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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.

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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