**Design Considerations:**

Four options were strongly considered of how to get a package from one location to another via Quadcopter. The first option was using GPS only to deliver the package to a predetermined location. Upon test trials the GPS could get the package within a five foot radius but was inconsistent beyond that point. Since the required tolerance is within an inch of the desired landing area GPS only will not suffice. The following options all use GPS to get the package within a five foot radius and then switch over to the custom guidance module to land.

The three options considered were: an infrared camera to locate LEDs on the ground and adjust accordingly, an optical camera to locate a red square on the ground and adjust accordingly, or an ultrasonic device to adjust according to the frequency of the reception of sound waves. In order to determine which option to choose a Pugh chart was made.



The Pugh chart above is weighted to allow for the emphasis to be placed on things that are crucial to the goals of the mailbird and reproduction of the mailbird. All of the options above are complex in design and precise when it comes to landing so there is no differentiation in these two categories. Because of the affordability and reliability of the infrared camera and LEDs the net score is higher for option 1 (IR LED), which is the design chosen for mailbird.

Another design consideration that was analyzed by Pugh charts was whether to fly from dock to delivery location on a predetermined path or by going to the location with collision avoidance implemented on the quadcopter.



The Pugh chart above is weighted according to the difficulty of the two choices and in order to not break any regulations already established by the FAA. Although collision avoidance in theory sounds good the practicality and difficulty of it compared to a predetermined route makes it a bad option.

The last Pugh Chart is shown to demonstrate why the design chosen is for general quadcopters and not just specific to the quadcopter used in mailbird. With a ratio of quadcopter size to landing pad size the design will hopefully be able to be implemented on any Arducopter device.



**Potential Problems:**

The following is a list of potential problems we could run into with implementing the IR camera and predetermined path onto the mailbird:

* Coding limitations. Our group as a whole is not familiar yet with Arduino programming and how to respond to the infrared camera on the Arducopter.
* Infrared White-out. How will the sun affect the IR camera? Will the sun reflect off the ground and cause the camera to see nothing but IR light? If this is the case, one alternative we have considered is building a focal point made out of PVC pipe painted black to block out some of the other light shining into the camera.
* Carrying Capacity. What is the maximum size package that the Arduino can carry? What is the ratio of increased package weight to battery life? How much power is the camera circuit going to take from the battery?
* New Buildings. When construction is going on the mailbird will continually have to be reprogrammed due to changes in geography and obstacles like cranes.
* Landing Module. How much is it going to cost each customer to buy/build the landing zone?