About V.R.S.E

(General overview of payload and system weak points)

V.R.S.E (Virtual Reality Space Experience) is a scientific payload whose mission is to collect quantitative and qualitative data of several kinds during flight and at apogee.

VRSE's primary mission is to obtain high quality 4k video footage of what is viewable at apogee from about 16 inches outside of the plate. The functionality of the scissor arm and camera control system is vital to the success of our primary mission. Points of weakness for the primary mission include the d-sub going into the camera case (connection must be solid in order for camera control), the fragility of the sight glasses (they are made of quartz and may be easy to break or scratch), the connection between the linear rod and the motor. Inspection of these points of weakness will be included in the testing and flight procedures below.

Our secondary experiment is a collection of sensors which will be obtaining data during flight to apogee until our system shutdown. The points of weakness of our secondary system are our solder points on the sensor pcbs themselves, and the connections running into the d-sub on the exterior of the Ebox. More specifics on how to check these points will be provided below.

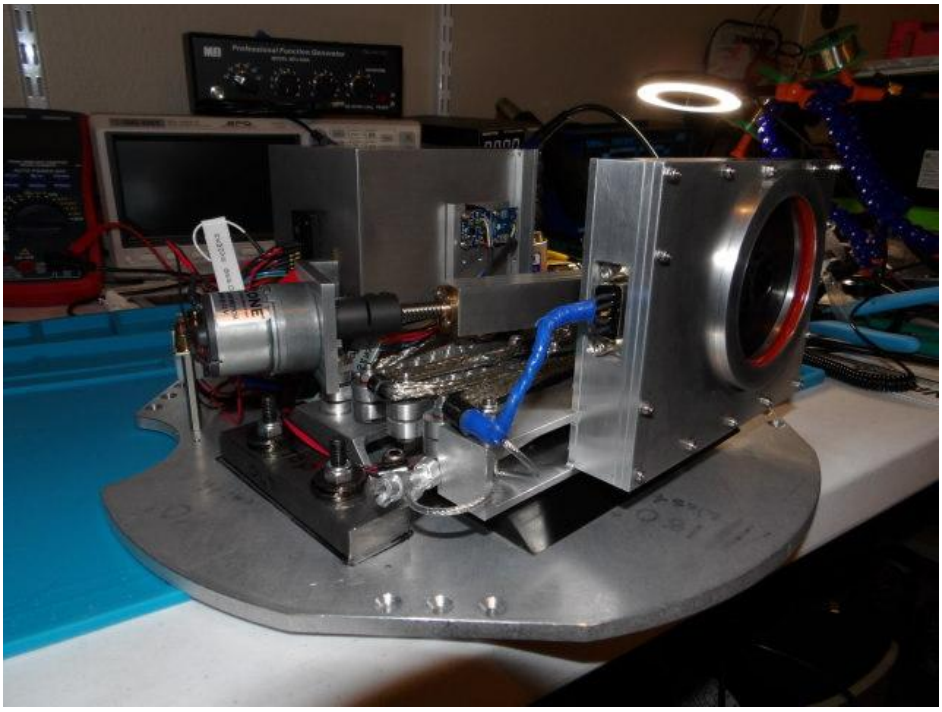
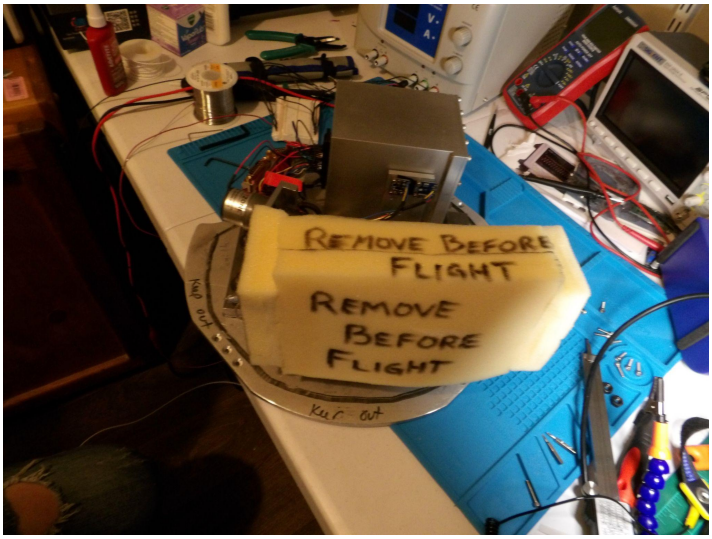


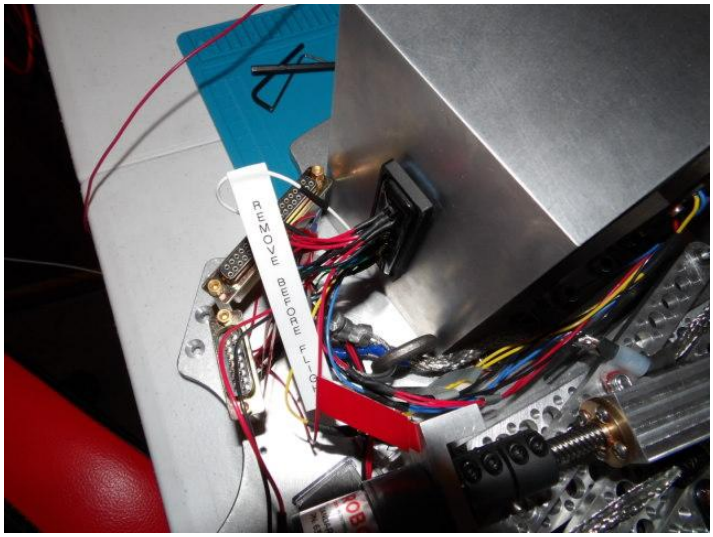
Image of the fully integrated payload in its resting position

REMOVE BEFORE FLIGHT ITEMS

1. Inhibit (clearly labeled on the Electronics Box d-sub) wire should be cut right before flight.
2. Camera case cover can be removed before testing but absolutely need to be removed before flight.



(Camera Case Cover)



Inhibit Wire

Expected Results of Successful Testing

GSE-1: This signal will turn the pi on. This will not be an observable result because the pi is mounted inside of the Ebox.

- Note that if this fails, no other events will occur as anticipated

TE-R: This signal will extend the arm *(this part will be inhibited during testing and uninhibited for flight)* and turn the camera on. The camera should then begin recording.

- The camera will beep in a sequence of 4 tones when turned on one after another in ascending pitches
- The camera will then beep once when camera goes to video mode and starts recording

TE-1: This signal will retract the arm *(this part will be inhibited during testing and uninhibited for flight)*, and then shutdown the camera and send footage to the pi

- The camera will beep to indicate the stopping of recording and the start of the data transfer.
- The camera will beep a sequence of 4 tones in descending pitches indicating that the camera has shut off and data transfer is complete. (It is important to note that in testing, if the user is not waiting the full amount of time of the timer event to signal TE-2, the video data will not transfer correctly)

TE-2: This signal will safely shut down the pi for reentry (will not be observable as they will shut off within the electronics box)

- This sequence will last roughly 5 seconds. After which all power can be cut to the payload.

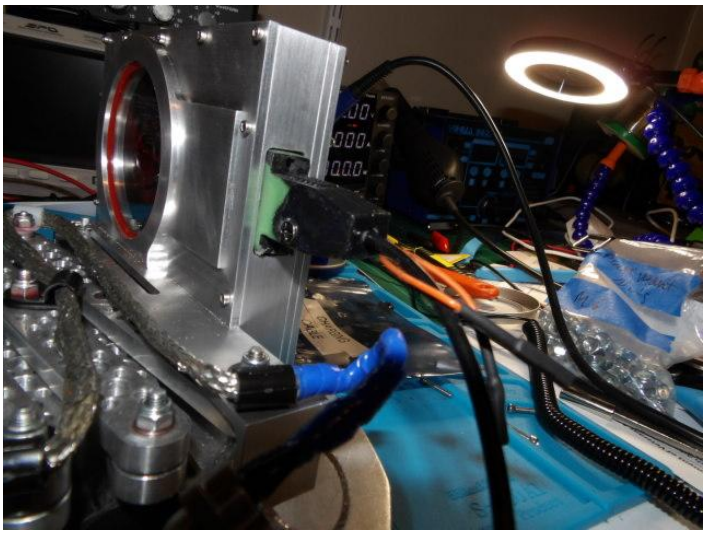
What to Check if Something Goes Wrong

What Went Wrong	What to Check
The camera didn't turn on	Check that the d-sub is completely connected through the camera case. Check there are no loose wires The camera my not be charged properly
The camera didn't begin recording (single beep after camera turns on)	Is the camera on? Check that the d-sub is completely connected through the camera case. The camera may not be charged properly
The camera didn't turn off (4 beeps after camera stops recording)	Check that the d-sub is completely connected through the camera case and bolts are secure In this case there is a fail safe in the code to turn the camera off at the end of our sequence if it fails to turn off when it is supposed to.

Testing Procedures (Pre-Flight)

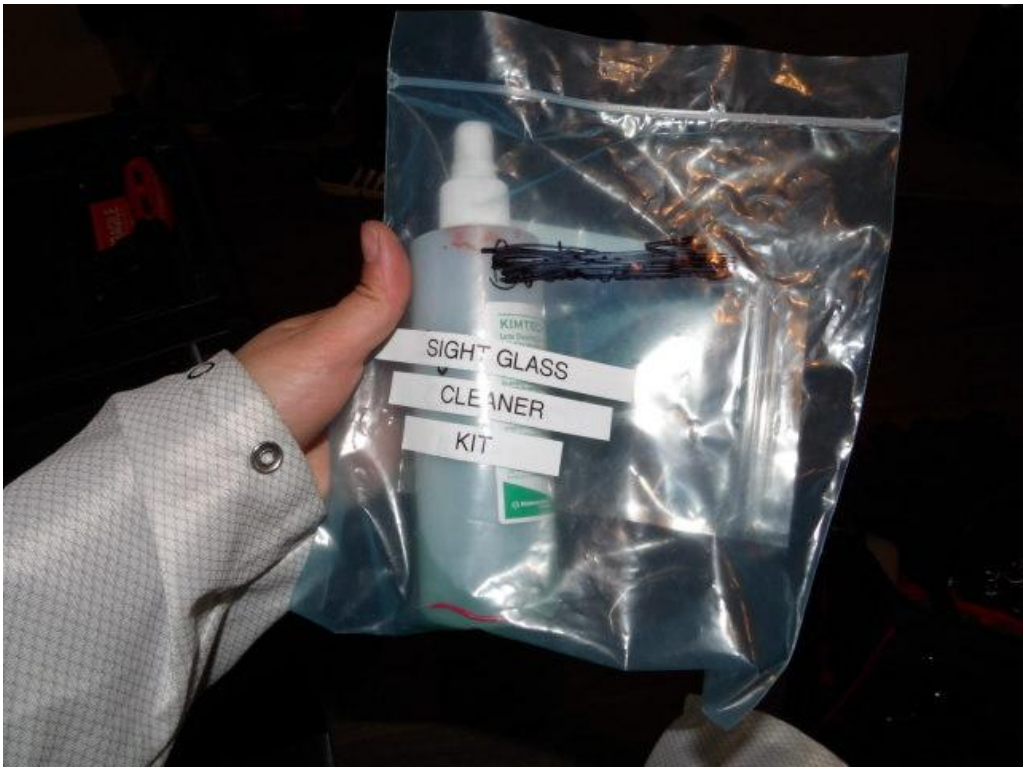
1. Charge the Camera: **Note that this process is mission critical**

    a. A d-sub connector has been provided that interfaces with the camera case in order to charge the Mad V camera and get data off the sd card.

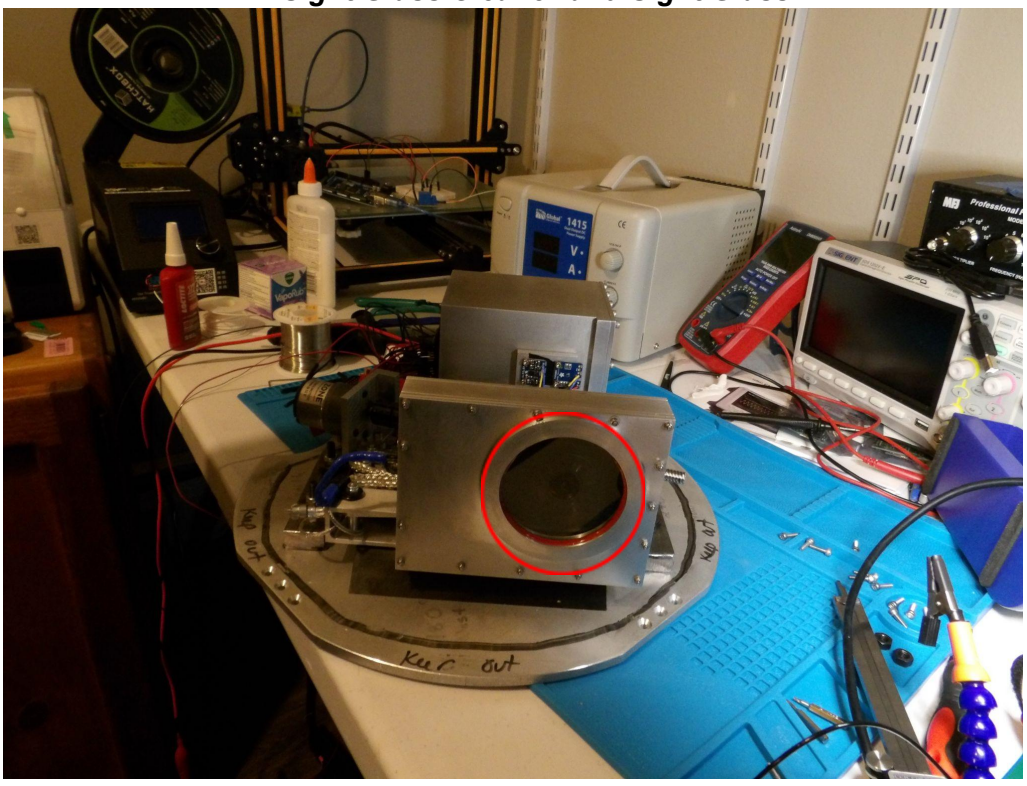


    b. The exterior dsub on the camera case will need to be removed before plugging in the charge device.
        i. An allen key has been provided in order to remove and replace this flight camera case d-sub for charging.
    c. At least 24 hours prior to any testing for a duration of at least 4 hours
    d. Confirmation of the camera charging is red battery light on the right side of the camera. When the camera is fully charged the charging light will change from red to orange.
    e. Once the camera has been charged properly, re-plug-in the flight d-sub (coming from the scissor arm) and bolts. Make sure the bolts are very tight in order to retain proper signal connection and water-tightness on the camera case

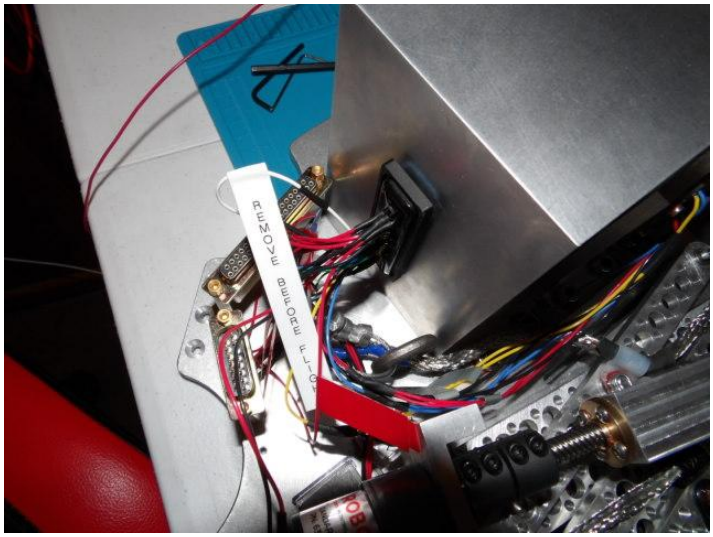
2. Clean the sight glass on front and back of the camera case
    a. A cloth and spray is provided for cleaning the site glass on the front and the back of the camera case
    b. Spray glass and wipe until no streaks remain. Just the exterior, no need to open the cam case



Sight Glass Cleaner and Sight Glass



3. Inhibit
    a. The inhibit wire should already be installed into the exterior Dsub on the Electronics Box when payload is delivered.
    b. The inhibit wire is clearly labeled.
    c. Inhibit should not be removed until right before flight.
    d. Check that the scissor arm is completely closed and that the camera case is sitting on the delrin block (vital for launch g-force impact).
    e. Check that the coupler between the motor and linear rod are very tight. Linear rod should not rotate within the coupler.
        i. Allen key is provided for any required tightening.
        ii. If the scissor arm has extended during shipping at all/ is not sitting on the delrin block, then you can manually rotate the rod and attached motor using a good amount of force with your hands. Do not use wrench or any other tool as it may damage the threads.

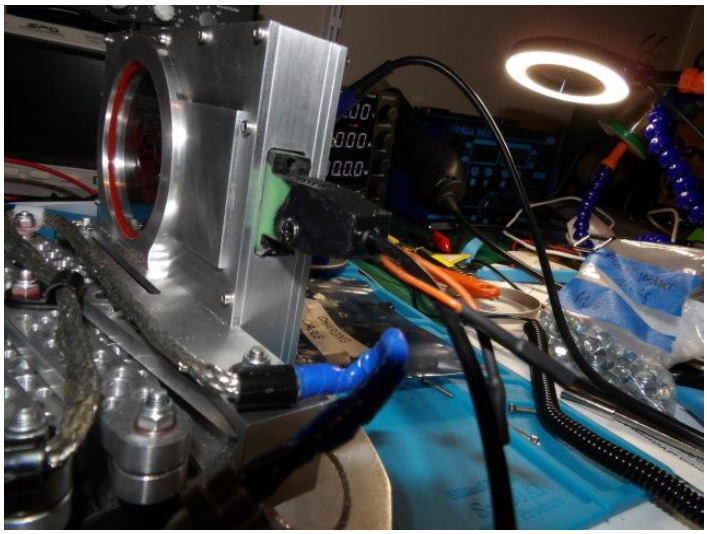


Inhibit wire

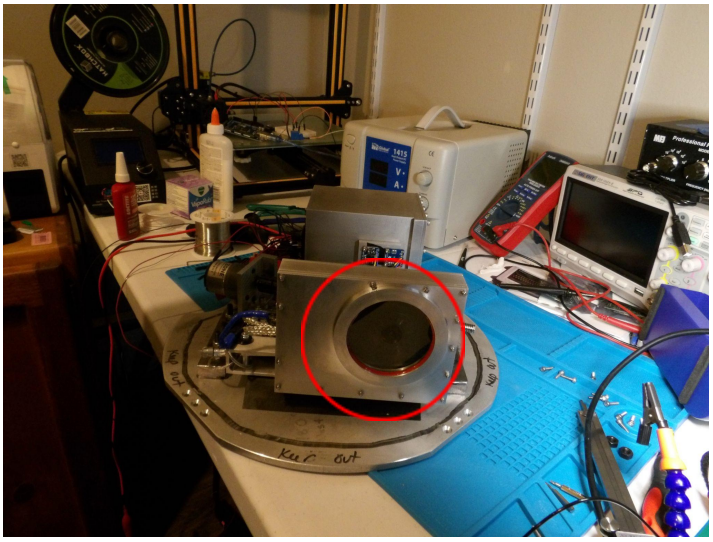
4. Overall Payload Inspection
    a. Check for broken connections/ loose wires coming from d-subs on the camera case, electronics box, and Wallops' mounted d-sub.
        i. All ends of wires should be soldered in place to their connection point
    b. Check tether is secured at both ends of the arm
    c. Check that the conduit running down the arm is secured down at clamp locations and the ends are both connected properly.
    d. Check that the machined parts are all mounted securely to the plate/ designated locations
    e. There should be no loose parts floating around. Everything should be secured down at their designated positions. Slack from wires should be minimal.

Flight Procedures

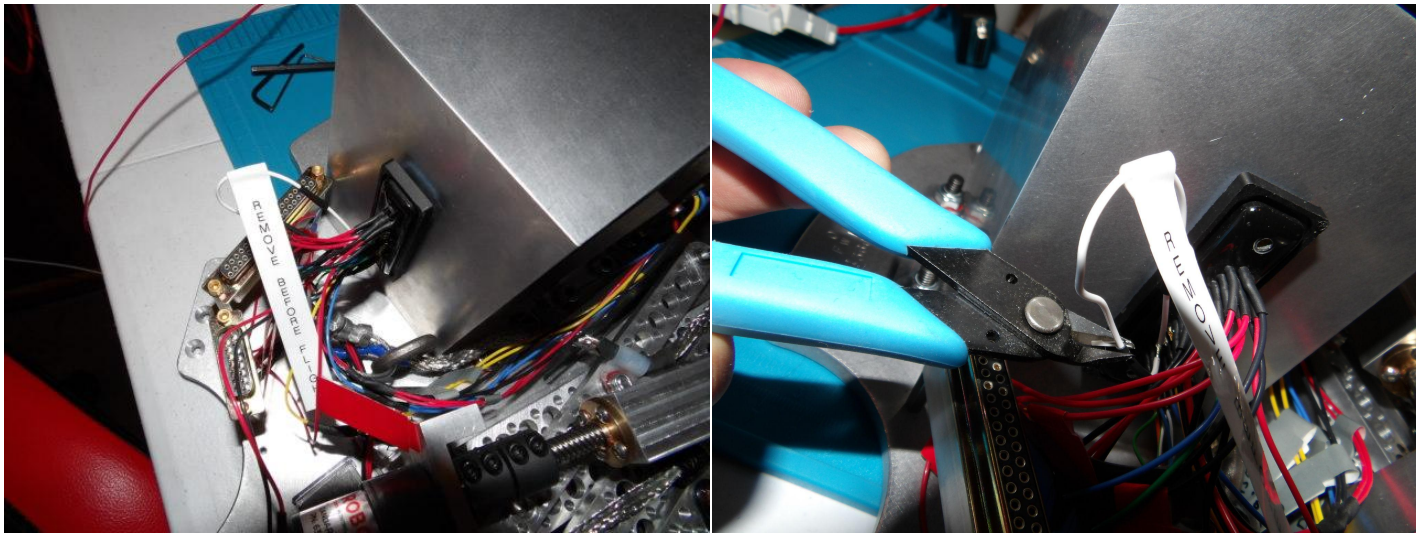
1. Charge Camera: **Note that this process is mission critical**
    a. A d-sub connector has been provided that interfaces with the camera case in order to charge the Mad V camera and get data off the sd card (if necessary)
    b. The exterior dsub on the camera case will need to be removed before plugging in the charge device.
        i. An allen key has been provided in order to remove and replace this flight camera case d-sub for charging.
    c. At least 24 hours prior to any testing for a duration of 4 hours
    d. Confirmation of the camera charging is red battery light on the right side of the camera. Once the camera is fully charged the light will change from red to orange.
    e. Once the camera has been charged properly, re-plug-in the flight d-sub (coming from the scissor arm) and bolts. Make sure the bolts are very tight in order to retain proper signal connection and water-tightness on the camera case



2. Remove foam case and clean the sight glass on front and back of the camera case
    a. A cloth and spray is provided for cleaning the site glass on the front and the back of the camera case
    b. Spray glass and wipe with cloth until no streaks remain. Just the exterior, no need to open the cam case



3. Remove Inhibit
    a. The inhibit wire should already be installed into the exterior Dsub on the Electronics Box when payload is delivered.
    b. The inhibit wire is clearly labeled
    c. Inhibit wire should be cut before flight in order to uninhibit the extension and retraction of the arm.
        i. With wire cutters provided, cut the labeled inhibit wire at each end, close to the d-sub so that the two severed ends cannot touch each other during flight. (any contact could prevent arm from extending)

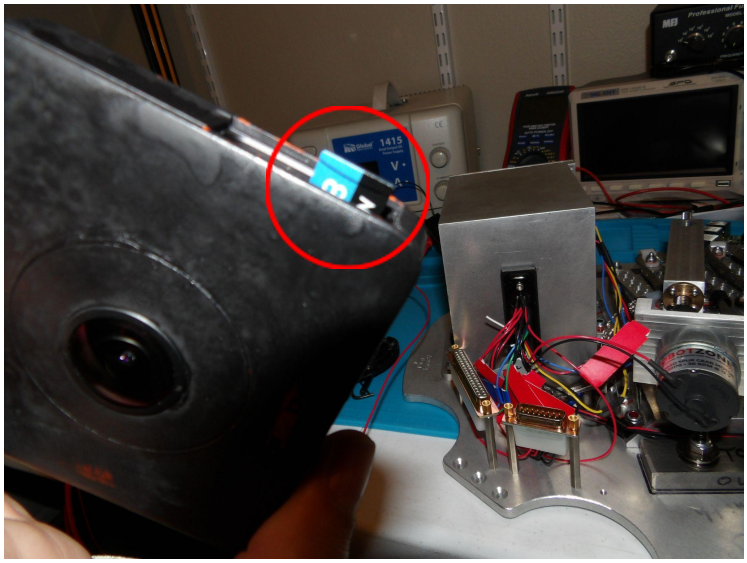


Cutting Inhibit wire after testing and before flight

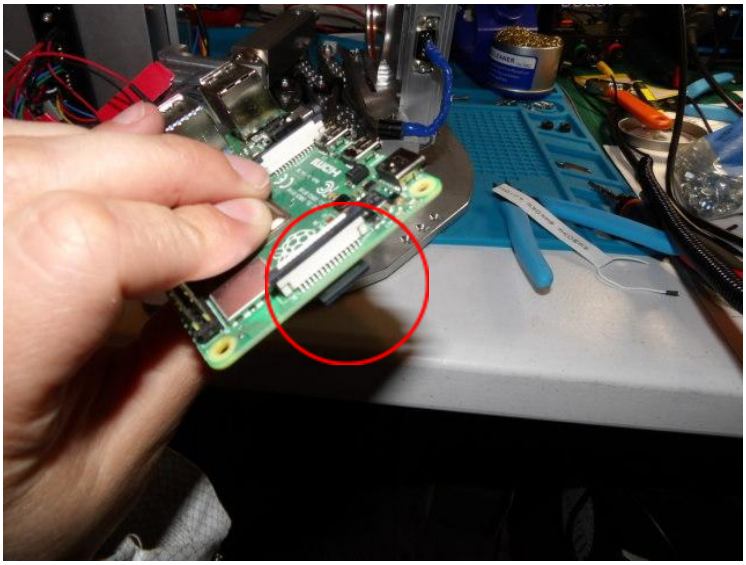
4. Overall Payload Inspection
    a. Check for broken connections/ loose wires coming from d-subs on the camera case, electronics box, and Wallops' mounted d-sub.
        i. All ends of wires should be soldered in place to their connection point
    b. Check tether is secured at both ends of the arm
    c. Check that the conduit running down the arm is secured down at clamp locations and the ends are both connected properly.
    d. Check that the machined parts are all mounted securely to the plate/ designated locations
    e. There should be no loose parts floating around. Everything should be secured down at their designated positions. Slack from wires should be minimal.

Post-Flight/ After Splashdown Procedures

1. Removal of pi SD card and Camera SD card



Camera SD



Pi SD

a. The camera case will need to be taken apart in order to remove the sd card from the camera and prevent any further water damage. This step is vital to the integrity and retention of our 4k footage.
b. Tools have been provided to take apart the camera (*see figure below*).
c. The SD card in mounted in the side of the camera closest to the d-sub connector
d. After the sd card has been removed, place it in the desiccant box (provided) and close it/ lock it.
    i. This separate box will fit with the payload case and should be shipped back with the payload inside the primary case that is full of desiccant.
e. Camera case can then be put back together. Replace the foam cover for the cam case before shipping back to protect sight glass.
f. The lid to the Electronics box will need to be removed in order to access the SD card within the pi
    i. The SD card will be sticking out of the pi, easily removable from the lid side of the electronics box once the lid has been removed.
g. Re-install the Electronics Box lid with the same bolts that were removed in step f. With the same bolts that were removed in step f.

VRSE Care Package Details

1. D-sub Connector for charging: (done)
    a. To plug into camera case for charging/data transfer of camera
2. Sight Glass cleaning kit: (done)
    a. For cleaning of the sight glass before flight
3. Coupler tightening allen key:
    a. For tightening of motor-linear rod connection
4. Camera Exterior d-sub allen key & ratchet wrench:
    a. For removal and replacement of bolts that connect the flight d-sub (running down the scissor arm) to the camera case system.
5. Camera Case socket & wrench:
    a. This will allow for the camera case to be taken apart and put back together
6. Electronics Box Lid allen key:
    a. This will allow for the removal and replacement of the electronics box lid
7. Desiccant Pelican Case:(done)
    a. This will be where post-flight SD cards from Pi and Camera will be stored to dry out (assuming there was any leakage).
8. Spare Cam Case d-sub bolts:(done)
    a. These can replace lost d-sub bolts since removal and replacement of the d-sub is necessary to charge the cam.
9. Spare Cam Case bolts/nuts:(done)
    a. These can replace lost cam case bolts since taking the cam case apart is necessary to procure the sd card and get it safely drying in the pelican case.
10. Spare Ebox lid bolts:(done)
    a. These can replace lost Ebox lid bolts since taking the lid off is required for procurement of the pi sd card in order to get it safely drying in the pelican case.
11. Wire cutters for cutting the inhibit: (done)
    a. Use these to cut the inhibit wire for flight. Cut close to the 44 pin DSub sticking out of the back of the EBox