

### Welcome



- I welcome you to what I hope what is going to be one of the most interesting experiences of your academic career.
- The program we have planned for you is based on our desire to make space exploration accessible to all students, regardless of your background and experience level.
- This program will comprise of various skill building modules leading up to the building of your very own balloon payload launched to the edge of space!

### **Introductions**

### Team:

- Ashleigh Bailey Space Minor Manager
- Bernadette Garcia Galvez Deputy Director, Space  $\bullet$ **Grant Consortium**
- Chris Koehler Director, Space Grant Consortium & • Managing Director, Space Minor
- Wesley Perkins Industry Mentor
- Natalie Alvarado Aerospace Undergrad & Lunar ullet**Mission Team Member**











## Responsibilities



- Students are responsible for:
  - staying on top of email communication from the Balloon Payload staff members.
  - completing all skill modules and showing competencies in those skills.
  - following all safety protocols closely when completing activities.
  - keeping track of and returning tools and other reusable kit supplies
  - asking questions and reaching out to staff team whenever needed.
  - participating in periodic meetings with staff leadership



# A bit about Balloon Payloads...

### What is a Balloon Payload?



- Low-cost
- Lightweight (300g 1kg)
- Small
- Built to survive extreme near-space environment
- Can be launched and recovered on the same day.
- Ideal for teaching introductory spacecraft skills.
- Can fly limitless experiments to the edge of space (100,000 ft)!



### History of Balloon Payloads



- 1896: Earliest use of high-altitude balloons for scientific purposes
- Instrumental in discovery of atmospheric layers (troposphere and stratosphere)
- Widespread use by mid-1900s for climate science and weather modeling





## Standardized Teaching Payload



- Chris Koehler, CO Space Grant Director
- Edge of Space Sciences
- Collaboration began in 1996



COLORADO SPACE GRANT CONSORTIUM





## **Extreme Environmental Conditions:**



- Near vacuum
- Post-burst:
  - Chaotic (whipping)
  - Mach 1
- -80°C
- High radiation
- Impact force



## Payload View









### At this point you should have received your skills modules kit



#### Full Balloon Payload Kit:

Soldering Iron Safety Glasses Solder Sucker Metal sponge Helping Hand Wire Strippe Wire cutter Solder Multimeter Sheet of foam core Electrical Tape Glue Gun Insulation SD Card & Adapter 8" Flight tube

Soldering 101 Kit 2 - 9V Batteries (one marked TESTING, one marked FLIGHT)

Ardunio Kit

<u>Shield Kit</u>

Sensor Kit

Structure Kit

Power Switch Kit



#### Full Balloon Payload Kit: Tools

- $\bullet$
- Soldering Iron Safety Glasses Solder Sucker

- Metal sponge Helping Hand Wire Strippers Wire cutter
- Solder
- **Multimeter**
- Sheet of foam core
- Electrical Tape Glue Gun  $\bullet$
- $\bullet$
- Insulation
- SD Card & Adapter  $\bullet$
- 9V batteries  $\bullet$
- 8" Flight tube •





#### Full Balloon Payload Kit: Module Kits

- Soldering 101 KitArduino Kit
- Shield Kit •
- Sensor Kit
- Structure Kit ullet
- Power Switch Kit  $\bullet$





### Full Balloon Payload Kit: Soldering 101 Kit

- Breadboard
- 2 x Resistors
- 2 x LEDs
- 1 x Capicitor
- Socket
- Microchip
- Battery snap





#### Full Balloon Payload Kit: Ardunio Kit

- 1x Breadboard
- 1x Arduino Uno
- Arduino cable •
- 4x LEDs (R,B,G,Y)
  6x 330Ω Resistors
- **Jumper Wires**  $\bullet$
- 1x Potentiometer





#### Full Balloon Payload Kit: Shield Kit

- 1x Shield Board
- 2x 8-pin stackable plug headers
- 2x 6-pin stackable plug headers
- 2x DIP Socket Halves
- 2x Header (6 Pin socket short pins)
- 1x Header (3 Pin socket)
- 2x Headers (2-Pin plug breakaway)
- 1x Header (3-Pin Locking)







### • Full Balloon Payload Kit: Sensor Kit

- 1x Humidity sensor
- 1x Temperature sensor
- 1x External temperature sensor
- 1x Pressure sensor
- 1x Accelerometer
- 1x 6 pin breakaway header
- 1x 3 pin plug breakaway header
- 1x Open Log Board (header already attached
- 2x External LEDs (Orange/Blue)









#### Full Balloon Payload Kit: Structure Kit •

- 2' Aluminum Tape
- 5x Glue Sticks
- 1x Flag Sticker •
- 'If Found' Stickers
- 2x Washers
- 2x Paper Clips  $\bullet$
- 5" Velcro •
- Xacto knife & Replacement Blades
- 1.5 ft of flight string sample Space Grant Sticker







#### Full Balloon Payload Kit: Power Switch Kit •

- **Rocker Switch** •
- 9V Barrel Connector
- 8" 22g stranded wire RED  $\bullet$
- 8" 22g stranded wire BLACK heat shrink •
- $\bullet$





### Modules



### • You also should have the link to all the skill modules

https://www.colorado.edu/spaceminor/space-minor-balloonpayload-program-information

Some modules will need to be completed in a specific order, while others can be done at any point

### Sequenced Modules:

- 1) Welcome to Balloon Payloads
- 2) Soldering 101
- 3) Arduino Intro
- 4) Sensors Part 1
- 5) Sensors Part 2
- 6) Wire Integration
- 7) Structure / System integration

Stand Alone Modules:

- A) The Design Process
- B) Testing

### **Program Timeline**



Modules are designed to be completed at your own pace. To stay on-track for launch, suggested timeline:

- Modules 1, 2, & A Completed by September 30
- Modules 3-5 Completed by October 16
- Module 6 & B completed by October 23

### **Other Important Dates:**

- Confirm flight participation by October 23
- Launch Readiness Reviews: October 21 November 5
- Launch date: November 7, 2020