The LIFT Project

Engaging Undergraduates in K-12 STEM Education Through High-Altitude Ballooning

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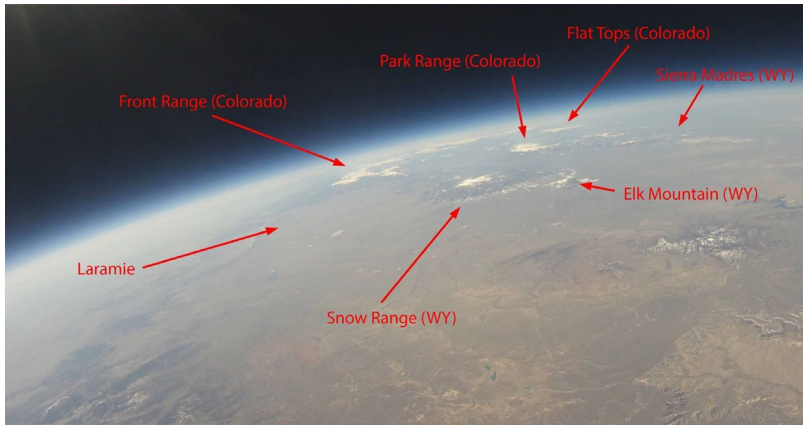
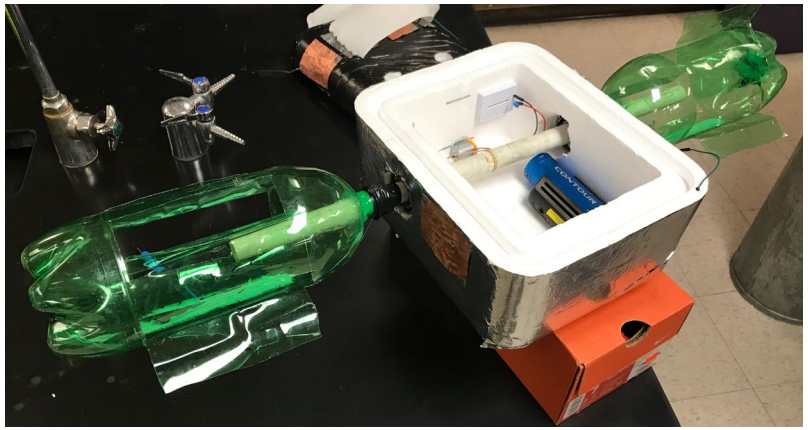
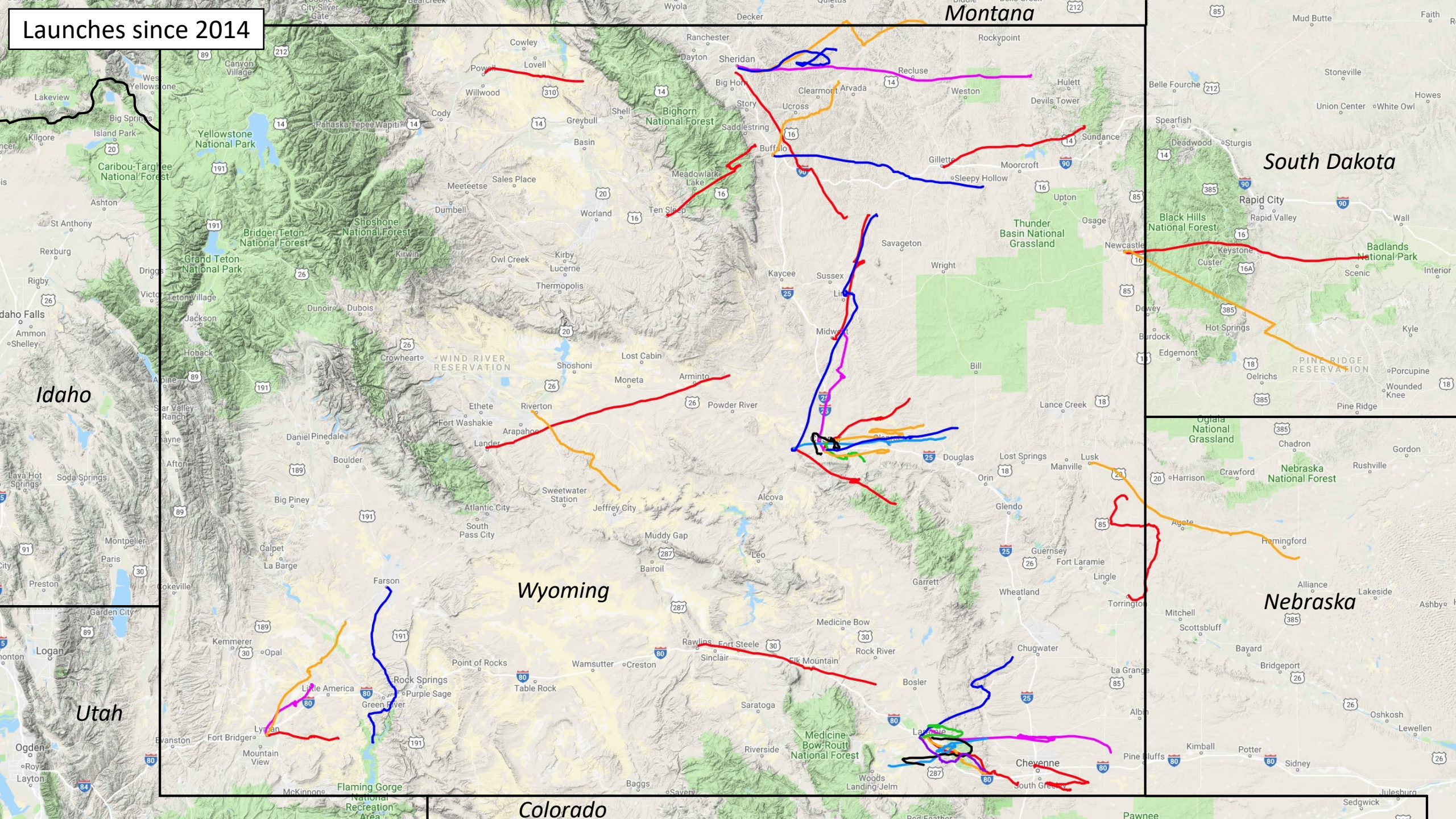




WYOMING
NASA Space Grant Consortium

HIGH-ALTITUDE BALLOON PROGRAM


Launches since 2014
Montana
South Dakota
Idaho
Wyoming
Nebraska
Utah
Colorado
Yellowstone National Park
Bighorn National Forest
Shoshone National Forest
Bridger-Teton National Forest
Grand Teton National Park
Caribou-Targhee National Forest
Thunder Basin National Grassland
Black Hills National Forest
Badlands National Park
Oglala National Grassland
Nebraska National Forest
Medicine Bow-Routt National Forest
Flaming Gorge National Recreation Area
WIND RIVER RESERVATION
PINE RIDGE RESERVATION
Sheridan
Buffalo
Gillette
Rapid City
Newcastle
Midwest
Lander
Riverton
Rock Springs
Lyman
Cheyenne
Torrington
Hemingford
Rawlins
Fort Steele
Sinclair
Elk Mountain
Medicine Bow
Rock River
Chugwater
Bosler
Saratoga
Riverside
Woods Landing-Jelm
Baggs
Savery
Little America
Green River
Purple Sage
Point of Rocks
Table Rock
Wamsutter
Creston
Farson
Kemmerer
Opal
Cokeville
Garden City
Logan
Ogden
Roy
Layton
Evanston
Fort Bridger
Mountain View
McKinnon
Pawnee
Sedgwick
Julesburg
Sidney
Potter
Kimball
Pine Bluffs
Albin
La Grange
Bayard
Bridgeport
Oshkosh
Lewellen
Mitchell
Scottsbluff
Alliance
Lakeside
Ashby
Hemingford
Agate
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Chadron
Gordon
Rushville
Lusk
Manville
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Douglas
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Fort Laramie
Lingle
Wheatland
Garrett
Leo
Alcova
Muddy Gap
Bairoil
Jeffrey City
Sweetwater Station
Atlantic City
South Pass City
Big Piney
Boulder
Daniel
Pinedale
Fort Washakie
Ethete
Arapahoe
Powder River
Arminto
Moneta
Lost Cabin
Shoshoni
Crowheart
Dunoir
Dubois
Jackson
Hoback
Alpine
Star Valley Ranch
Thayne
Afton
Lava Hot Springs
Soda Springs
Montpelier
Paris
Preston
Ashton
St Anthony
Rexburg
Rigby
Driggs
Victor
Teton Village
Ammon
Shelley
Idaho Falls
Kilgore
Island Park
Big Springs
Lakeview
West Yellowstone
Canyon Village
Cody
Powell
Willwood
Lovell
Cowley
Greybull
Basin
Shell
Meeteetse
Sales Place
Dumbell
Worland
Ten Sleep
Meadowlark Lake
Kirwin
Owl Creek
Kirby
Lucerne
Thermopolis
Dayton
Ranchester
Big Horn
Story
Saddlestring
Ucross
Clearmont
Arvada
Recluse
Weston
Rockypoint
Hulett
Devils Tower
Sundance
Moorcroft
Sleepy Hollow
Upton
Osage
Savageton
Wright
Kaycee
Sussex
Bill
Lance Creek
Mud Butte
Faith
Belle Fourche
Stoneville
Union Center
White Owl
Howes
Spearfish
Deadwood
Sturgis
Rapid Valley
Wall
Keystone
Custer
Scenic
Interior
Dewey
Burdock
Hot Springs
Kyle
Edgemont
Oelrichs
Porcupine
Wounded Knee
Pine Ridge
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FUNDED BY THE
NSF
LIFT
PROJECT
LEARNING TO INTEGRATE FUNDAMENTALS THROUGH TEACHING

THE LIFT PROJECT

What is it?

Three-year NSF-funded undergraduate science outreach program run by the WY NASA Space Grant at UW

Objective

Develop authentic K–12 STEM projects that incorporate the use of high-altitude weather balloons

Purpose

- Improve the science content of WY NASA Space Grant ballooning program
- Provide undergraduates at UW with real-world, hands-on experiences to help build skills & confidence in their chosen area of study

THE LIFT PROJECT

How it works

1) Student recruitment (sophomores/juniors; science, engineering, & education majors)
2) Organize into teams, assign a K–12 partner teacher
3) Develop projects from scratch (payloads, curriculum, etc.)
4) Deliver projects to K–12 classrooms (lessons/activities, balloon launch, & data analysis)

Educational approaches

- Collaboration
- Learning through teaching

RECAP OF YEAR 1 (2019)

Six undergraduate fellows (2 teams)

Projects

- Cosmic radiation (high school)
- Speed of sound (middle school)

Timeline

- Project development (Spring)
- Payload testing (late Spring / early Fall)
- Classroom visits & balloon launch (Oct/Nov)

COSMIC RADIATION PROJECT

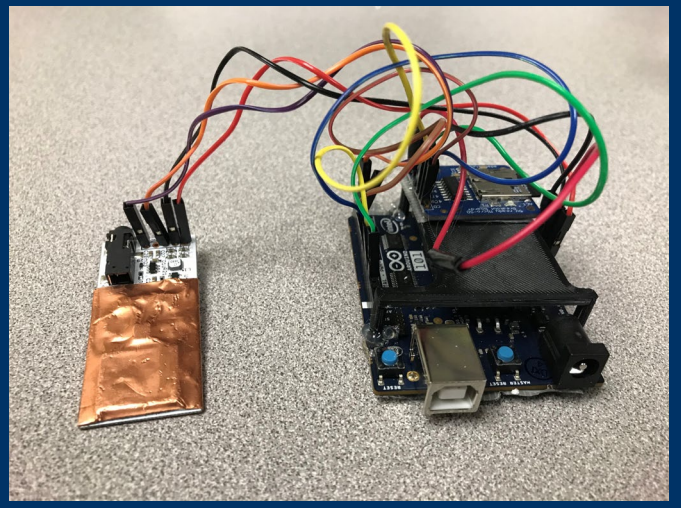
Challenge
Students must design & build cosmic radiation shielding to protect a balloon payload

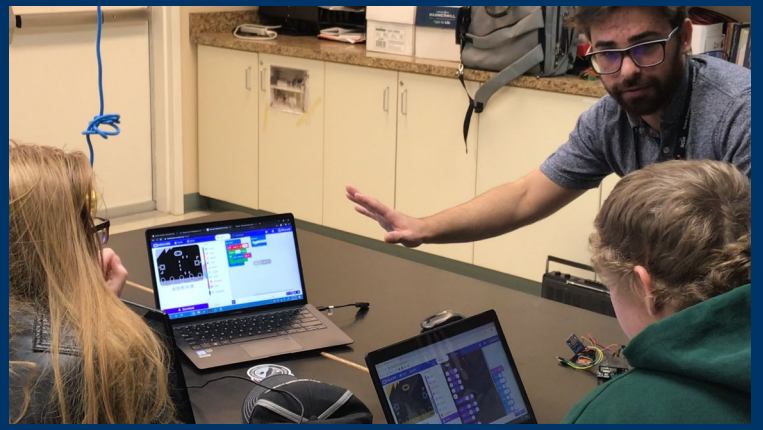
Scenario
“Space race” between two teams (budget, roles, etc.)

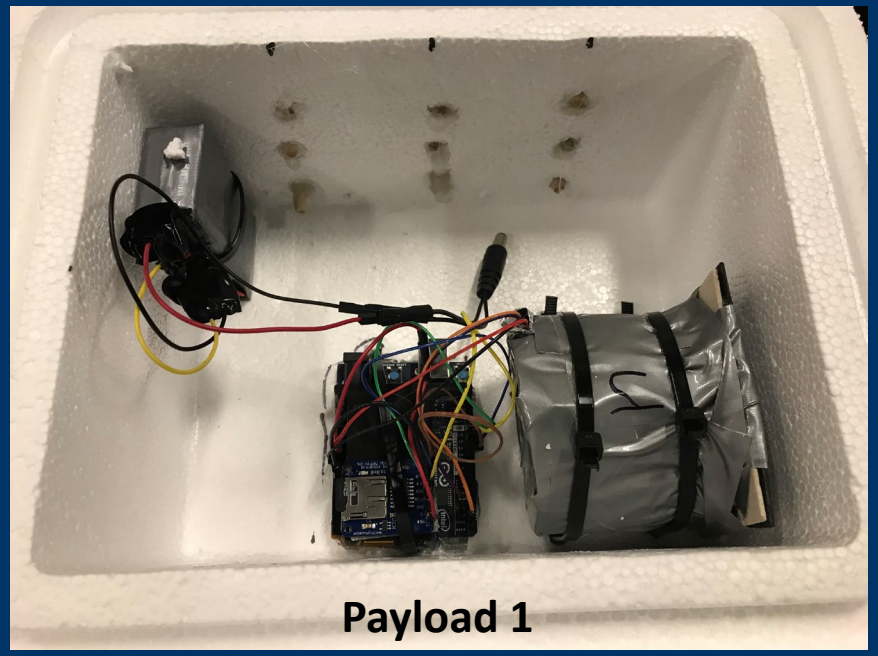
Payload
Arduino system w/ Geiger radiation sensor (β and γ)

Curriculum

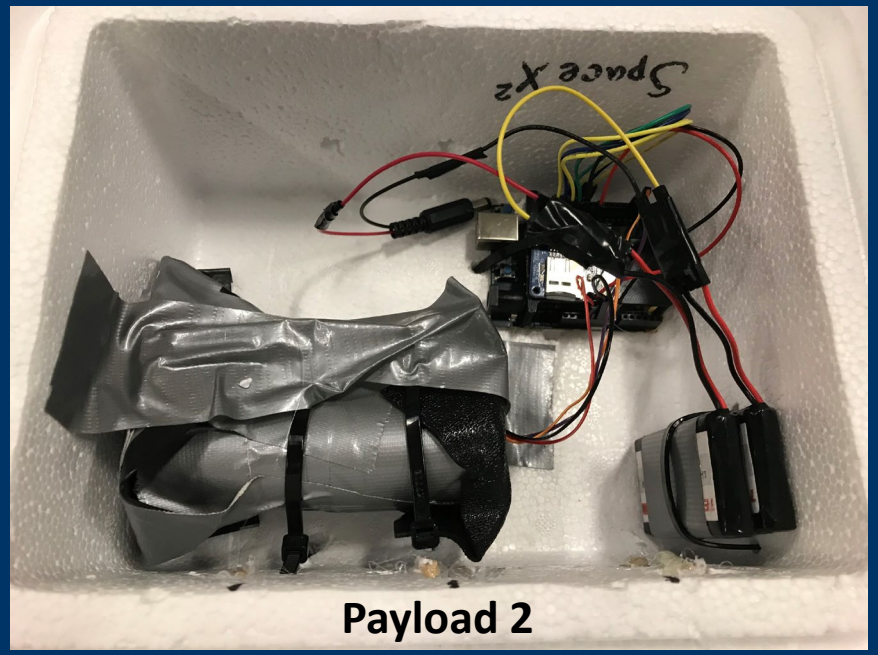
- Basics of cosmic radiation
- Computer programming (Arduinos)
- Hands-on activities (building the shielding)



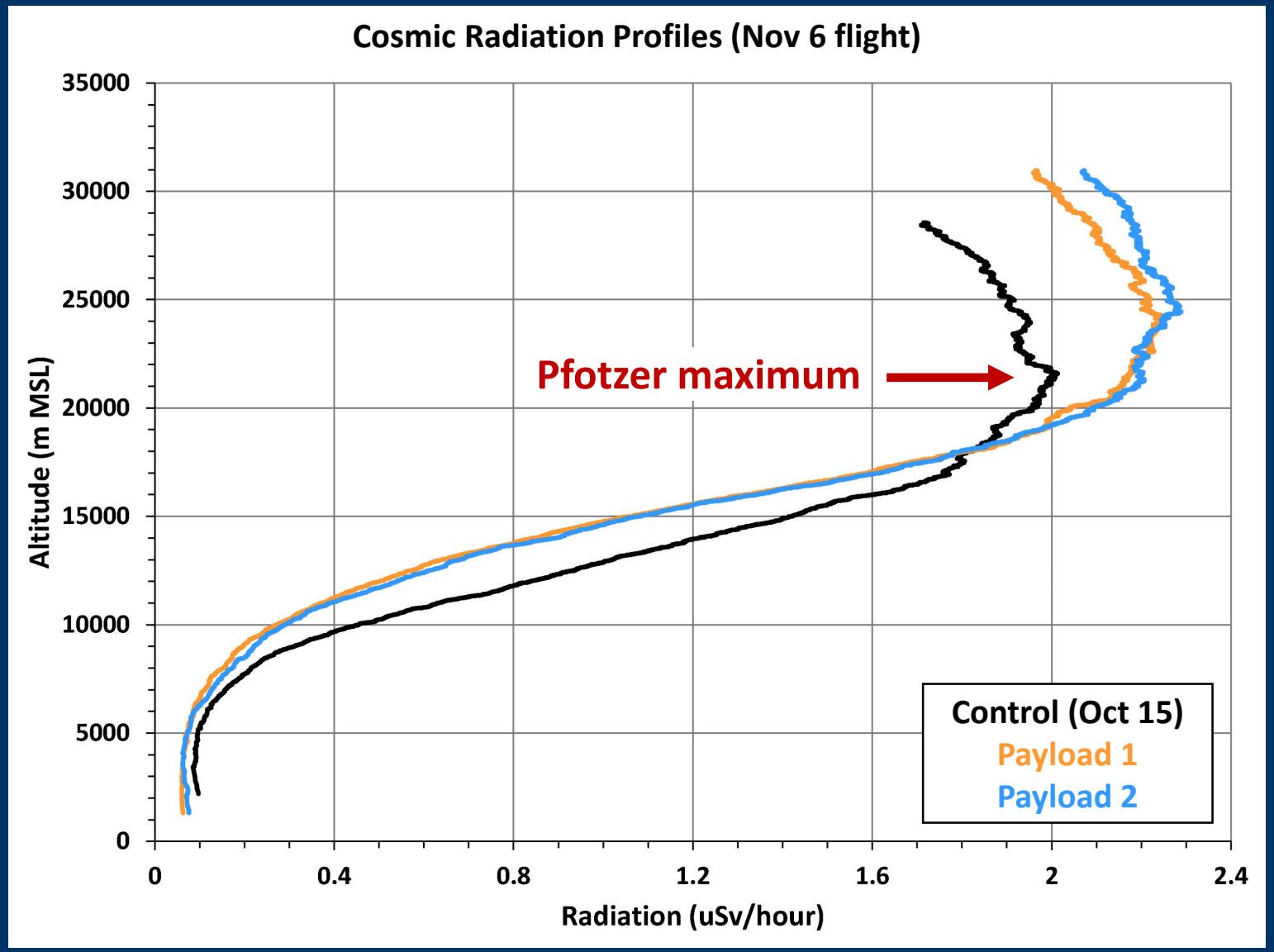




Payload 1



Payload 2



Highlight video: wyomingspacegrant.org/balloonvideo

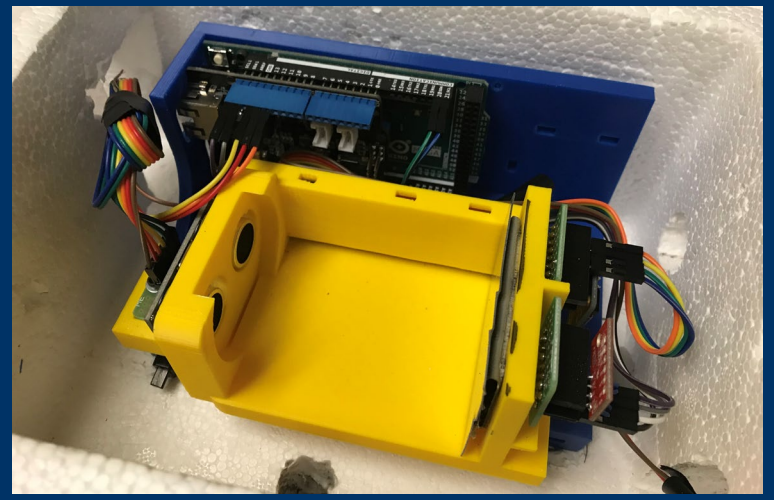
SPEED OF SOUND PROJECT

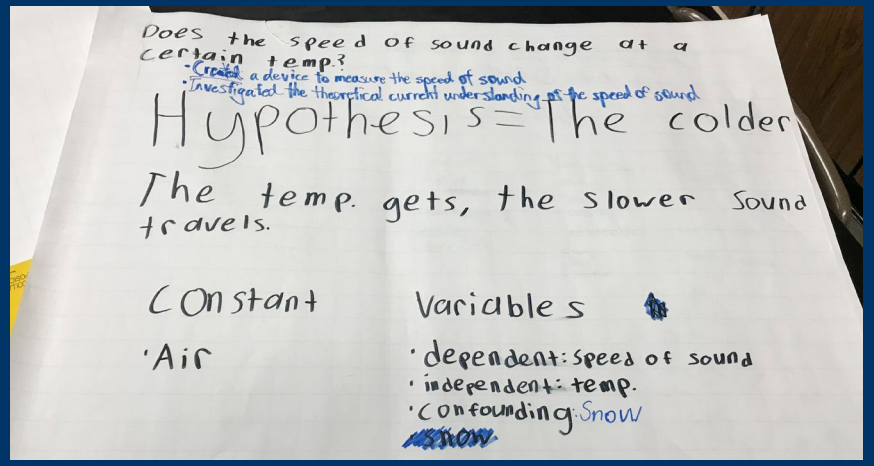
Challenge
Build a payload to directly measure changes in the speed of sound throughout the atmosphere

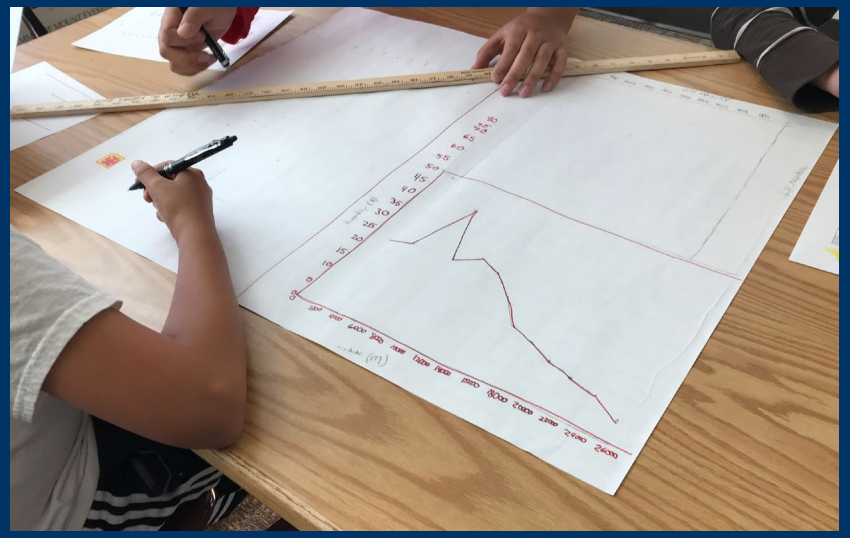
Payload
Arduino system w/ ultrasonic distance sensor

Curriculum

- Basics of sound & waves
- Components of an experiment, develop hypotheses
- Hands-on activities (plotting data)







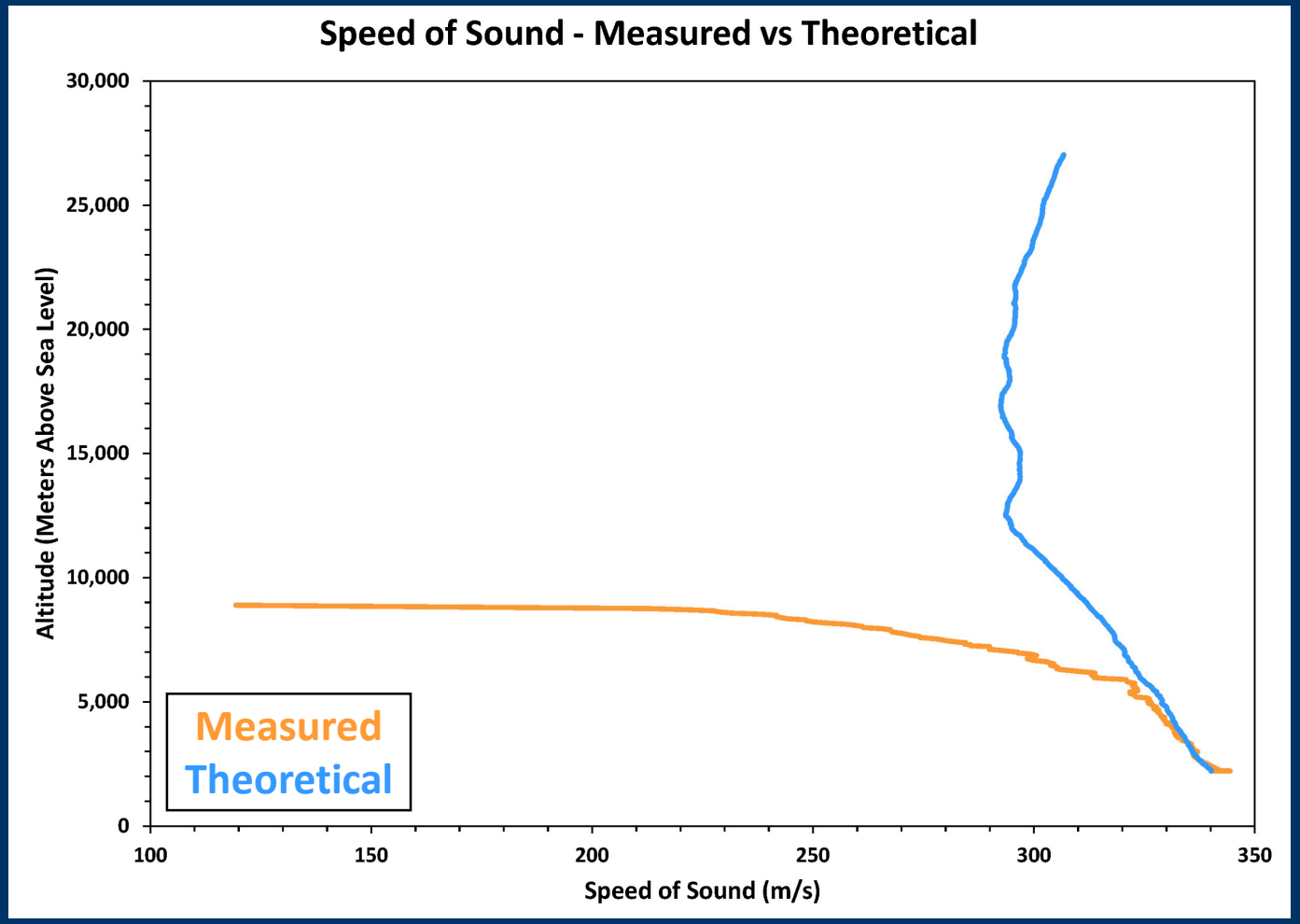
Speed of sound in an ideal gas:

$$v_{sound} \cong \sqrt{kRT}$$

k = ratio of specific heats

R = gas constant

T = temperature (K)



Wrapping Up

Summary

- New undergraduate science outreach program focused on high-altitude ballooning
- Goals…
  1) Provide UW students with opportunities to apply what they've learned to a real-world science/engineering project
  2) Improve the science content of WY Space Grant ballooning program

Looking forward to Year 2 (2020)

- Nine undergraduate fellows (three teams)
- Microbe project

Questions?

2019 LIFT Fellows

Jeff Bell

Mary Block

Garrett Burrows

Josh Crips

Jacob Plowman

Tyra Relaford

2019 K–12 Partners

Newcastle High School

UW Lab School

Jennifer LaVanchy

Andy Pannell

Jim Stith

Teresa Strube

Theresa Williams

wyomingspacegrant.org/balloonprogram