1.2 Customer Needs

To gain a better understanding of the expectations from the customer, a series of questions was developed for the customer, sponsor, and advisor. The customer for this design is the CIA as they will ideally be able to use the developed product on missions to locate and track objects and/or targets of interest. The questions are primarily focused on design specifications and trying to learn what the customer is truly asking for. Once the statements were collected from the customer, interpretations of the design needs were formed. The questions, statements, and interpreted needs can be found in the table below.

Table 1: Customer Needs

Question/Prompt	Customer Statement	Interpreted Need
What is the estimated weight of the design?	Must be able to carry a payload without impacting maneuverability.	Focus primarily on a lightweight design to compensate for the extra weight that will be added.
Is the design based on the F1tenth competition requirements?	Yes, but improve on the design to gear towards the CIA requirements.	Follow F1tenth specifications but optimize being able to keep up with a tracked target.
What is the estimated cost of the design?	F1tenth bill of materials approximates $3500.	Work adjacent with team 504 to combine budgets and determine which team is financially capable of buying what items.
What is the general design of the obstacles?	min: 12x12x30cm max: 35x32x30cm	Design the obstacle out of cardboard to be detectable by

	LiDAR perceivable material	LiDAR, starting at one of the size extremes.
Are the obstacles static or dynamic?	Both	Design for static obstacles first, then make the design more complex.
Define failure to avoid an obstacle?	The goal is to keep up with a target being tracked so, ideally, the design should not crash.	LiDAR specifications: detection range = 10 m scanning frequency = 40 Hz angular resolution = 0.25°
What speed is the vehicle operating at?	The average speed on a track is 35mph while the vehicle can go upwards of 70mph. Cornering and maneuverability affect speed.	Determine an optimal speed that does not sacrifice maneuverability. An even weight distribution can achieve an infinite critical velocity; however, acceleration will compromise weight distribution.

The table above is a breakdown of the questions, customer statements, and the interpreted needs for the project. The initial interaction with the customer yielded seven key questions that will increase the success of the project and satisfy the customer's needs. The questions include the design weight, cost, and speed. Additional questions were also the functionality of the design

based on obstacles, the failure to avoid the obstacles, whether those obstacles were dynamic or static, and if the design should be based on within the F1Tenth competition.

The Model will be based on the F1Tenth competition design but will be augmented and optimized to be able to maintain position relative to a moving target. For the weight, speed, and cost of design, the focus will be to develop a lightweight model that can support specified weights that will not deter movement in any way. For the speed, the focus should be on monitoring various F1Tenth models in terms of track speed and total speed while ensuring no sacrifice in maneuverability and weight distribution. As for the cost, a budget of $3500 has been deemed necessary for the project's success, based on the cost of building a F1Tenth vehicle. The project objective of this team and team 504 are closely related and will hopefully work together during the final stages of the project completion. Based on this realization, the cost of parts should not reach the total budget because we can combine budgets. A crucial part of the customer's needs was the functionality of the design based on obstacles. Based on the specifications of the customer, various tests will be run by creating obstacles using LiDAR perceivable material with diverse sizes that can perceive both dynamic and static obstacles.