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| 2023 First Nations Launch |
| Critical Design Review Report |
| For Wisconsin Space Grant Consortium |

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| [School Name][Date] |

Please use this template as a guide to writing your team design reports. The headers (and bullets) outline the minimum information required. For continuity across teams, do not re-order the sections. You can however, add more information or sections when deemed necessary, or further detail is required.

There are some unique formatting features to this template. Please learn and utilize them. You may add to the formatting, but do not delete any existing formats.

Any [square] bracketed text is expected to be filled by your team. Bulleted text is expected to be deleted/replaced with your content.

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# Team Information

Team Name: [insert team name]

School Name: [insert school]

Faculty Advisor: [insert advisor name]

Co-Advisor (if applicable): [insert advisor name]

Student Team Lead: [insert team lead name]

Safety Lead: [insert safety lead name]

NAR/TRA Mentor: [insert NAR/TRA mentor name]

NAR/TRA Membership: [provide NAR/TRA membership number]

NAR/TRA Certification: [provide mentor certification level]

Team Members: [list team members and roles]

# Summary of Critical Design Review Report

## Launch Vehicle Summary

* Vehicle dimensions and mass
* Final motor selection
* Recovery system description
* Rail button size

## Challenge Summary

* Summarize your approach to satisfying the challenge requirements
	+ Provide final materials selected
	+ Provide final methods selected

# Changes Made Since PDR

* Highlight Major Changes Made Since PDR
	+ Major changes to vehicle criteria
	+ Major changes to challenge criteria
	+ Major changes to project plan

# Vehicle Criteria

## Design of Launch Vehicle

* Identify which of the design alternatives from PDR were chosen as the final materials / components for the launch vehicle.
	+ Describe why those alternatives are the best choices.
* Demonstrate that the designs are complete and ready to manufacture / procure.
* Using the final designs, create dimensional drawings (using solid modeler software, or 2D simulation images at a minimum) to illustrate the final launch vehicle, its subsystems, and its components
* If airframe build / manufacture has begun, include:
	+ Pictures of major assembly or fabrications
	+ Pictures of manufacturing and joining steps (especially sealed components that can no longer be examined once joined)
* Update estimated masses for each subsystem (MARS Only)\*\*

## Recovery Subsystem

* Identify which of the design alternatives from PDR were chosen as the final components for the recovery subsystem. Describe why those alternatives are the best choices.
* Describe the parachutes, harnesses, bulkheads, and attachment hardware.
* Include any diagrams, drawings, schematics, sketches, images

## Avionics Subsystem

* Describe the avionics bay that will be used to deploy the recovery system.
* Discuss the number of altimeters (is the system redundant), and include a description of the altimeters
* Describe the avionics sled material, avionics bay layout, the size/location and number of vent holes
* Describe the switch to be used to power on the electronics from the outside of the vehicle.
* Include any diagrams, drawings, schematics, sketches, images

## Motor Selection

* Describe final motor selection
* Describe motor retention system

## Mission Performance Predictions

* Show flight profile simulations, altitude predictions with simulated vehicle data, and sim­ulated motor thrust curve.
* Show stability margin and simulated Center of Pressure (CP)/Center of Gravity (CG) relationship and locations (using simulations).
* Calculate the expected descent rate (using simulations) for the rocket and any section that descends untethered from the rest of the vehicle.
* Calculate the drift (using simulations) for each independent section of the launch vehicle from the launch pad for three different cases: no wind, 10-mph wind, and 20-mph wind.(MARS Only)\*\*

# Challenge Criteria

## Challenge Approach

* Present the final components you plan to fabricate
* Include what components are to remain commercial-off-the-shelf (COTS).
* Discuss what final material you are using to fabricate each component.
* Discuss what final methods you are using to fabricate each component.
* Discuss the approach to ensure all components interface and fit properly during vehicle assembly.
* Include results of Challenge Requirements Methods: Item 3 (Moon) and Item 3-4 (Mars) as applicable.
* You may include 3D CAD rendering if desired.

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# Safety

## Launch Concerns and Operation Procedures

* Submit draft of final assembly and launch procedures, including (see Appendix C-4 for guidance):
	+ Avionics preparation checklist
	+ Recovery preparation checklist.
	+ Final assembly checklist.
	+ Setup on launcher checklist.
	+ Troubleshooting checklist.
	+ Post-flight inspection checklist.
* These procedures/checklists should include specially demarcated steps related to safety. Examples include:
	+ Warnings of hazards that can result from missing a step
	+ PPE required for a step in the procedure (identified BEFORE the step)
	+ Required personnel to complete a step or to witness and sign off verification of a step

# Project Plan

## Test Plan

* Refine and update your fabrication component test plan (see Appendix C-2 for guidance)
	+ Discuss the results of any tests
	+ Discuss any remaining critical tests
* Refine and update your functional tests required to prove integrity of design.
	+ Describe the results of any tests
* Discuss the remaining critical tests

## Requirements Compliance\*\*

* Update the verification plan for every requirement from sections 1-5 of the Project Requirements listed in the Competition Handbook.
* Identify what is required to verify the requirement:
	+ test, analysis, demonstration, or inspection
	+ Include the associated plan needed for verification.

## Project Budget

* Refine and update your budget. Provide an updated line item budget with market values for individual components, you should account for:
	+ material vendors
	+ applicable taxes
	+ shipping/handling fees.
* Provide an updated funding plan describing:
	+ sources of funding
	+ allocation of funds
	+ material acquisi­tion plan.

## Project Timeline

* Refine and update your schedule. The schedule should be complete and encompass the full term of the project. Deliverables should be defined with reasonable activity duration. GANTT charts are encouraged

# Appendix

* use the Appendix section if needed to show checklists, budget tables, timelines, MSDS data, and any other large sets of data that would disrupt the flow within the document