



EFFECTIVE-1

Rocket Team at UC Santa Cruz

Vehicle Summary

Mission breakdown:

The vehicle is designed to be...

- Lightweight
- Durable
- Safe
- Easily serviceable
- Modular
- Aerodynamically efficient
- Aerodynamically reactive

Vehicle Properties

Dimensions:

Length: **6.74 ft**

Outer/Inner Diameter: **3.1/3.0 in**

Mass: **7.45 lbs**



Structure:

Airframe Material: **Blue Tube 2.0**

Motor Mount, Fins: **G20 Fiberglass**



Recovery:

Parachutes: 18 in drogue chute, 48 in primary chute

System: Stratologger PerfectFlite (x2), Jolly Logic Chute Release

Tracking: Eggfinder GPS system



Vehicle Properties

Motor:

AeroTech J540 Redline

Total Impulse: **1146 Ns**

Peak Impulse: **667 N**

Burn Time: **2.2 s**

Mass: **2.39 lbs**

Motor Selection Criteria:

- Yields optimal apogees
- High rail exit velocity
- Meets all handbook regulations
- Commercially available
- Short, efficient burn

Stability:

CG: **12.0 in**

CP: **29.7 in**

Static Stability Margin: **5.71**

Flight Properties

Apogee: **5588 ft**

Max Velocity: **713 ft/s**

Max Acceleration: **429 ft/s²**

Thrust/Weight Ratio: **13.3**

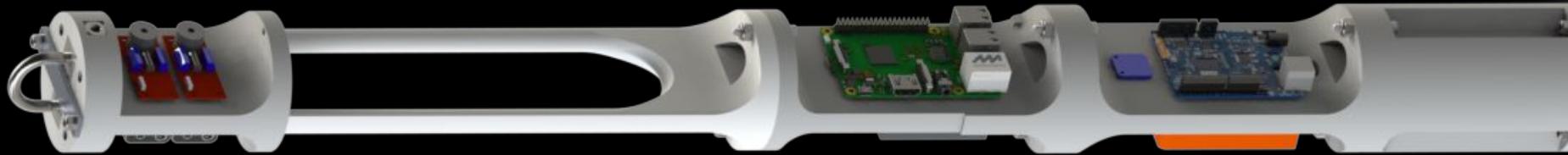
Rail Exit Velocity: **81.2 ft/s**

Rail Exit Dynamic Stability Margin: **2.08**

Total Parachute Drift, 10 mph: **~986 ft**

Landing Kinetic Energy: **57.3 lbf-ft**

Subsystems



Subsystem: Avionics

Primary Components:

- Arduino 101 flight computer with built-in IMU
- HP206C Altimeter

Functions:

- Measure and record inflight telemetry
- Facilitate active aerodynamic corrections with ADAS subsystem using a PID control algorithm



Computer Selection

Board	Bits	I/O	Voltage	Micro Controller	Clock Speed	Memory	Physical size
Arduino Uno	8	14 digital pins (6 PWM) and 6 analog inputs	5V	ATmega328P	16Mhz	32kb FLASH, 2kb SRAM, 1kb EEPROM	2.7" x 2.1" @ 25 grams
Arduino Zero	32	20 digital I/O pins (18 PWM))	3.3V	ATSAMD21G18	48 Mhz	256kb FLASH, 32kb SRAM, 0kb EEPROM	2.7" x 1.2" @ 12 grams
Arduino 101	32	14 Pins (4 PWM)	3.3V	Intel Curie	32 Mhz	196kb FLASH, 24kb SRAM	2.7" x 2.1" @ 34 grams
Raspberry Pi Zero	32	40 Pins (0 PWM)	5V	BCM2835	1Ghz	512 MB FLASH	1.18" x 2.55" @ 9 grams

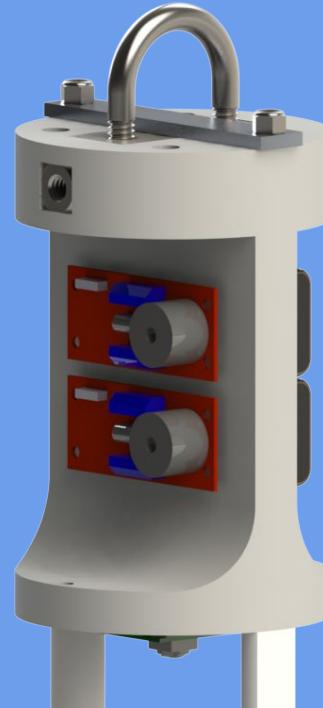
Subsystem: Recovery

Primary Components:

- Parachutes: 18 in drogue chute, 48 in primary chute
- Stratologger PerfectFlite (x2)
- Jolly Logic Chute Release
- Eggfinder GPS system

Functions:

- Deploy drogue parachute at apogee
- Deploy main parachute at 500 ft



Subsystem: ADAS

Primary Components:

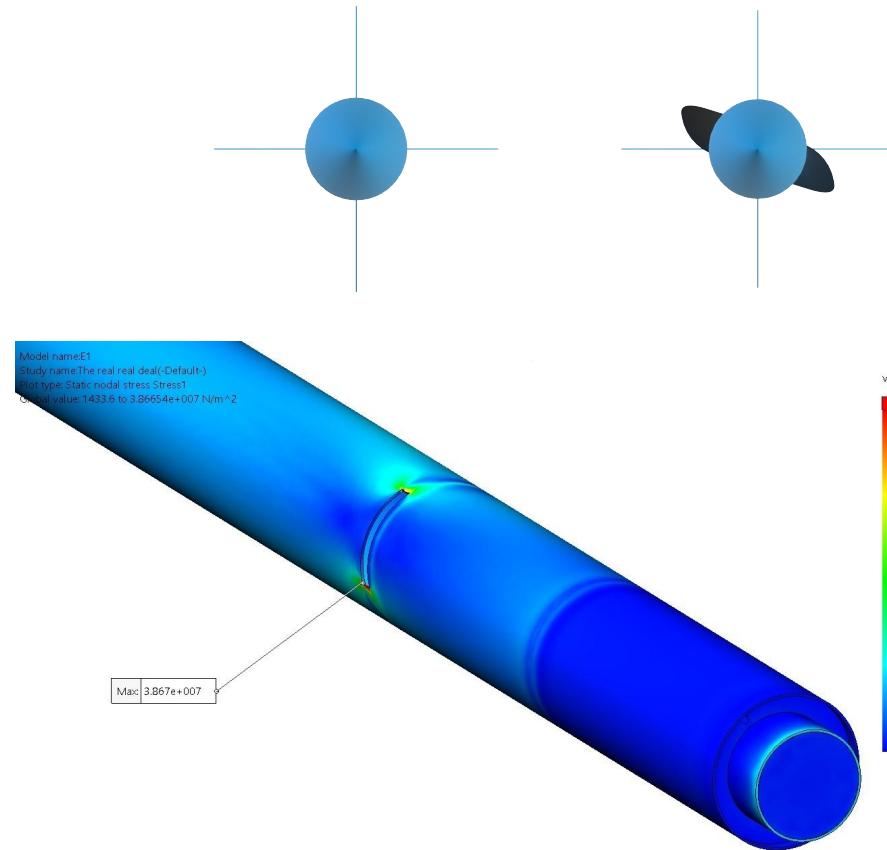
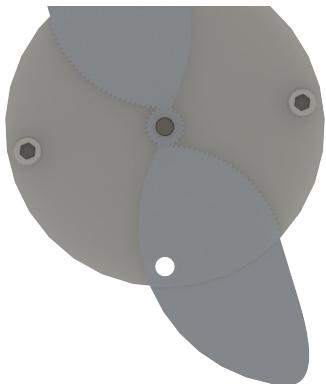
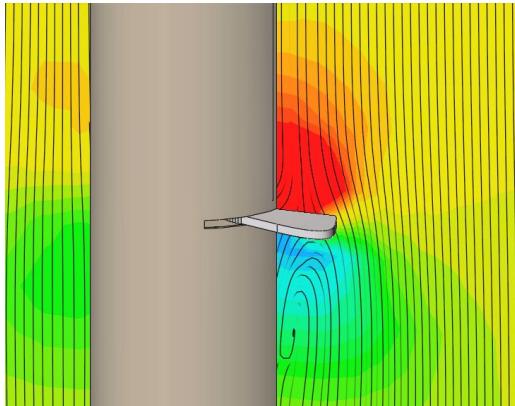
- High-torque NeveRest Classic 40 Gearmotor
- Custom-built aluminum deployable fin segment

Functions:

- Perform precision inflight adjustments to vehicle's flight profile at > 10 Hz
- Reduce vehicle apogee by up to 15%



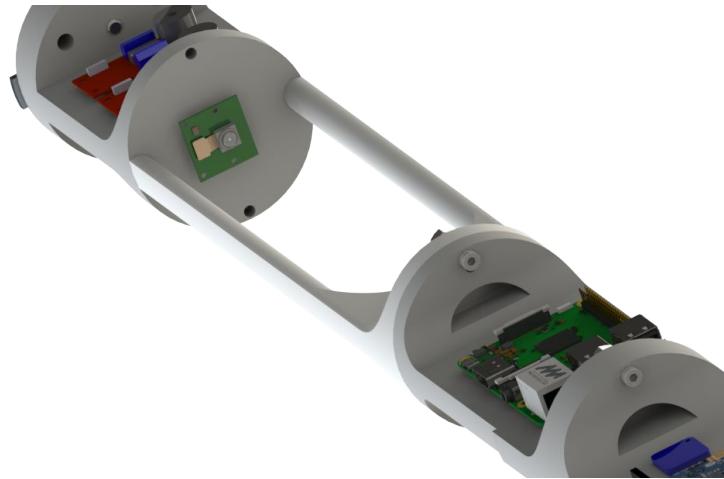
Modeling



Payload: TARS

Components:

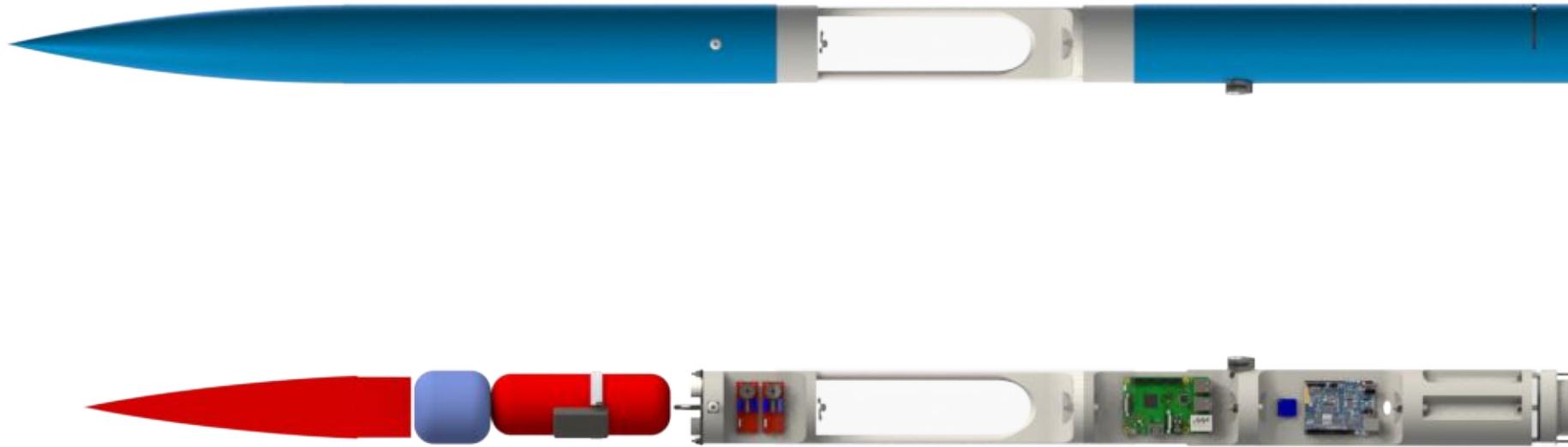
- Raspberry Pi Camera v2
- Raspberry Pi 3-b with custom image recognition software
- Clear polycarbonate window section

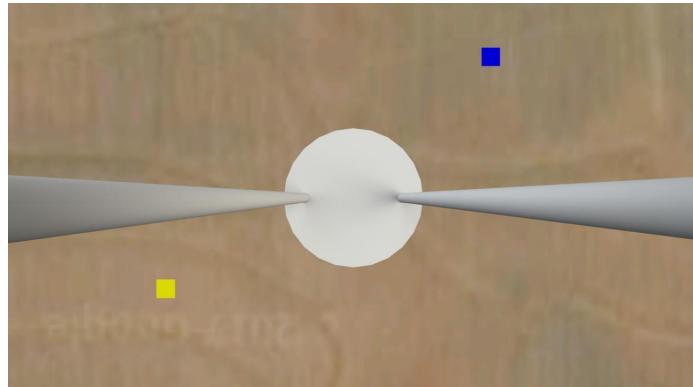
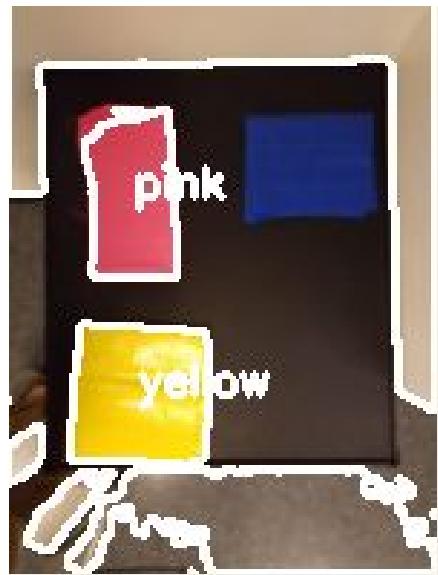


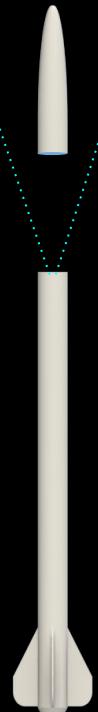
Functions:

- Fast and precise ground target detection

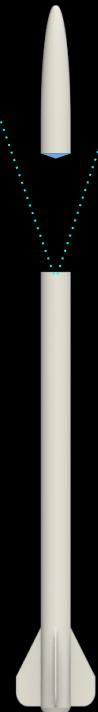








Flat Mirror



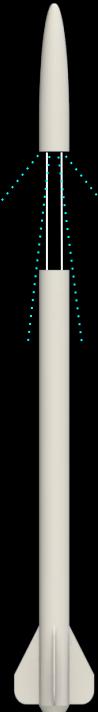
Conical Mirror



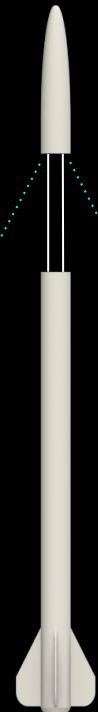
Single Externally
Mounted Camera



Two Externally
Mounted Cameras

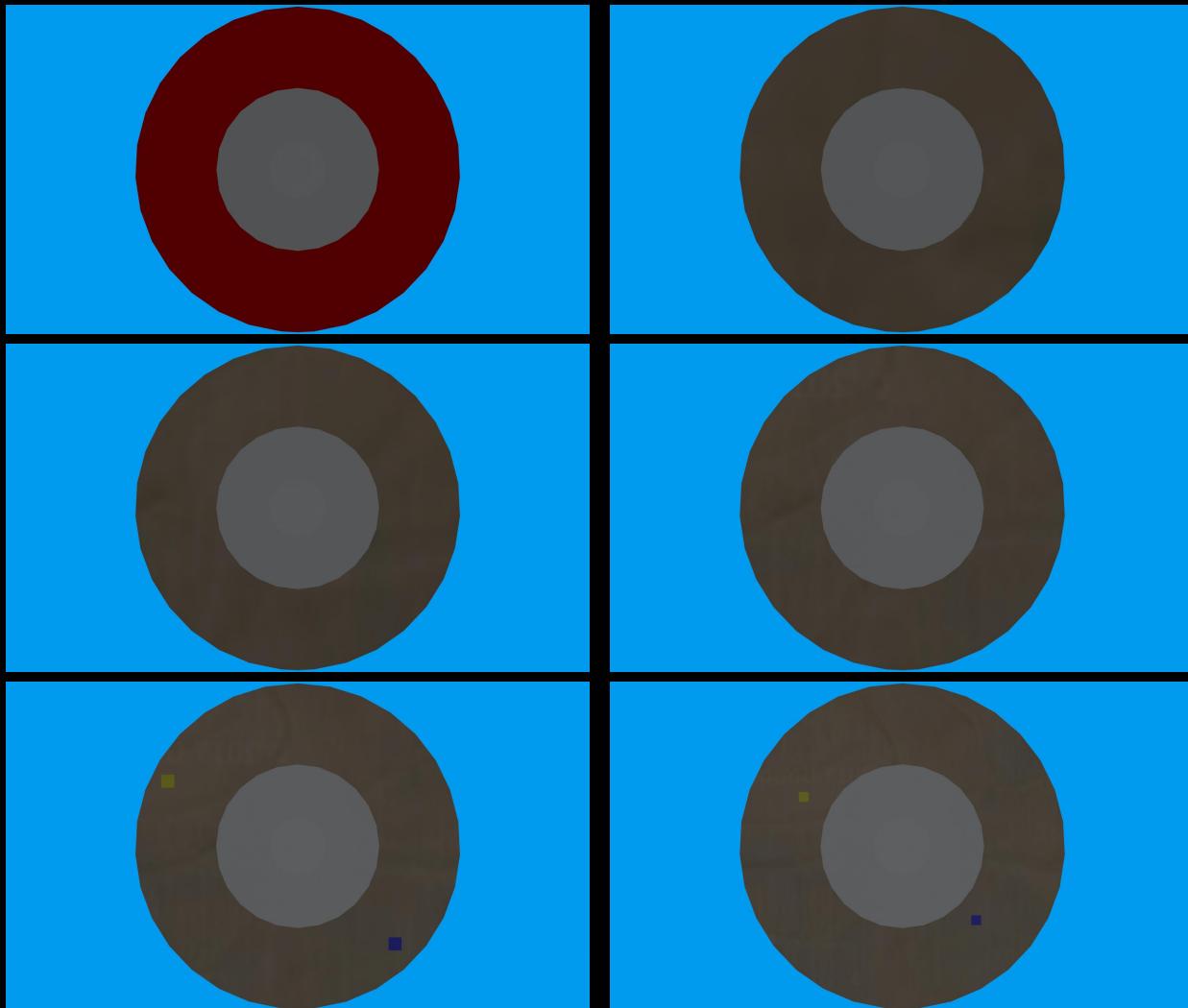


Two Down-Facing
Cameras

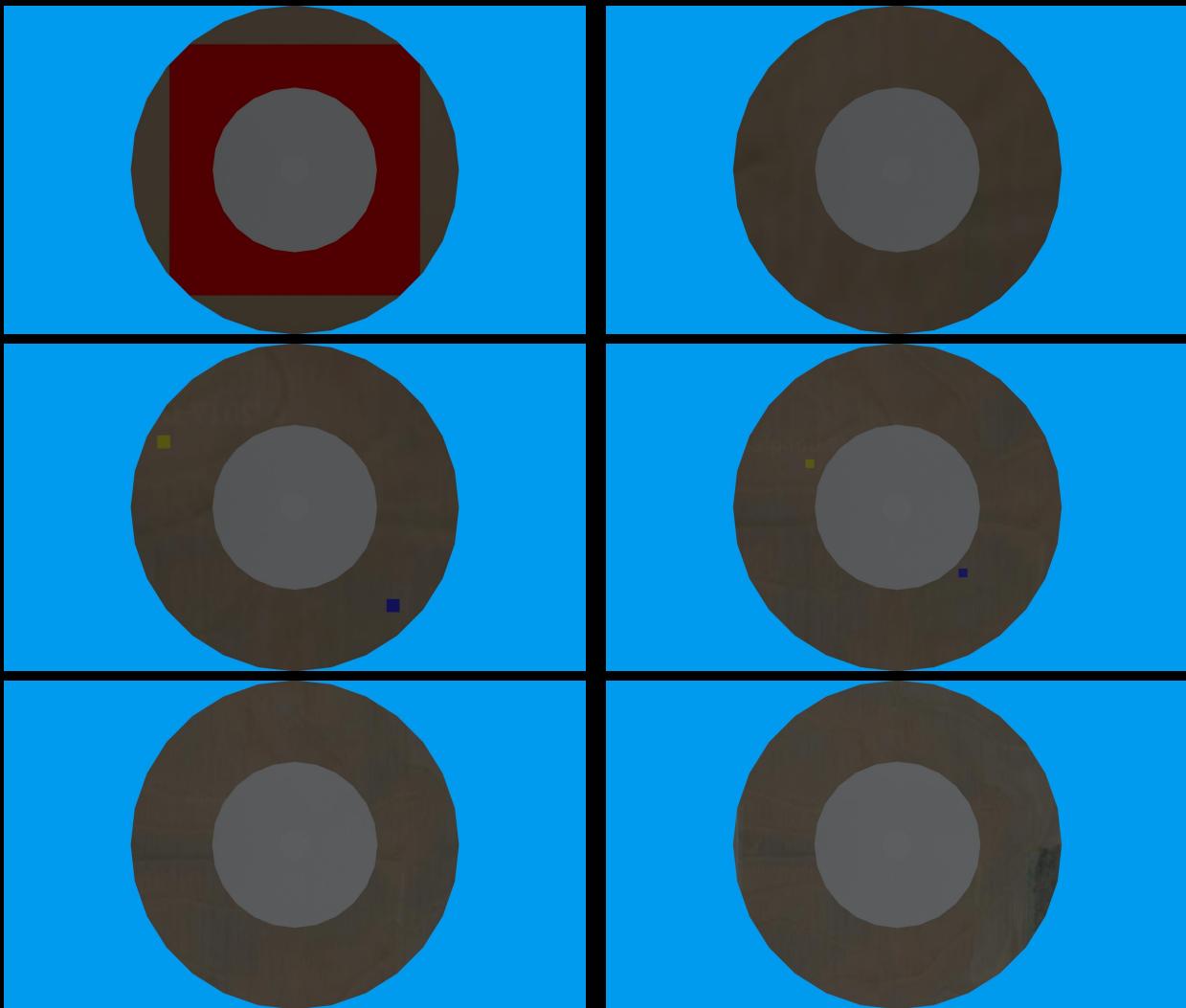


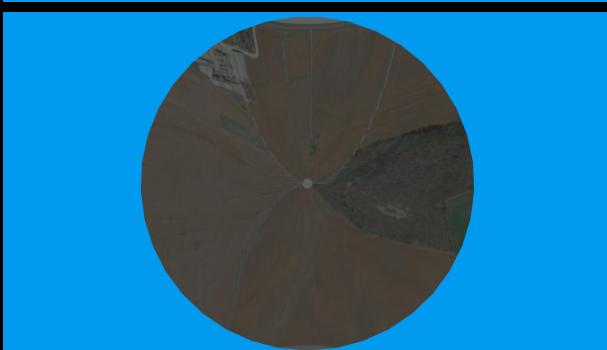
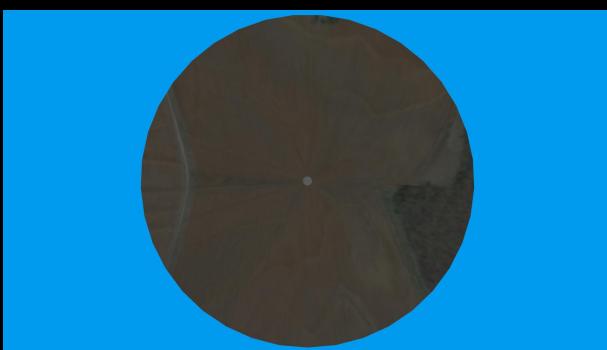
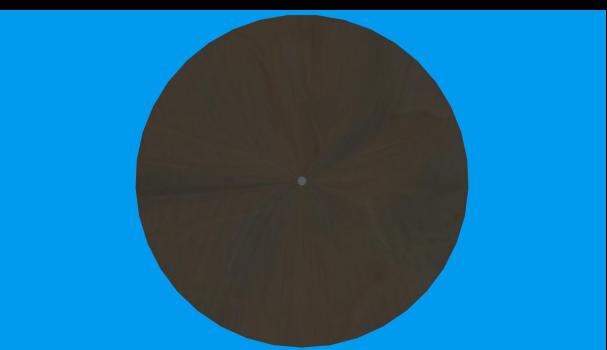
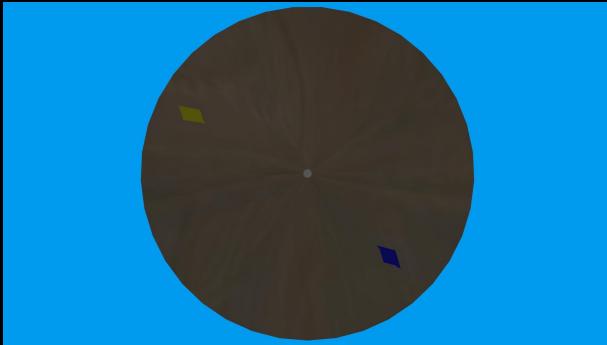
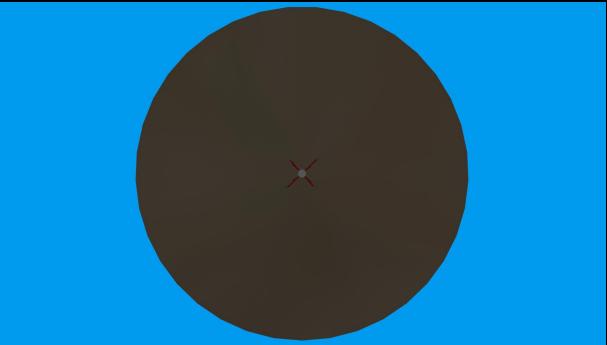
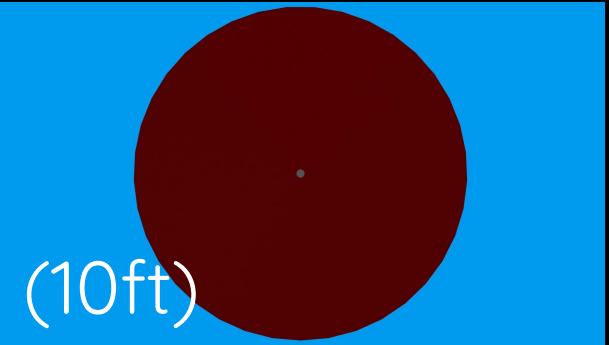
One Wide Angle
Down-Facing
Camera

Flat Mirror 10in Gap



Flat Mirror 6in Gap

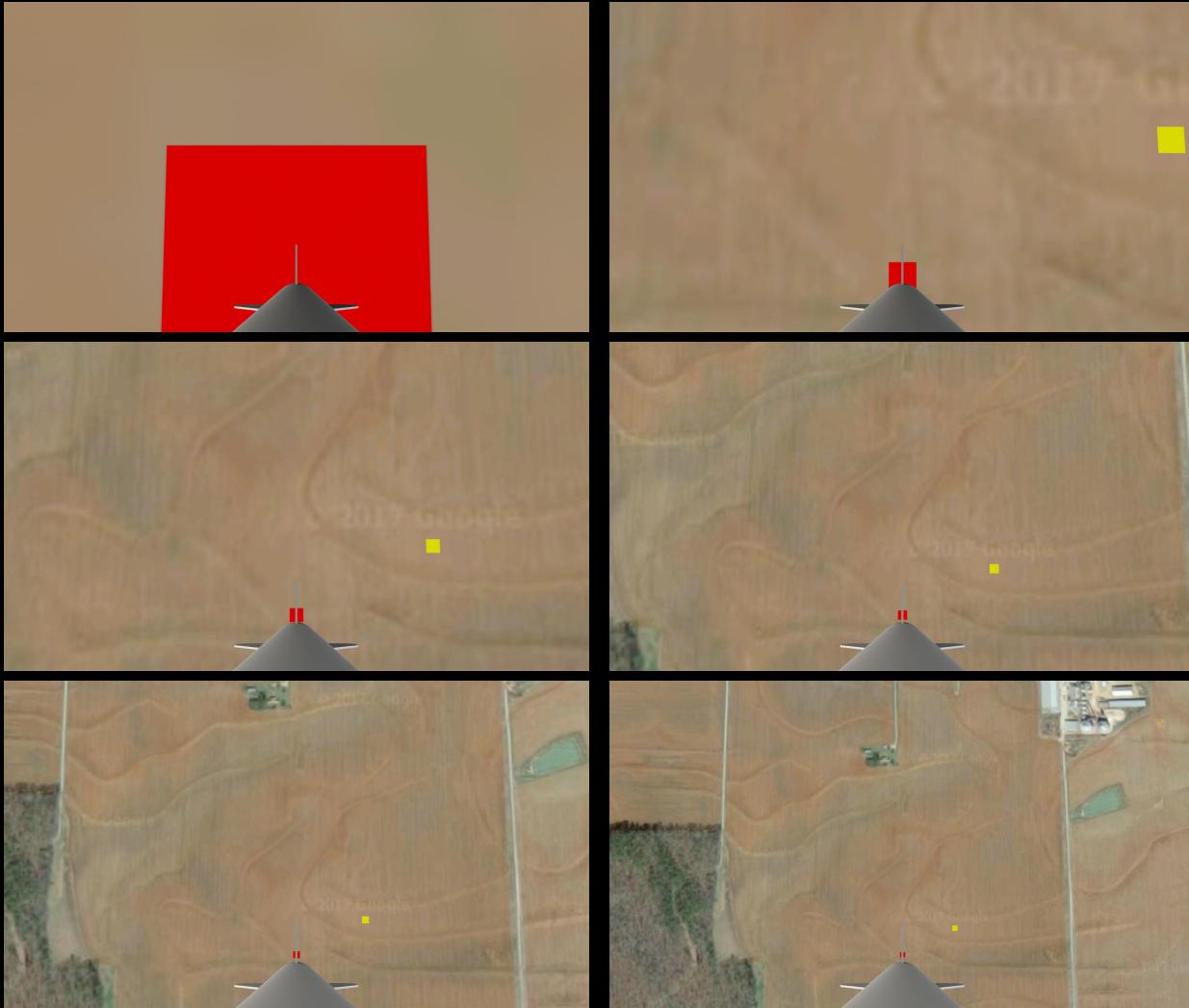




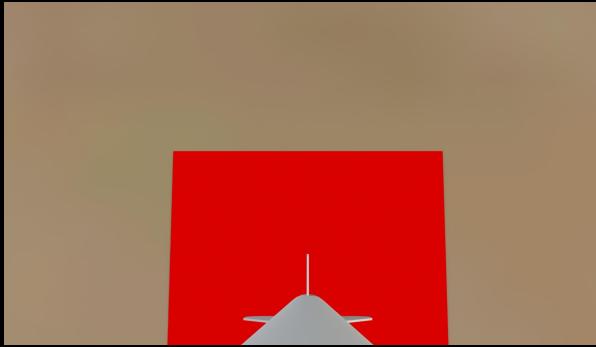
Cone Mirror 6in Gap



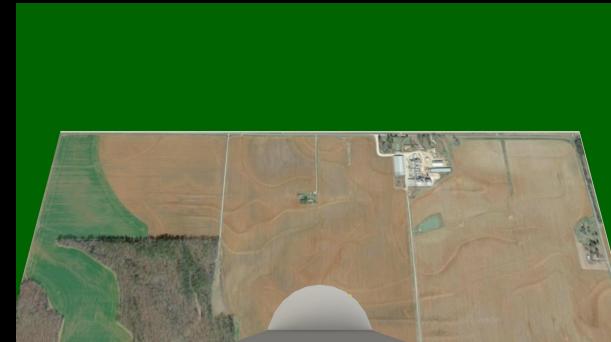
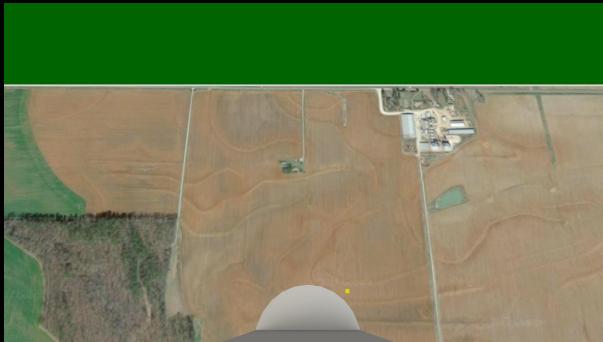
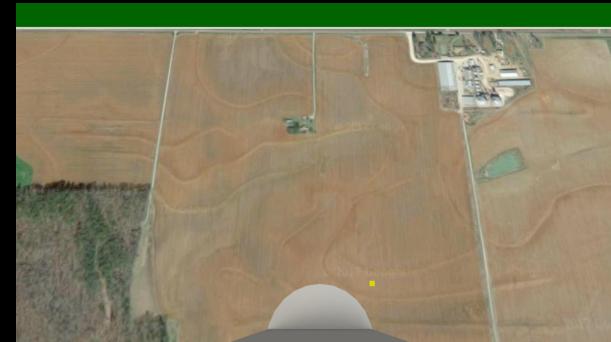
Single Camera



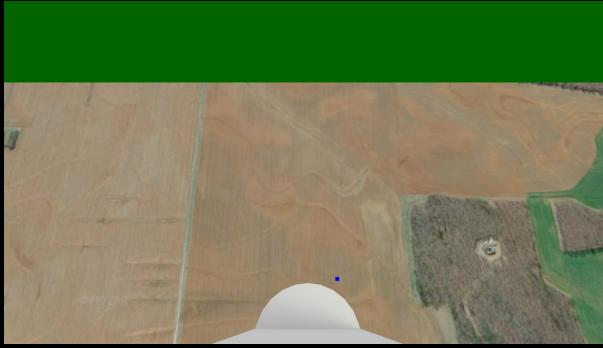
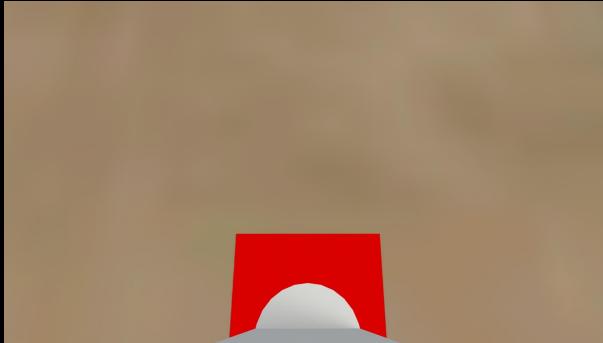
Second Camera



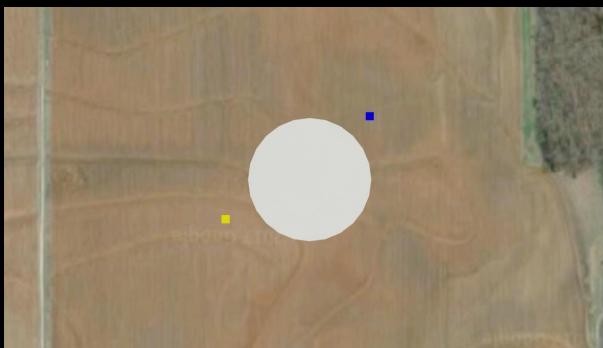
Window Camera 1



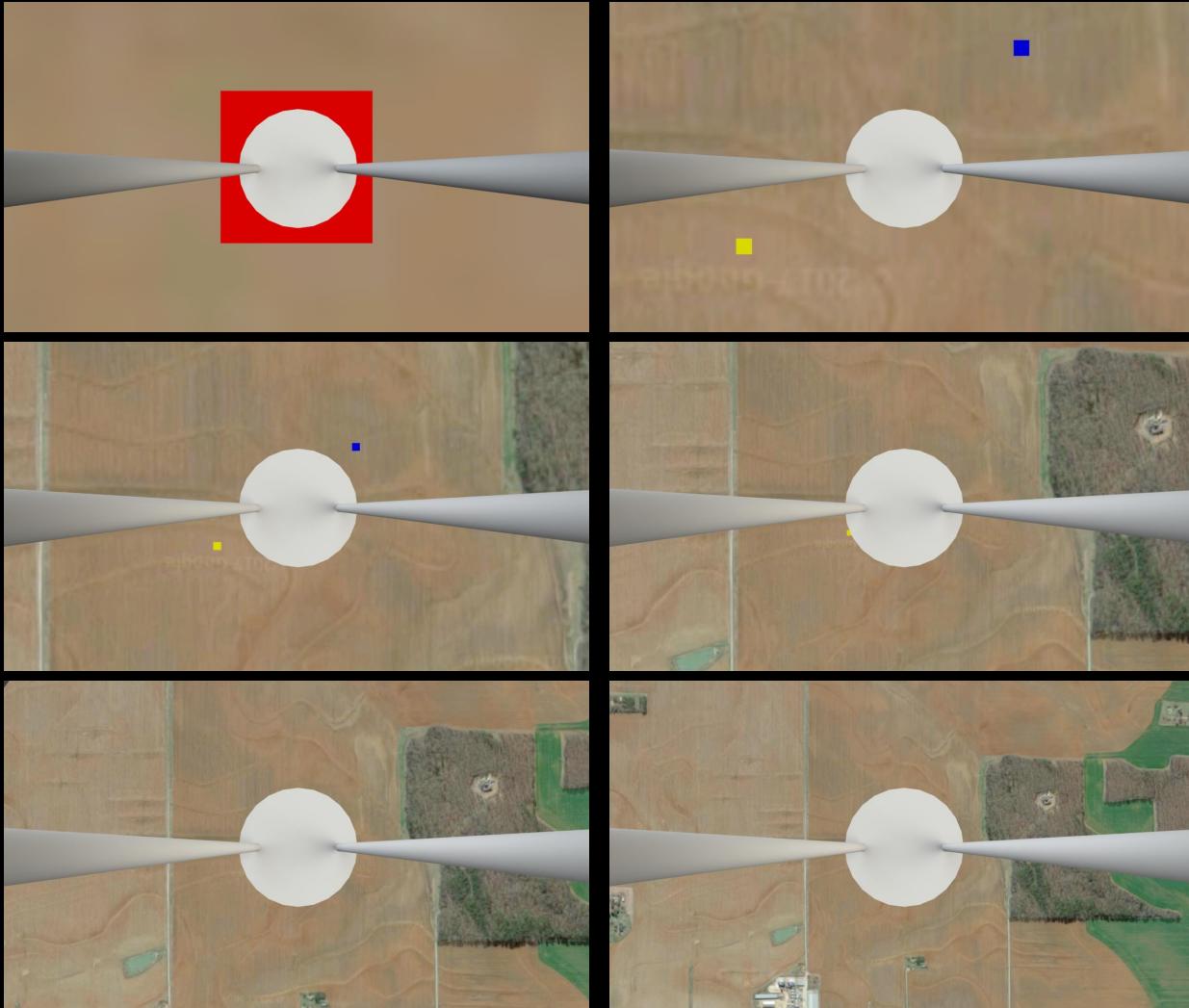
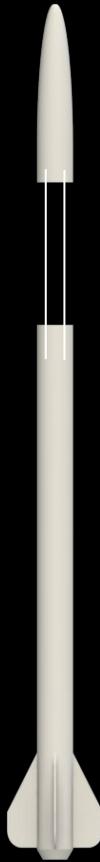
Window Camera 2

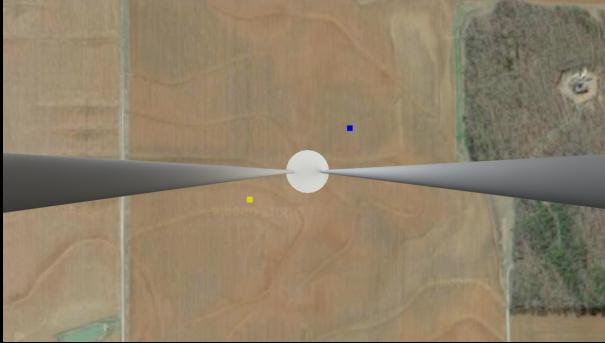


Face down 10in gap
45 deg lens

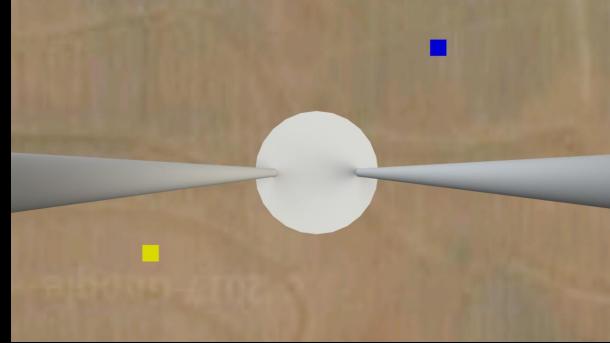


Face down 10in gap
45 deg lens w/ all thrd.





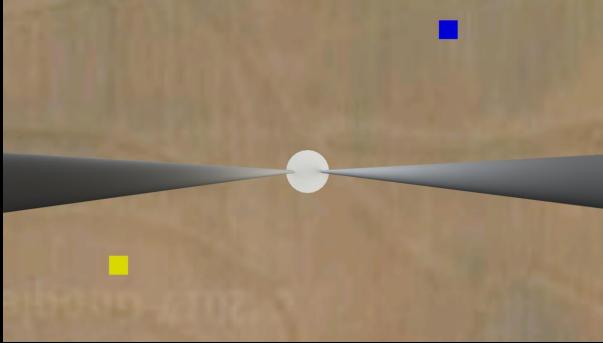
1000ft 100 deg face down lens



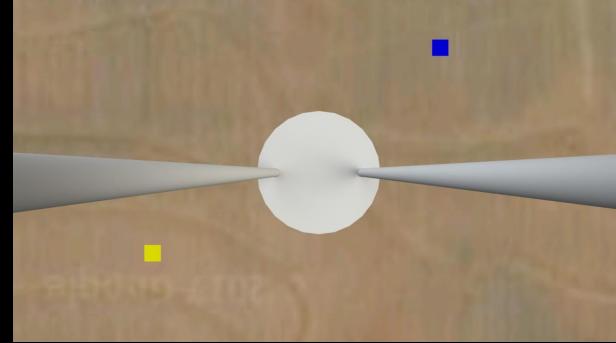
1000ft 45 deg face down lens



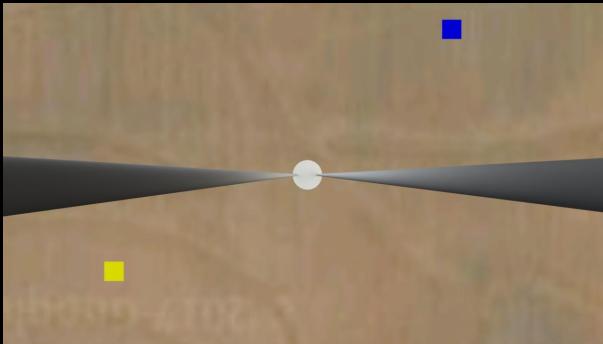
1000ft 120 deg face down lens



300ft 100 deg face down lens

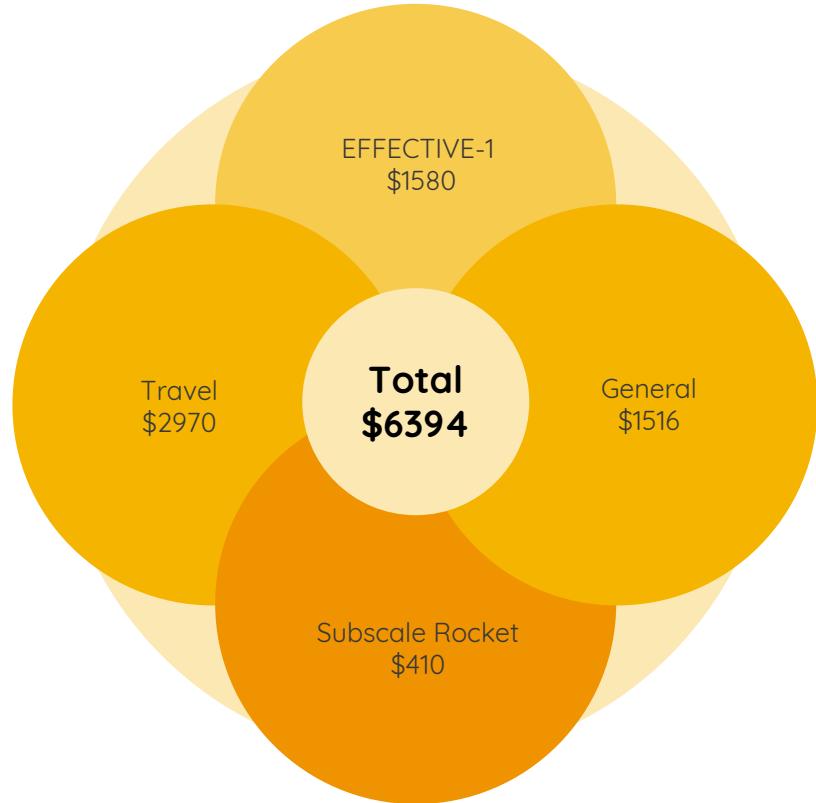


1000ft 45 deg face down lens



200ft 120 deg face down lens

Budget



Safety



Questions?

