Balloon Payload Workshop

Introduction
Welcome

• I welcome you to what I hope will 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 Grant Consortium
• Chris Koehler – Director, Space Grant Consortium & Managing Director, Space Minor
• Wesley Perkins – Industry Mentor
• Natalie Alvarado – Aerospace Undergrad & Lunar 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
Extreme Environmental Conditions:

- Near vacuum
- Post-burst:
  - Chaotic (whipping)
  - Mach 1
- \(-80^\circ C\)
- High radiation
- Impact force
Payload View
Your Kit

• 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 Stripper
- 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)

Arduino Kit
- Shield Kit
- Sensor Kit
- Structure Kit
- Power Switch Kit
Your Kit

Full Balloon Payload Kit: Tools

- Soldering Iron
- Safety Glasses
- Solder Sucker
- Metal sponge
- Helping Hand
- Wire Strippers
- Wire cutter
- Solder
- Multimeter
- Sheet of foam core
- Electrical Tape
- Glue Gun
- Insulation
- SD Card & Adapter
- 9V batteries
- 8” Flight tube
Your Kit

**Full Balloon Payload Kit:** Module Kits

- Soldering 101 Kit
- Arduino Kit
- Shield Kit
- Sensor Kit
- Structure Kit
- Power Switch Kit
Your Kit

Full Balloon Payload Kit: Soldering 101 Kit

- Breadboard
- 2 x Resistors
- 2 x LEDs
- 1 x Capacitor
- Socket
- Microchip
- Battery snap
Your Kit

Full Balloon Payload Kit: Arduino Kit

- 1x Breadboard
- 1x Arduino Uno
- Arduino cable
- 4x LEDs (R,B,G,Y)
- 6x 330Ω Resistors
- Jumper Wires
- 1x Potentiometer
Your Kit

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)
Your Kit

- **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)
Your Kit

• **Full Balloon Payload Kit:** Structure Kit

  - 2’ Aluminum Tape
  - 5x Glue Sticks
  - 1x Flag Sticker
  - ‘If Found’ Stickers
  - 2x Washers
  - 2x Paper Clips
  - 5” Velcro
  - Xacto knife & Replacement Blades
  - 1.5 ft of flight string sample
  - Space Grant Sticker
Your Kit

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

  • Rocker Switch
  • 9V Barrel Connector
  • 8” 22g stranded wire RED
  • 8” 22g stranded wire BLACK
  • heat shrink
Modules

• You also should have the link to all the skill modules
  https://www.colorado.edu/spaceminor/space-minor-balloon-payload-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