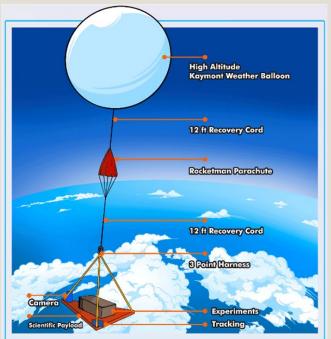
# Final Project

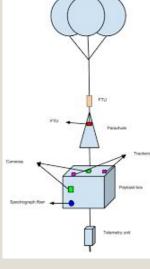
Alternative Payload Design for DemoSat High Altitude Balloon

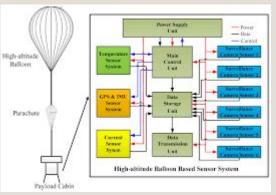


Eli Leshtz



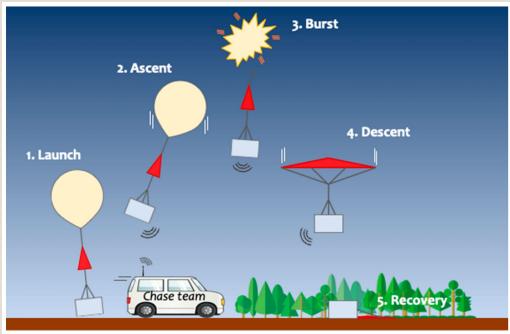






#### DemoSat High Altitude Balloon Payload

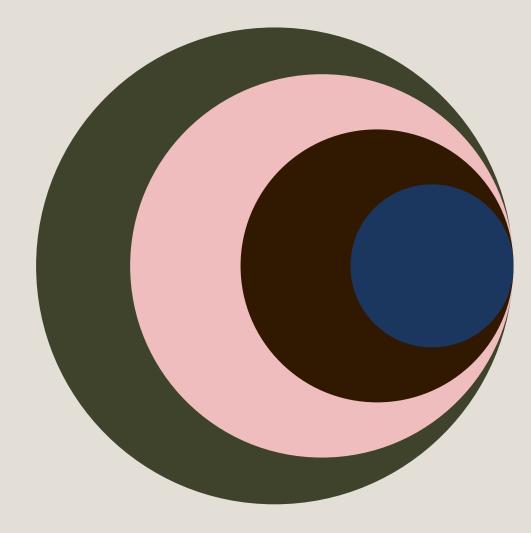
The DemoSat High-Altitude Balloon is a compact, cost-effective experimental platform designed to reach near-space altitudes of approximately 100,000 feet. It provides a testing ground for engineering experiments in extreme conditions, including low pressure & intense cold. This project focuses on redesigning the payload to improve performance while ensuring component availability, reducing costs, and minimizing weight.



### Project Objectives

#### Objectives:

- Evaluate the existing payload system
   & create detailed block diagram.
- Identify alternative components to maintain or improve functionality.
- Develop a custom PCB for optimized integration with my alternative components.
- Ensure compliance with a 200g weight limit and a \$147 budget.
- Compare weight, power, and cost analysis to the original design.



XXXXXXXXXX

XXXXXXXXXX

Arduino Uno R3

Totals:

Battery

LEDs

uР

Rocker Switch

9 Volt Battry

System Evaluation (Phase 1 Findings)	Richard Switch Pressure Sensor Truspublity 7.59 Pressure Sensor Truspublity 1.59 Accelera
Original Payload Design	5V-1.5-MA-1.0075W DI P 5V-1.5-MA-1
Key Components: See below.	TMBS TEMP Sensor AN Externa Sens
Challenges Identified: Limited component availability, outdated components, & high cost.	Data Logger Vacks TAN 54.2004-0.001
	7-tol Pawer 0.127W

		0,01W	
	Roched Switch	Pressure Sensor	Truspolity SSC
	TEDEL	1.59	Accelerometer AD
	0.59 .6 = 39	AN AN	1.279
-	51-150A-0,0075W DI	PYDI	5V.1.5mA. 0.0075W
	29 70	N AN	Sensor
	Starten Data Logge	309 TAN	22.79 -2004-0.001 W
	open by 59	Humid	11
	O D D Card	11 . (0127).	869
	7	otal weight i 139.5g	

X1335

0 XXXXXXX 0

0 XXXXXXX 0

0 XXXXXXX 0

0 <u>Link</u>

0.127153

111311190)	9.59·6=39 AN AN 1.279 5V:1.5mA-0.0075W DI P
ow. ited component availability, high cost.	TMP3 Temp Sensor AN External Sensor S
	7 of all Weight i 139.5 g

0.4

4.55

26

4.5

130.86

0.5

7.5

30

45

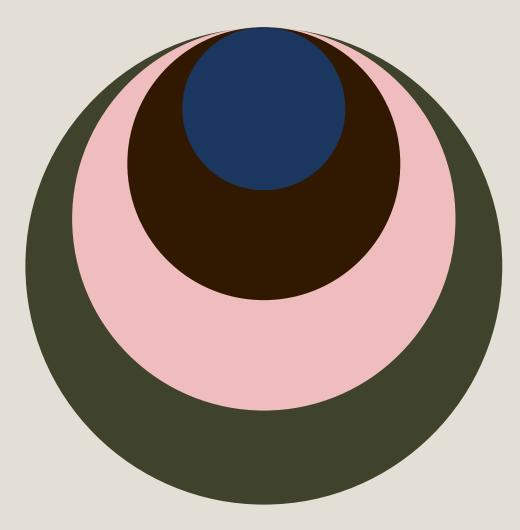
139.53

Key Components: See below.  Challenges Identified: Limited component availability, outdated components, & high cost.				TMPS Temp Sensor  AN External Temp TMP36  24.7g 5v.200A=0.1W MART)  Sensor  100 Data Logger UnoR3 TAN 5v.200A=0.001W  Humidity Sensor SEN-09569  Total Power 0.127W  Total Weigh 1139.5g		
Original Design						
<u>Type</u>	<u>Component</u>	<u>Quantity</u>	Weight (g)	Cost (\$)	Power Consumption (W)	<u>Link:</u>
Pressure Sensor	TruStability SSC	1	1.5	40.56	0.01	<u>Link</u>
Accelerometer	ADXL335	1	1.27	7.5	0.001153	<u>Link</u>
Temp Sensor	TMP36	2	22.7	3.95	0.0075	<u>Link</u>

Original Payload Design				5V-1.SnA-0,007	SW OI	External Temp TMP36
Key Components: See below.				7MP36 Temp Server	NART) U	Sensor TMP36
<u>Challenges Identified:</u> Limited component availability, outdated components, & high cost.		ilability,	Startin Data Logger Vacks N 54-200 uA=0.001 W		Sensor SEN-09569	
Original Design						
<u>Type</u>	<u>Component</u>	<u>Quantity</u>	Weight (g)	Cost (\$)	Power Consumption (W)	<u>Link:</u>
Pressure Sensor	TruStability SSC	1	1.5	40.56	0.01	<u>Link</u>
Accelerometer	ADXL335	1	1.27	7.5	0.001153	<u>Link</u>
Temp Sensor	TMP36	2	22.7	3.95	0.0075	<u>Link</u>
Humidity Sensor	SEN-09569	1	0.86	20.5	0.001	<u>Link</u>
Open Log Board	Sparkfun Open Log	1	5	16.95	0.1	<u>Link</u>

## Alternative System Design (Phase 2)

- <u>Component Selection:</u> Researched and selected alternative sensors with improved efficiency and compatibility.
- <u>New Circuit Design:</u> Implemented a custom PCB layout to for optimized integration with chosen alternative components.
- <u>Performance Improvements:</u>
  - Lower power consumption with optimized components.
  - Reduced weight while maintaining full functionality.
  - Streamlined system integration for easier assembly and testing.



#### Cost, Power, and Weight Breakdow

Comparison Table:

**Alternative Design** 

Pressure, Humidity, & Temp

Accelerometer

Temp Sensor

Open Log Board

Rocker Switch

9V Battery

<u>Type</u>

Sensor

LEDs

uP

- Total Cost Calculation (Bill of Materials)
- Power Consumption Analysis

Component

2019

**TMP36** 

Battery

XXXXXXX

XXXXXXXX

Arduino Uno R3

Adafruit Industries

Adafruit BME280

Sparkfun Open Log

Weight Estimation

r	1	

Quantity

Totals:

**Power Consumption** 

Cost

1.27

22.7

0.5

7.5

30

45

115.47

Original System

**Power Consumption** 

139.53q

\$130.86

0.127

15

23.2

3.95

16.95

0.4

4.55

26

4.5

96.55

Alternative Design

115.47q

\$96.55

0.122

Link:

0.001153 Link

0.012 Link

0.0075 Link

0.1 Link

0.00025 XXXXXXX

0 Link

0.122153

0 XXXXXXX

0 XXXXXXX

Feature

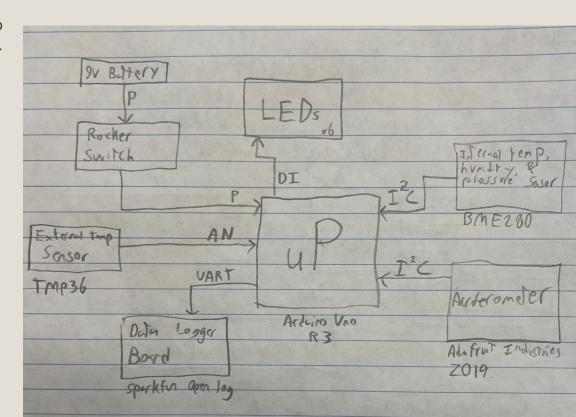
Weight

Cost

Weight

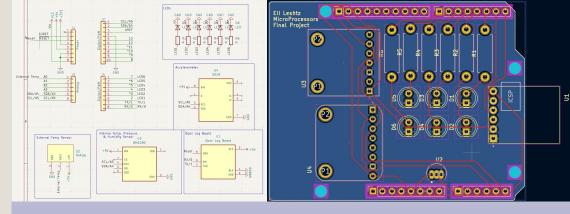
# Block Diagram of the Alternative System

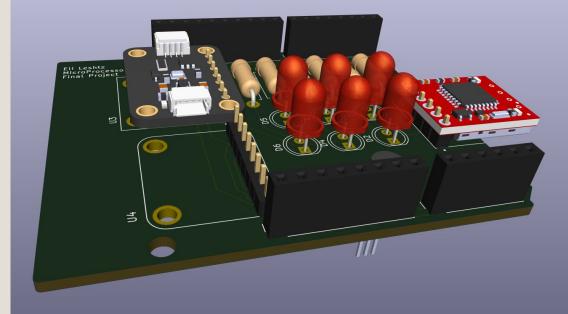
A block diagram was constructed similar to the one designed for the original prototype. Slight differences in components and connections were needed. Specific Components are listed.



#### PCB Design

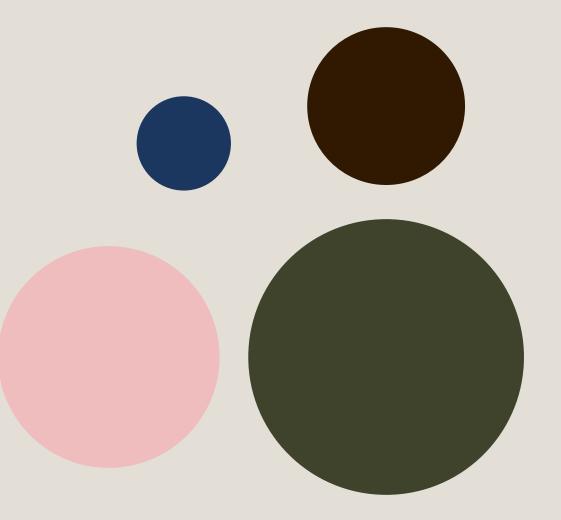
The custom PCB was a crucial part our design process. I focused on creating a layout that minimized trace lengths and improved component placement. By integrating multiple sensor symbols found online, I created my labels, made connections to the arduino sockets, and assigned my footprints which I also found online. The new PCB layout led to a more efficient and user-friendly design, making future iterations easier to implement.





#### Conclusion

- Final Summary:
  - Successfully designed an alternative payload system
  - Met weight, cost, and power constraints
  - Ensured full functionality
- Future Projects:
  - Explore additional power-saving techniques
  - Test system in a real-world launch environment



### Thank You

Eli Leshtz 03/14/25