No Heat Shield
Semi-Finalist List
for
NASA HUNCH
Design and Prototyping 2021

Congratulations for being chosen as a Semi-Finalist for NASA HUNCH Design and Prototype 2021. Your design was chosen as a semi-finalist because you have a prototype that shows some or all of your idea, interesting/original ideas in your design, you did some valuable testing, and/or had some CAD designs that conveyed significant contributions. Despite the difficulties and not as many schools participating this year, I believe that HUNCH has received as good of quality of projects as ever. You should be very proud of your prototypes and ideas especially because of the difficulties surrounding this school year. Some schools have been out of class all year and others have been in class all year but students were being pulled out of class for weeks at a time. Some students were only able to work and build from home. One school was only able to work together on their project for 3 weeks before their CDR. Everyone should be commended on your resilience to finish your project and the great ideas and work you have put together in front of your own eyes. Prototyping and testing are the first steps in any engineering project and all of you have learned the value of it.

It is from the Semi-Finalist list that we will narrow down our choice for Finalists. We at HUNCH are very proud of how difficult you as students and teams have made it to choose which designs should go forward. **Congratulations!!!**

This list may be updated in the next day or two if we find we are missing a few team's brochures.

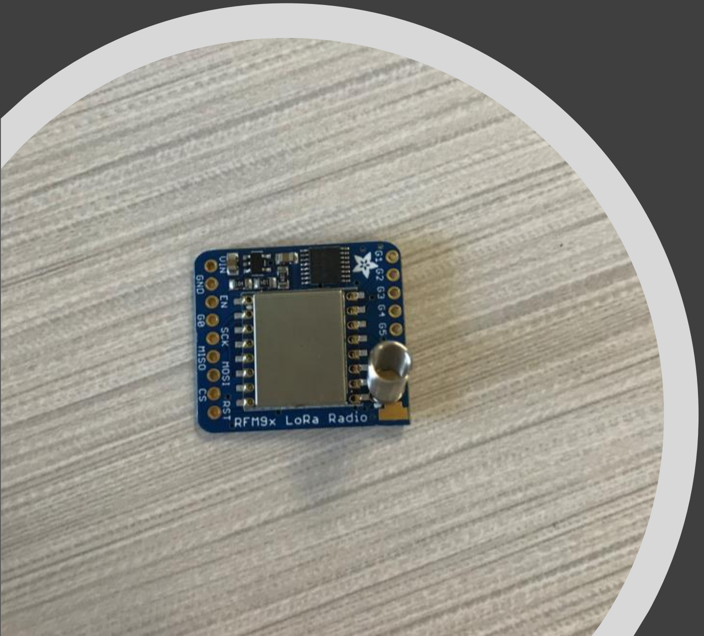
We expect to have the list for the Final Design Review in the next day or so as well.

No Heat Shield

- Cole Valley Christain School
- Teacher: Julie Morgan
- Team: Ellison Daniel, Alex Smith

MECHANICAL DESIGN:

- This project is designed to gracefully tumble though the atmosphere from any angle. It has as drag coefficient of 1.176, where a solid object of similar mass has a drag coefficient of 0.14. It is also designed to fold so that it can be as small as possible before deployment.



Electronics Package

- (top left) For our electronics package we have decided to use 4 solar panels, a lightweight GPS module, a small battery, and a transmitter.

Components

- HC-12 transmitter transmits a signal approximately 725ft (220m) though buildings. With the HC-12 transmitter, the signal drops 10 db per 100 ft.
- Each solar panel produces 30 mA.
- We are using a 500mAh battery to power the transmitter when the solar panels.
- With a 500 mAh or a 3.7 V battery while GPS was transmitting for twenty-five minutes, the battery only drained to 3.54 V without solar panels connected.
- Our electronics package can withstand and continue to transmit from 0 to 106 degrees Celsius.

Our Team

- Alex (left) mainly worked on the CAD design of our prototype. Ellison (right) mainly worked on the electronics, planning, and testing for this project.

Further Development

We are looking into using Carbon-Fiber tubes as the frame material. Another point of improvement the payload and payload housing.

Outside Research Sites

NASA

https://www.nasa.gov/

Aerospace

https://aerospace.org/

The University of Tokyo

Center for Aviation Innovation Research

http://aviation.u-tokyo.ac.jp/

About Team TARP

Based at CCHS, Team TARP specializes in aerodynamics and dropping stuff. Some notable drops include: Dylan's monitor, TARP, and pretense.

Aaron Edwards   Carter Hewett   Dylan McElroy

Contact Team TARP

Clear Creek High School

Advisor: Ms. Elizabeth McCarty

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League City, Texas 77573

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Email: emccarty@ccisd.net

TARP: The Atmospheric Reentry Parachute

A NASA 2021 Hunch Project

The Problem:

When in orbit, a space craft is circling the Earth at around 17.500 miles per hour. Returning from space through Earth's atmosphere usually requires a heat shield to protect the occupants from the excessive temperatures generated as the friction of the air particles slow down the space craft. These heat shields are costly to make and are usually single-use.

The Hypothesis:

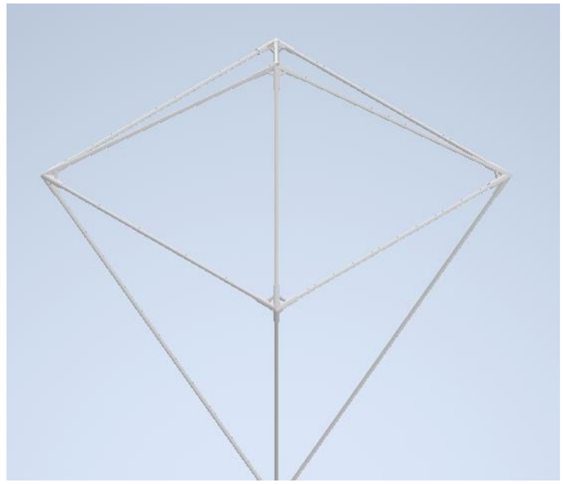
Dr. Shinji Suzuki suggested that an object with a small amount of mass and a large amount of surface area could be released from orbit and return to Earth without burning up. His initial proposal was to use paper airplanes but NASA wanted a more accurate testing device.

Our Solution:

We have designed a testing device that can be released from anywhere in the atmosphere to prove the idea that a low mass, high surface area object will not burn up in re-entry with no heatshield. It will have an electronic package attached to transmit location data to be tracked. It has been calculated to have an approximate terminal velocity of 4.25 m/s.

Our Design

We designed TARP to be a lightweight rectangular pyramid unmanned parachute that can operate even in the upper atmosphere. It has a fixed-support-frame to ensure that no matter which way it is dropped it will always right itself and operate as it was intended.



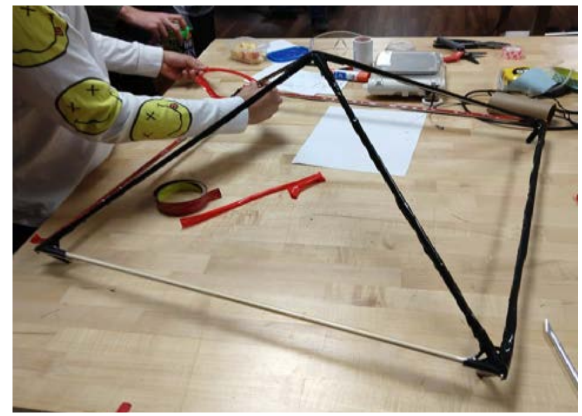
The Ideas Behind TARP

The Plan: TARP was designed with the idea of easy manufacture and assembly in mind. The parts necessary to make it are all off the shelf materials with the exception of the 3D printed corner joints.

Easy to build: The assembly is extremely easy well. The rods only have to be cut down to the proper length and the parachute material only has to be cut down as well. Once that is all done, the pieces simply attach together.

Cheap to Build: The re-entry device is relatively cheap to make with the electronics being $44.55 and the carbon fiber tubing and mylar sheets being $9.625 per ft for .31"OD and $0.265 per sq.ft respectively.

One Time Build: This design was made to be a single use device but it could potentially be used multiple times with minimal repair depending on weather and terrain conditions.



We are working on Earth to prepare for Mars.

NO HEAT SHIELD PROJECT

iSchool of Lewisville

Contact Us

bg6770@students.responsiveed.com
or
ns1443@students.responsiveed.com

ABOUT OUR PROJECT

Our glider is a simple, lightweight, item that descends through the atmosphere without burning up. It can be built by using simple and common material that anyone can buy. And by using simple Arduino-compatible components it is able to take in information and transmit it at a frequency of 433MHz. This makes it capable of being used as a temporary atmospheric probe to transmit atmospheric data.

OUR MAIN MATERIALS

CARDBOARD SHEETS

We use cardboard sheets to construct the main body due to it being lighter than the other materials we have considered and after receiving feedback from Glen Johnson that said to go for something light.

ARDUINO COMPATABLE

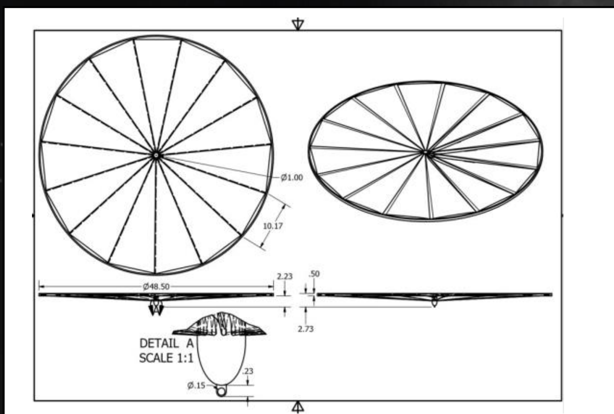
All of our electronics from the sensor to the transmitter are fully Arduino compatible in order to make sure that everything runs smoothly.

SOLDERING KIT

Although the majority of our electronics can be connected through pins, inputs, and female-to-male jumper wires, soldering is required to connect specific components to the rest of the system

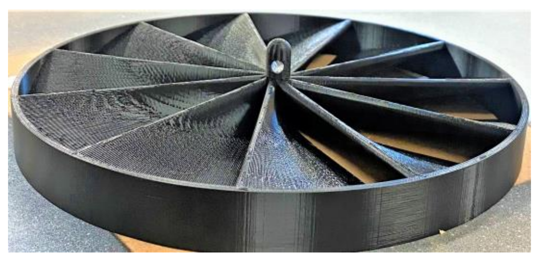
Why was this project requested?

Nasa discovered that dust particles from space can travel back into the earth’s atmosphere without burning up. So, they wanted to see if we can design a prototype that can successfully re-enter the atmosphere without the use of a heat shield and without burning up.



Objective/ problem statement

We are tasked to design a payload that is reentering the atmosphere without the use of a heat shield, due to money costs, a heat shield may not be used. It is proven possible that you can reenter the atmosphere without a heat shield. The object we designed will collect and provide data as well as carry a microchip and a special location device that will provide a location every 10 minutes while in space and every 60 seconds when hitting the pressure point of the atmosphere so we can accurately track if our design made it thru the reentry of the atmosphere successfully and it will give us a more accurate location.



What is Heat Shielding?

Objects re-entering the athmosphere are using a heat shield, a heat shield is needed to utilize aerodynamic drag during re entry. The force is significantly greater during re entry compared to launch. The athmosphere is on average 56 Fahrenheit, due to the increase in force during re entry the tempature can increase up too 3000 Fahrenheit. Because space crafts are very heavy, they have no option but to use a heat shield.

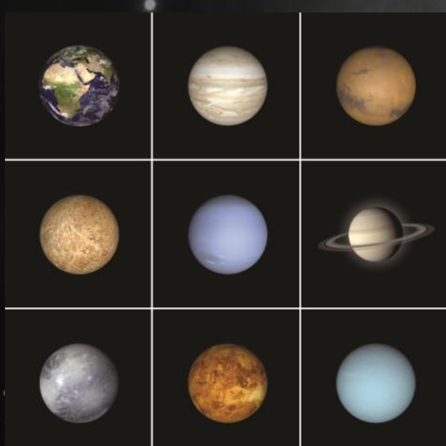
PROTOTYPE 1 (LEFT), PROTOTYPE 2 (RIGHT)

AFTER CREATING PROTOTYPE 1 WE NOTICED THAT WE NEEDED MORE STOPPING POWER. WE DESIGNED A SECOND ONE AND MOVED THE BLADES CLOSER TO OPTIMIZE STOPPING POWER AND ROTATION ENERGY

Future Goals/Objectives:

Our goal is to make a difference in the future, our objectives are trying to reenter the atmosphere without a heat shield and help with the exploration of mars and other planets.

We believe our project can make a difference in collecting data from unexplored planets to help the future of **Space Exploration**. Our hope is that we can turn our project into a weather data collector or potentially fit a little camera and send it towards unexplored planets.



Don't tell me the sky is the limit when there are footprints on the moon

– Paul Brandt

NO HEAT SHIELD

NASA HUNCH
Critical Design Review

Project Title: **No Heat Shield**

School Name: **Space Coast Jr/Sr High School**

Teacher: **Mr. Luis Reyes**

Team Member Names: **Jorge Corado and Shea Edmondson Wood**

Description of your Prototype / Data collected:

The Interstellar Glider is a simple and reusable electronic housing unit designed to be sent through the Earth's atmosphere and is designed to withstand the high temperatures of reentry. Its design and its functionality is like the space shuttle, it is simple and reusable and can safely travel through the atmosphere without burning up. Once in the atmosphere, a pressure sensor would deploy a parachute like mechanism to help it slowly and safely land for recovery. If it is to land in water, helium tanks in the interior would help it to stay afloat to prevent it from sinking and further causing leaks within and to avoid damage to the electronics. We were able to bring a 3D scaled down model of the glider as seen below in Solidworks and after the printing process.

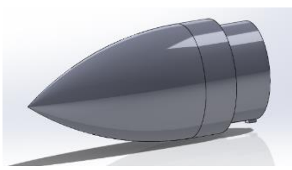
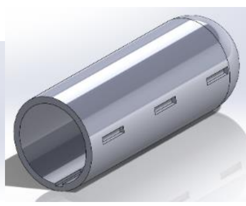
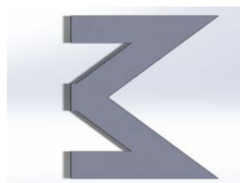
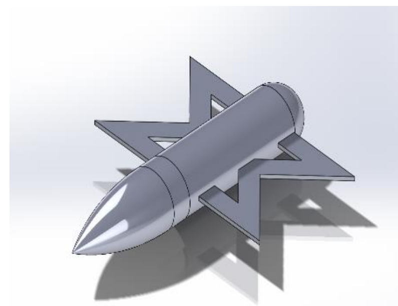
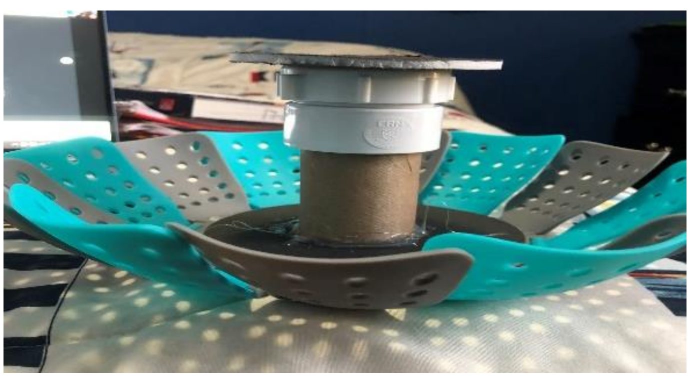
My teammate and I were able to test our two different solutions with recorded testings. Both were good but had major flaws in their descent patterns. Mine fell downwards nose first rapidly while Jorge's fell slower but swayed a lot. We came up with the idea to use both in a combination of both which helped fix our problems with its descent.

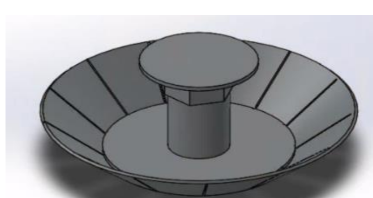
Though this is just a prototype, the model is exactly how it would look if mass produced. However, materials for would be different, reentry is 3000F so we needed a material that could shield heat for the real one. Jorge and I came up with 2 ideas, we could use ceramic coatings with patterns in it to reduce heat in one area, similar to the space shuttles, and we also came up with the idea of a custom alloy metal of light metals with high heat resistance to exceed the 3000F of reentry and so it doesn't add too much weight to the glider.

We are aware that this would work differently in microgravity. The glider was designed to be sent through the atmosphere via being deployed from the ISS or any other space station in orbit. The glider would descend similarly to the space shuttle and as gravity builds it would turn forward to allow the parachute to properly deploy.

This project uses COTS for the first prototype for Shea's and both Jorge's prototypes feature COTS.





Our Team

Top (left to right): Matt Gorton, John Greener, Rick Hamilton

Middle (left to right): Emily Anne Matheson, Tyler Fiore

Bottom (left to right): Shriya Sivakumar, Kyle Hughes

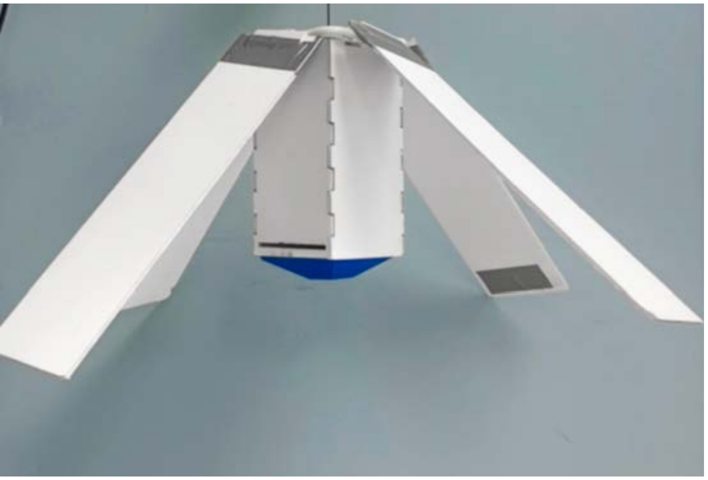
Contact Us

tricountyhunch@gmail.com
(508) 528-5400

Sharks No Heat Shield

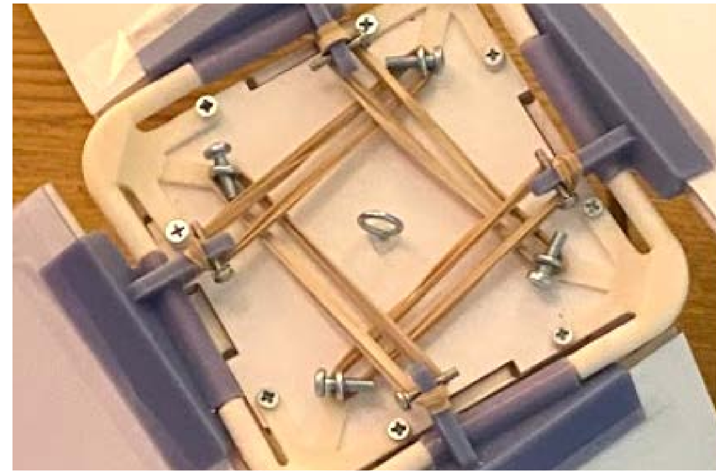
Tri-County RVTHS, Franklin MA

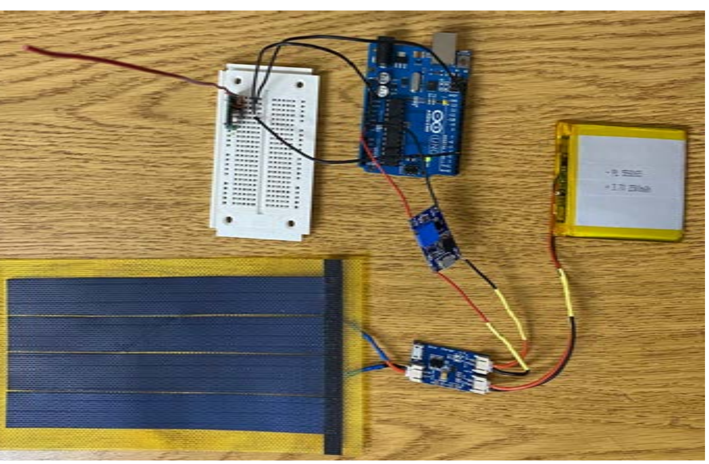
Advisor & Teacher: Kristen Magas



VEHICLE: HELICOPTER

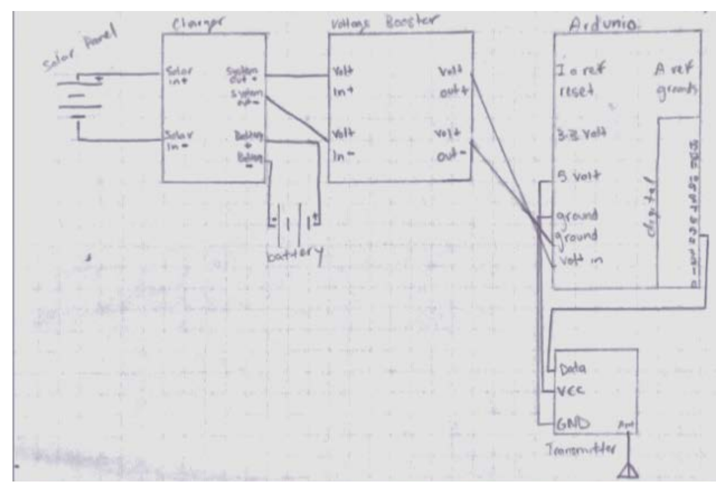
4 attached helicopter blades provide drag to slow down while rotating the body to increase stability. The blades fold down for compact storage on the carrying spacecraft and automatically deploy after being released. The body of our design includes a spacious 5x5x10" inch box for the electronic transmission components and additional experiments if desired. The sides of the storage compartment will contain the solar cells.



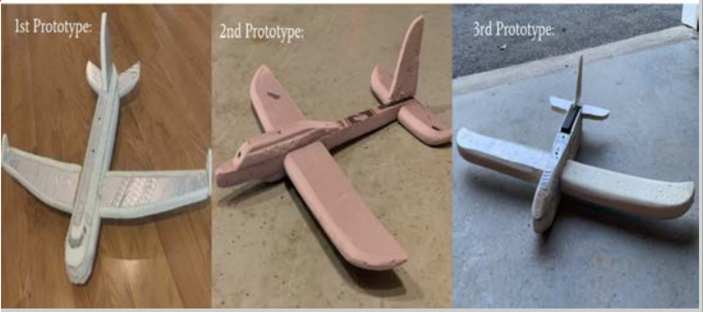


ELECTRONICS: WSPR

Solar panels built into the sides of the helicopter body power a charger for the battery. The battery runs through a voltage booster which increases the battery's voltage to 5 volts. The transmitter uses the WSPR protocol to send GPS location to a receiver and WSPR.net. WSPR allows a small circuit of under 150 grams to transmit signals at distances of up to 300 km using low power.



Our Project Design Evolution



Prototype 1 (left):

- Front heavy, too bulky
- 9.1oz
- Fuselage length > wingspan
- Very few curves in design

Prototype 2 (mid):

- Mirrors design of original mockup
- Much lighter, w/ stronger styrofoam
- 6.3oz lighter than first design
- To small to carry package (inside)

Prototype 3 (right):

- Increased wingspan, smaller fuselage
- Weigh's ⅔ of 1st prototype
- Hollow fuselage
- Hold's package and maintains airtime

NASA HUNCH

QUESTIONS?

Email us at ghsheatshield@gmail.com or visit our website at https://sites.google.com/inst.hcpss.org/ghsnoheatshield

GHS NO HEAT SHIELD J.E.D.

Glenelg High School

No Heat Shield

By: Jonah Wisniewski, Evan Whatley, David Richman

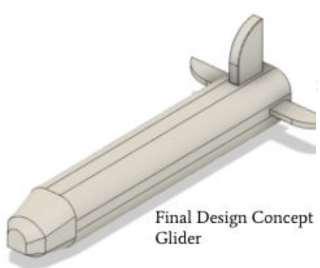
Background:

NASA's heat shields are very expensive and come with a lot of issues, we were tasked to find a solution for a spacecraft to enter the atmosphere withstanding high temperatures and the atmospheric pressures while sending a signal to earth recording different data points such as location, pressure, and time

CAD

Cons: Body Nose is too large/front heavy. Intended to hold package. Package adds additional weight to front

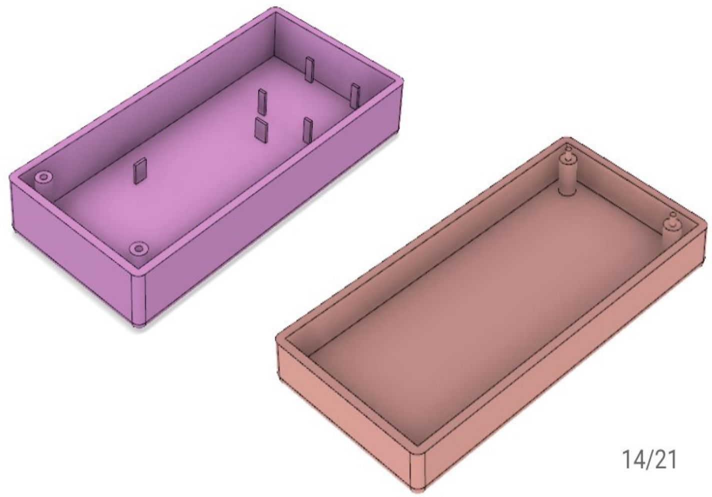
Much longer wingspan. Intended to stabilize excessive weight in front. Cons: The longer wing design adds to weight. Also lacks winglets.



Pros: Nose is domed to decrease drag. Much narrower and sleeker. Lightweight. Stabilizers modeled after mockup.

Wings more aerodynamic and lighter. Added winglet to decrease drag. Wing is also shorter and lighter.

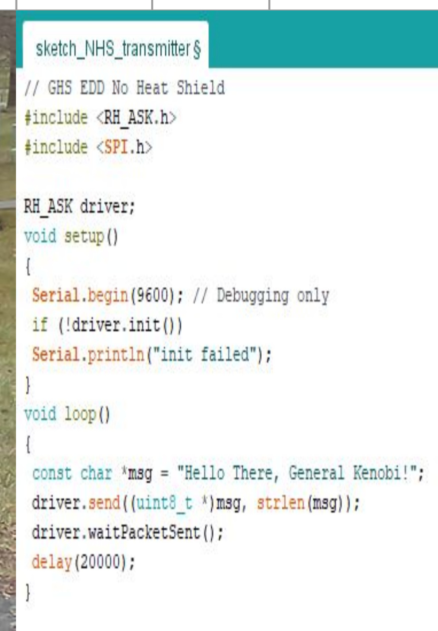
Transmitter and Receiver



The completed circuits for our transmitter and receiver electronics packages. Both have an Arduino UNO, a breadboard, and three wires. One has a transmitter module and one had a receiver module. The transmitter assembly will be attached to the glider and send a pre-designated signal to the receiver assembly, which will relay the message to a computer. This pair only works as a proof-of-concept for the tracking system a glider in space would need and does not broadcast the location, only a message.

Transmitter Testing

Trial	Message (Character Length)	Delay Time (s)	Distance (m)	Received?
1	28 characters	20.0s	100	Yes
2	28 characters	20.0s	200	Yes
3	28 characters	20.0s	300	Yes
4	28 characters	20.0s	400	Yes
5	28 characters	20.0s	500	Yes
6	28 characters	20.0s	600	No



```
sketch_NHS_transmitter §
// GHS EDD No Heat Shield
#include <RH_ASK.h>
#include <SPI.h>

RH_ASK driver;
void setup()
{
 Serial.begin(9600); // Debugging only
 if (!driver.init())
 Serial.println("init failed");
}
void loop()
{
 const char *msg = "Hello There, General Kenobi!";
 driver.send((uint8_t *)msg, strlen(msg));
 driver.waitPacketSent();
 delay(20000);
}
```

No Heat Shield

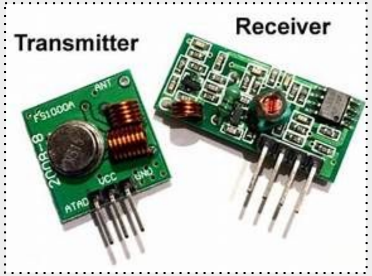
School: Council Rock South
Teacher: Mr. Bauer

MARS 1

The Prototype

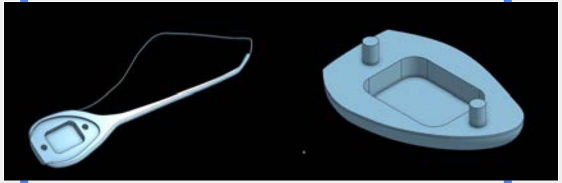
Our project is based off a maple seed and is made to copy the vortex spin of the seed in order to slow it down upon reentry enough so that a heat shield is not necessary to keep it from burning up. It also has an electronic payload which will broadcast a ping frequently so that the prototype can be located as it descends.

MARS 2



Constraints and requirements

- 200 gram electronic payload including radio
- Transmit 437 MHz
- Antenna 6 .42”
- Send a ping every 10 seconds
- Light with a large surface area to reduce friction



Team

Demetra Kohart
Landon Hennicke
Sabrina Adler
Vincent Chiccarine
Matt Floyd
Ben Hogan
Kari Johnson
Greg McDonald
Zachary Miller
Anvitha Naikoti
Joe Salevsky
Matt Staller
Gracie DeSaro
Isabella Francisco

MARS 1

- Designed to mimic a maple seed
- Curved to refrain from pointy edges
- Designed to slow itself down to not burn up in the atmosphere
- 3D wing shape to mimic airfoils
- Tested vie drone drop of 400 ft

MARS 2

- Designed to mimic a maple seed
- More straight stem with a sharper, angled spine
- Designed in Onshape by tracing an image of a real maple seed
- Tested via drone drop of 350 ft

Future Improvements

- Experiment with triboelectric nanogenerators
- Harness the static energy being stored in the seed on descent
- Similar to how a helicopter generates a lethal voltage during flight

Materials

- RF 433 Transmitter
- Recommend use of
  - Titanium Alloys
  - Carbon Composites
- Used materials
  - Monocoat
  - Plywood/balsa wood

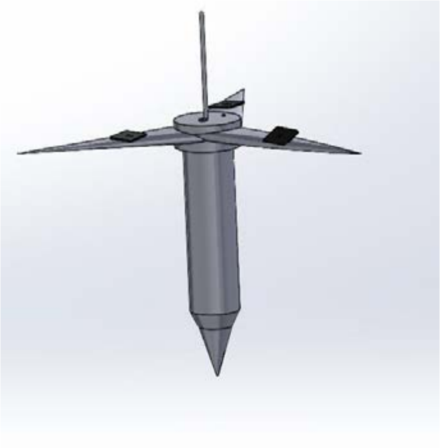
Propeller
No Heat Shield

Conroe High School

Mr. Canestorp

Jefte Delgado

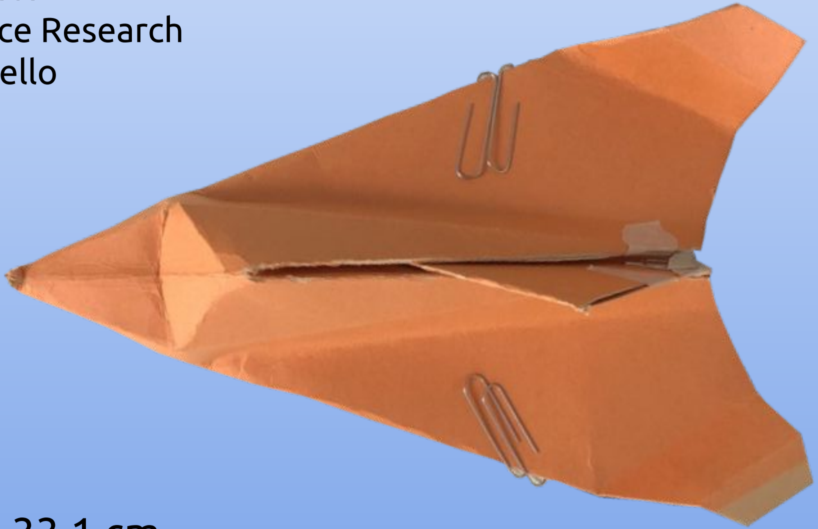
Description: The purpose of the propeller is for its wings to slow down and be steady while being dropped with the goal of it falling slowly and not to quickly and unbalanced to where it will not capture any data. The wings are going to long and having a curve on the wings beginning from the middle of the propeller to the end of it. With the electronics being in the side where the base which is a cylinder and the wings are connected.

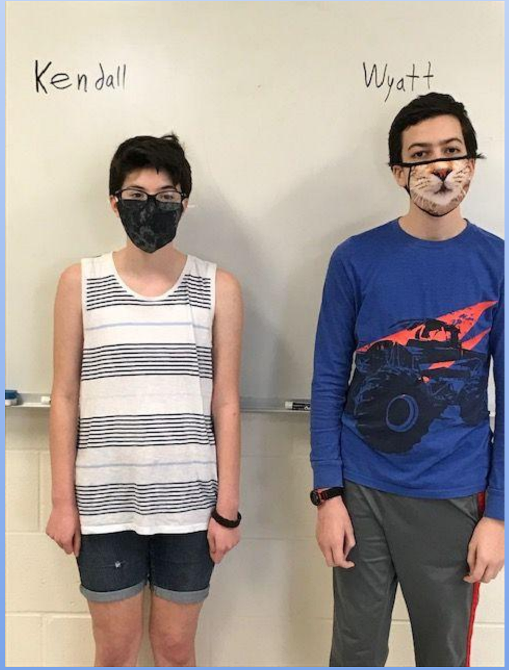


No Heat Shield

Group Members
Wyatt Mortimer
Ken Meyers

Fairport High School
1 Dave Paddock Way,
Fairport, NY
Nasa Space Research
Mr. Stornello





Length: 33.1 cm
Width: 23.2 cm
Height: 9.0 cm

Pros

- ➔ Lots of space for electronics
- ➔ Flat areas where solar panels could fit.
- ➔ Has things that can be adjusted
- ➔ Flies stable when properly balanced

Cons

- ➔ Multiple Layers add weight
- ➔ Needs to be balanced
- ➔ It is difficult to fold

Future plans

- ➔ Balance the plane better
- ➔ Figure out which size batteries and solar panels are needed
- ➔ Test if airtight container for electronics is needed

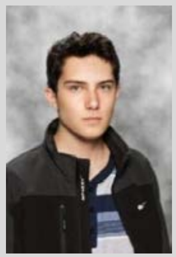
No-Heat Shield Company

(No Heat Shield; Hunch Project)

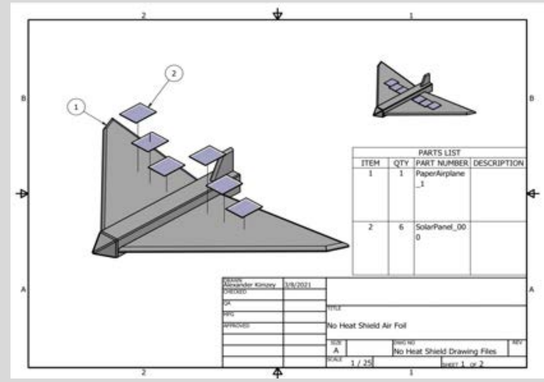
Team members:

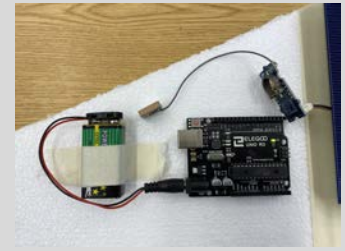
Jose De Leon

Alexander Kimzey



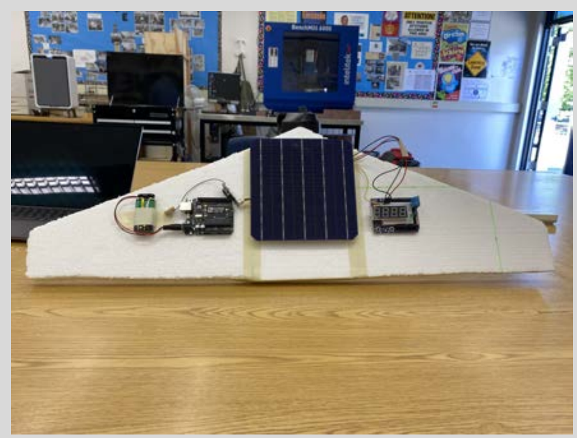
Jose Rojas Rojas





Details:

Our project will focus on creating a prototype that could possibly reenter the earth's atmosphere without the need for a heat shield, we will also collect data to help with creating an effective model that could be used.



Cypress Springs High School

Industrial Technology

Engineering Design II

Cypress Fairbanks ISD

Cypress, Texas

NASA HUNCH PROGRAM

Pods dream

Team members:

1. Abigail Orellana

Instructor:

Steven Marcus

HUNCH Advisor/Mentor

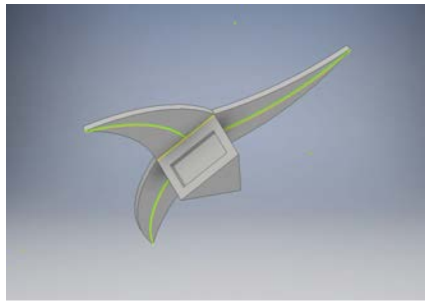
Glen Johnson

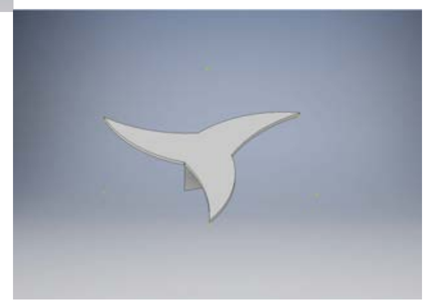
Engineering Design II

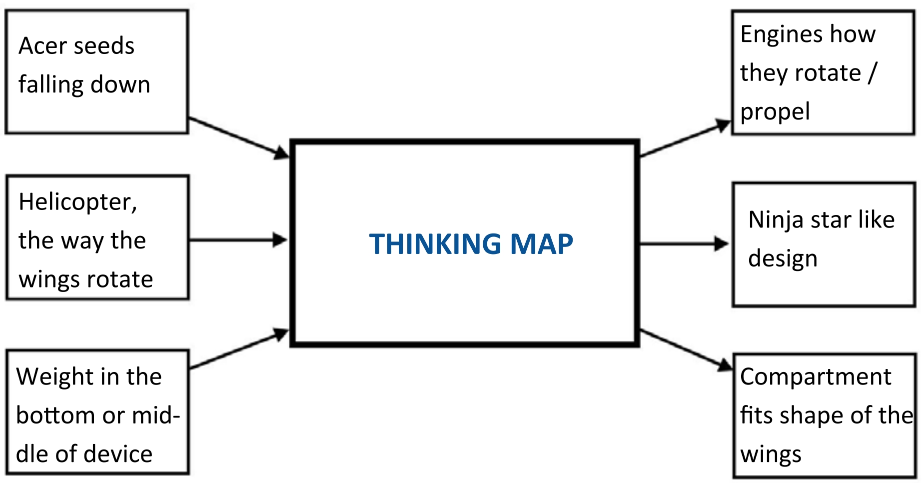
Cypress Fairbanks ISD

Cypress, Texas

No Heat Shield







GENERAL INFORMATION:

Star pod was made to track the orbit while using solar panels and batteries for back-up.

OBJECTIVES:

Create a device that allows electronic tracking to track orbital positioning .

MATERIALS:

Carbon

(Balsa wood exoskeleton)

SOLUTIONS:

The device is made to look like a ninja star, there is a compartment that will hold the electronic packaging and around the device there will be solar panels.

CHALLENGES:

The difficulties I had during the project was trying to find a design that would fit best. Although I also struggled with how I was going to start the design was the main problem that needed a solution.

E-mails:

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Information :

I am a high school senior at Cypress Springs High school and I have an unreasonable liking to math. I'm going to major in Electrical engineering and will one day be an Electrical engineer. Please enjoy my device and its lack of originality. Its okay it's a joke. Thank you fro your time in viewing my brochure.