Question #1:
Can the system operate under smaller scaled conditions compared to other designs?

- smaller scale means higher RPM at same angular velocity
- reel in/reel out will be ramped faster, more prone to snagging/impulse due to sudden increase in tension
- in simulation @ 0.675 kg 1.4 m wingspan, 0.3 m chord length at 10 m/s, tension oscillates up to 2000 N
- at 5 m/s max tension is 460 N, at 2 m/s, 114 N peak tension decays to 70 N
- However a rough estimate of the minimum speed the glider must fly to maintain lift was 7.8 m/s~18 mph
- Can the glider support this oscillation of tension at any of these parameters. How does the bridle system distribute the load?

Question #2
What circular tether guide is most effective? Can this be figured out without wasting money with prototyping?

Ring itself would need to be all machined, would need to be lubricated. Ball bearings could be anywhere between $18 and $40, maybe machine a part.
FURTHER RESEARCH: guided joint KC mentioned?

Question #3
How long can the battery power the motor that is on our plane? And basic ramp up voltages for the motor, i.e. we don't want the motor to instantly pull at full force on the glider so what ramp up time is necessary and how do achieve it?

- At 11.1V and 1300mAh the battery is not large enough to power anything on the base except for controls. As we have multiple batteries this may be a way to provide power to everything except the motor in the base.
- Initially I looked at several hobby motors such as the P.N. FK-280PA-1511A which is a small flat hobby motor that at 6V spins 1500 RPM and at 12V 3000 RPM. This is however with no load.
- However our motor on the plane is exactly 11.1V and 1300mAh so the battery should give an hour of flight. However losing power in the air is not ideal under any circumstances so probably 45 minutes of flight as a maximum is a safe bet.

Question #4

How can we make contact with the ground safely and repetitively?

Most hobby planes have sets of wheels which take the damping of the landing and transfer wind energy into rotational energy. Other landing methods such as nets and soft crashes could make detrimental impacts on the plane's wings or other subcomponents.
For a plane with a soft material such as EPO foam it would be best to protect the nose of the plane and choose a tricycle, three wheeled, nose method.
The three wheels are able to balance the plane so that tipping does not occur. Also this method, could be used to launch since with appropriate wheel bearing the plane could reach high speeds.
The wheel in the front should be sized so that it holds 5%-20% of the load while the back two wheels should distribute the remaining weight.

Question #5
To make Base station/Glider balanced and stable, Is it better to make “house” for electrical components?

There must be electrical components on the base and glider but there are no designated place to stay on the surface. By researching on previous MSD teams, they glued and duct-taped electrical parts inside of the EPO forms. Especially, this treatment made glider unbalanced.

So there is need to make a housing for electrical parts inside of the glider and base station. by using a “housing board” (‘ - ‘ shape), wires and electrical components, such as ESC and batteries, can be lined.

Here are some advantages for apply the housing system :
1. Easier to be tested with multimeter.
2. Adjust the components positions so that calibrate the balance easier
3. Protect wires and hardwares from the surroundings

-Benchmarking

	Coat substance	Weight	Size	Price	Easy to Build
single board	copper	1 oz	2.9’’ * 5.9‘’	$ 2.95	Yes
double board	copper	2 oz	2.9’’ * 5.9‘’	$ 3.95	Complicated

Question #6

How heavy does the base need to be in order to remain firmly on the ground? Should the weight required be contained in the base, or should another outside source be used (stakes) to secure the base to the ground? Similarly, will the plane be able to withstand the tension force from the tether?

To answer these questions, the magnitude of the forces applied by the tether need to be obtained. This can be done using the MatLab simulation that was provided at the start of the project. According to this simulation, the base and the plane could experience a tension force of close to 1500 N. Calculations need to be performed to determine whether or not each system can withstand these forces. A simple free body diagram is provided below to illustrate:

These forces are drawn vertically assuming a 90 degree angle from each system. This will not be the case in reality, and any calculations using these models therefore will be an underestimate of what the system can actually handle. This built in safety could be of some use. Also, since these forces will have horizontal components, these may also need to be considered.

Question #7

Are the launch and land systems worth the resources (building and testing) and the man hour commitment (project should not be focused on making so many modifications to the plane)?

Most gliders should be capable of launch by hand and landing on their belly in the grass. Any modifications add weight to a glider that isn't be able to generate much lift, especially if it will be attached to a long tether.

Is it worth using a motor instead of human power at this early state of analysis?

Our current project should be focused more on getting a glider flying in its intended path before adding any additional components to the base. The simulation also shows that tension forces can reach 1000N and that can require a lot of power to reel in using a motor. A more powerful motor adds additional strain on the budget (25% is already used)