversely affect any of the participants, the researchers and/or the University, and the steps that will be taken to address them.	
1	Risks to participants For example: sector-specific health & safety, emotional distress, financial disclosure, physical harm, transfer of personal data, sensitive organisational information. If you have identified in section D that there are no participants then enter N/A and go skip to question 3.	
	Risk to participants: n/a <i>(this box should expand as you type)</i>	How you will mitigate the risk to participants: <i>(this box should expand as you type)</i>
2	If research activity may include sensitive, embarrassing or upsetting topics (e.g. sexual activity, drug use) or issues likely to disclose information requiring further action (e.g. criminal activity), give details of the procedures to deal with these issues, including any support/advice (e.g. helpline numbers) to be offered to participants. Note that where applicable, consent procedures should make it clear that if something potentially or actually illegal is discovered in the course of a project, it may need to be disclosed to the proper authorities	
	<i>(this box should expand as you type)</i>	
3	Risks to the investigator For example: personal health & safety, physical harm, emotional distress, risk of accusation of harm/impropriety, conflict of interest	
	Risk to the investigator:  <i>(this box should expand as you type)</i>	How you will mitigate the risk to the investigator: <i>(this box should expand as you type)</i>
4	University/institutional risks For example: adverse publicity, financial loss, data protection	
	Risk to the University: n/a <i>(this box should expand as you type)</i>	How you will mitigate the risk to the University: <i>(this box should expand as you type)</i>
5	Environmental risks For example: accidental spillage of pollutants, damage to local ecosystems	
	Risk to the environment: Environmental impact of using explosives <i>(this box should expand as you type)</i>	How you will mitigate the risk to environment: Reduce the amount of explosive used to the minimal amount required to achieve reliable data. <i>(this box should expand as you type)</i>

SECTION G: Feedback, Consent and Confidentiality

If you have identified in section D that there are no participants then enter skip this section and continue to section H.

1	Feedback What de-briefing and feedback will be provided to participants, how will this be done and when? You don't need to email your participants with your final report. A good alternative is to set up an email address that they will be able to contact for further details or results. (this box should expand as you type)
2	Informed consent Describe the arrangements to inform potential participants, before providing consent, of what is involved in participating. Describe the arrangements for participants to provide full consent before data collection begins. If gaining consent in this way is inappropriate, explain how consent will be obtained and recorded in accordance with prevailing data protection legislation. If you are using a paper questionnaire then you should have the participants sign an appropriate consent form. These forms will count as personal data and should be noted as such in section J. If you are using an online questionnaire, then you should have a screen before the questions start that acts as a consent form, informing participants that by clicking on the NEXT button they are providing consent. (this box should expand as you type)
3	Confidentiality / Anonymity Set out how anonymity of participants and confidentiality will be ensured in any outputs. If anonymity is not being offered, explain why this is the case. Do not collect names unless you really need them. Do not name participants or organisations in any research publications (including the thesis) without their explicit permission. (this box should expand as you type)

SECTION H: Data Protection and Storage

	Does the research activity involve personal data (as defined by the General Data Protection Regulation 2016 "GDPR" and the Data Protection Act 2018 "DPA")?	YES	NO
1	"Personal data" means any information relating to an identified or identifiable natural person ('data subject'). An identifiable natural person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person. Any video or audio recordings of participants is considered to be personal data.	☐	☐
	If YES, provide a description of the data and explain why this data needs to be collected:		
2	This includes audio/video data of participants, but can also include IP addresses and usernames. Names, addresses and emails also count, as do consent forms. (this box should expand as you type)		
	Does it involve special category data (as defined by the GDPR)?	YES	NO
3	"Special category data" means sensitive personal data consisting of information as to the data subjects' – (a) racial or ethnic origin, (b) political opinions, (c) religious beliefs or other beliefs of a similar nature, (d) membership of a trade union (within the meaning of the Trade Union and Labour Relations (Consolidation) Act 1992), (e) physical or mental health or condition,	☐	☒

	(f) sexual life, (g) genetics, (h) biometric data (as used for ID purposes),		
	If YES, provide a description of the special category data and explain why this data needs to be collected:		
4	What counts as 'sensitive' will differ between cultures. Any information on behaviour that is not in accordance with cultural norms would count as sensitive personal data. (this box should expand as you type)		

	Will data from the research activity (collected data, drafts of the thesis, or materials for publication) be stored in any of the following ways?	YES	NO
5	Manual files (i.e. in paper form)?	☒	☐
6	University computers?	☐	☒
7	Private company computers?	☒	☐
8	Home or other personal computers?	☐	☒
9	Laptop computers/ CDs/ Portable disk-drives/ memory sticks?	☒	☐
10	"Cloud" storage or websites?	☐	☒
11	Other – specify:	☐	☒
12	For all stored data, explain the measures in place to ensure the security of the data collected, data confidentiality, including details of backup procedures, password protection, encryption, anonymisation and pseudonymisation: If possible, save your data on computers that are secure and regularly backed up. Many cloud services only provide GDPR-compliant storage for business customers. An example of suitable text is given below. <i>All data will be kept in password protected cloud storage on the University Office 365 system which will not be shared. Audio/visual data will be transcribed and would be shown to participants to check accuracy of reporting. Any USB sticks used to store or transfer data will be password protected. All participants will be given a unique identifier to ensure confidentiality and this list will be kept securely in the password protected folder.</i> (this box should expand as you type)		

Data Protection			
	Will the research activity involve any of the following activities:	YES	NO
13	Electronic transfer of data in any form?	☒	☐
14	Sharing of data with others at the University outside of the immediate research team?	☐	☒
15	Sharing of data with other organisations?	☒	☐
16	Export of data outside the UK or importing of data from outside the UK?	☐	☒
17	Use of personal addresses, postcodes, faxes, emails or telephone numbers?	☐	☒
18	Publication of data that might allow identification of individuals?	☐	☒
19	If YES to any question, please provide full details, explaining how this will be conducted in accordance with the GDPR and Data Protection Act (2018) (and/or any international equivalent): This includes data such as drafts of your thesis as well as experimental or survey data. An example of suitable text is given below. <i>All data will be encrypted and kept in password protected cloud storage on the University Office 365 system which will not be shared. Any USB sticks used to store or transfer data will be password protected. All data</i>		

	<i>transfers will be encrypted and password protected. All participants will be given a unique identifier to ensure confidentiality and this list will be kept securely in the password protected folder. The data will be stored until the completion of the project and then deleted. In accordance with the DPA2018, participants will have the right to ask to see what data is held relating to them, and this data will be deleted immediately if the participant requests this, in which case the data will not be used in the project.</i> <i>(this box should expand as you type)</i>	
20	List all who will have access to the data generated by the research activity:	
	Principle Researcher, Supervisor and Industry Employer	
	<i>(this box should expand as you type)</i>	
21	List who will have control of, and act as custodian(s) for, data generated by the research activity:	
	Principle Researcher and Industry Employer	
	<i>(this box should expand as you type)</i>	
22	Give details of data storage arrangements, including security measures in place to protect the data, where data will be stored, how long for, and in what form.	
	<i>All data will be encrypted and kept in password protected cloud storage on the University Office 365 system which will not be shared. Any USB sticks used to store or transfer data will be password protected, and will be reformatted at the end of the project in order to destroy the data. The data will be stored until the completion of the project and then deleted.</i> <i>(this box should expand as you type)</i>	
22	Confirm that you have read the UWTSD guidance on data management (se)	☒
23	Confirm that you are aware that you need to keep all data until after your research has completed or the end of your funding	☒

SECTION I: Declaration

	The information which I have provided is correct and complete to the best of my knowledge. I have attempted to identify any risks and issues related to the research activity and acknowledge my obligations and the rights of the participants. In submitting this application I hereby confirm that I undertake to ensure that the above named research activity will meet the University's Research Ethics and Integrity Code of Practice which is published on the website: https://www.uwtsd.ac.uk/research/research-ethics/		
1	Signature of applicant:		Date: 14/03/2023
2	Director of Studies/Supervisor:	Gareth Collett	Date:
3	Signature:		

FOR INTERNAL USE ONLY:

	Ethical approval given		
1	Signature of assessor:		Date:
2	Name:		

References

 15

- [1] J. F. S. S. A. Weckert, "Explosive Line Wave Generators," Weapons and Counter Measures Division, Defence Science and Technology Organisation, Edinburgh South Australia, Australia, 2013.
- [2] BAE Systems, "Detonics Course," BAE Systems UK, Glascoed, 2021.
- [3] D. J. Mann, "UK Wedge Tests on Rowanex 1100," QinetiQ Ltd, Farnborough, 2006.
- [4] Wei Xiong, Xian-feng Zhang, Zhong-wei Guan, Yong He, Liang Qiao, Li-li Guo, "Study of simple plane wave generator with an air-metal barrier," *Defence Technology*, vol. 10, no. 2, pp. 190-197, 2014.
- [5] Bradley W. White, Robert V. Reeves, Eric V. Bukowsky, Michael D. Grapes, Steven T. Pease, "Computational Modeling of Detonations in Branching HE Structures for Plane Wave Generator Applications," Lawrence Livermore National Laboratory, Livermore, CA, 2018.
- [6] UKMOD, "Hugoniot," *JSP 333 Service Textbook of Explosives*, no. 1, p. Glossary 22, 2020.
- [7] S. I. Jackson, J. M. Austin, J. E. Shepherd, "Planar Detonation Wave Initiation in," California Institute of Technology,, Pasadena, 2006.
- [8] W. H. Lee, *Computer Simulation of Shaped Charge Problems*, Singapore: World Scientific Publishing Co Ltd, 2006.
- [9] C. M. Tarver, "Jones–Wilkins–Lee Unreacted and Reaction Product Equations of State for Overdriven Detonations in Octogen- and Triaminotrinitrobenzene-Based Plastic-Bonded Explosives," *The Journal of Physical Chemistry A*, vol. 124, no. 7, p. 1399–1408, 2020.
- [10] Ministry of Defence, "EXPLOSION PROCESSES," *JSP 333- Services Textbook of Explosives*, vol. Chapter 7, no. 1, pp. 11-16, 2020.

 16

Major_Project_Proposal_Planar_Wave_Generator_1906968

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

72/100

Intro / Aim & Objectives (150 words)		426
<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 in order to be a success.</i>		
<i>Description any deliverables that will be produced at the end of the project</i>		
The title provides clear information on the purpose of the project	20	14
In the project brief, the problem to be investigated is identified which explains why the project is worth doing		
Sound use of SMART aims and objectives. All aims are very clearly specified. The objectives show what the project needs to do to be successful but there is not much discussion.		
Three clear deliverables are provided. This section is over the word limit		
Background to the Project / Literature Review (450 words) 266		
<i>Description of how the work to be done in the project relates to the work identified in the literature review. Discussion of any ethical issues raised by the project Identifying what</i>	20	15

<i>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> An explanation of why there are no ethical issues is provided You show familiarity and understanding of the topic The relevant literature (mainly books and journal articles) you used demonstrates the relationship between your proposed project and previous work. Models from the literature are relevant This section is below the word limit		
Project Design (200 words) 146		
<i>Clear statement of which development methods are to be used and why they are appropriate.</i> <i>Clear statement of which tools are to be used and why they are appropriate.</i> <i>Clear description of how data collected will be analysed</i> The selection of methods and tools proposed for this project is described and justified but below the expected word limit	30	24
Resources / Planning (200 words)		

<i>List of any deliverables. Clear diagram showing both timing and resource use. Completed ethics form.</i> <i>Limited and relevant appendices</i> List of deliverables provided and used to build the Gantt chart Completed and signed Ethics Form is submitted	15	11
Document Presentation		
Correct spelling. Grammar and punctuation. Flow of narrative/fluency. Coherence. Word processed. Correct use of referencing with bibliography. Strict word limit for main text – 1000 words. Pay more attention to spelling, grammar, and punctuation. Some mistakes are shown within the text. Use Editor or Grammarly Rather good flow, coherent due to understanding of the topic, affected occasionally by grammar errors IEEE referencing method used with confidence. Errors in authors' names The project plan is within the required word limit	15	8

Tables of content, figures, and tables not included		
TOTAL	100	72

PAGE 1

PAGE 2



Comment 1

there is no need to repeat the title here; use these words for more relevant details of your project



Comment 2

good justification why this project is important



Comment 3

what research? reference(s) would be needed here



Comment 4

very thoughtful note



Comment 5

coma; punctuation

PAGE 3



Comment 6

punctuation!



Comment 7

'In order to...' should be a new sentence

Text Comment. developed



Comment 8

grammar!



Comment 9

do you think that project related to formulation of new explosives for applications different than mining, quarry, etc does not raise ethical issues?



Comment 10

why straight line is desirable?

Text Comment. is



Comment 11

explain in footnote what isosceles triangular sheets of explosives are

PAGE 4

PAGE 5



Comment 12

literature review should be extended

PAGE 6

PAGE 7



Comment 13

it seems quite tight

PAGE 8

PAGE 9

PAGE 10



Comment 14

no comment

PAGE 11

PAGE 12



Comment 15

S. A. Weckert, J. Freundt, S. Stojko

these are the authors



Comment 16

be consistent when listing authors' names (use either full first names or initials)