
Sputnik 2022

Team 25 MRR
Feb 20, 2022

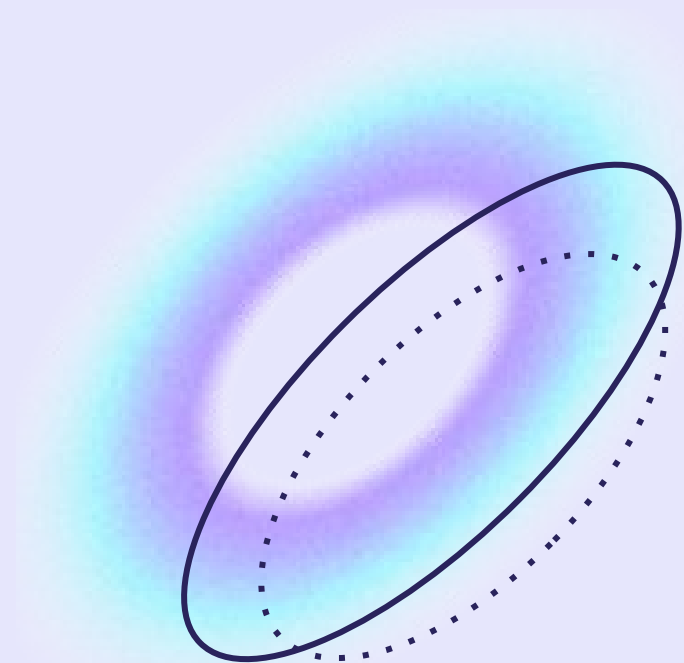
Meet Our Team

Victor Li- third year mech

Peter Lin- third year mech

Leo Cheng third year mech

Crystal Zheng third year mech



Background

- The current food service industry needs an efficient drone delivery method
 - help address the employment and traffic issue



<https://www.gloriafood.com/how-to-improve-food-delivery-service>

Design Process



Stage 1

- Identify objectives and constraints

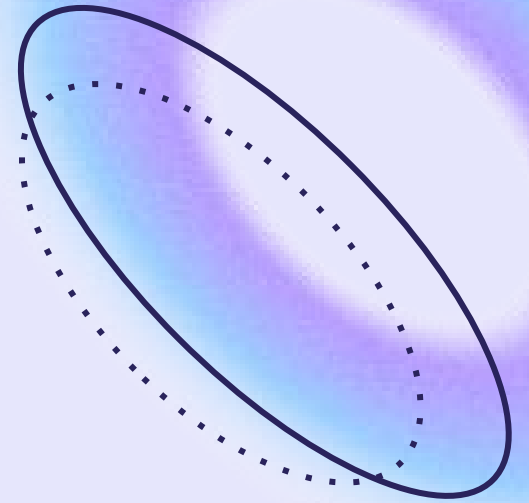
Stage 2

- Brainstorm drone design ideas and hand sketch

Stage 3

- CAD and assembly
- Calculation

01. Design Objectives



Design Objectives

01.

Drone can be **recharge** and fly at least **20 min** each time

02.

Drone has a minimum **0.5m x 0.5m** food container

03.

Food **does not slide around** the container

04.

Food container has a **locking** mechanism

05.

Drone should carry a **least 2 pounds** of weight

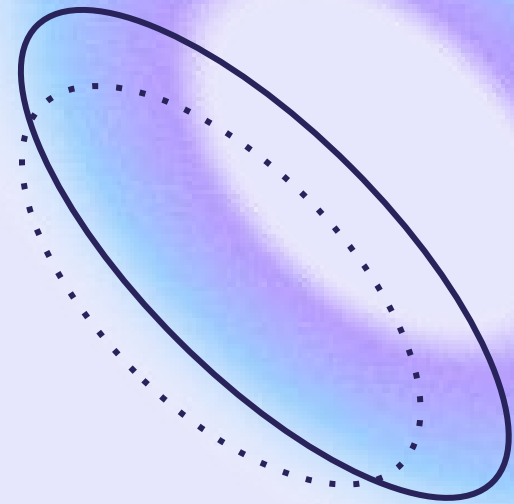
06.

Drone frame is easy to clean

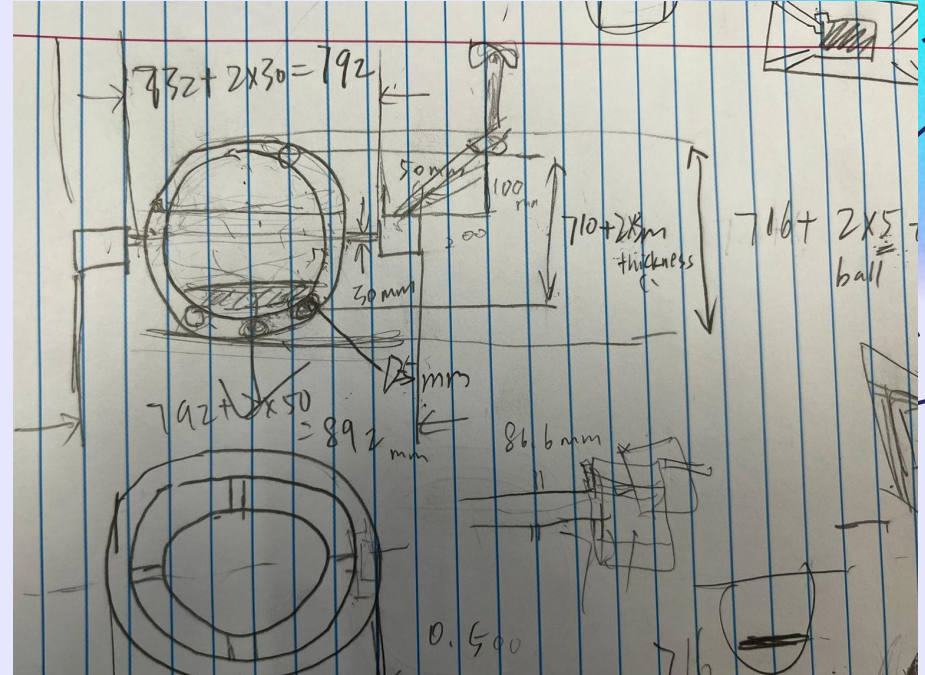
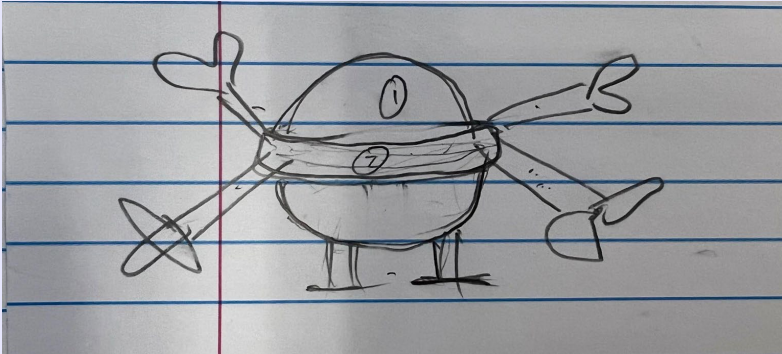
02.

Brainstorm

Ideas



Some Rough Sketches...



Some of Our Design Thinking

Placement*

The food container will need to **stay upright to the ground** at all time to prevent spills

Food Moves*

Need to ensure the food **does not slide around** during flight

Drone Shape

Use **streamline bodies** to **reduce drag** during flight

User Experience

Easy to use and clean

Materials

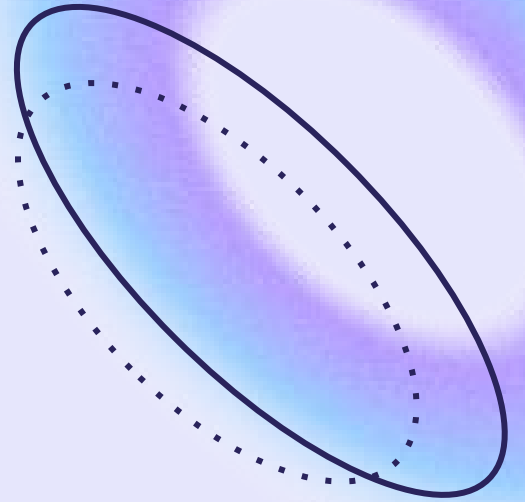
Durable, cheap, relatively lightweight

Creativity

We want an **INTERESTING** design!

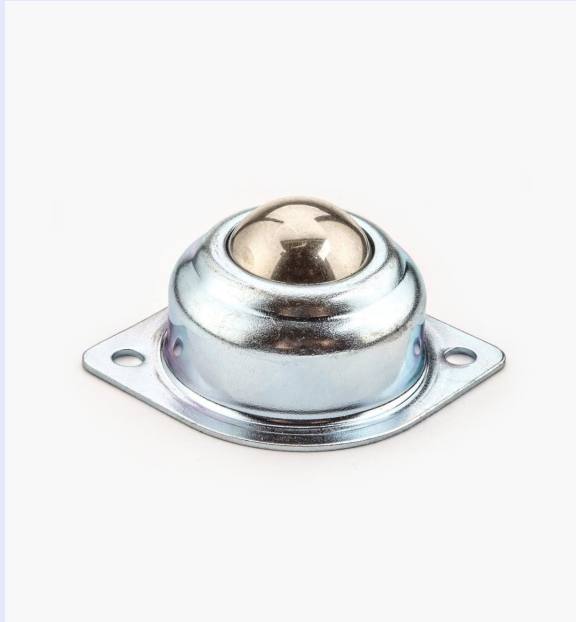
03.

Design Details



Upright Placement of Food Container

How the food container can stay in the upright position while the drone is flying?

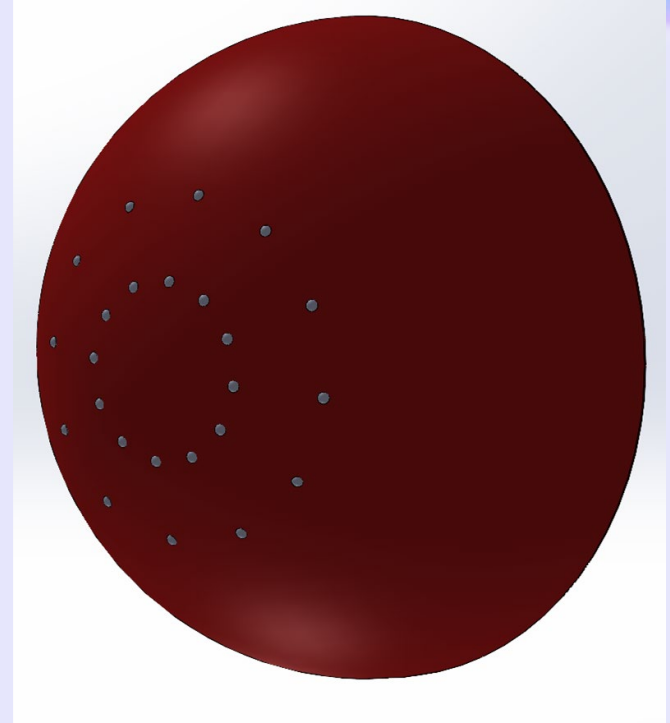
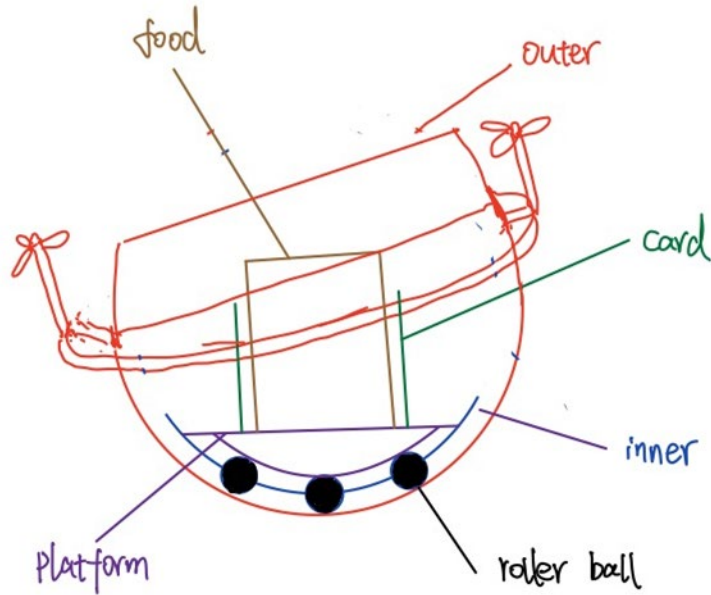


<https://www.leevalley.com/usa/shop/hardware/jig-and-fixture-parts/3006-roller-balls?item=99K5220>

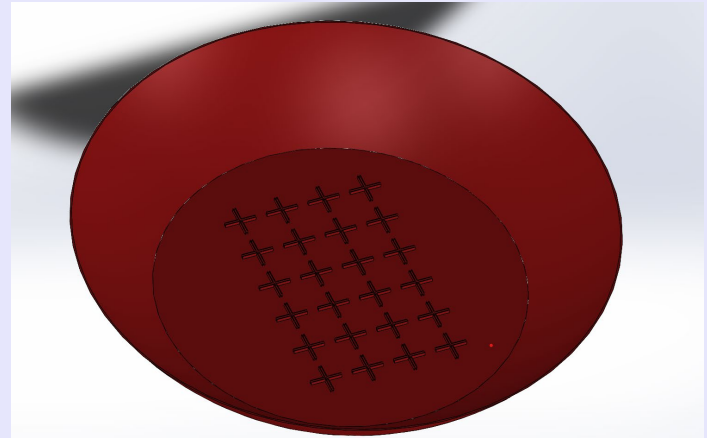
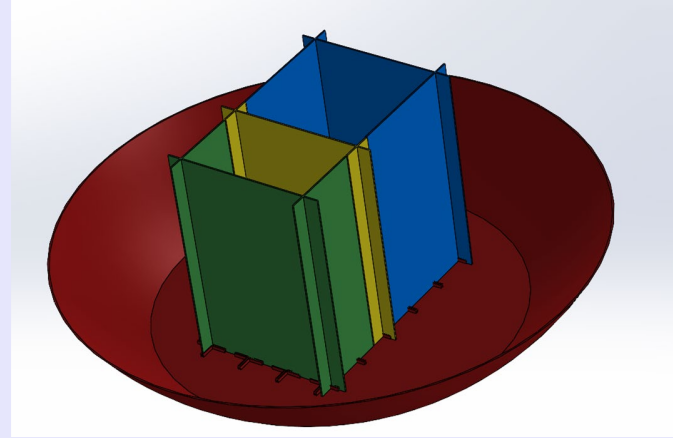
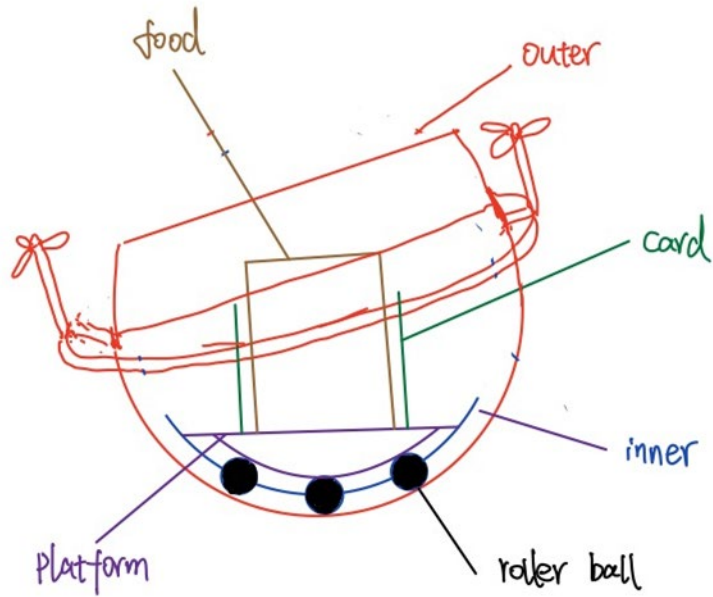


<https://www.memorylanetherapy.com/product/rollerballbodymassageglovefor-seniors/>

Upright Placement of Food Container

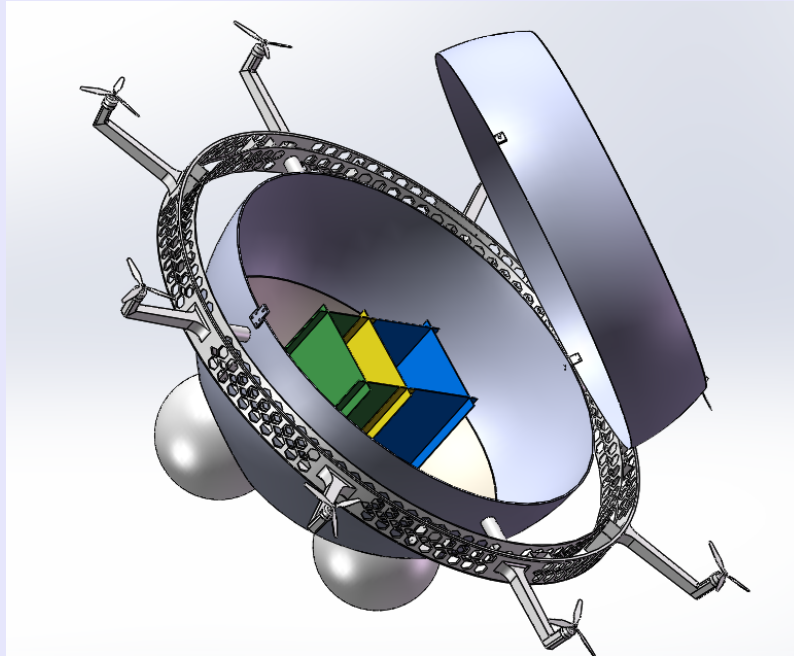


Prevent Food Sliding



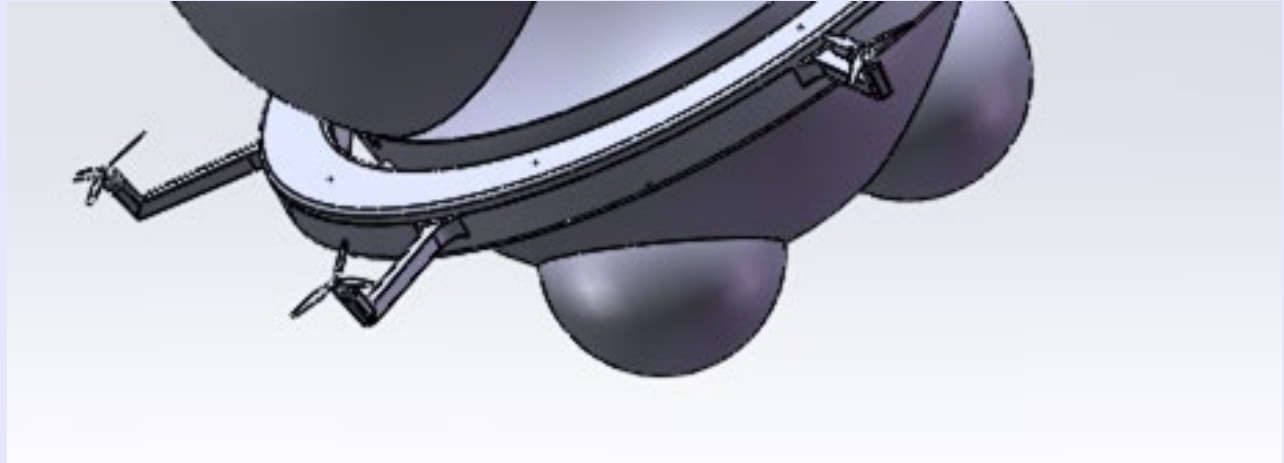
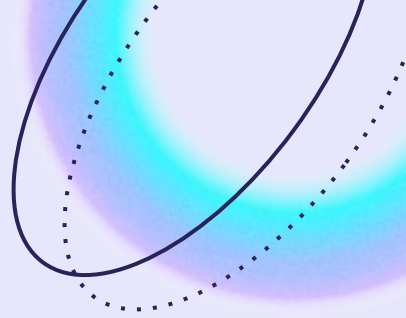
User Experience

- Users can open the spherical shells like boxes
- Smooth surfaces easy to clean



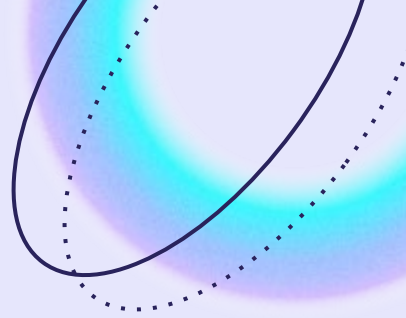


Safe Landing






Material Choice



- **Polymethylpentene**
 - The least dense thermoplastic resin
 - Density around **0.835 kg/m³**
 - Low moisture absorption
 - High melting point
 - Highly insulating

Electric Components

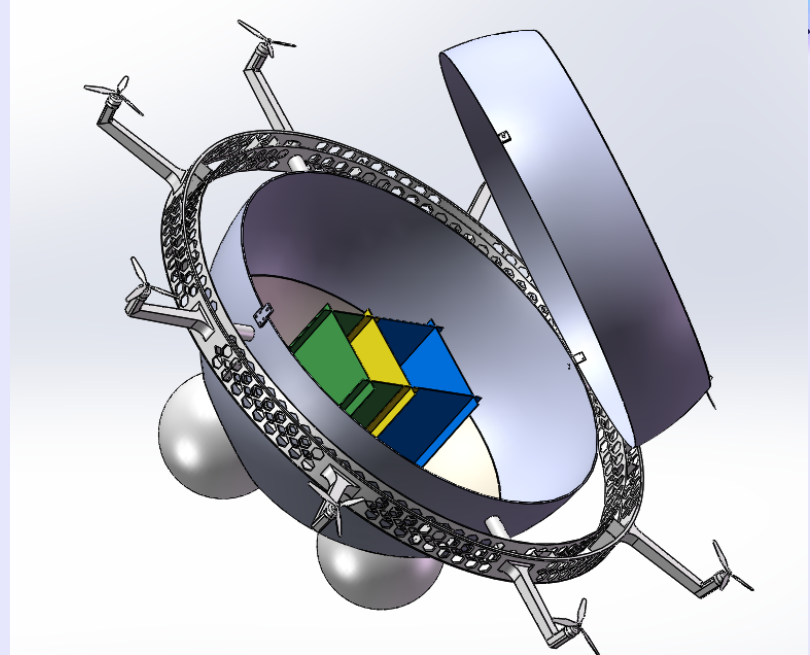
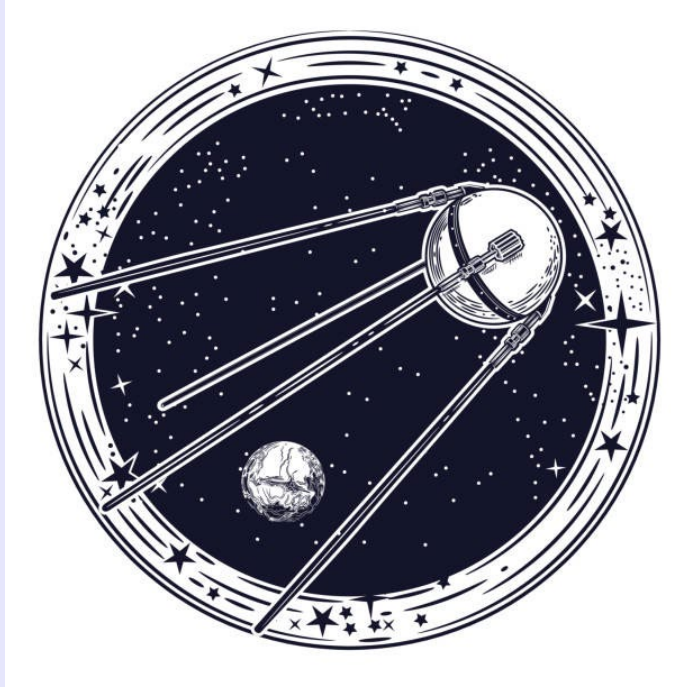
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01. Propeller Choice
greatest thrust and max weight
that can afford
-



1	
100%	
Thrust (g)	3000
Amps	55
Efficiency	2.3
Prop Diameter (in)	6
Weight(g)	38.2

-
02. Batteries
9 batteries to travel 15 min
- 

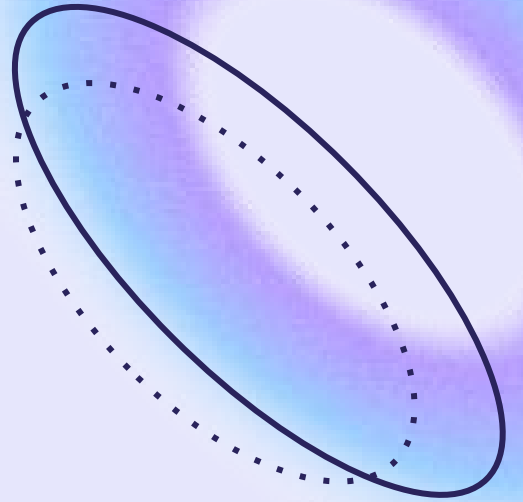
Get Creative!

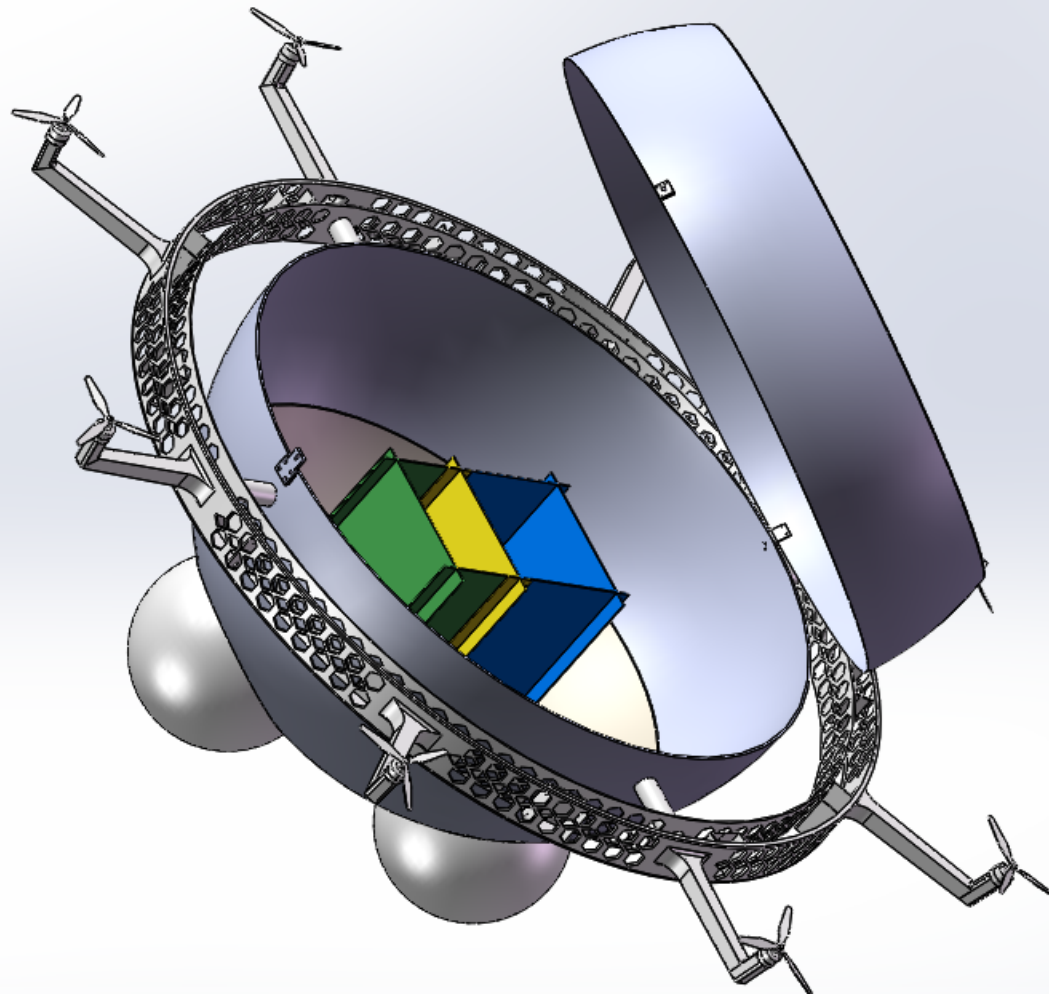


<https://www.istockphoto.com/illustrations/sputnik>

04.

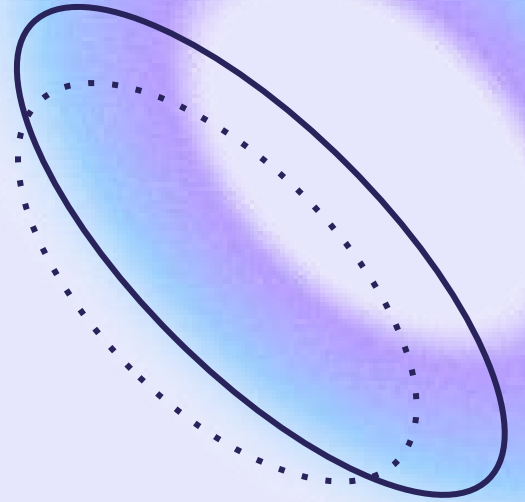
Final Assembly





05.

Calculations





Weight

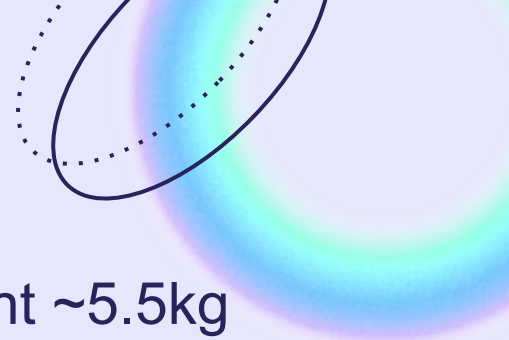
- The size of food container is 0.5m x 0.5m x 0.5m
- Weight reduction strategies*
 - **Hollow** design (instead of rigid rods etc)
 - Material choice **light** plastic, foam)



Cost

- **Polymethylpentene** can use 3d printing
Around \$700
- Cost for machining parts (hinge, locks) is relatively cheap
- Programming cost

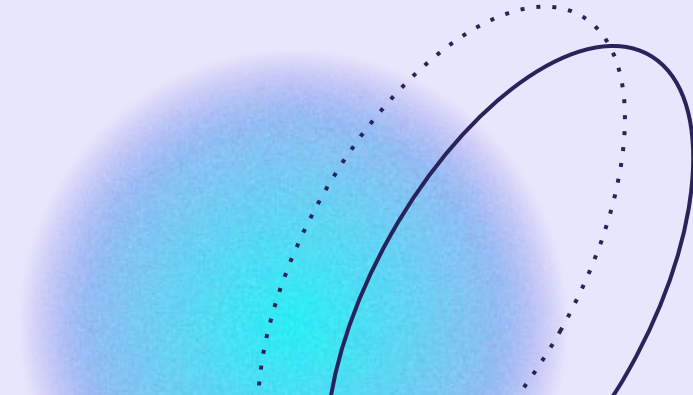
<https://catalog.cshyde.com/viewitems/films/tp-polymethylpentene-film?>
<https://patents.justia.com/patent/20200230873>



Flight Duration

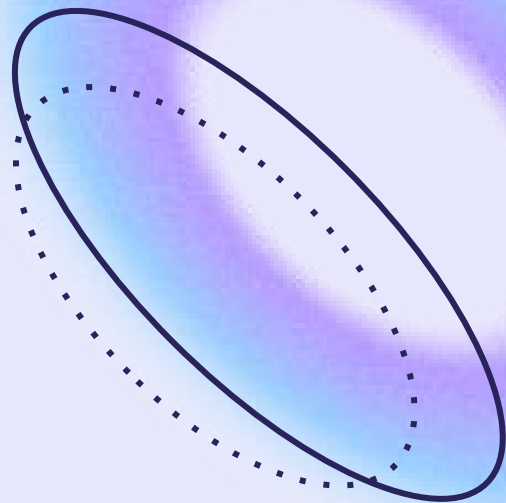
- 9 batteries for 15 min flight with current weight ~5.5kg
- Reduce food container size down, can achieve 20 min flight time

<https://catalog.cshyde.com/viewitems/films/tpoly-methylpentene-film?>
<https://patents.justia.com/patent/20200230873>



06.

Conclusions



Project Reflection



Teamwork is key

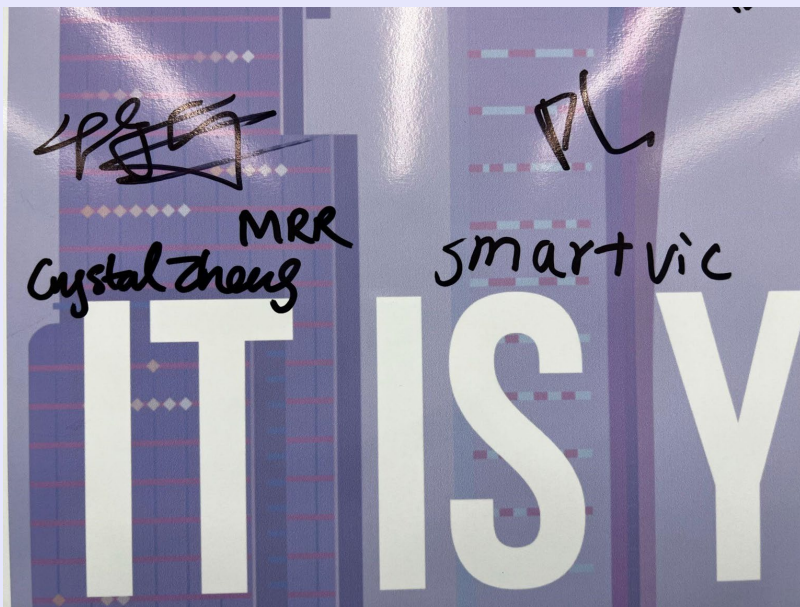
Think outside the box

Inspiration from real life application



Thank You!

Any questions? :)





References

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<https://www.mdpi.com/2073-4360/10/3/314/html>
https://www.engineeringtoolbox.com/wood-density-d_40.html

