Australian Universities Rocket Competition 2018/2019

Project Technical Report - Tasking Statement

1 Introduction

The purpose of the Project Technical Report (PTR) is for your team to document and present the culmination of all of your work as part of the AURC. This document will also serve as the design baseline to which the AURC will be comparing your actual launch vehicle to at Thunda Down Under 2019. As such, it is pertinent that any major design changes that occur after the submission of the PTR be reported to the AURC Committee prior to Thunda Down Under 2019.

As per the latest *AURC Scoring* document (Rev 1.3), the Project Technical Report is worth 55 out of the total 250 marks for the AURC. However, it is expected that teams include all information necessary for the AURC to concurrently mark your Virtual Vehicle Design (17.5/250 marks) and Analytical Simulation/Analysis (17.5/250 marks) criteria whilst marking your Project Technical Report.

The PTR has a 55-page limit. This page limit is from the introduction to the conclusion; appendices are excluded from the page limit but are not to be used for storing run-over from the report body. If your report exceeds the page limit, a 10% deduction will be applied to your final mark (e.g. a score of 35/55 that exceeded the page limit would result in a final mark of 31.5/55).

The report should aim to address the points outlined in the Required Information section as a minimum. From the perspective of the AURC Committee, reports that show evidence of the system's engineering process will be looked upon favourably. Furthermore, teams may organise the PTR as they wish, however, all formatting must comply with the MEA Report Writing Guide (https://www.eait.uq.edu.au/filething/files/get/teaching_learning_docs/MEA_Rep_Write_Guide_2011.pdf).

Reports will be evaluated for both their overall quality and compliance with the marking criteria as well as the technical aptitude of the team that is reflected through the document. In addition, the PTR should be written such that an audience who have a technical background, but may not be experts in high power rocketry, could understand and be able to clearly judge your team's performance.

The PTR will be marked/peer assessed by engineers in industry. Alternatively, if your team does not wish for your report to be marked by an industry representative please advise the AURC Committee in writing before the 18th March 2019 and engineers on the AURC Committee will instead be asked to mark your team's report.

NOTES:

1. Teams will have a period of 1 week after the release of marks and feedback for the PTR to request clarification on their mark. After this 1-week period has lapsed the AURC Committee will not be providing any additional feedback on the marking of the project technical report.
2. The Project Technical Report is due on the 18th March 2019, unless your team contacts the AURC Committee prior and provides suitable justification to warrant an extension.

2 Required Information

The following information shall be included in the Project Technical Report:

- Executive Summary (2.5%)
- Introduction (4%)
- Project Scope, Assumptions and Constraints (12.5%)
    - Shall also identify and document all key project requirements.
- System Architecture (38%)
    - Requires both an overall system diagram and a detailed overview of each of your relevant sub-systems.
    - Minimum required sub-systems to be detailed and included:
        - Propulsion system
        - Aero-structural system
        - Recovery system
        - Payload system
        - Electrical/avionics system
- Overall System Performance (15%)
    - Analysis of trajectory simulation results.
    - Sensitivity analysis of your flight performance.
- Operational Architecture (10%)
    - Identification of mission phases.
    - Description of the nominal operations of all sub-systems during each mission phase.
    - Identification of what mission events signify a mission phase transition.
- Risk Assessment (10%)
    - DFMEA - Design Failure Modes and Effect Analysis
        - Identification of at least ten Design Failure Modes
        - Rank their Severity, Occurrence and Detectability
        - Appropriate risk mitigation, leading to new Severity, Occurrence and Detectability of that Design Failure Mode
        - Use an appropriate spreadsheet.

      Hints for DFMEA: The DFMEA focuses on how the design can malfunction, become fatigued, or cause harm when being used by an operator.
    - PFMEA - Process Failure Modes and Effect Analysis
        - Identification of at least ten Process Failure Modes
        - Rank their Severity, Occurrence and Detectability
        - Appropriate risk mitigation, leading to new Severity, Occurrence and Detectability of that Process Failure Mode
        - Use an appropriate spreadsheet.

      Hints for PFMEA: The PFMEA focuses on how a process affects the product, such that there is a negative impact on product quality, reliability, safety or environmental hazard.

    - *Further hints:*
        - *You cannot use a risk mitigation strategy to reduce the severity of a failure mode;*
        - *It is most desirable to reduce the occurrence and eliminate any possibility of it occurring at all, but if this cannot be changed, then increasing the detectability is the next best;*
        - *The Risk Priority Number shows how important managing that failure mode is to ensure a safe design and achieve mission success, for numbers that are sufficiently high a mitigation strategy is required;*
        - *Use a rubric when ranking severity, occurrence and detectability that is standard across all your failure modes;*
        - *A design/process can have multiple failures modes.*
    - *An example DFMEA and PFMEA has been attached.*
- Conclusions and Lessons Learnt (3%)
    - Main conclusions of the report/the project/your design.
    - What could have been done better?
- Appendix (2.5%)
    - Must include the following:
        - Technical drawings (Assembly drawings, system drawings, wiring diagrams, mechanical drawings, etc.) – must include all relevant drawings necessary to manufacture your system [Required for the marking of your Virtual Vehicle Design component].
        - Parts and Materials List (to complement your mechanical and electrical assembly and manufacturing drawings) [Required for the marking of your Virtual Vehicle Design component].
        - Launch preparation procedure including your assembly, pre-flight procedure, launch and post-flight steps.
        - Flight performance data (that is not already covered in the Overall System Performance section).
        - ACO details and L3 approval [if applicable].
        - Final budget breakdown.
        - Any details of previous testing, including test flights or sub-system tests.

[NOTE: Remaining 2.5% of the PTR marks allocated to general formatting, spelling, grammar and punctuation.]

Furthermore, the following items should be addressed/included throughout the relevant sections of the PTR in order to meet the criteria for the Virtual Vehicle Design (17.5 marks) and the Analytical Simulation/Analysis (17.5) components of the AURC:

Virtual Vehicle Design

- CAD model.
- Drawings:
    - Mechanical drawings compliant with AS1100 or equivalent.
    - Circuit/Wiring diagrams compliant with AS1103 or equivalent.
- Model tree and assembly drawings.

Analytical Simulation/Analysis

- Utilise results from modelling/simulation to justify design decisions and prove that your systems are safe and will meet your mission requirements.
- Minimum required:
    - OpenRocket model plus [optional] other trajectory software model.
    - Structural analysis/simulation – verify structural integrity of the launch vehicle (modal, static, etc.).
    - Electrical analysis/simulation – verify that your design will function as expected.

3 Submission Details

As part of your team's Project Technical Report submission your team will be required to upload the following items to the portal that will be made available on the AURC's website (http://aurc.ayaa.com.au/):

1. Project Technical Report - including all justification supporting your Virtual Vehicle Design and your Analytical Simulation/Analysis components of the AURC.
2. Your team's most up to date OpenRocket file at the time of the Project Technical Report's submission.

Note that your team's OpenRocket file will be reviewed as part of your team's Analytical Simulation/Analysis marking criteria.

4 Marking Rubric

4.1 Project Technical Report

Criteria	Poor (0) Poor quality - This section requires numerous substantial corrections of grammatical errors, technical disambiguation and general scientific knowledge	Average (2.5) Average quality - This section requires some substantial correction of grammatical errors, technical disambiguation, and general scientific knowledge.	Excellent (5) Excellent quality - This section requires no substantial correction of grammatical errors, technical disambiguation, and general scientific knowledge.	Score
Executive Summary (2.5%)	No or limited attempt at providing the information outlined in the Excellent column. No evidence to suggest the writer knows the target audience of their document.	An adequate attempt is made at providing an overview of the project, with some mention of a few points outlined in the Excellent column. The Executive Summary somewhat manages to communicate to the reader the viability of the system.	Clear, concise and informative overview of: • High level project and program goals and objectives • Your launch vehicle, mission and altitude category • Design characteristics, key flight performance and payload objectives. • Highlight any unique design characteristics Executive Summary written in a fashion that provides the reader with all pertinent information necessary to make an informed decision about the probability of success of your mission.	
Introduction (4%)	There is no evidence of an introduction, or the introduction fails to communicate to the reader the salient details of the report. No clear team management structure is outlined. No easily identifiable objectives for the team, or objectives listed prove to be unfeasible. Lacking a summary of subsequent report sections.	The introduction somewhat summarises the background of the project, with some justification for the purpose of the report. An adequate attempt is made at presenting the team management structure, however the overview is confusing or convoluted at times to read. Team objectives lack justification or are not made immediately obvious. Some objectives are not specific, measurable, achievable, realistic or time-bounded. Some mention of subsequent report sections.	Introduction clearly summarises the background of the project and outlines the purpose of the report. An overview of your team management structure is presented in a clean and informative manner. All objectives of your team have been clearly stated with sound rationale. All objectives are specific, measurable, achievable, realistic and time-bounded. Brief summary of your report sections.	
Project Scope, Assumptions and Constraints (12.5%)	No or limited attempt at defining the project scope. No consideration is given to the key project assumptions and constraints. No evidence to suggest the writer has an understanding of the relevant project, AURC and regulatory requirements.	The scope of the project is outlined, with some consideration for your team's capabilities and target altitude. A few key project assumptions and constraints acknowledged, with some justification. Project requirements identified and stated, however requires more justification and analysis. Some uncertainty around planned verification methods and timelines. An attempt is made at acknowledging the relevant project, AURC and regulatory requirements, with some verification through the team's system architecture and design details.	Detailed and accurate scope definition for your project in the context of your team's capabilities and target altitude. Accurate and justified key project assumptions and constraints presented. Well formulated and concise project requirements defined and laid out in an efficient manner. Appropriate verification methods and timelines identified for each project requirement. All pertinent project, AURC and regulatory requirements identified and capable of being verified through your system architecture and design details.	

System Architecture – Overview (8%)	An incomplete or lacking functional block diagram of project system. No or limited attempt at presenting the system and its sub-systems. No or limited pictorial diagrams of the launch vehicle. No or limited attempt at presenting how your sub-systems are integrated.	An adequate and functional block diagram of project system is presented. An overview of the system is shown, with some explanation for sub-system functions and interactions. Some 3D renders and images of launch vehicle are presented, however are at times unclear/confusing. Attempt at presenting how your sub-systems are integrated is present. May not be clear, logical or appropriate.	Complete, accurate and visually appealing functional block diagram of your system presented. High level overview of your system and how the relevant sub-systems function and interact. All relevant sub-systems identified. 3D renders and images of your launch vehicle are required for full marks. Overall cutaway view of your launch vehicle to be included (detailed technical drawings to be put in the Appendix). Clear and logical overview of how your sub-systems are integrated.	
System Architecture - Propulsion System (6%)	No or limited description of the sub-system. No or limited overview of the sub-system's purpose and final design presented. No or limited technical analysis of the sub-system to support your design choices. Unable to ascertain if your team meets all regulatory requirements associated with the selected propulsion system OR non-compliance with regulatory requirements.	An adequate description of the sub-system is presented, with some mention of the system boundaries, interfaces and major components. Some evidence of presenting an overview of the sub-system's purpose and the final selected design. An adequate technical analysis of the sub-system, with some justification offered. Some considerations of other sub-systems. Some evidence and justification presented to demonstrate the selected propulsion system meets regulatory requirements.	Detailed but clear description of the sub-system, including system boundaries, interfaces and major components. Accurate overview of the sub-system's purpose, allocated requirements and final selected design presented. Technical analysis of your sub-system to support your design choices. For full marks, interactions with other sub-systems are considered during the justification of your design choices. Clear evidence presented to show that your team meets all regulatory requirements associated with the selected propulsion system.	
System Architecture - Aero-Structural System (6%)	No or limited description of the sub-system. No or limited overview of the sub-system's purpose and final design presented. No or limited technical analysis of the sub-system to support our design choices. No or limited manufacturing overview for your sub-system. Unable to clearly ascertain the materials and processes used for the sub-systems construction and assembly.	An adequate description of the sub-system is presented, with some mention of the system boundaries, interfaces and major components. Some evidence of presenting an overview of the sub-system's purpose and the final selected design. An adequate technical analysis of the sub-system, with some justification offered, including some consideration of other sub-systems. A manufacturing overview of the sub-system is presented, with some justification for choices of materials and processes. Limited use of images and diagrams to support the overview.	Detailed but clear description of the sub-system, including system boundaries, interfaces and major components. Accurate overview of the sub-system's purpose and final selected design presented. Technical analysis of your sub-system to support your design choices. For full marks, interactions with other sub-systems are considered during the justification of your design choices. Provides a detailed manufacturing overview for your sub-system with appropriate justification of materials and processes. Judicious use of images and diagrams required for full marks.	
System Architecture - Recovery System (6%)	No or limited description of the sub-system. No or limited overview of the sub-system's purpose and final design presented. No or limited technical analysis of the sub-system to support our design choices. No or limited manufacturing overview for your sub-system. Unable to clearly ascertain the materials and processes used for the sub-systems construction and assembly.	An adequate description of the sub-system is presented, with some mention of the system boundaries, interfaces and major components. Some evidence of presenting an overview of the sub-system's purpose and the final selected design. An adequate technical analysis of the sub-system, with some justification offered including some consideration of other sub-systems.	Detailed but clear description of the sub-system, including system boundaries, interfaces and major components. Accurate overview of the sub-system's purpose and final selected design presented. Technical analysis of your sub-system to support your design choices. For full marks, interactions with other sub-systems are considered during the justification of your design choices.	

		A manufacturing overview of the sub-system is presented, with some justification for choices of materials and processes. Limited use of images and diagrams to support the overview.	Provides a detailed manufacturing overview for your sub-system with appropriate justification of materials and processes. Judicious use of images and diagrams required for full marks.	
System Architecture - Electrical/Avionics System (6%)	No or limited description of the sub-system. No or limited overview of the sub-system's purpose and final design presented. No or limited technical analysis of the sub-system to support our design choices. No or limited manufacturing overview for your sub-system. Unable to clearly ascertain the materials and processes used for the sub-systems construction and assembly.	An adequate description of the sub-system is presented, with some mention of the system boundaries, interfaces and major components. Some evidence of presenting an overview of the sub-system's purpose and the final selected design. An adequate technical analysis of the sub-system, with some justification offered, including some consideration of other sub-systems. A manufacturing overview of the sub-system is presented, with some justification for choices of materials and processes. Limited use of images and diagrams to support the overview.	Detailed but clear description of the sub-system, including system boundaries, interfaces and major components. Accurate overview of the sub-system's purpose and final selected design presented. Technical analysis of your sub-system to support your design choices. For full marks, interactions with other sub-systems are considered during the justification of your design choices. Provides a detailed manufacturing overview for your sub-system with appropriate justification of materials and processes. Judicious use of images and diagrams required for full marks.	
System Architecture - Payload System (6%)	No or limited description of the sub-system. No or limited overview of the sub-system's purpose and final design presented. No or limited technical analysis of the sub-system to support our design choices. No or limited manufacturing overview for your sub-system. Unable to clearly ascertain the materials and processes used for the sub-systems construction and assembly.	An adequate description of the sub-system is presented, with some mention of the system boundaries, interfaces and major components. Some evidence of presenting an overview of the sub-system's purpose and the final selected design. An adequate technical analysis of the sub-system, with some justification offered, including some consideration of other sub-systems. A manufacturing overview of the sub-system is presented, with some justification for choices of materials and processes. Limited use of images and diagrams to support the overview.	Detailed but clear description of the sub-system, including system boundaries, interfaces and major components. Accurate overview of the sub-system's purpose and final selected design presented. Technical analysis of your sub-system to support your design choices. For full marks, interactions with other sub-systems are considered during the justification of your design choices. Provides a detailed manufacturing overview for your sub-system with appropriate justification of materials and processes. Judicious use of images and diagrams required for full marks.	
Overall System Performance (15%)	Limited, none or irrelevant results from the simulation of your launch vehicle's presented. Incorrect or limited interpretation of the data production from the simulation software. Presented analysis (or lack thereof) shows a poor understanding of the behaviour of the system. Limited or no sensitivity analysis undertaken. Poor understanding of the critical input variables for your simulations. No meaningful conclusions able to be drawn from the sensitivity analysis that can support design decisions. Inappropriate conclusions drawn from the trajectory data. Team appears to not have the required level of understanding in safe aerodynamic design practices. *[Refer to Analytical Simulation - Trajectory Simulation criteria for further details]*	Most, but not all, of the relevant results from the simulation of your launch vehicle's trajectory have been presented. Results may not be concisely summarised within the body of the report. Most of the interpretation of trajectory simulation results is correct, but some conclusions drawn indicate that the team may not have a complete understanding of the behaviour of the system. Sensitivity analysis is attempted and some variables identified (may or may not be critical in nature). Some conclusions drawn as to the effects different variables have on your launch vehicle's performance. Sensitivity and trajectory analysis results attempted to be used to justify design decisions and provide an operational envelope. Most conclusions drawn from the trajectory data are appropriate with some spurious conclusions indicating that the team may not have a full understanding of safe aerodynamic design practices. *[Refer to Analytical Simulation - Trajectory Simulation criteria for further details]*	Clearly and concisely outlines the relevant results from the simulation of your launch vehicle's trajectory. Interpretation of the data produced from the simulation software provides insight into the performance of the launch vehicle and indicates that the team has a strong grasp on the behaviour of the system. Thorough and informative sensitivity analysis undertaken that identifies the critical variables and demonstrates the effects they will have on your launch vehicle's performance. Uses the data from the sensitivity and trajectory analysis to justify their design decisions and provide an operational envelope for their launch vehicle whereby all mission requirements can still be met. Appropriate conclusions drawn from the trajectory data and shows that the team has a clear understanding of safe aerodynamic design practices. *[Refer to Analytical Simulation - Trajectory Simulation criteria for further details]*	

Operational Architecture (10%)	No or limited attempt at presenting the important mission phases and events which signify a phase change. No or limited attempt to outline the nominal operations of each sub-system during the mission phases. No or limited attempt to outline any interactions between different sub-systems during mission phases. No or limited attempt to identify any points of failure for each mission phase.	Most pertinent mission phases are identified - may not be clearly or concisely described or completely correct. In general, the events which signify the change from one mission phase to another are clearly identified - some ambiguity in events present or some phases/events missing. For most mission phases, the nominal operations of each sub-system are described - may not be clear or completely accurate. Most interactions between different sub-systems during mission phases are captured - may or may not be relevant. Most points of failure identified for each mission phase - presented points of failure may not be critical or critical points of failure may be missing.	All pertinent mission phases are identified and clearly and concisely described. The events which signify the change from one mission phase to another are clearly identified. For each mission phase, the nominal operations of each sub-system are clearly described. All relevant interactions between different sub-systems during mission phases are captured and summarised within the report body. All critical points of failure identified for each mission phase.	
Risk Assessment (10%)	No or limited attempt at developing an appropriate DFMEA and PFMEA. DFMEA - Design Failure Modes and Effect Analysis • Fewer than five design failure modes identified • No, limited or inappropriate ranking of the severity, occurrence and detectability of the presented design failure modes • No, limited or inappropriate risk mitigations implemented, leading to new, inappropriate, severity, occurrence and detectability for each design failure mode • Raw DFMEA results presented in an unclear or inappropriate manner PFMEA - Process Failure Modes and Effect Analysis • Fewer than five process failure modes identified • No, limited or inappropriate ranking of the severity, occurrence and detectability of the presented process failure modes • No, limited or inappropriate risk mitigations implemented, leading to new, inappropriate, severity, occurrence and detectability for each process failure mode • Raw PFMEA results presented in an unclear or inappropriate manner Poor, limited or no presentation and assessment of the outcomes from the DFMEA and PFMEA. Evidence to suggest that your team is not appropriately managing the risks within your project.	An adequate attempt at developing an appropriate DFMEA and PFMEA - room for improvement present. DFMEA - Design Failure Modes and Effect Analysis • Identification of at least ten design failure modes • Most design failure modes appropriately ranked with respect to their severity, occurrence and detectability • Majority of risk mitigations implemented are appropriate - leads to most of the new severity, occurrence and detectability for each design failure mode to be appropriate • Use of an adequately formatted table/spreadsheet to display the raw DFMEA results - display method may not be completely clear PFMEA - Process Failure Modes and Effect Analysis • Identification of at least ten process failure modes • Most process failure modes appropriately ranked with respect to their severity, occurrence and detectability • Majority of risk mitigations implemented are appropriate - leads to most of the new severity, occurrence and detectability for each process failure mode to be appropriate • Use of an adequately formatted table/spreadsheet to display the raw PFMEA results - display method may not be completely clear Adequate presentation and assessment of the outcomes from the DFMEA and PFMEA that indicate your team is attempting to manage the risks within your project. Evidence to suggest that some areas require improvement but your team is aware of possible areas of high risk.	An excellent and appropriate DFMEA and PFMEA – only minor comments or changes required. DFMEA - Design Failure Modes and Effect Analysis • Identification of at least fifteen design failure modes • All design failure modes appropriately ranked with respect to their severity, occurrence and detectability • Appropriate risk mitigations implemented, leading to new appropriate severity, occurrence and detectability for each design failure mode • Use of an excellently formatted table/spreadsheet to display the raw DFMEA results PFMEA - Process Failure Modes and Effect Analysis • Identification of at least fifteen process failure modes • All process failure modes appropriately ranked with respect to their severity, occurrence and detectability • Appropriate risk mitigations implemented, leading to new appropriate severity, occurrence and detectability for each process failure mode • Use of an excellently formatted table/spreadsheet to display the raw PFMEA results Excellent presentation and assessment of the outcomes from the DFMEA and PFMEA that indicate your team is successfully managing the risks within your project.	

Conclusions and Lessons Learnt (3%)	No or limited conclusions from your report outlined. No or limited summary concluding that your current design does meet all constraints, assumptions and requirements outlined at the start of your report. Alternatively, conclusion may suggest your design does not meet critical requirements. No, limited or unsupported summary of key lessons learnt by your team during the course of the AURC project. No or limited insight into what could have been done better and how your team can improve in future.	Most major conclusions from your report outlined, including those pertinent to your rocket design and your payload - some critical conclusions may be missing or poorly presented. Summary concludes that you have met all critical constraints, assumptions and requirements outlined at the start of your report - some minor constraints, assumptions and requirements may not be met. Average summary of key lessons learnt by your team during the course of the AURC project - limited or no critical analysis of lessons learnt. Basic insights provided into what could have been done better and how your team can improve in future.	All major conclusions from your report outlined, including those pertinent to your rocket design and your payload. Overall summary concluding that your current design does meet all constraints, assumptions and requirements outlined at the start of your report. Critical summary of key lessons learnt by your team during the course of the AURC project. Provides clear and well thought out insights into what could have been done better and how your team can improve in future.	
Appendix/Other (2.5%)	Contains excessive superfluous information that does not enrich or complement the body of your report. Contains excessive overrun from your report sections. No or limited pertinent technical drawings required to manufacture and understand how your system operates (Assembly drawings, system drawings, wiring diagrams and parts and materials lists etc.) [marked as part of the Virtual Vehicle Design]. No, limited or unsafe flight preparation procedure that covers: • Assembly process • Preflight procedure • Range set-up procedure • Launch process • Recovery process Either includes unnecessary flight performance data (that is not used to support conclusions drawn throughout the report body) OR does not include enough data to support any conclusions drawn throughout the report. Does not includes ACO details and L3 approval details [if applicable]. No or limited high level breakdown of the final budget (to a sub-system level). No or limited details of previous testing (e.g. test flights and sub-system tests). Testing results in-adequate to sell of system requirements.	Contains small quantities of superfluous information. Contains small quantities of non-critical overrun from your report sections. Includes most pertinent technical drawings required to manufacture and understand how your system operates (Assembly drawings, system drawings, wiring diagrams and parts and materials lists etc.) [marked as part of the Virtual Vehicle Design]. Includes a flight preparation procedure that is safe but may be lacking in details. Flight preparation procedure covers the majority of the following: • Assembly process • Preflight procedure • Range set-up procedure • Launch process • Recovery process Includes most flight performance data (that is not already covered in the Overall System Performance section) and is used to support conclusions drawn throughout the report body. Some minor conclusions have insufficient data within the appendix to support the claims. Includes ACO details and L3 approval details [if applicable]. Includes a high-level breakdown of the final budget (to a sub-system level) - missing some critical aspects or systems. Includes some details of previous testing (e.g. test flights and sub-system tests). Some testing results can be used to verify of system requirements, others may not support requirements verification.	Does not contain any superfluous information. Does not contain any overrun from your report sections (other than large figures or tables etc.). Includes all pertinent technical drawings required to manufacture and understand how your system operates (Assembly drawings, system drawings, wiring diagrams and parts and materials lists etc.) [marked as part of the Virtual Vehicle Design]. Includes a descriptive and logical flight preparation procedure that covers: • Assembly process • Preflight procedure • Range set-up procedure • Launch process • Recovery process Includes any flight performance data (that is not already covered in the Overall System Performance section) and is used to support conclusions drawn throughout the report body. Includes ACO details and L3 approval details [if applicable]. Includes a high-level breakdown of the final budget (to a sub-system level). Includes any details of previous testing (e.g. test flights and sub-system tests). Testing results used to sell of system requirements.	

General Formatting, Spelling, Grammar and Punctuation (2.5%)	Report clearly does not comply with MEA guidelines. Several blatant major and minor formatting errors can be observed. Several major punctuation, grammar or spelling mistakes.	Most of the report complies with MEA guidelines - only minor infractions observable. Some minor formatting errors can be observed, but no major formatting errors appear to be present. Some minor observable punctuation, grammar or spelling mistakes.	Report fully complies with MEA guidelines. In general, no major or minor formatting errors can be observed. No substantial punctuation, grammar or spelling mistakes.	
			Total (/55)	

Final Mark (/55) = SUM [Individual Criteria Score*Weighting %] *11 - [Page Limit Penalty (As Required)]
Your final grade for the Project Technical Report will be rounded to the nearest tenth of a mark.

4.2 Virtual Vehicle Design

Criteria	Poor (0) Poor quality - This section requires numerous substantial corrections of errors.	Average (2.5) Average quality - This section requires some substantial correction of errors.	Excellent (5) Excellent quality - This section requires no substantial correction of errors.	Score
CAD model (10%)	No or a poor-quality 3D model/renders of your launch vehicle present. No value added to your 2D drawings.	3D model of your launch vehicle present. Some renders present. May not appreciably enhance your 2D drawings.	3D model and renders present of your launch vehicle that enhance your 2D drawings.	
Mechanical drawings (30%)	No, limited or poor-quality mechanical drawings present. Insufficient information present within the mechanical drawings necessary to construct the corresponding systems. No, limited or poor-quality general arrangement drawings, assembly drawings and manufacturing drawings present. Majority of drawings non-compliant with AS1100 or equivalent. Major discrepancies between drawings and the parts and materials list. Poor formatting and/or unclear assembly layouts. Excellent formatting and clear layout of assemblies.	Most mechanical drawings present that are necessary to construct the corresponding systems. Some minor drawings missing or of a poor quality. Most pertinent general arrangement drawings, assembly drawings and manufacturing drawings present and compliant with AS1100 or equivalent. Some minor drawings missing or non-compliant to AS1100 or equivalent. Majority of drawings match exactly with parts and materials list - some minor discrepancies present. Average formatting and generally clear layout of assemblies.	All relevant mechanical drawings present that are necessary to construct the corresponding systems. All pertinent general arrangement drawings, assembly drawings and manufacturing drawings present and compliant with AS1100 or equivalent. All drawings match exactly with parts and materials list. Excellent formatting and clear layout of assemblies.	
Electrical drawings (30%)	No, limited or poor-quality electrical drawings present. Insufficient information present within the electrical drawings necessary to construct the corresponding systems. No, limited or poor-quality block diagrams, cable plans and wiring diagrams present. Majority of drawings non-compliant with AS1103 or equivalent. Major discrepancies between drawings and the parts and materials list. Poor formatting and/or a large number of incorrect symbols.	Most electrical drawings present that are necessary to construct the corresponding systems. Some minor drawings missing or of a poor quality. Most pertinent block diagrams, cable plans and wiring diagrams present and compliant with AS1103 or equivalent. Some minor drawings missing or non-compliant to AS1103 or equivalent. Majority of drawings match exactly with parts and materials list - some minor discrepancies present. Average formatting and with most symbols used correct.	All relevant electrical drawings present that are necessary to construct the corresponding systems. All pertinent block diagrams, cable plans and wiring diagrams present and compliant with AS1103 or equivalent. All drawings match exactly with parts and materials list. Excellent formatting and accurate use of symbols.	
Parts and materials lists (20%)	No, limited or poor parts and materials lists present. Parts and materials list may not be accurate for the majority of assembly, electrical and manufacturing drawings. Insufficient detail within the lists to procure all parts necessary for the corresponding assemblies.	Parts and materials lists present and accurate for most assembly, electrical and manufacturing drawings - some minor components/parts missing. Sufficient detail within the majority of lists to procure most parts necessary for the corresponding assemblies - some minor errors present.	Parts and materials lists present and accurate for all assembly, electrical and manufacturing drawings. Sufficient detail within the lists to procure all parts necessary for the corresponding assemblies.	
Tolerancing and surface finishes (5%)	No, limited or poor tolerances and surface finishes specified for the majority of drawings.	Most pertinent drawings have appropriate tolerances and surface finishes specified - some drawings missing specifications or inappropriately specified.	All pertinent drawings have appropriate tolerances and surface finishes specified.	
Model tree (5%)	No, limited or poor model tree that does not outline all major components or sub-assemblies within your system.	Adequate model tree that outlines most components and sub-assemblies within your system - some minor components or sub-assemblies missing.	Detailed model tree that outlines all relevant components and sub-assemblies within your system.	

	Model tree presented in an unclear manner that does not identify most sub-systems.	Model tree presented in a relatively clear manner that identifies most sub-systems.	Model tree presented in a clear manner that identifies all sub-systems.	
			Total (/17.5)	

Final Mark (/17.5) = SUM [Individual Criteria Score*Weighting %] *3.5
Your final grade for the Virtual Vehicle Design will be rounded to the nearest tenth of a mark.

4.3 Analytical Simulation

Criteria	Poor (0) **Poor quality - This section requires numerous substantial corrections of grammatical errors, technical disambiguation and general scientific knowledge**	Average (2.5) **Average quality - This section requires some substantial correction of grammatical errors, technical disambiguation, and general scientific knowledge.**	Excellent (5) **Excellent quality - This section requires no substantial correction of grammatical errors, technical disambiguation, and general scientific knowledge.**	Score
Trajectory Simulation (37.5%)	OpenRocket model is lacking detail, or completely missing. Does not accurately represent your launch vehicle or include all relevant components and equipment. Inappropriate materials, coefficients and properties have been set within your OpenRocket model. Inappropriate input parameters have been implemented in your OpenRocket simulation - simulation indicates a lack of understanding of the critical aspects required for the analysis. Poor or no attempt to either: • Enrich your OpenRocket simulation, OR • Utilize higher fidelity software, OR • Develop your own higher fidelity software. Any attempt to develop a higher fidelity simulation does not add any additional value on top of your OpenRocket model. Limited or poor understanding of rocket dynamics and modelling techniques evident through any/all trajectory simulation models.	OpenRocket model is lacking in some detail and is not a completely accurate representation of your launch vehicle. May be missing some pertinent components and equipment from the model. Most materials, coefficients and properties within your OpenRocket model are appropriate - inappropriate selections have a minor impact on your simulation's validity. Most input parameters in your OpenRocket simulation are appropriate - demonstrates a working, but not proficient understanding of the critical aspects required for the analysis. Average, moderately detailed and partially successful attempt at either: • Enriching your OpenRocket simulation, OR • Utilizing higher fidelity software, OR • Developing your own higher fidelity software. Higher fidelity simulation may, or may attempt to, bridge gaps or address weaknesses in the extant OpenRocket model of your launch vehicle. Most but not all, underlying assumptions and limitations of your enriched OpenRocket simulation model are identified and appropriate - shows an average understanding of both rocket dynamics and modelling techniques (room for improvement available).	OpenRocket model is a highly detailed, accurate representation of your launch vehicle and includes all pertinent components and equipment. Appropriate materials, coefficients and properties have been set within your OpenRocket model. Appropriate input parameters have been implemented in your OpenRocket simulation - demonstrates a clear understanding of the critical aspects required for the analysis. Excellent, highly detailed and successful attempt at either: • Enriching your OpenRocket simulation, OR • Utilizing higher fidelity software, OR • Developing your own higher fidelity software. Higher fidelity simulation clearly bridges gaps or addresses weaknesses in the extant OpenRocket model of your launch vehicle. Underlying assumptions and limitations of your enriched OpenRocket simulation model are identified and appropriate - shows a clear understanding of both rocket dynamics and modelling techniques.	
Structural Analysis (37.5%)	Limited or no structural analysis/justification of design decisions. Inappropriate assumptions made in structural calculations leading to inaccurate results. Incorrect, inappropriate or no use of finite element analysis. Evidence to suggest insufficient understanding of the loading experienced by your launch vehicle during its flight phases. Inappropriate engineering safety factors applied and/or not justified accordingly/appropriately. Inappropriate mesh and element selection for all finite element analysis. Limited or no justification provided as to your mesh/element suitability.	Most important structural design decisions justified with hand calculations and finite element analysis. Majority of assumptions made in the calculation of structural loads and stresses are accurate but some errors present. Finite element analysis of your system or sub-systems presented in most cases where appropriate. Results may not necessarily be accurate and indicate your team may not have a full understanding of the loading your launch vehicle will experience during its flight phases. Most safety factors are appropriate, with some exceptions. Justification may be lacking for some safety factor selection. Majority of mesh and element selection is appropriate or almost acceptable for your team's finite element analysis. Justification for most elements and mesh quality is provided and in general is correct.	Clearly and concisely presents hand calculations and finite element analysis results to justify design decisions. Accurate and appropriate assumptions made in the calculation of structural loads and stresses. Discerning and accurate use of finite element analysis that shows an in-depth understanding of the loading your launch vehicle will experience during its flight phases. Appropriate engineering safety factors applied and justified accordingly. Structural analysis goes beyond modal and basic structural analysis in the justification of results. Appropriate mesh and element selection for all finite element analysis. Justification provided as to the suitability of your mesh/element types.	

Electrical Analysis (25%)	Limited or no calculations or simulations undertaken for any custom or COTS electrical equipment, antenna, or components utilised within your launch vehicle. No or limited consideration of safe working limits of COTS equipment, including voltage, current, and power.	Basic hand calculations or simulations undertaken for most custom electronics which justifies most key design decisions. Some errors or inappropriate justification present but will not cause critical failure of your systems. Power and other appropriate calculations undertaken for most COTS equipment. Some errors may be present but will not cause critical failure of your systems. Attempts made at presenting calculations pertaining to antenna range. Some errors may be present but will not cause critical failure of your systems. Safe working limits of equipment, including voltage, current, and power considered for most components where necessary from datasheets. Some errors may be present but will not cause critical failure of your systems.	Basic hand calculations or simulations undertaken for any custom electronics which justify any key design decisions. Power and other appropriate calculations undertaken and clearly presented for all COTS equipment. All relevant calculations pertaining to antenna range presented and used to justify antenna selection. Consideration of safe working limits of all equipment, including voltage, current, and power where necessary from datasheets.	
Bonus Marks – Additional bonus points are available for teams which present innovative simulations or go above and beyond the required analysis level for the technical report. A maximum of 25% of the analytical simulation marks will be award in this section. *Potential options include, but are not limited to, detailed CFD, range safety analysis, coupled fluid structure interactions, 6 degrees of freedom trajectory simulations, etc.* *These bonus marks will be awarded at the discretion of the marker and will be subject to peer review.*				
			Total (/17.5)	

Final Mark (/17.5) = SUM [Individual Criteria Score*Weighting %] * 3.5 + bonus marks [max. 4.375 bonus marks awarded]
Your final grade for the Analytical Simulation will be rounded to the nearest tenth of a mark.