NORTHERN ARIZONA UNIVERSITY

To: Dr. David Willy

From: Abel Aldape, Preston Berchtold, Martín Dorantes, Trent Todd

Date: March 19, 2021

Re: Team Memo – Individual Analysis Topics

Introduction

This memo serves as the deliverable for the Team Memo assignment. Each team member is to summarize what their respective individual analysis topic is in one paragraph. Each topic is to be unique, involving advanced calculations learned throughout all engineering courses up to this point. All topics have been sent to and approved by client Professor Wood prior to the submission of this memo.

Abel Aldape

Abel will be analyzing the frame to determine if the rectangular aluminum 6061 tubing can withstand the anticipated bending stresses with minimal deflection. This will be done using bending diagrams, moment calculations, and then further testing in SolidWorks simulation. The roll cage is also critical to the safety of the rider and will only be tested in the simulation due to the complex geometry.

Preston Berchtold

Preston will be undergoing the analysis for the gear selection. Preston will be determining the number of gears, the gear ratios, as well as an "off the shelf" product that can be used for the child-size HPV. Preston will be researching gear systems on typical child size bikes that can be purchased by the general population. Equations from *Shigley's Mechanical Design* textbook will be used to determine satisfactory gear ratios that will maintain a safe speed while applying sufficient torque for steeper terrains. This analysis will help the team design a bike that will be exciting for kids by allowing them to travel efficiently and not overexert themselves.

Martín Dorantes

Martín was originally going to analyze the aerodynamics of the fairing using SolidWorks and Ansys Fluent. After reviewing the topics with Professor Wood, it was decided that the fairing analysis would not properly fit for the new scope of the project focusing on a low-speed HPV for children. The HPV has no means for high speeds, so the analysis to create low drag was considered negligible and the fairing is to be manufactured for aesthetics. Martín is shifting to focus on braking analysis. He will evaluate the disc brakes to ensure a deceleration is produced needed to safely bring the HPV to a steady stop. Torque relation, dynamics, and basic physics

equations will be used to ensure the brakes can come to a safe and steady stop within 8m. Deceleration, net stopping force, brake force, and stopping distance will all be calculated to validate the HPV's safe braking capabilities.

Trent Todd

For Trent's analysis he will investigate the steering subsystem. Utilizing equations such as Ackermann steering geometry which allows for the calculation of the turning radius, which will need to be under 8 meters to meet the customer requirements. Other steering geometries include caster angle, kingpin angle, camber angle and wheelbase. These geometries can be further evaluated and compared with multiple steering concepts considered in the team's design, while checking for any interference with other parts such as the seat to avoid future issues.