Generic Ag Nano Lab
Finalist List
for
NASA HUNCH
Design and Prototyping 2021

Congratulations for being chosen as a Finalist for NASA HUNCH Design and Prototype 2021. Your design was chosen as a Finalist because your team has fulfilled all or most of the requirements for your project along with quality in design and manufacturing the prototype. Your team demonstrated good testing of your prototype and knowledge of the problems and extensive understanding of the environment for your project. There was a lot of really amazing competition for these spots and all people from the semi-finalist

By being a Finalist means that you are a winner but this does not mean your idea will fly to space. This is real engineering. Although it is possible the reviewers could see one design that is exactly what they want, it is more likely NASA may choose one or a few ideas from each team to incorporate into a different design. It is also very possible that requirements or needs have changed since the beginning of the school year and they are not interested in the idea at this time. This is the nature of engineering but it does not diminish your accomplishments.

Design to Flight

The goal of HUNCH is to keep your names attached to these ideas and to have you assist with later developments of your projects when possible. Your projects and information will be provided to Mike Bennett who runs the HUNCH Design to Flight program that will coordinate the sending of your ideas to the engineers as they request it and working with your team to give engineers assistance whenever possible. This might include updating or making new CAD drawings, assembly of prototypes, choosing flight components and/or assisting with presentations. You will receive an email through your teachers in the coming days requesting specific information about your project.

Patents

In general, NASA does not seek patents on materials that are only related to space, however, if there are other potential uses for the device or ideas related to Earth bound applications, HUNCH will ask NASA Tech Transfer to assist in working through patent process. It is our goal that students and schools are included in any patents with as much credit as possible. We do not anticipate this as an income generator but more as value to your resumes.

Presentations:

General:

- Practice your presentation ahead of time.
- Look sharp and professional.
- Everyone from the team should talk.
- Briefly introduce yourselves including your name and grade and school and state.

- Reviewers will already be aware of the problem and the constraints– I'll take care of that.
- Start with a demonstration of your prototype and briefly describe the testing that has been done.
- Point out details that make your design innovative, more robust, cleanable, repairable or desirable.
- Mention one or two things that didn't work initially but you were able to make changes and move forward.
- Briefly talk about how your prototype is different from the final product would be and include the materials you think will be used on the design that would fly to space.
- Answer questions quickly and concisely but completely so you can answer more questions and receive more comments. If you don't know something, say that you will have to check on it and plan to get back with them with an answer by email.
- Relax. These people are interested in what you have to say and know what its like to be on the spot.

Specific to Ag Lab:

- Show how a research team will be able to alter your Ag Lab so that it can be manipulated to fit many experiments.
- Show how easy it is to alter the timing for the lights and camera with your software.

NASA HUNCH: AGRICULTURE BOX

Middle Park High School

Drew Landy

Teacher: Mrs. Hargadine

carla.hargadine@egsd.org

Description

This is a computer automated lab set up for growing plants. Its design is made from three layers and a lid, also it features a wire protector to ensure that no water breaks the system.

First Time Set up: https://bit.ly/3dmlh43

Code: https://bit.ly/32funcq

Capillary Action

Cotton cheesecloth connects the water bag into the soil and by being woven throughout there will be equal distribution of water.

Capillary Action Outside view

LID

- Light
  - Has ability to change wavelength of the outputted light using values of red, blue, and green.
- Camera
  - Small black square on photo

GROWTH LAYER

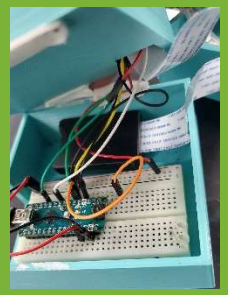
- Capillary tubes
  - Fed from Water Layer in through holes and then the cotton inside them is threaded through the soil (growth medium)
- Fan
  - There is a small fan that will help regulate internal temperature.
- Nylon Mesh
  - A surrounding bag to hold in the soil even tighter

WATER LAYER

- IV Bag
  - To create additional protection of water damage
- Cotton Cheesecloth
  - Threaded through IV bag to bring water into soil (growth medium
- Gaskets (not pictured)
  - Will allow the capillary tubes to be fed through but will not let soil into the water layer

COMPUTER LAYER

- Arduino
- SD card extender
- Programing in C



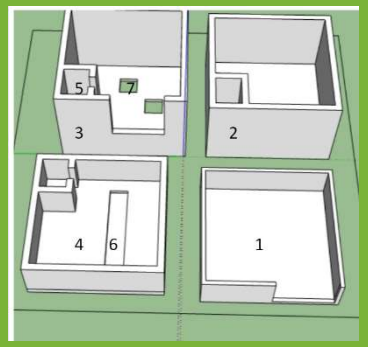


Image Reference:

1. Base / Computer Bay
2. Water Tank
3. Soil Tank
4. Top end / Light Bay
5. Wire Port
6. Light Strip Insert Bay
7. Capillary Action Access points

0GORS Zero-G Organic Research Station

Team Information

School: Hickman High School

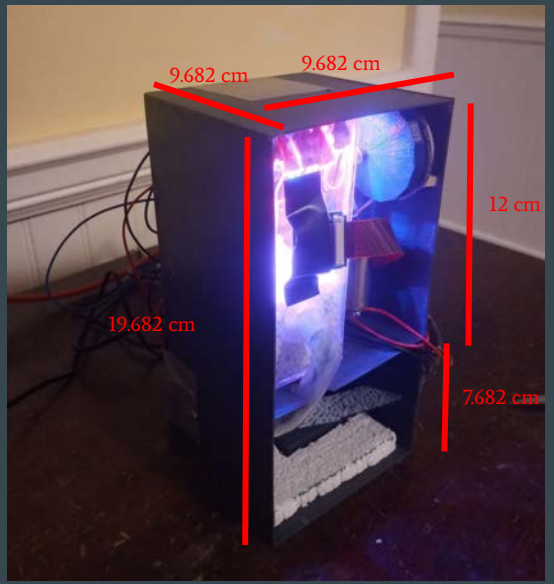
Location: Columbia, MO

Teacher: Matthew Leuchtmann

Team Members: Brady Lunceford, Alec Hume, Jonas Ferguson (left to right)

Key Factors

- Toggleable wicking system allows for steady, controllable flow.
- Our air control system allows for an inner chamber to be sealed and unsealed from the outer chamber. This allows for more accurate gas data and protects electronics from humid air (air output leads to moisture absorbing packet).
- Arduino for systems control while Raspi collects and processes data.



A part of our wiring is outside of the box so that the inside is easier to show off. The problem of bulky wiring would most likely be solved if this were created with NASA grade equipment.

Mission Statement

To create a universal, versatile Agricultural Nanolab that is designed and manufactured in a cost effective manner to alleviate the impediments faced by researchers, and efficiently facilitate a seed or small plant growth study in microgravity for all invested parties.

The task of developing a flight ready platform for an agricultural experiment in microgravity is a major deterrent for many research groups. Experimental designs can be costly, sometimes delaying proposed research for multiple years before reaching the launchpad.

$DSEB^2$

Glenelg High School

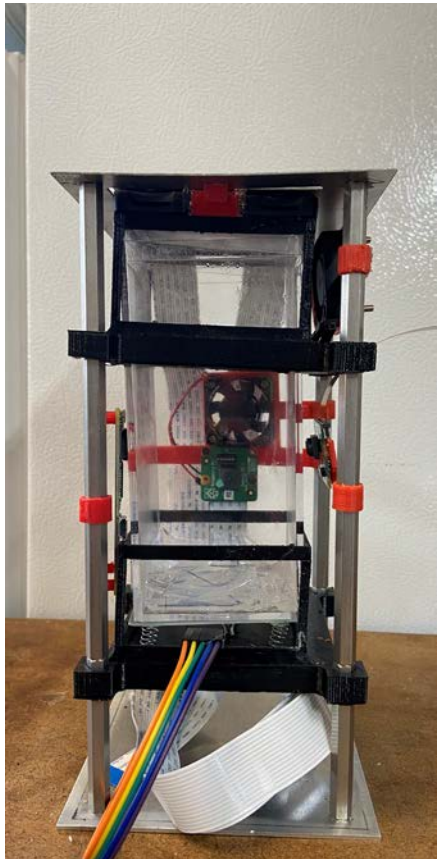
Derek Spratley

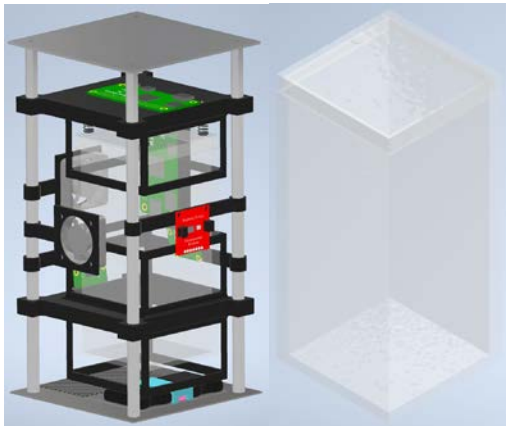
Ethan Barajas

Ethan Bomhardt

GHS AG NANOLAB TEAM

PROJECT PERSEPHONE:
Plant **E**xperiments **R**edefining **S**pace **E**xploration, **P**utting **H**umans **ON** **E**xoplanets.





Growth Chamber Design

Our Design uses a replaceable growth chamber that allows for the exchange of plant experimentation and the associated customized code without having to modify the NANOLAB. This permits researchers to send new experiments to the ISS at a fraction of the normal cost and in a more expeditious manner.

CAD Design

Our CAD Design allows for the electronics mounts to be customized. Researchers can use the same NANOLAB module as a reusable platform to accommodate experiment parameters specifically defined by them.

COST EFFECTIVENESS

NANOLAB With Growth Chamber and Outer Case:

2.631 lbs

Growth Chamber (Alone):

0.261 lbs

Average Gel Weight:

15 grams or ~.035 lbs

Cost per Pound to Ship:

$1500 w/ the SpaceX Falcon 9 Rocket

Cost for Full NANOLAB:

(2.631+.035)($1500) = $3999

Cost for Growth Chamber Only:

(.261+.035)($1500) = $444

FOR THE COST OF 1 FULL NANOLAB WE CAN CONDUCT ~9 FULL EXPERIMENTS WITH THE REPLACEABLE GROWTH CHAMBER SYSTEM.

THE REPLACEMENT GROWTH CHAMBER REDUCES COST BY

89%

Key Features

- Customizable Mounting Solutions
- Customizable Code and Growth Experiment Parameters
- Customizable Growth Medium and Environment
- Ease of Use
- Cost Effectiveness
- Reusability
- Accuracy of Operation and Data Collection
- Real Time Data and Images

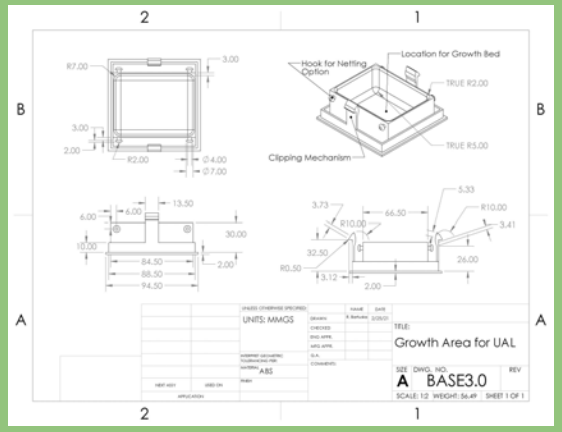
Key Clients

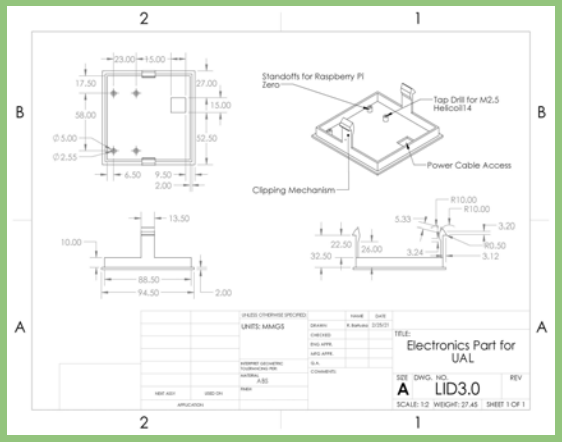
- Students of all levels
- University Researchers
- Astronauts
- Plant Science Corporations
- Space Exploration Interests

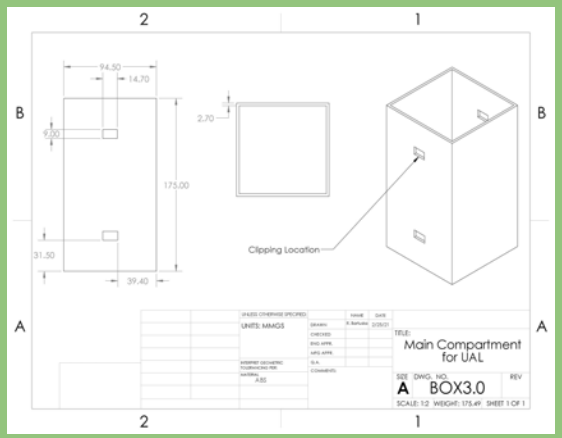
Contact Us

Email:
ghs.agnanolab@gmail.com

CAD Drawings







Clipping Solution: To remove top or bottom pieces, simply squeeze in on the tab and slide the piece out. To secure back into the lab, simply slide the piece back in until it clips into place.

About Us

Riley Bartuska

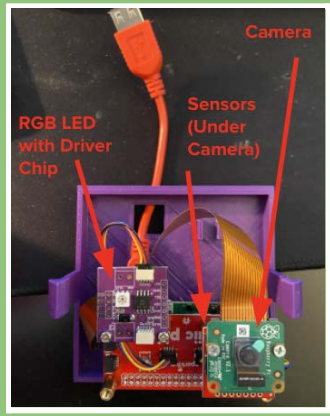
Daniel Kobilan

Chatfield Senior High School
HUNCH Program
Littleton, CO

Instructor Contact:
Joel Bertelsen
jbertels@jeffco.k12.co.us

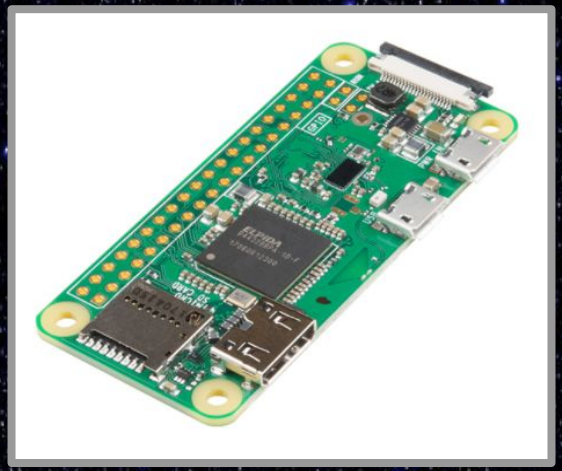
UAL

Universal Agriculture Lab



Effects of Gravity

Due to the nature of space flight and low gravity, screws must be used in place of friction fit holds
Water acts differently in microgravity, so alternative watering methods are needed.
Since plants cannot rely on their Gravitropism, Phototropism is the only thing that will allow them to grow in the correct direction



Programming Hardware

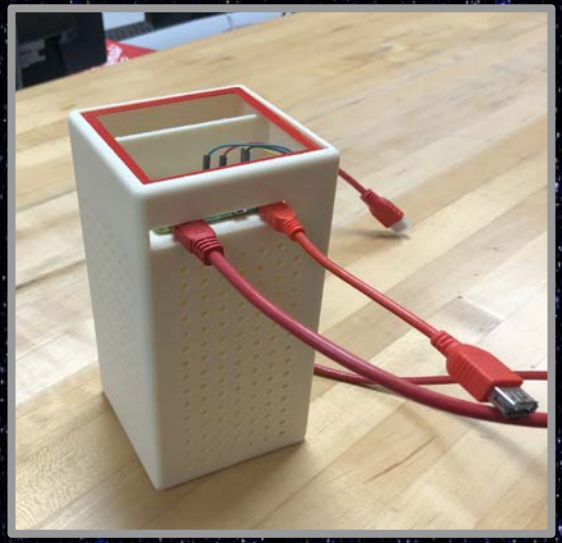
Raspberry Pi Zero W

We will use a Raspberry Pi zero W, a small portable computer, to control the Pi cam v2 component that will be used to take pictures, Qwiic Environmental Combo to monitor temperature, and SparkFun RGB LED Breakout to deliver light. A Mini SD card will be holding the data of the Raspberry Pi, and there is functionality to transmit the data through twitter!

Customizable Agricultural Mini-Lab

Brody Pen, Chris Griffin
Sean Tran, Jose Cantu

Instructor: Robin Merritt
Clear Creek High School
Clear Creek ISD
2305 East Main Street,
League City, TX, 77573

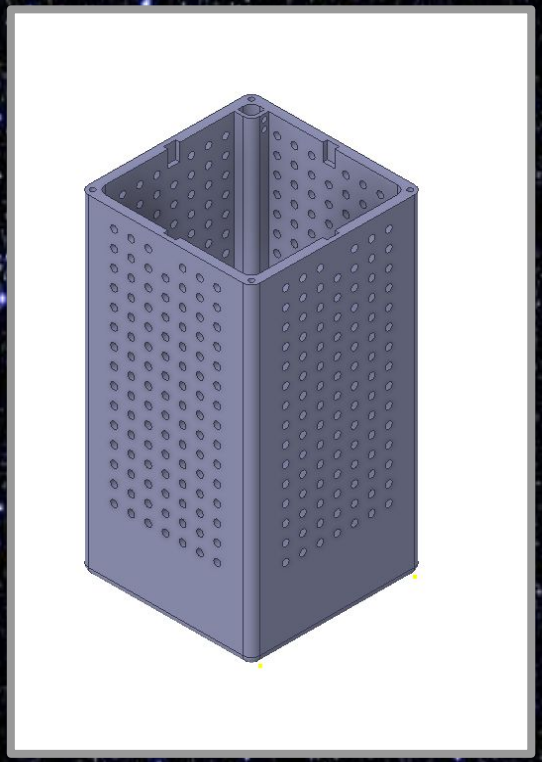


The Problem

The world is moving towards the possibility of life away from Earth. To support life in space, on another planet, or on the moon, new ways to grow and develop food will need to be created. Many brilliant researchers have experimented with ideas to conduct in microgravity, but are held back by the time and money of developing their own nanolab to run the experiments, so we aim to develop a solution. A generic Nanolab, allowing for modulability and customization for any plant in a 30 day trip.

Current Design

A highly customizable nanolab intended to be the housing of many agricultural experiments. The current design is based on customizability, and ease of installation of different modules. The holes on the side are inspired from pegboards, seeing all of the different modules and ways to customize it to all the needs of the user.



Plant life

. Plant life requires a rather hefty amount of nutrients and elements. The plants can be supported by a nutrients and water dense gel, or in clay pockets for watering. The plants will also need access to controlled light and air content, especially as some plants need a specific humidity to grow well.

Photo: NASA


CLEMSON
TIGERS