VRSE
Full Mission Simulation Review (FMSR)

Red Rocks Community College & Arapahoe Community College
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Presentation Outline

- Section 1: Mission Concept and Interfaces
- Section 2: Design Overview
- Section 3: Subsystem Integration and Test Status
- Section 4: Full Mission Simulation Results
- Section 5: Project Schedule
- Section 6: June Operations
- Section 7: Conclusion

1.0 Mission Concept and Interfaces

Cass

Mission Overview

Primary Mission: Create a virtual reality camera apparatus and record 360° video of the RockSat-X 2020 sub-orbital flight for NASA's Education and Outreach program.

Secondary Mission: Collect acceleration, distance, sensor data & record footage of extension and retraction with pi cam.

Success Criteria

Minimum Success Criteria:

- Recovery of high quality 360 degree video footage

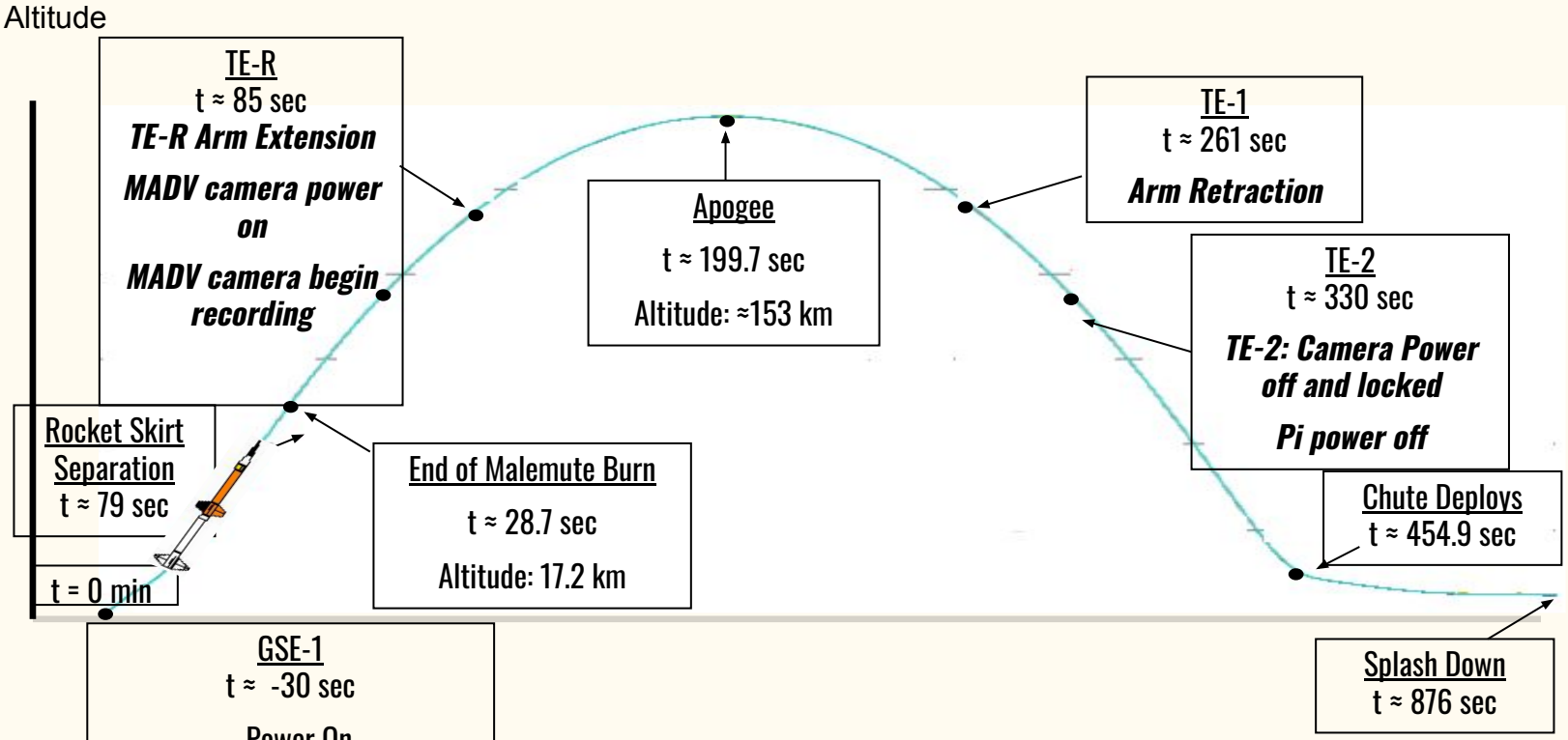
Comprehensive Success Criteria:

- Full extension and retraction of arm
- Recovery of camera and full quality video from both cameras
- Telemetry data
- Sensor data

Concept of Operations

- Our payload will extend outside of the normal diameter of the rocket shell body and record a 360 degree video of the rocket housing including of our payload and anything past our payload including the earth and space.
- GSE-1 at T-30 will power the Raspberry Pi we are using to control our system
- TE-R at T85 will start arm extension and video recording
- TE-1 at T261 will start arm retraction and video data transfer
- TE-2 at T330 will start shutdown sequence of all electrical components to prepare for reentry and splashdown into the ocean.

ConOps


Altitude
TE-R
t ≈ 85 sec
TE-R Arm Extension
MADV camera power on
MADV camera begin recording
Apogee
t ≈ 199.7 sec
Altitude: ≈153 km
TE-1
t ≈ 261 sec
Arm Retraction
TE-2
t ≈ 330 sec
TE-2: Camera Power off and locked
Pi power off
Rocket Skirt Separation
t ≈ 79 sec
End of Malemute Burn
t ≈ 28.7 sec
Altitude: 17.2 km
Chute Deploys
t ≈ 454.9 sec
t = 0 min
GSE-1
t ≈ -30 sec
- Power On
- All Pi Systems On
- Pi camera recording
Splash Down
t ≈ 876 sec

2019 Mission Timeline

Mission Time Line
46.030/Koehler

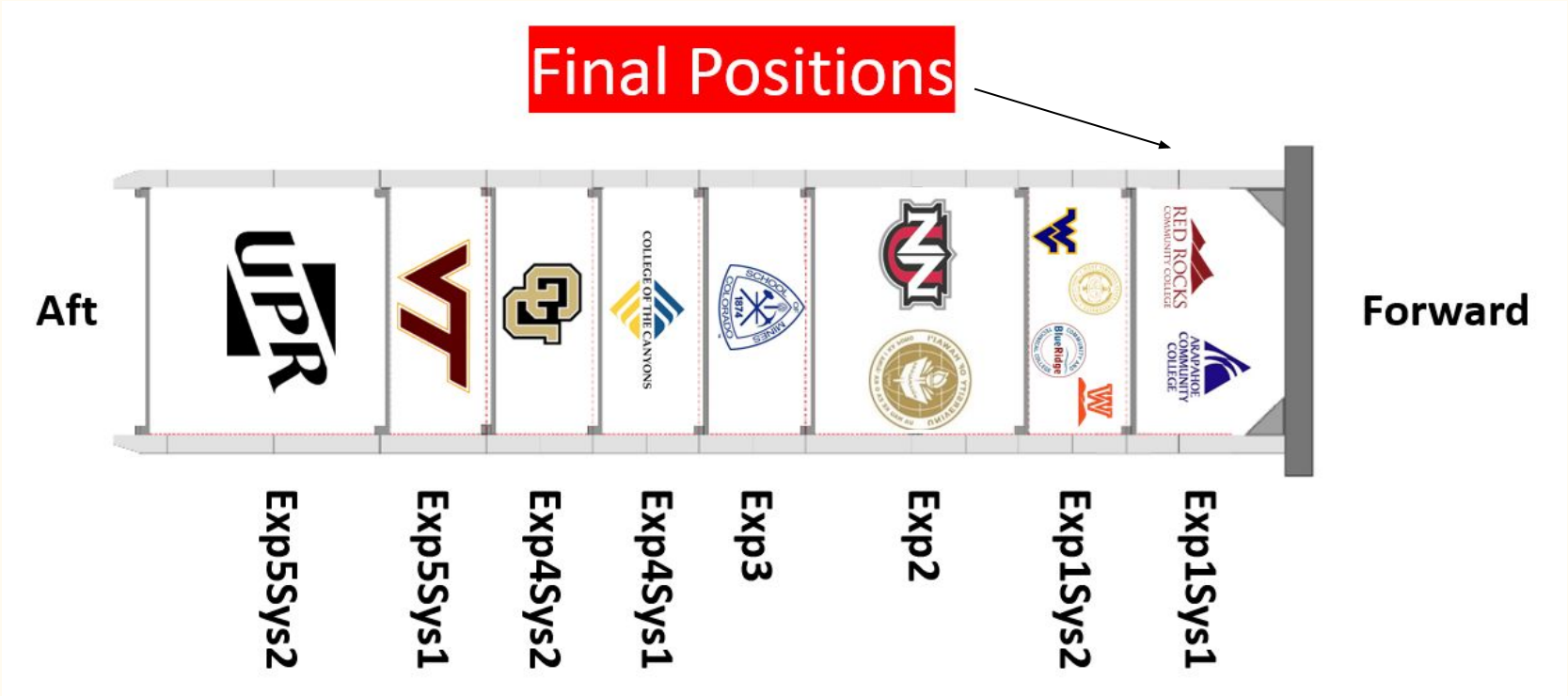
Weight: 872.9 lbs QE: 84.0 deg. AZ: 110.0 deg.

4/13/2020
Rev B

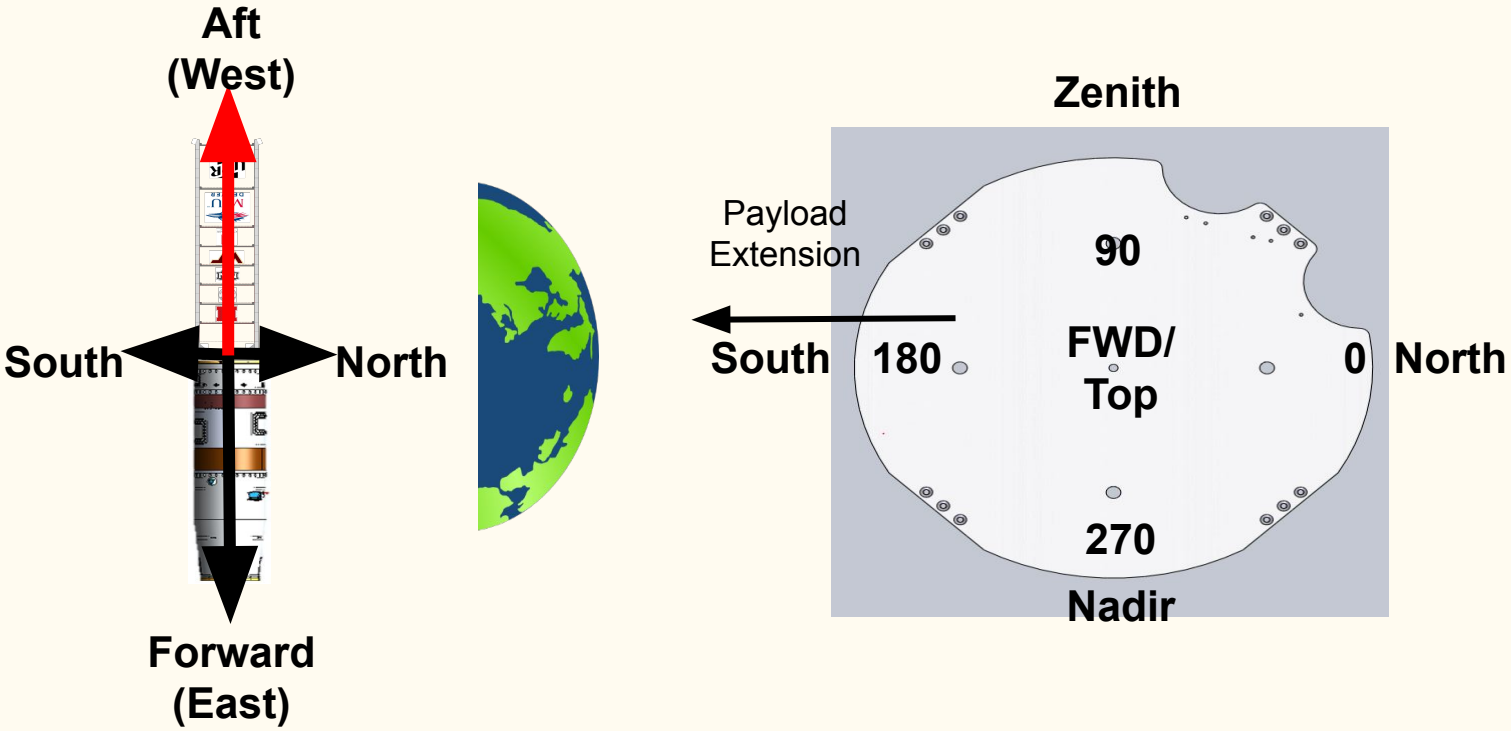
Event	Time (sec)	2 Sigma Low Altitude (km)	Nom. Alt. (km)	2 Sigma High Altitude (km)	Nominal Range (km)	Nominal Mach Number	Nominal Vel. (m/s)	2 Sigma Low Q (psf)	Nominal Q (psf)	2 Sigma High Q (psf)	Nominal Flight Elevation (deg)	Event Control	Dwell Time (sec)
Exp GSE Backup Event	0.1	0.0	0.0	0.0	0.0	0.0	-	-	0.0	-	84.0	TM DIRT Timer 2	34.9
UPR (Exp5 TE-1) - More Power	0.1	0.0	0.0	0.0	0.0	0.0	-	-	0.0	-	84.0	TM DIRT Timer 2	336.0
Rail Release	0.5	-	0.0	-	0.0	0.1	44.2	-	25.1	-	84.0		
Terrier Burnout	5.2	-	1.5	-	0.2	1.6	559.0	-	3448.1	-	82.9		
CoC (Exp4 TE-1) - System Power	10.0	3.8	3.9	3.9	0.5	1.3	434.4	1630.0	1638.1	1653.5	82.2	TM DIRT Timer 1	326.0
Imp. Malemute IGN	18.0	-	6.7	-	0.9	0.9	288.7	-	532.3	-	80.3	CDI DIRT Timer	1.0
CSoM (Exp3 TE-1) - Comp. Pwr On	20.0	7.3	7.4	7.5	1.0	1.4	449.5	1188.9	1189.6	1199.4	79.8	TM DIRT Timer 1	316.0
Imp. Malemute Burnout	29.7	-	17.2	-	2.9	5.7	1666.0	-	4075.3	-	78.8		
UoC (Exp4 TE-R) - GoPro & Lighting On	65.0	64.7	67.2	69.5	13.8	4.3	1276.2	3.0	2.2	1.7	76.1	TM DIRT Timer 1	360.0
Heat Shield Enable	66.0	65.8	68.4	70.8	14.1	4.3	1266.9	2.5	1.8	1.4	76.0	TM DIRT Timer 1	600.0
Despin to 0 hz	68.0	-	70.8	-	14.7	4.3	1248.3	-	1.2	-	75.9	CDI DIRT Timer	1.0
UPR (Exp5 TE-2) - Detect Skirt Deploy	70.0	70.4	73.2	75.9	15.3	4.2	1229.7	1.2	0.9	0.6	75.7	TM DIRT Timer 2	266.0
Motor Sep	72.0	-	75.6	-	15.9	4.2	1211.2	-	0.6	-	75.4	CDI DIRT Timer	1.0
ACS, Rate Damping	72.0	72.7	75.6	78.4	15.9	4.2	1211.2	0.9	0.6	0.4	75.4	ACS Timer	6.0
Aft Skirt Sep	79.0	-	86.8	-	18.0	4.2	1146.5	-	0.1	-	74.7	TM DIRT Timer 1	1.0
Kaulda (Exp2 TE-1) - Start Deploy & Bluetooth	81.0	82.3	85.8	89.1	18.6	4.1	1128.1	0.2	0.1	0.1	74.4	TM DIRT Timer 1	255.0
Nose Sep	82.0	-	86.8	-	18.9	4.1	1118.9	-	0.1	-	74.3	TM DIRT Timer 1	1.0
ACS. Align to and Maintain Target	83.0	84.4	87.9	91.3	19.2	4.1	1109.7	0.1	0.1	0.0	74.2	ACS Timer	224.0
CCoC (Exp1 TE-1) - Arm Extension	85.0	86.4	90.0	93.6	19.8	4.1	1091.4	0.1	0.1	0.0	73.9	TM DIRT Timer 1	251.0
CSoM (Exp3 TE-2) - Actuators Enabled	85.0	86.4	90.0	93.6	19.8	4.1	1091.4	0.1	0.1	0.0	73.9	TM DIRT Timer 1	251.0
UoC (Exp4 TE-3) - Deploy Seq. Setup	85.0	86.4	90.0	93.6	19.8	4.1	1091.4	0.1	0.1	0.0	73.9	TM DIRT Timer 1	265.0
300 kFt Upleg	86.4	-	91.4	-	20.2	4.0	1078.9	-	0.0	-	73.7		
VT (Exp5 TE-R) - Sig Deployment Seq.	115.0	111.8	117.2	122.5	28.7	2.2	821.5	0.0	0.0	0.0	68.7	TM DIRT Timer 1	160.0
Apogee (nominal)	196.9	-	148.5	-	52.3	0.7	293.3	-	0.0	-	0.0		
CoC (Exp4 TE-2) - Ejection	198.0	138.3	148.5	158.5	52.6	0.7	293.4	0.0	0.0	0.0	-1.9	TM DIRT Timer 1	138.0
CCoC (Exp1 TE-R) - Arm Retraction	270.0	109.1	123.7	137.7	73.4	1.9	744.0	0.0	0.0	0.0	-66.5	TM DIRT Timer 1	66.0
UPR (Exp5 TE-3) - Pwr Off Flag	305.0	77.4	94.0	110.1	83.7	4.0	1055.9	0.4	0.0	0.0	-73.4	TM DIRT Timer 2	31.0
ACS Spin Up	307.0	75.3	92.0	108.2	84.3	4.0	1074.2	0.6	0.0	0.0	-73.7	ACS Timer	40.0
300 kFt Downleg	307.5	-	91.4	-	84.4	4.0	1079.0	-	0.0	-	-73.7		
WVC (Exp1 TE-3) - Latch Int battery	321.0	59.1	76.6	93.7	88.5	4.2	1202.3	6.6	0.5	0.0	-75.4	TM DIRT Timer 1	15.0
All Experiment Power Off	336.0	39.9	58.1	76.0	93.0	4.3	1333.4	87.9	7.9	0.6	-76.9	TM DIRT Timer 2	1.0
ACS Vent	348.0	24.3	42.0	60.4	96.6	4.4	1410.3	756.7	67.5	6.3	-77.8	ACS Timer	40.0
ACS Valves Off	388.0	4.0	7.1	11.9	103.3	0.9	295.3	433.7	530.5	946.2	-83.0	ACS Timer	End Dwell
Ballistic Impact (nominal)	420.5	-	0.0	-	103.8	0.5	174.8	-	390.5	-	-88.2		
Parachute Deploy (nominal)	477.5	-	4.9	-	103.8	0.3	90.0	-	63.1	-	-88.3		
ACS Control Off	790.0	-	0.4	-	103.8	0.0	9.7	-	1.2	-	-90.0	ACS Timer	
ACS Power Off	800.0	-	0.3	-	103.8	0.0	9.7	-	1.2	-	-90.0	ACS Timer	
Payload Impact	839.7	-	0.0	-	103.8	0.0	9.7	-	1.2	-	-90.0		

Experiment Events
ACS Events

Payload Location



Pointing


Aft
(West)
South
North
Forward
(East)
Zenith
Payload
Extension
90
South
180
FWD/
Top
0
North
270
Nadir

Activation Sequence: CCofCO and WV

	School	Start (sec only)	Start (min, sec)	Dwell (sec)	End (sec only)	End (min, sec)	Comments
GSE-1	CCofCO	T-30s	T-0min, 30 s	Flight	Flight	Flight	Power to Pi and Pi cam power up and begin recording, power to sensors
GSE-2	WV	T-180s	T-3min	Flight	Flight	Flight	Power On
TE-R	CCofCO	T+85s	T+1min, 25s	245 s	330 s	5 min, 30 s	Power to motor hat, arm extension and primary camera turns on and begin recording
TE-1	CCofCO	T+261s	T+4min, 21s	69 s	330 s	5 min, 30 s	Arm Retraction, recording stopped
TE-2	CCofCO	T+330s	T+5min, 30s	5 s	335 s	5 min, 35 s	Lock Camera Power Off Data Loss Prevention
TE-3	WV	T+321s	T+5min, 21s	Flight	Flight	Flight	Latch of Internal Battery

Pin Assignments: Power

Power Connector--Customer Side	
Pin	**Function**
1	+28 Volts (GSE-1)
2	Timer Event Redundant (TE-RA)
3	WV
4	Timer Event 1(TE-1)
5	GND
6	GND
7	GND
8	GND
9	WV
10	Timer Event 2 (TE-2)
11	WV
12	WV
13	WV
14	WV
15	WV

Telemetry Connector--Customer Side			
Pin	**Function**	**Pin**	**Function**
1		20	
2		21	
3		22	
4		23	
5		24	
6		25	
7		26	
8		27	
9		28	
10		29	
11		30	
12		31	
13		32	RS-232 Data (TP1)
14		33	RS-232 GND (TP2)
15		34	
16		35	
17		36	
18		37	
19			

Updated Power Budget

Power Budget						
Wallops Power Line	Subsystem	Voltage (V)	Max Current (A)	Time On (min)	Watts	Ah
GSE1/2	Raspberry Pi, Sensors	5.0	0.20	10	1.00	0.03
	DC Motor	12.0	0.50	2	6.00	0.02
TE1/2/3/R	Signal Arm Retraction	1.8	0.01	2	0.02	0.10
	Signal System Shutdown	1.8	0.01	0.083	0.02	0.12
TER	Signal Arm Extension	1.8	0.01	2	0.02	0.10
		GSE 1/2 Total	0.7			
		TE1 Total	.03			
		Total	0.73		7.05	.37
		Total Power Capacity	1.85			.5
		Over/Under	1.12			19.7

Detailed Weight Budget

Detailed Weight Audit

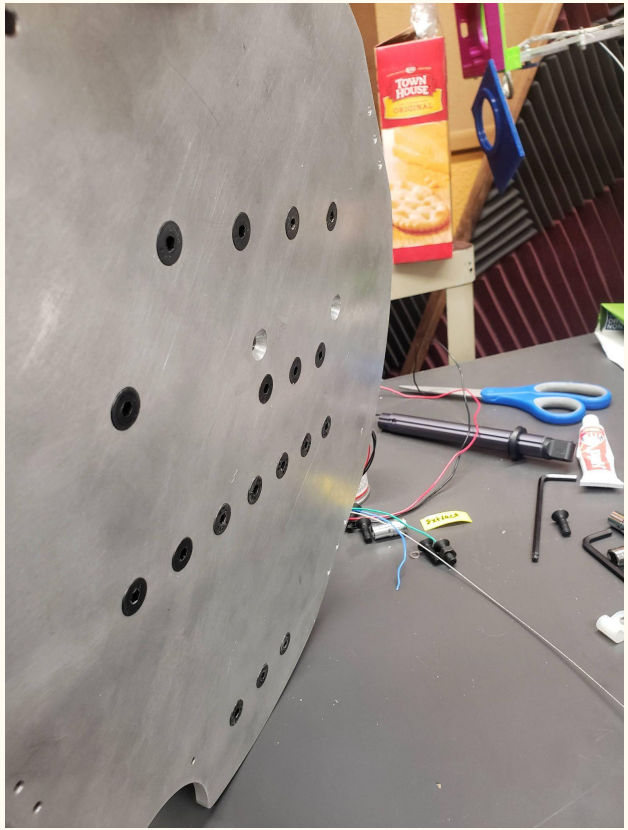
Subsystem Name	Description	Combined Weight of Machined Parts (lbs)	Wire Weight (lbs)	Subsystem Total Weight (lbs)
Arm System	scissor arm pieces, base mount, linear arm, motor mount, undertrack, motor, conduit down arm, delrin block, linear rod, coupler	3.1965	0	3.1965
Plate	plate, wallops interface dsub, tether eye bolt,	3.5625	0.125	3.6875
Camera System	camera case, madV 360 cam	2	0.125	2.125
Electronics System	Ebox, Ebox lid, sleeve, bucks, pi, motor hat, dsub, pi cam, sensor mount, sensors	4.3125	0.25	4.5625

Total Weight for payload:	**13.5715**
Weight Goal:	14.5
Under:	0.9285

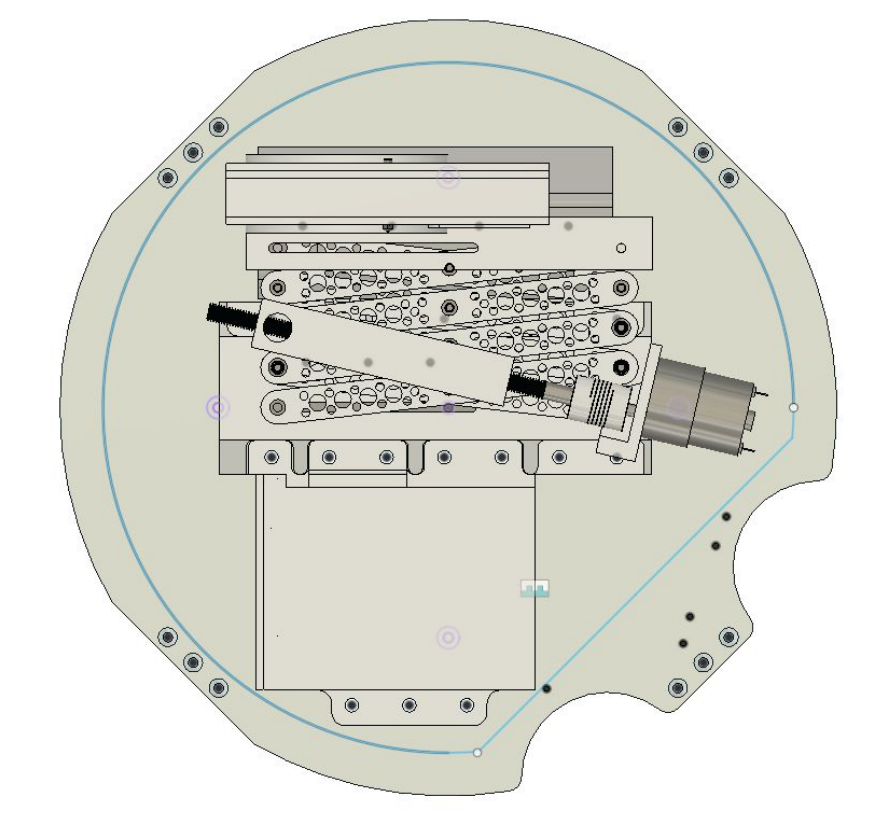
User Guide Compliance

Requirement	*Status/Reason (if needed)*
Center of gravity in 1" plane of plate?	Yes (no when extended)
Weight 30.0+/- 1.0 (15.0 +/- 0.5) lbs?	no(need to add additional weight)
Max Height < 10.75” (5.13”)	yes/5.09 inches
Bottom of deck has flush mount hardware?	YES, see picture on slide 17
Within Keep-Out Zone	YES, see picture on slide 18
Using < 10 A/D Lines	Using on 8 lines
Using/Understand Parallel Line	N/A
Using/Understand Asynchronous Line	YES, at 19200 Baud
Using X GSE Line(s)	YES, GSE 1
Using X Non-Redundant PWR Lines (TE-1, TE-2, TE-3)	YES, TE-1 and TE-2
Using X Redundant Power Lines (TE-R)	YES, TE-R
Using < 1 Ah	YES
Using <= 28 V	YES
Using RF (If yes, list frequency and TX Power)	N/A
Using deployable?	YES, camera arm extends 16 inches past plate edge at ~.6 in/sec
Whole team consists of US Persons	YES
Using ITAR and/or Export Controlled hardware	NO

User Guide Compliance : Bottom Deck



User Guide Compliance : Keep Out Zone



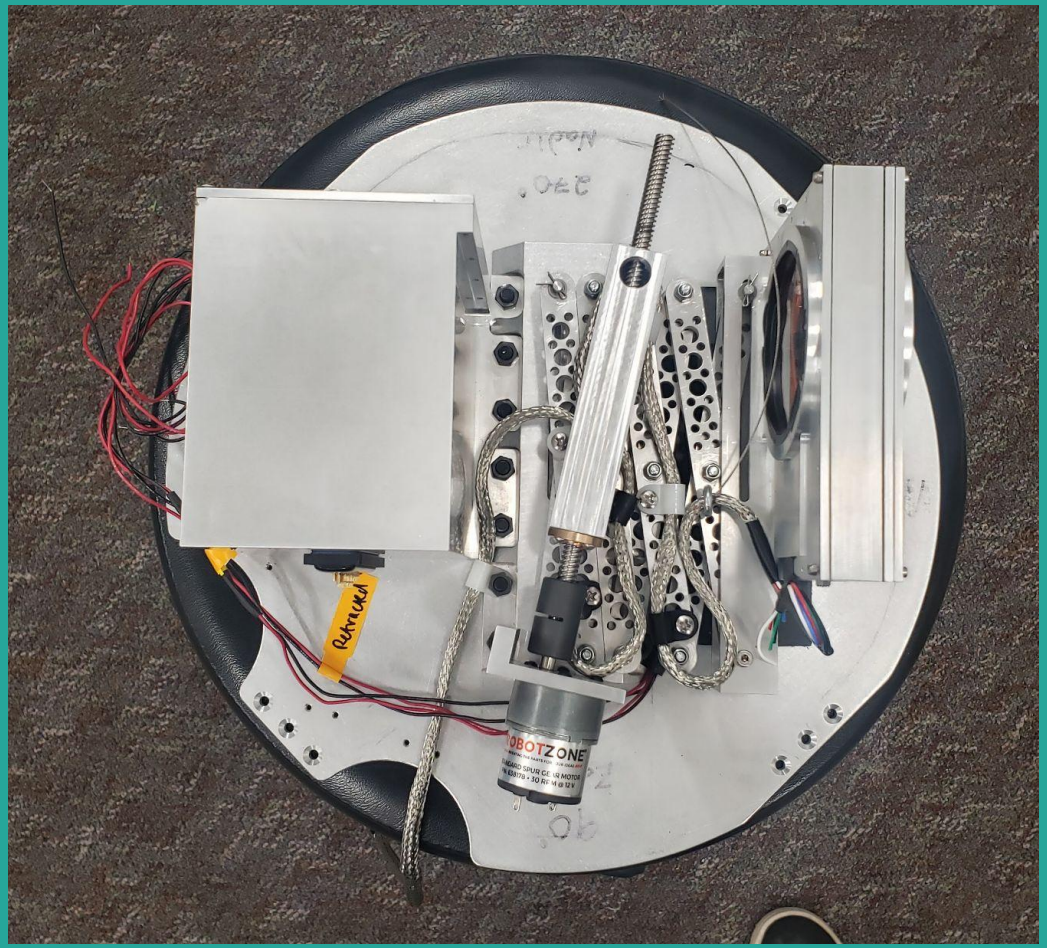
2.0 Design Overview

Anton Vandenberge

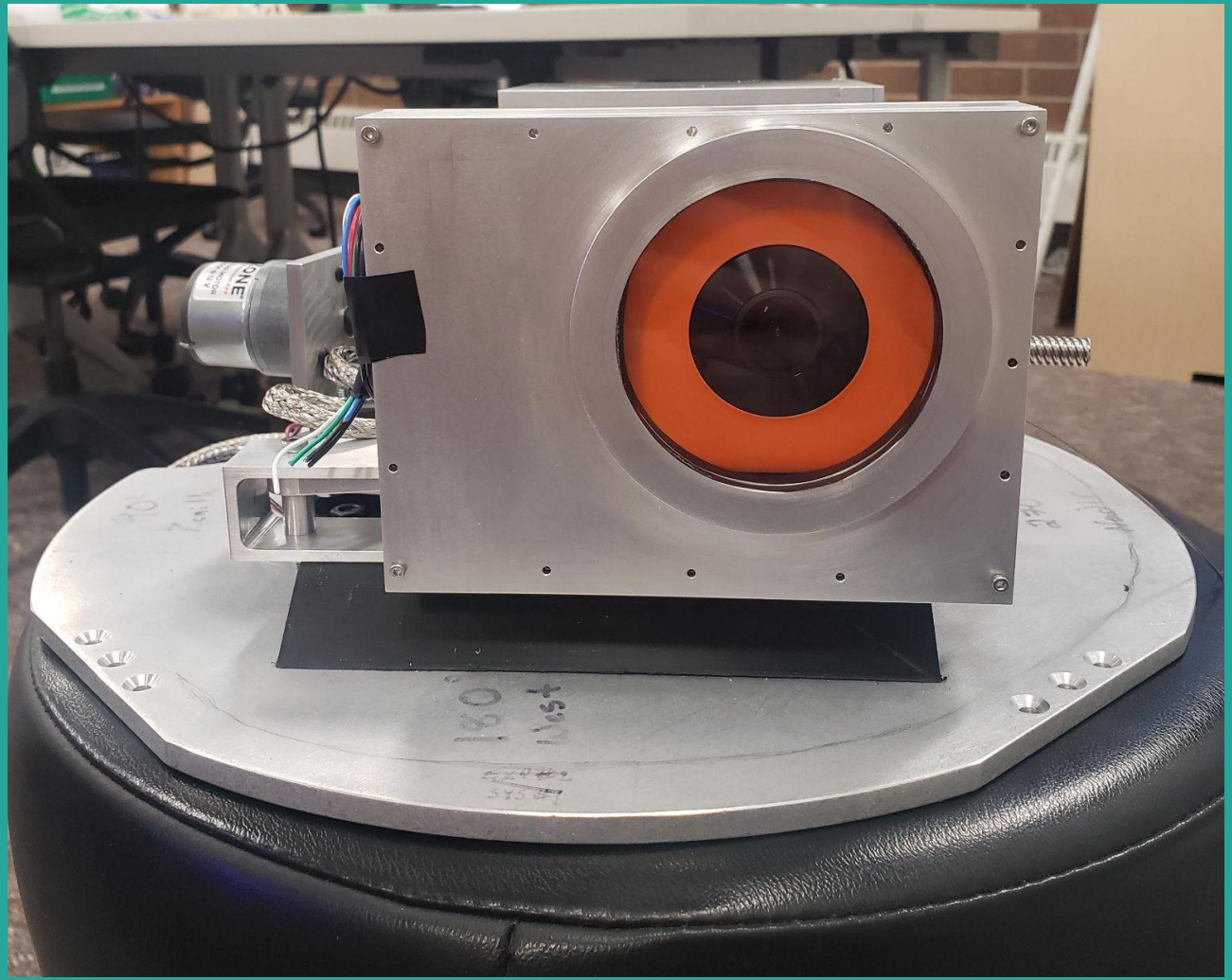
System Changes Since ISTR

- No major system changes since ISTR
- Physical inhibit jumper will be integrated into our system for testing only

TOP VIEW : Retracted Position

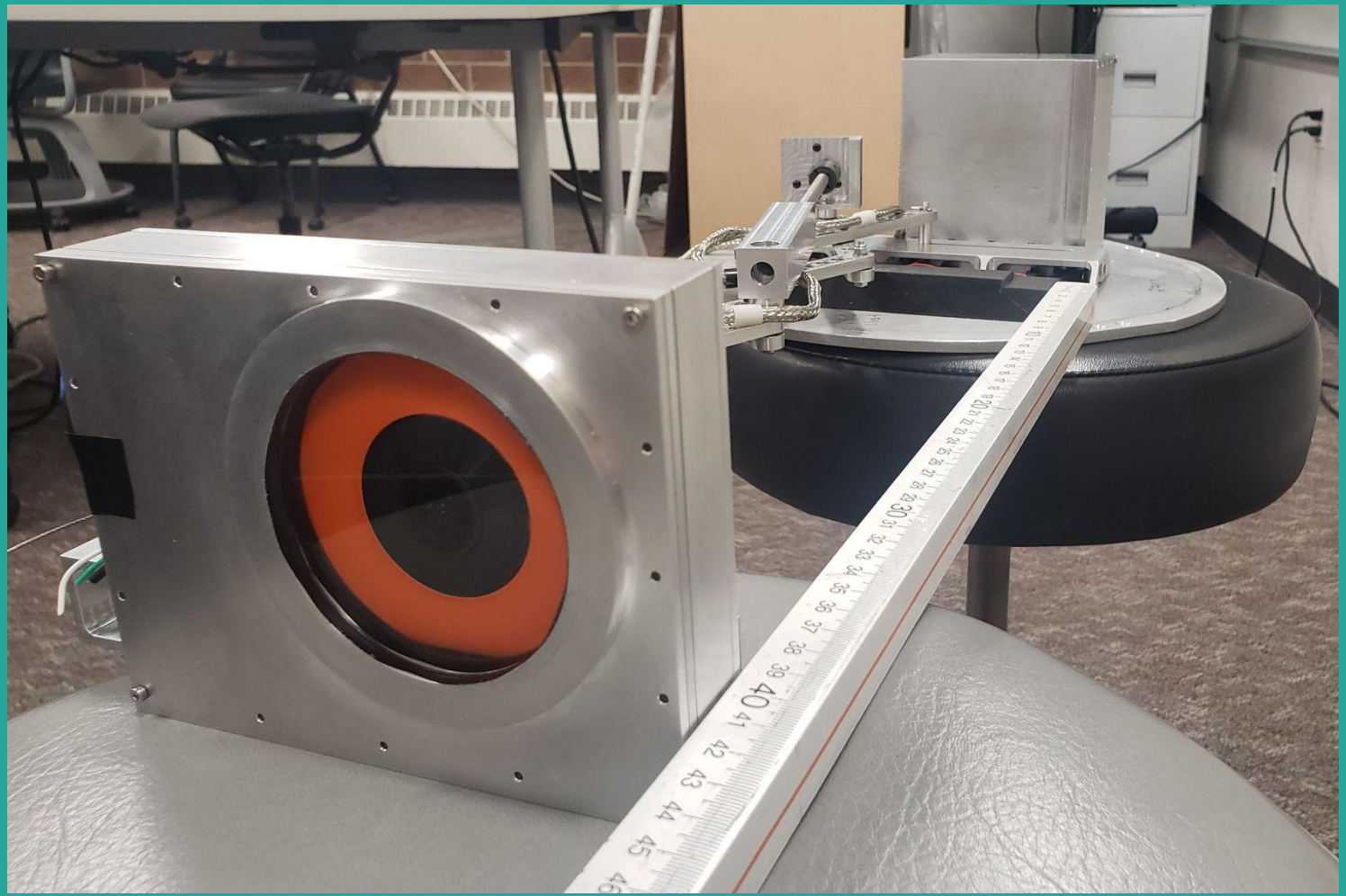


TOP VIEW : Extended Position (fully extended for ~144 seconds

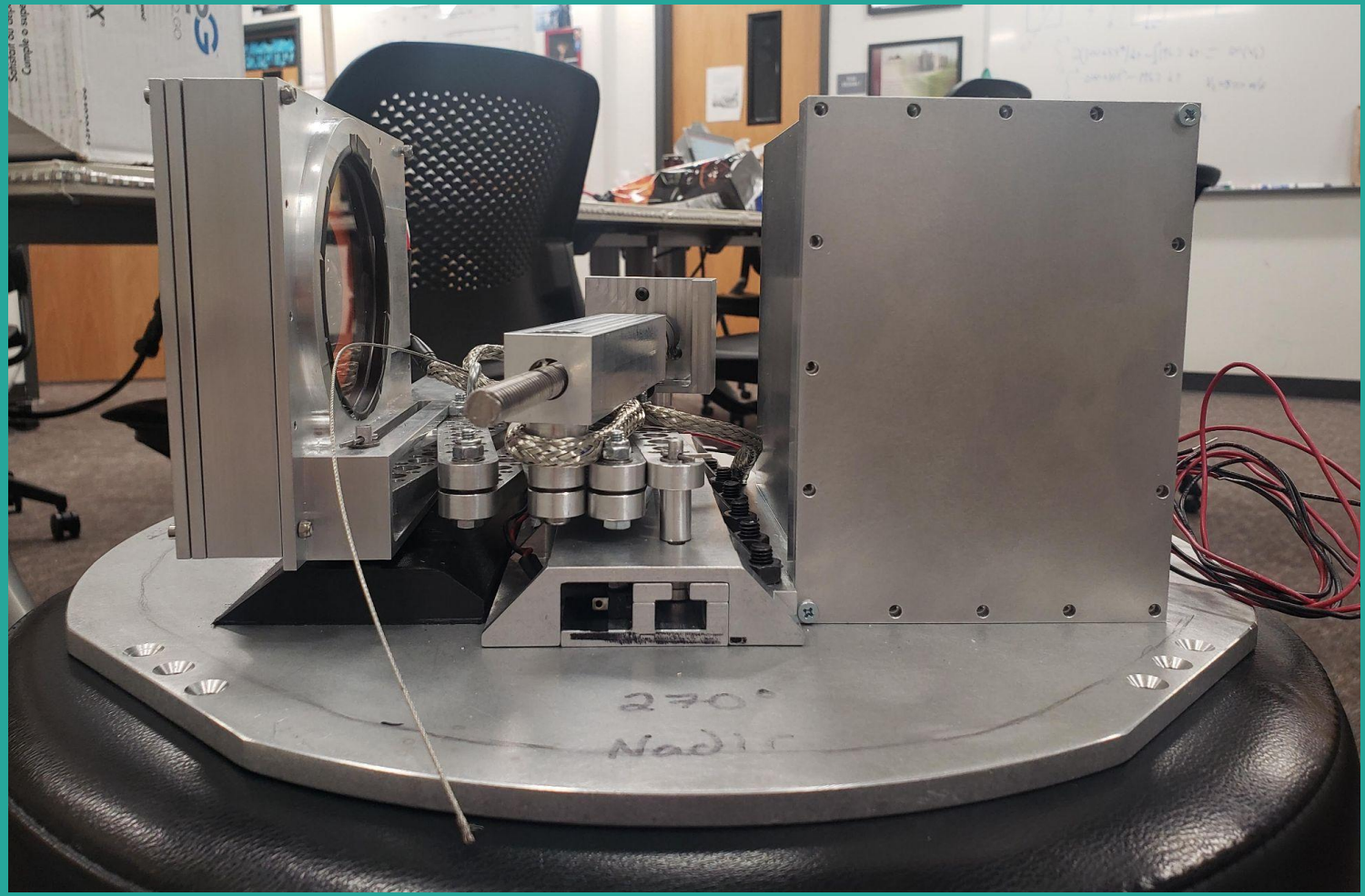


FRONT VIEW :
Retracted Position

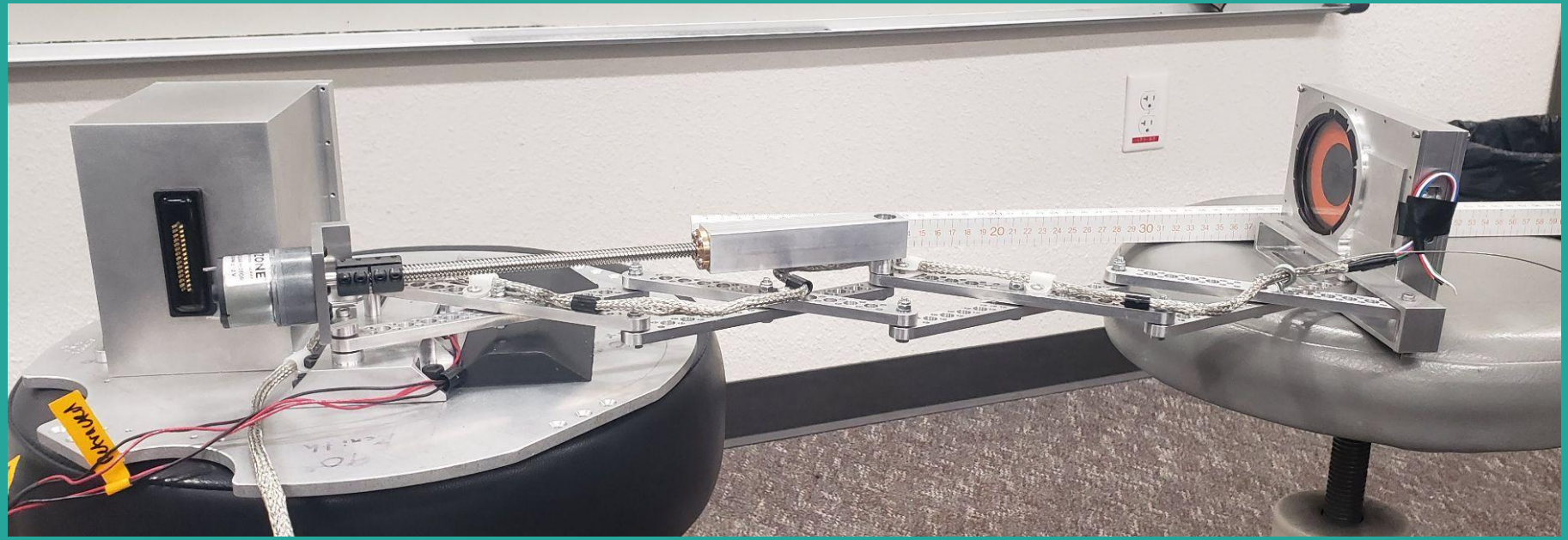
FRONT VIEW : Extended Position



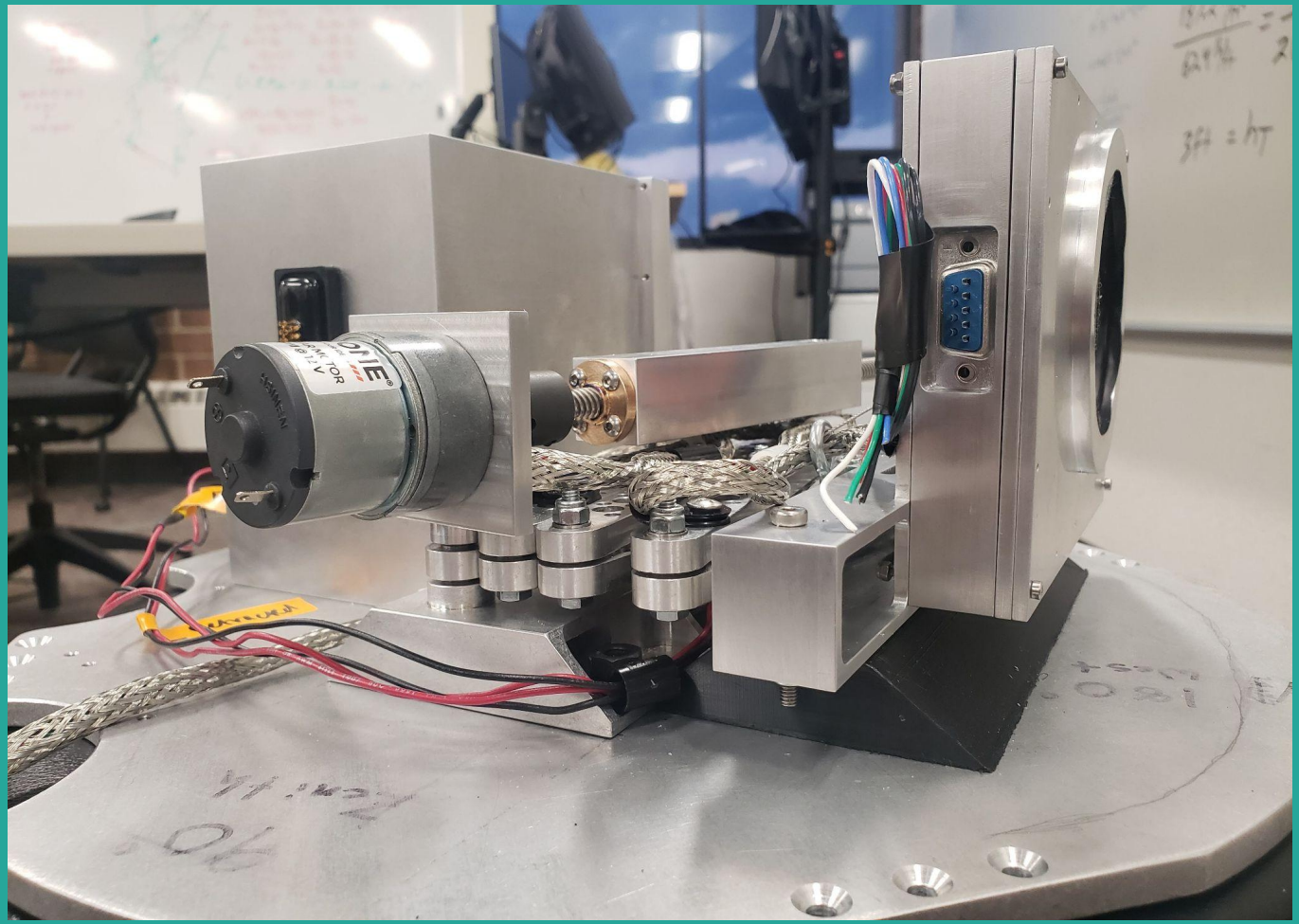
LEFT VIEW :
Retracted
Position



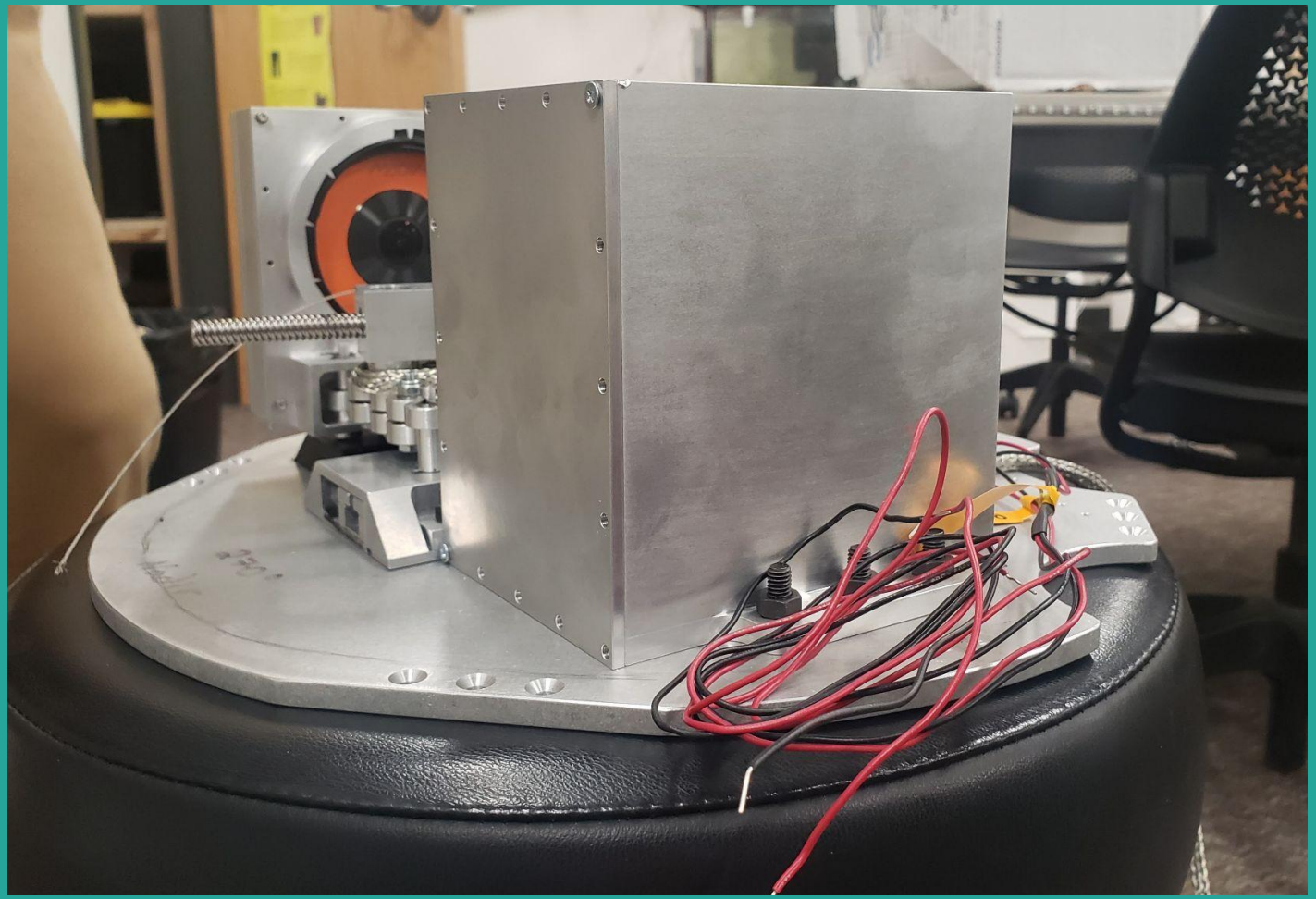
RIGHT VIEW :
Extended Position



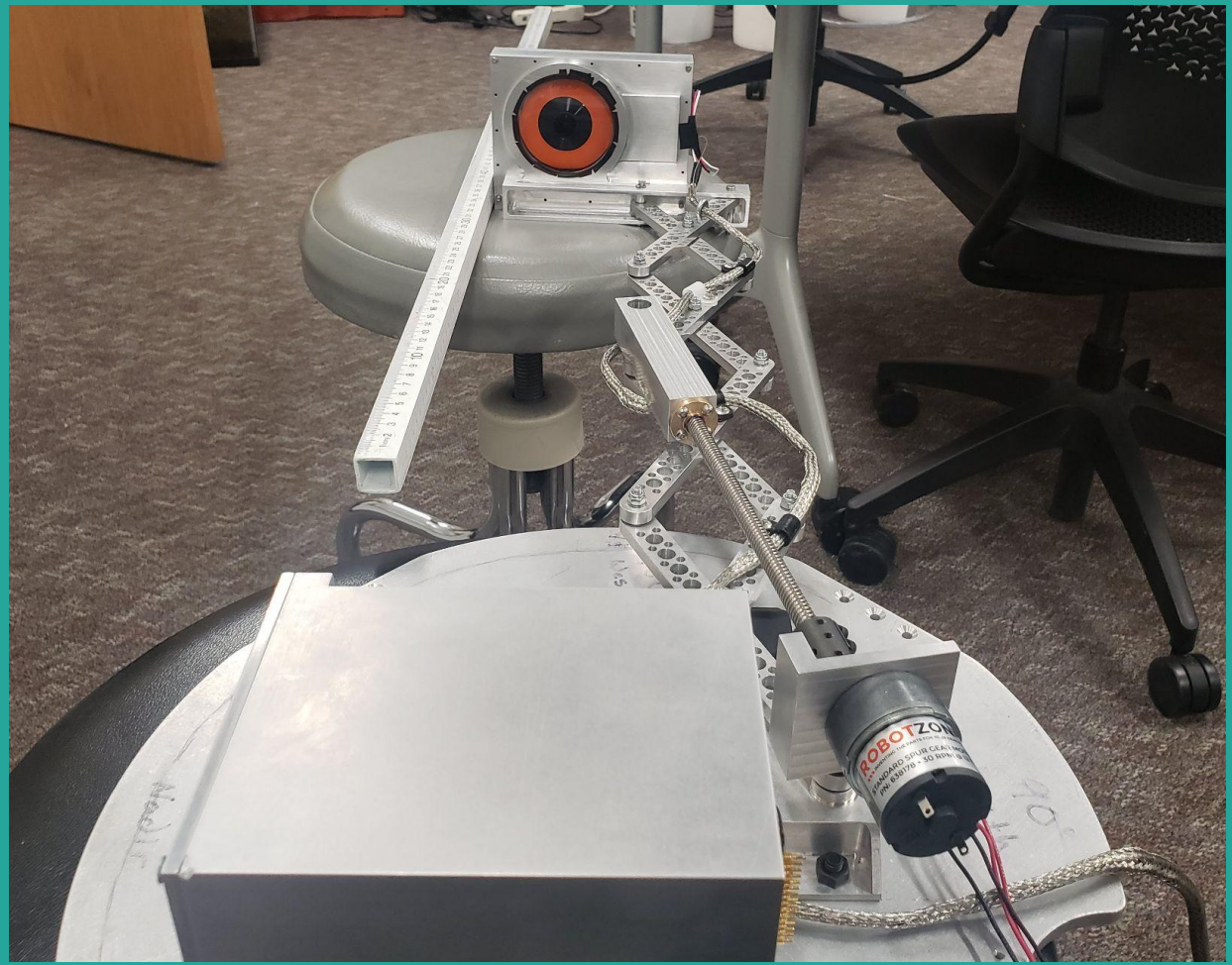
FRONT/RIGHT VIEW : Retracted Position



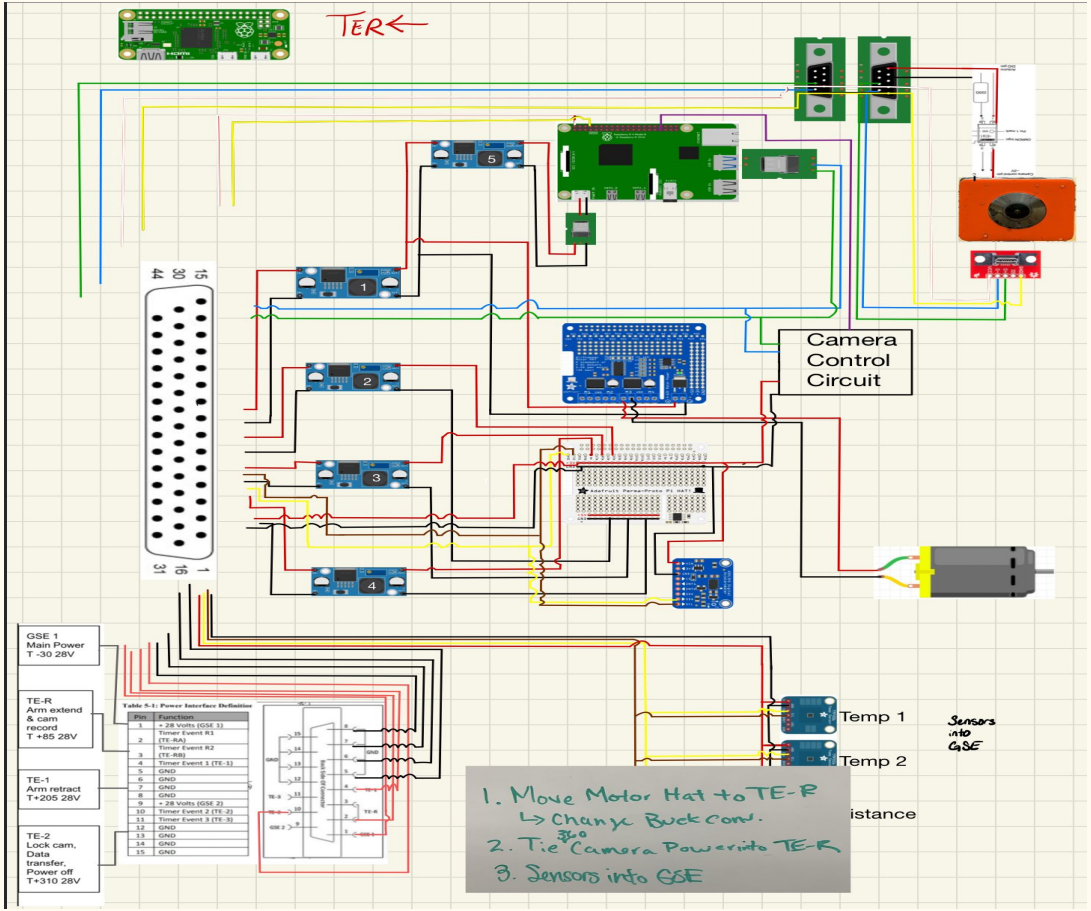
BACK/LEFT VIEW : Retracted Position



TOP/BACK VIEW :
Extended Position



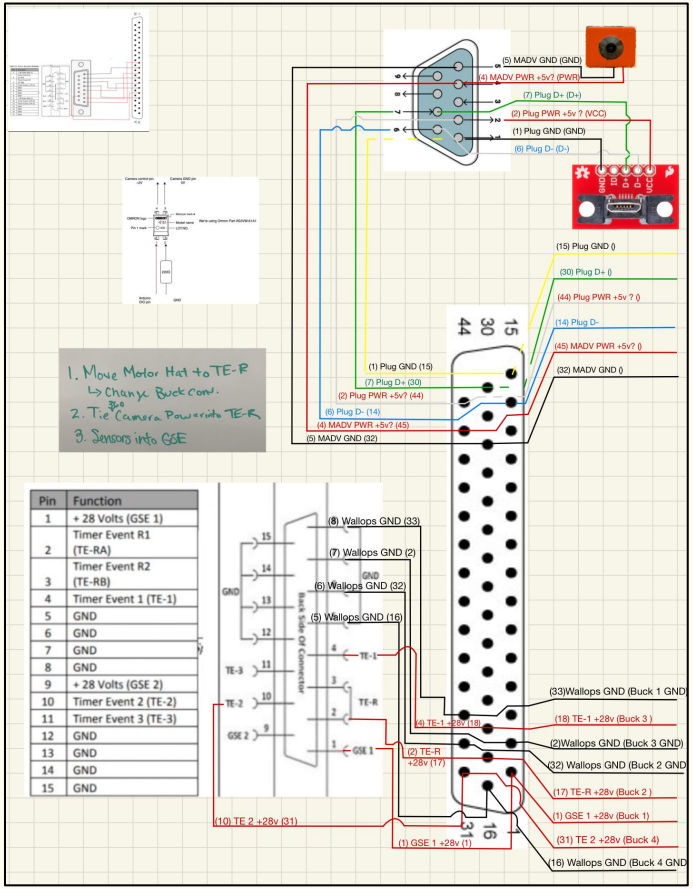
Functional Block Diagram



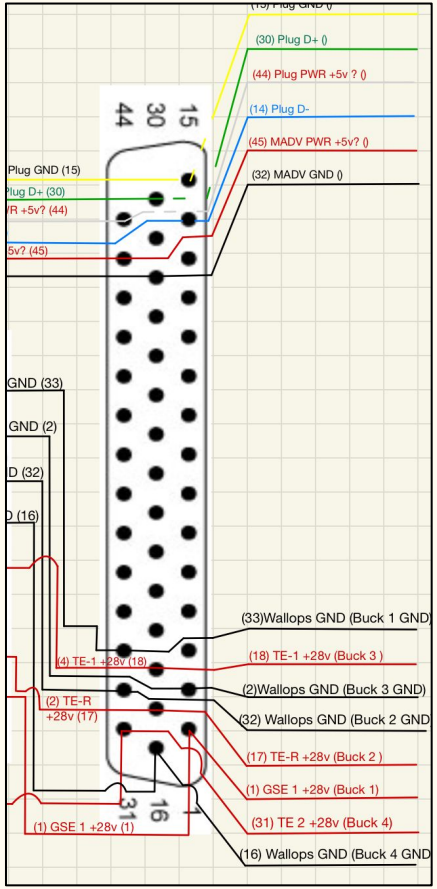
Full System Overview Diagram

- Has not changed since ISTR

Functional Block Diagram



Pin	Function
1	+ 28 Volts (GSE 1)
2	Timer Event R1 (TE-RA)
3	Timer Event R2 (TE-RB)
4	Timer Event 1 (TE-1)
5	GND
6	GND
7	GND
8	GND
9	+ 28 Volts (GSE 2)
10	Timer Event 2 (TE-2)
11	Timer Event 3 (TE-3)
12	GND
13	GND
14	GND
15	GND



- Electrical systems have been wired up and tested successfully on flat sat
- Buck converters have been added into systems successfully
- Ready to move into E-box configuration this next week
- Wallops power simulation incorporated in new tests
- We are ready to solder to our flight Dsubs and connect flight wire in system
- Camera Control Circuit has been soldered onto Motor Hat and tested successfully

Hazardous Mechanical Items

- Premature armature deployment could be hazardous to rocket/ change center of mass enough to cause problems
  - Will be addressed within our timer events, by not allowing power to the motor hat until rocket skirt deploys

- Arm takes ~32 sec to extrude and another ~35 sec to retract.
  - Our dwell times between TE1 and TE2 are inclusive to the average time spent at apogee for past missions

- Arm will extend out about 16 inches from edge of plate
  - Arm does not completely retract to starting position, but is within our bounds

Hazardous Electrical Items

- High voltage items/components
  - None

- Operational hazards
  - MadV Camera has Lithium ion battery (non removable)

Special Requests

Top canister position

- Request already granted

TE event times to be specified based upon the following flight events

- TE-R: Arm extension and MADV camera power-up
- TE-1: Arm retraction
- TE-2: Camera power-off and system power-down

Update on Partnerships

- New Collaborations:
  - Myles Rauch: Linux, Bash & Python
  - Konstantin: Linux, Bash & Python
    - Both will be assisting Andrew in finishing flight scripts

- Continuing Collaborations:
  - Mines: Bri, Graham & Bradley
  - Assisting in integration, troubleshooting of electronics, mechanical, & software

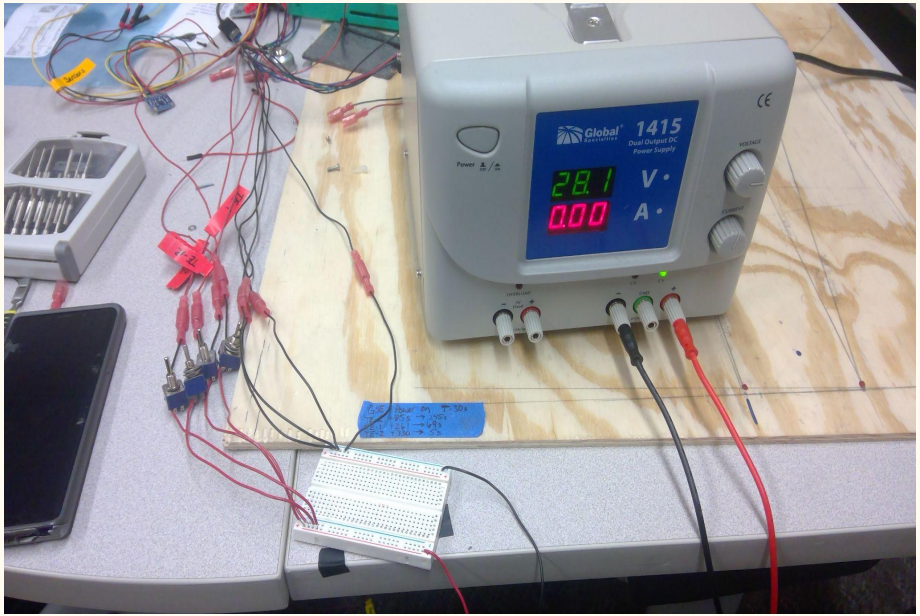
3.0 Integrated Subsystem Testing Status

Cass

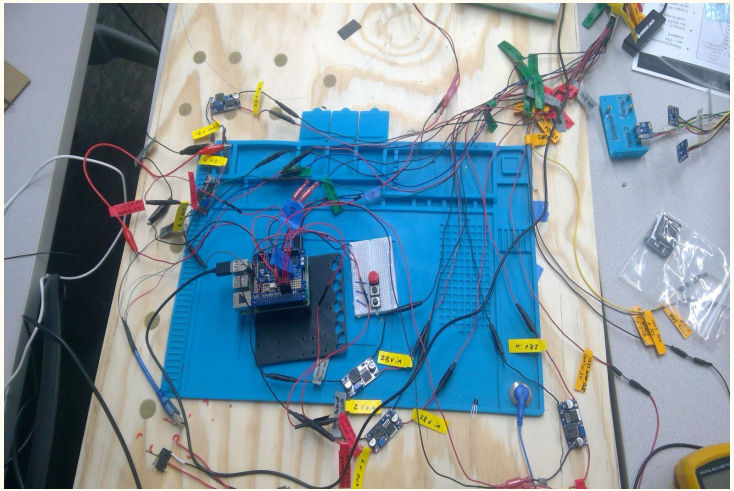
Integrated Subsystem Testing Status

99%

1.0 Wallops Power Simulation Testing



Incorporated switches to simulate Wallops power



Incorporated buck converters into electrical system

Integrated Subsystem Testing Status

99%

1.0 Arm Subsystem

Mechanically:

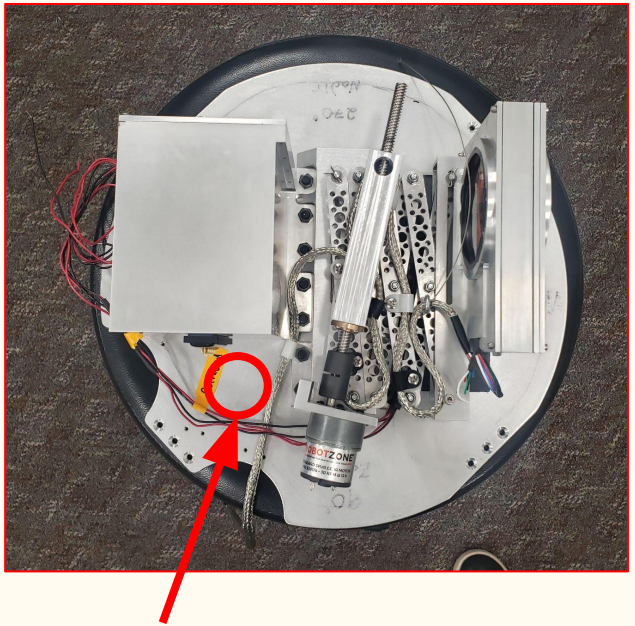
- The arm system has been fully tested mechanically
- The protective conduit that will hold the tether & cables running to the camera have been integrated

Software:

- Code to extend and retract the arm is working consistently with Wallops simulated power systems

Electrical:

- Flight electrical configuration (out of Ebox) including motor hat is consistently working
- Need to integrate wires running down arm into electrical system (starting this week of 5/10)
- Inhibit of arm extension and limit switch dependence on camera function will be integrated week of 5/10.



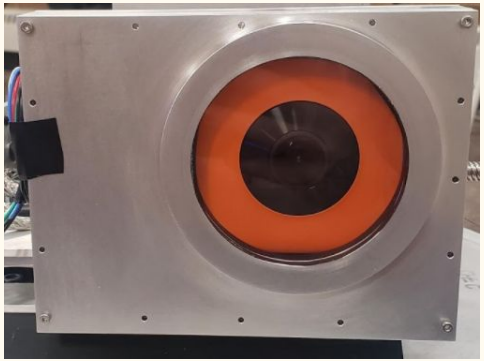
Mounting location for tether eye-bolt

Integrated Subsystem Testing Status

1.0 Camera Subsystem

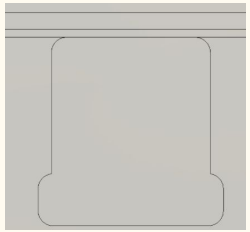
Mechanical:

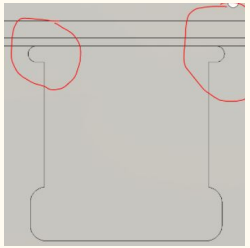
- Flight hardware is fitting together except for the D-sub area which will be corrected Monday 5/10/21.
- Gaskets need to be created for lens and section seals
- Camera system is heavy on the end of the arm but shouldn't be a problem in microgravity
- Glare from orange light & surface is damaging to footage under certain lighting circumstances
    - Will be corrected with black paint (one cam done)



Software:

- Cam control working except for sending low quality footage down data line consistently
    - Software team will be addressing this week of 5/10
    - Seems like a mounting problem





Electrical:

- Still need full simulated testing through the dsub. Will be testing week of 5/10

Integrated Subsystem Testing Status

1.0 Camera Subsystem Focus/Lighting Testing

100%

- The orange from the surface of the camera and the blinking light caused glare back from site glass under certain lighting.
- To fix this, we put black electrical tape over the surface of the camera (will be black paint for flight)

Integrated Subsystem Testing Status

100%

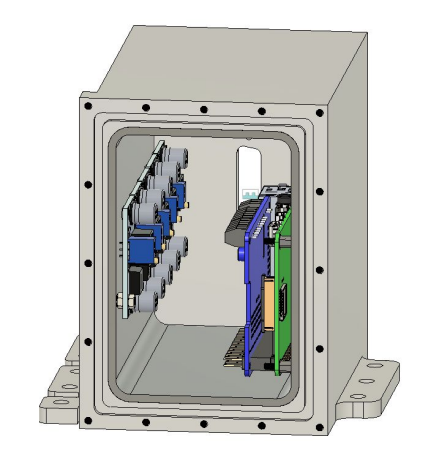
1.0 Camera Subsystem Focus/Lighting Testing

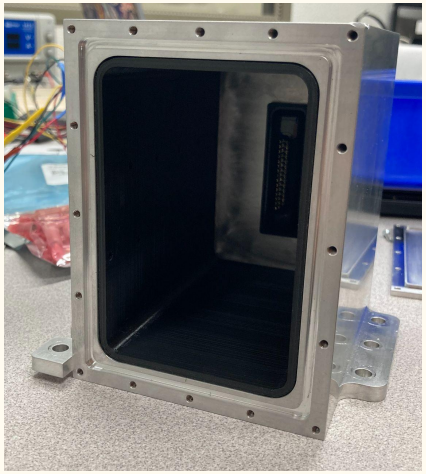
- Indoor/Outdoor lighting
- Distance & close up
- Seemed to adjust well in all: moving forward with autofocus settings

Integrated Subsystem Testing Status

1.0 Electronics

- Flight Ebox is mechanically integrated
  - Still need to fully integrate electronic parts into the sleeve and move to flight wire integration
- Have had some issues with quick connects, so will be switching type.
- Ready to move all flat sat electronics into Ebox for next step in Full Sim testing





Integrated Subsystem Testing Status

Telemetry

- Uses pre-fabricated sensors for data collection
- Data is stored in a file for later analysis
- Serial is used to send data in real time
- Run as a background process on startup

Telemetry system has not been integrated.

- Has been tested on separate setup
- Not sure how serial will work on final packaging

```
i2c = busio.I2C(board.SCL, board.SDA)

# Define serial port
ser = serial.Serial(
        port='/dev/ttyS0', #Replace ttyS0 with ttyAM0 for Pi1,Pi2,Pi0
        baudrate = 9600,
        parity=serial.PARITY_NONE,
        stopbits=serial.STOPBITS_ONE,
        bytesize=serial.EIGHTBITS,
        timeout=1
)

def TempConversion(c):
    return c * 9.0 / 5.0 + 32

def write_sensors():
    with open("/home/pi/data/Telemetry.csv", "a") as log:
        log.write("{0},{1},{2},{3},{4},{5},{6},{7},{8},{9},{10},{11},{12},{13},{14},{15},{16},{17}\n"
        .format(strftime("%Y-%m-%d %H:%M:%S"),"Temp1",str(TempConversion(die1))+" F",str(TempConversion(obj1))
        " ","Temp2",str(TempConversion(die2))+" F",str(TempConversion(obj2))+" F",str(die2)+" C",str(obj2)+" C
        " ","Distance","BLANK MM"
        ,str(xAxis),str(yAxis),str(zAxis)))

def sensors():
    # Temperature Sensor 1
    sensor1 = TMP006.TMP006()
    sensor1 = TMP006.TMP006(address=0x40, busnum=1) # Default i2C address is 0x40 and bus is 1.
    sensor1.begin()
    # Temperature Sensor 2
    sensor2 = TMP006.TMP006()
    sensor2 = TMP006.TMP006(address=0x41, busnum=1) #change 3v to ad0
    sensor2.begin()
    # Accelerometer Sensor
    accelerometer = adafruit_adxl34x.ADXL345(i2c)
    # Distance Sensor
    vl53 = adafruit_vl53l0x.VL53L0X(i2c)
```

Integrated Subsystem Testing Status

Control Version 3

- Control accepts input from buck converters
- Limit switches are used to tell arm to stop
- USB ports are turned off so camera is able to record
- USB is plugged in so backups can be made of footage
- Uses hexdumps to record current state
  - In event of power loss it should recover
- Relies on rockets timing

```
kit = MotorKit(i2c=board.I2C())
button1=18 #Event 1
button2=27 #Event 2
button3=22 #Event 3
limit_1=23 #Arm open
limit_2=24 #Arm closed
GPIO.setup(button1,GPIO.IN,pull_up_down=GPIO.PUD_UP)
GPIO.setup(button2,GPIO.IN,pull_up_down=GPIO.PUD_UP)
GPIO.setup(button3,GPIO.IN,pull_up_down=GPIO.PUD_UP)
GPIO.setup(limit_1,GPIO.IN,pull_up_down=GPIO.PUD_UP)
GPIO.setup(limit_2,GPIO.IN,pull_up_down=GPIO.PUD_UP)

filename = 'save_state' #Name of the hex dump

def dump(): #Save state
    data = [] #data array
    raw = current_state #holder value
    data.append(raw) #add current_state to data array
    file = open ('save_state', 'wb') #open file for writing
    pickle.dump(data,file) #dump information to file
    file.close #close file

def load(): #Load State
    file = open('save_state', 'rb') #open file
    global data #global decleration for other functions
    data = pickle.load(file) #dump infomration to function
    file.close() #close file

def counter():
    cnt = 0 #iteration variable
```

Integrated Subsystem Testing Status

Camera

- Uses modified selfie stick to control modes
- Is connected to pi with USB and GPIO
- GPIO controls power and recording
- USB is used for charging and data transfer
  - USB needs to be off for camera to record
  - USB needs to come back on to transfer data
- Stores low quality copy on Pi
- Camera has own power source so save functions could be thrown off

```
pin = int(config['usbcamctl']['pin'])
poweron_delay = float(config['usbcamctl']['poweron_delay'])
setmode_delay = float(config['usbcamctl']['setmode_delay'])
recordon_delay = float(config['usbcamctl']['recordon_delay'])
poweroff_delay = float(config['usbcamctl']['poweroff_delay'])
recordoff_delay = float(config['usbcamctl']['recordoff_delay'])

# Setup GPIO
GPIO.setmode(GPIO.BOARD)
GPIO.setwarnings(False)
GPIO.setup(pin, GPIO.OUT)

# Control the camera's powered state from the USB port (uhubctl, then GPIO)
def power(mode):
    try:
        GPIO.output(pin, GPIO.HIGH)
        time.sleep(poweron_delay if mode else poweroff_delay)
        GPIO.output(pin, GPIO.LOW)
        return True
    except:
        return False

# Control the USB ports on the pi
def usb(mode):
    try:
        os.system('sudo uhubctl -a ' + ('on' if mode else 'off') + ' -l 1-1')
        return True
    except:
        return False
```

4.0 Full Mission Simulation Results

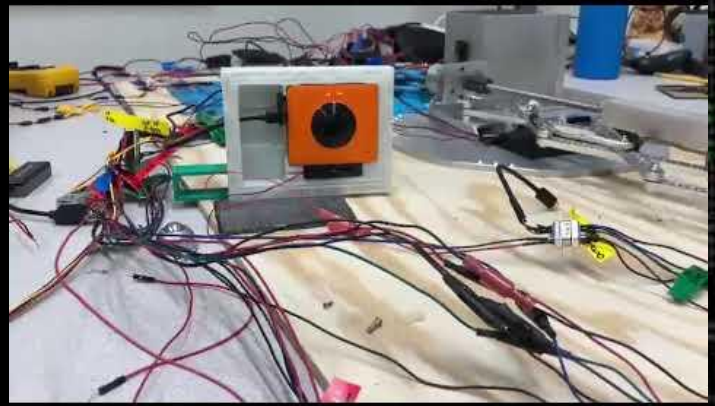
Anton, Andrew & Cass

Full Mission Simulation Results

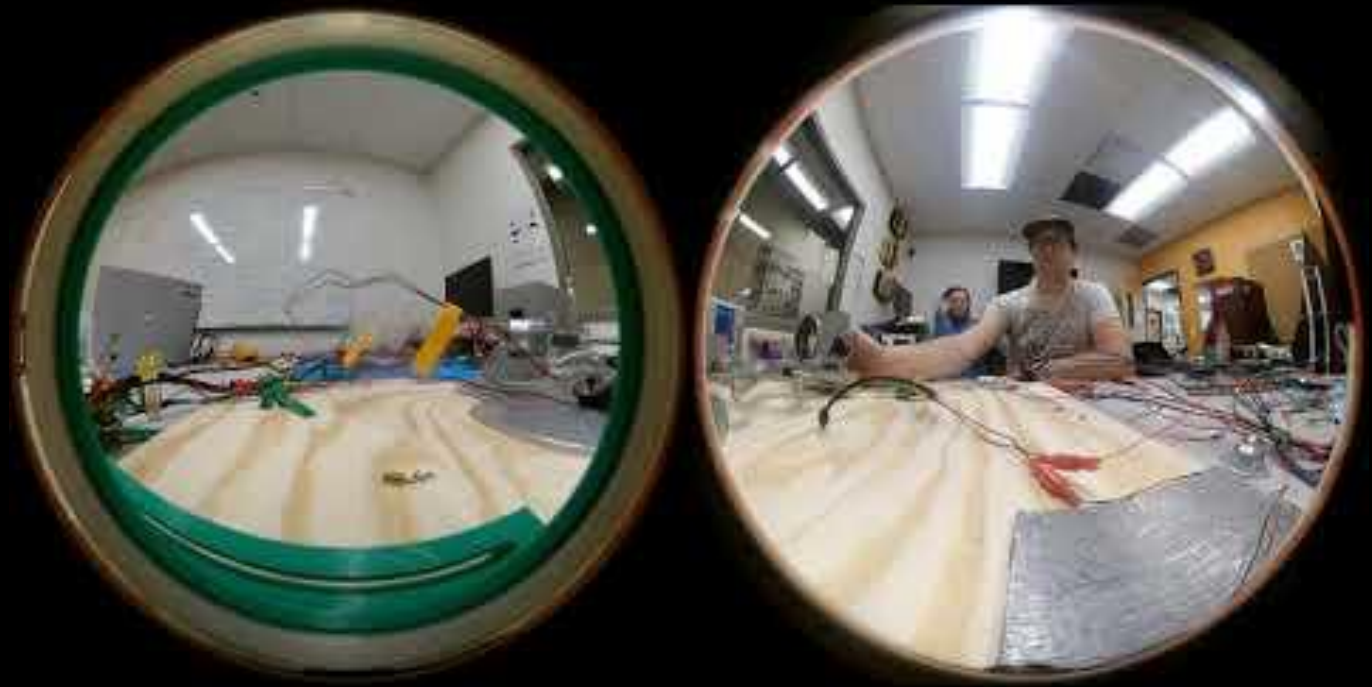
- Still having trouble consistently mounting sd card in order to send low quality footage down to pi
    - May be wiring, permissions, UUID issues etc
- Flight script will not be run in terminal but will be waiting on pi for Wallops signals only
- Camera is able to be physically mounted in case once camera dsub is soldered and working properly/ cable along arm is fully integrated into Ebox
- Full sim does not yet include telemetry, sensor data, or pi cam (coming within 2 weeks)

Full System Simulation

5/8/21



Footage from Same Test
5/8/21



5.0 Project Schedule

Anton

Schedule

- **May 10 :**
  - Bring camera case to local machinist for fillet removal.
  - Work with software team on finishing flight script.
  - Integrate delrin block
- **May 10 - 15 :**
  - Complete integration of electronics into E-box.
  - Complete wiring for camera with flight D-Sub components
  - Finalize flight script
  - Mount eye-bolt to base plate for safety tether,
  - Full testing simulation iterations.
  - Work on testing procedure documentation (first draft already started)
  - Begin integration of inhibit & testing.
  - Format and prepare backup sd cards & E-sleeve
- **May 17 - 22 :**
  - Test final system (primary goal)
  - Prepare weight piece additions
  - Add Temperature and distance sensor (secondary).
  - Vibration testing.
  - Finalize inhibits.
  - Complete testing procedure document.
  - Care package assembled
  - Final build, sealing, loctite and conformal coating
- **May 24 :** Deliver Completed payload to CU Boulder for final testing

6.0 June Operations

Cass

June Operations

- We will provide a thorough testing procedure for whomever is handling our payload to follow for both testing prep and flight prep.
- We will also be on call and available for any questions, at any time.

June Operations

- During Testing at Wallops:
  - Arm will not extend/retract
  - Physical inhibit will likely be a jumper header within the Ebox and will need to be attached.

June Operations

- All of our features can be tested on the ground assuming the payload is not being tested in integration with the rocket (pre flight Wallops testing)

June Operations

- Do not have a finished/ decent draft of the procedures at this time.
- Rough outline has been made:

Things to include in our final procedures			
	Testing Intructions	jumper on	diagram
	Flight Instructions	jumper off	diagram
	Camera charge	charging dsub	
	Clean sight glass	include cloth and cleaner	
	Check connections	plug labels match check and connection integrity	

7.0 Conclusions

Anton

FMSR To FSTI

- As of now our team is very confident that we will have our primary goals met before handing our payload over to CU Boulder.

Worries and Concerns

- We are very confident that as long as we can get the code working as required, the rest of the systems are working as anticipated.
- We may have a small hurdle in going from flat electronic configuration to E box configuration, but in concept it will be identical and any issues we run into are likely soldering/ wire resizing and easy to fix.
- Our major hurdle now is getting the code to run with the flight configuration (bucks & wallops power simulation) exactly as we need and we have brought on a linux expert to assist in ironing out these small details.