# HASP Payload Specification and Integration Plan

**Payload Title:** Sol Seeker

**Payload Class:** Small Large (circle one)

**Flight Number:** 09

**Institution:** College of the Canyons

**Contact Name:** Derek Peraza

**Contact Phone:** (818)-634-0303

**Contact E-mail:** daperaza@my.canyons.edu

**Submit Date:** 6/30/2023

## I. Mechanical Specifications:

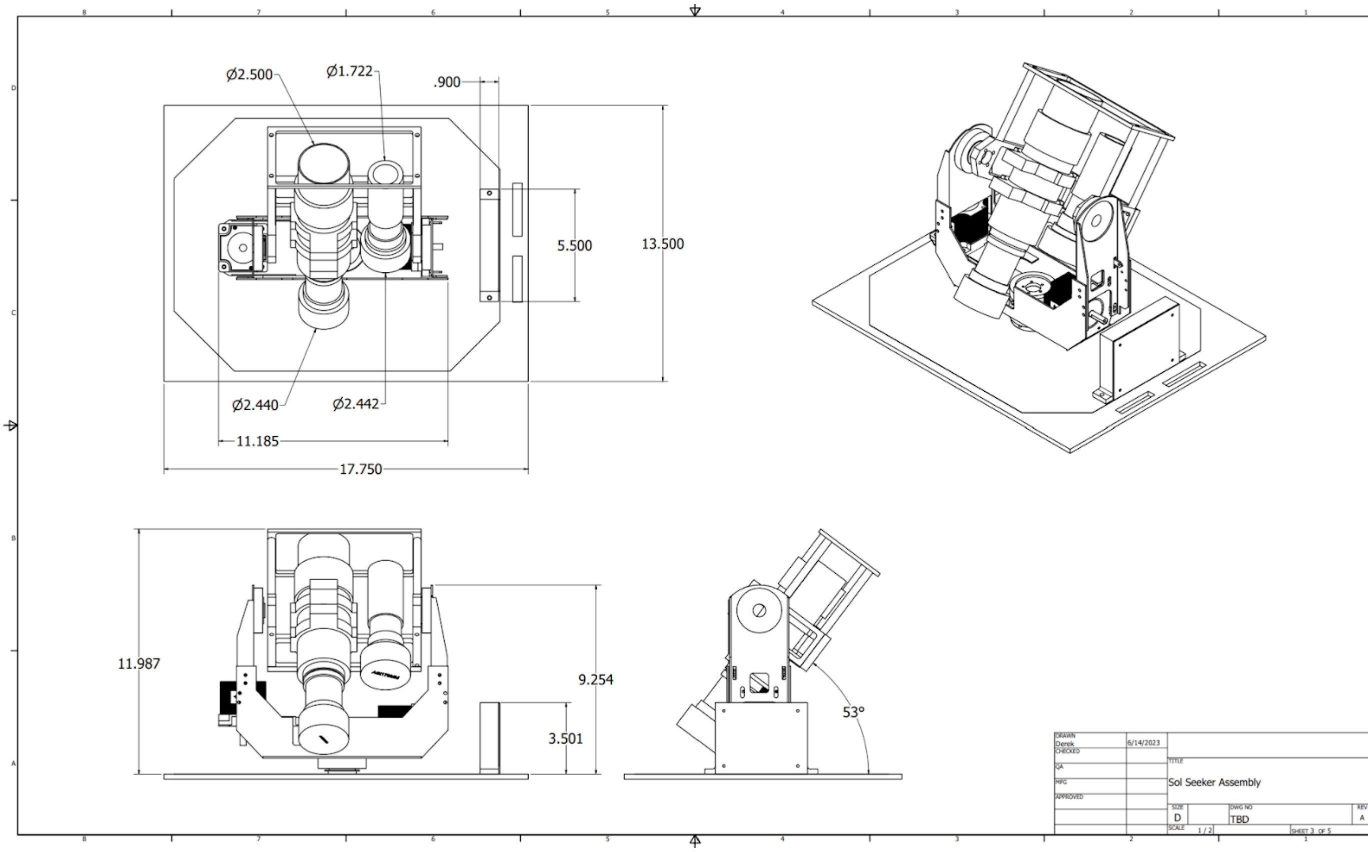
A. Measured weight of the payload in grams (not including payload plate): 6.311 kg

| Item | Mass (g) | Uncertainty | Measured or Estimated |
|---|---|---|---|
| ZWO - ASI178MM with guide scope | 322 g | 0.002 kg | Measured |
| ZWO - ASI585MC with Askar scope | 1.325 kg | 0.002 kg | Measured |
| Stand with motors and uprights and swing | 3.544 kg | 0.002 kg | Measured |
| Electrical components | 1.076 kg | 0.002 kg | Measured |
| Solar shield bracket | 44 g | 0.002 kg | Estimated |
| **TOTAL** | 6.311 kg | 0.002 kg | |

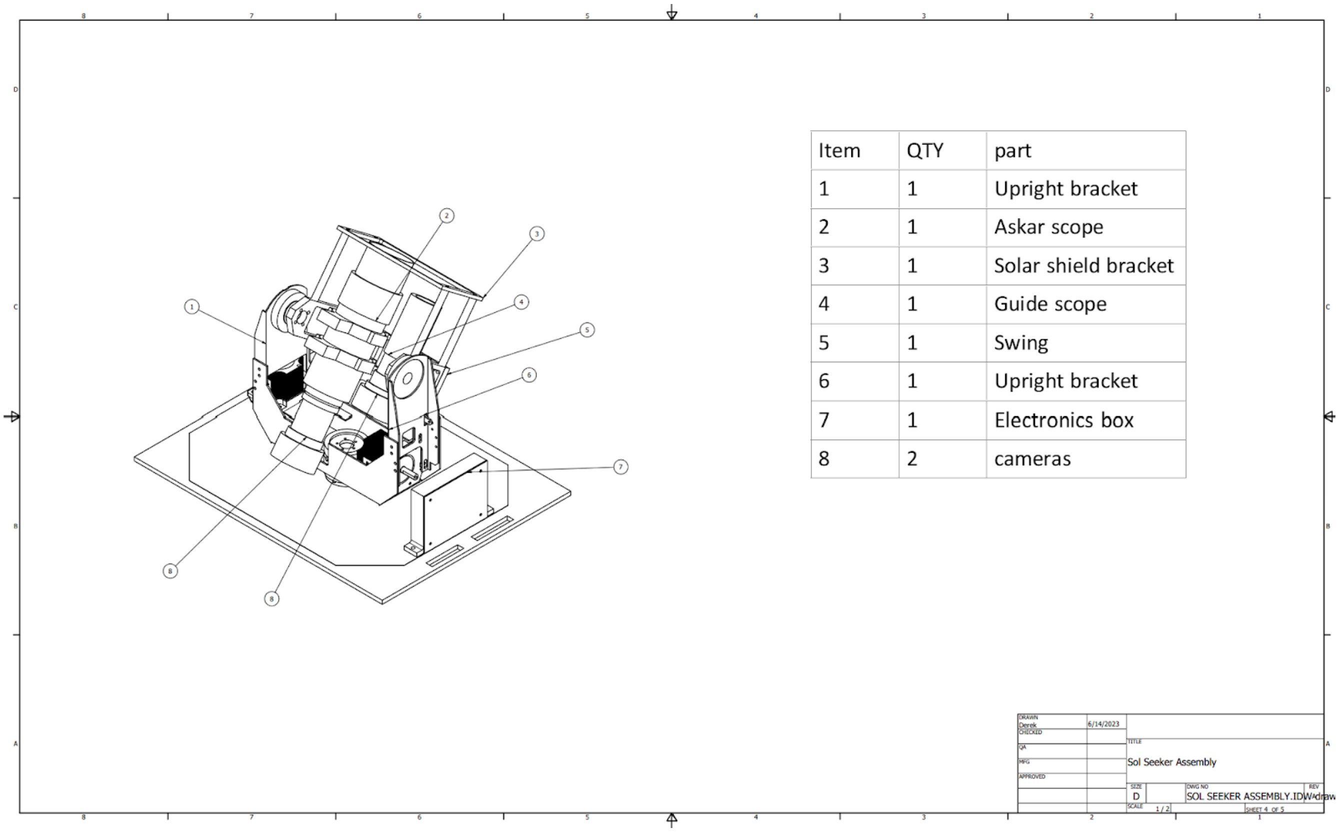
A. Provide a mechanical drawing detailing the major components of your payload. Mechanical drawings detailing the attach points from the payloads to the payloads plate are required.

***All dimensions are in inches***

**Payload dimensions**

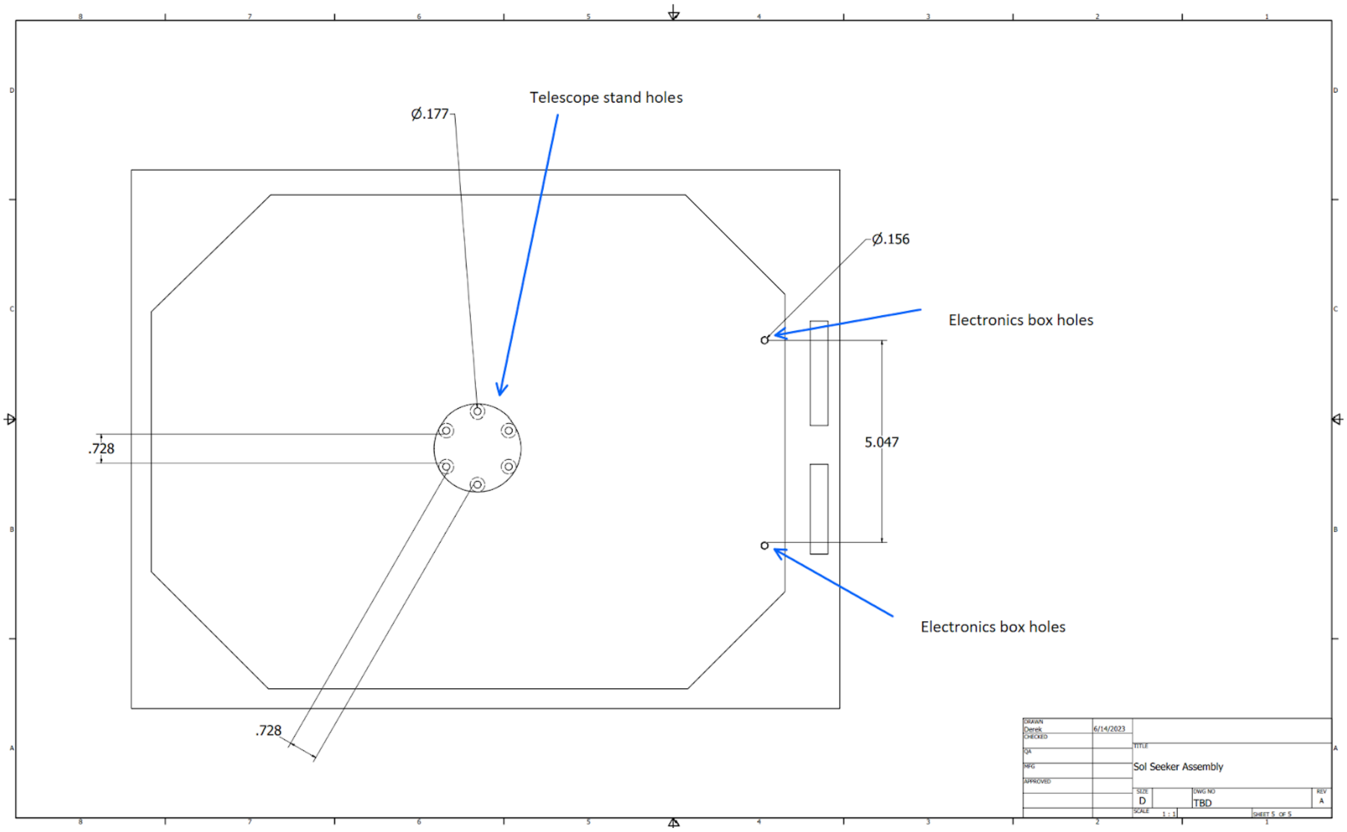


**Main components of payload**




| Item | QTY | part |
|---|---|---|
| 1 | 1 | Upright bracket |
| 2 | 1 | Askar scope |
| 3 | 1 | Solar shield bracket |
| 4 | 1 | Guide scope |
| 5 | 1 | Swing |
| 6 | 1 | Upright bracket |
| 7 | 1 | Electronics box |
| 8 | 2 | cameras |

**Attach points from the payload to the payloads plate**




B. Other relevant mechanical information

Max height is 11.987 in at a 53 angle

All telescope orientations are within keep out zone

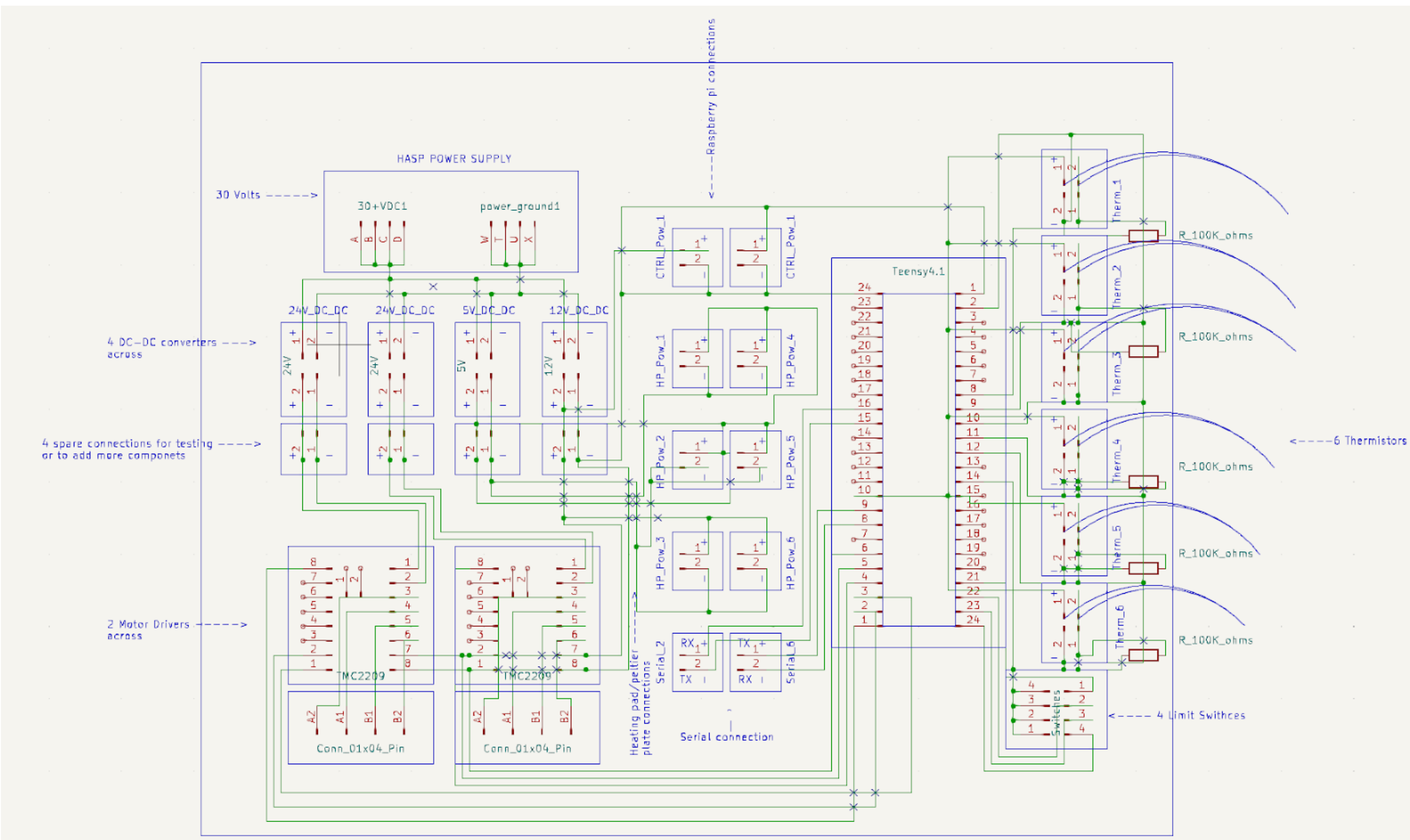
## II. Power Specifications:

A. Measured current draw at 30 VDC: ____~0.45 A______

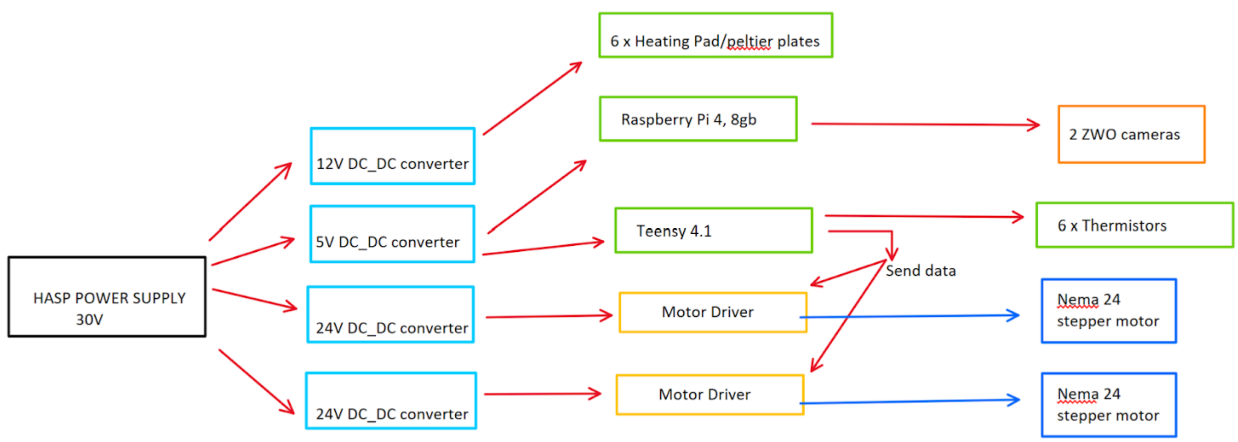
| Item | Current (A) | Voltage (V) | Power (W) | Uncertainty |
|---|---|---|---|---|
| 1st Nema 24 stepper motor | 0.3 A | 24 V | 7.2 W | ± 10% watts |

| | | | | |
|---|---|---|---|---|
| 2nd Nema 24 stepper motor | 0.3 A | 24 V | 7.2 W | ± 10% watts |
| Raspberry pi 4 8gb ram | 885 mA | 5 V | 4.43 W | ± 10% watts |
| teesny 4.1 | 100 mA | 5 V | 0.5 W | ± 10% watts |
| 6 x (thermistors) | 240 mA | 0 | 0 W | ± 10% watts |
| ASI585MC | 150 mA | 5V | 0.75 W | ± 10% watts |
| ASI178MM | 150 mA | 5V | 0.75 W | ± 10% watts |
| 2 x 24V DC-DC Converter | 2 A | 0 V | 0 W | ± 10% watts |
| 12V DC-DC Converter | 1 A | 0 V | 0 W | ± 10% watts |
| 5V DC-DC Converter | 1 A | 0 V | 0 W | ± 10% watts |
| **TOTAL** | 0.45 A | 30 V | 13.63 W | |

B. If HASP is providing power to your payload, provide a detailed power system wiring diagram starting from pins on the student payload interface plate EDAC 516 connector to all major components of your payload. All voltage lines must be labeled, and any power converters must be documented.



C. Other relevant power information:




## III. Downlink Telemetry Specifications:

A. Serial data downlink format: Stream Packetized

B. Approximate serial downlink rate (in bits per second): 0.37 considering we are sending 1 downlink packet every 5 minutes

C. Specify your serial data record including record length and information contained in each record byte. You must complete the table and include a sample data record.

| Byte | Bits | Description |
|---|---|---|
| 1 byte | 0-8 | Starting Symbol |
| 1 byte | 9-17 | Color Camera Temperature |
| 1 byte | 18-26 | Monochrome Camera Temperature |
| 1 byte | 27-35 | Color Camera Scope Temperature |
| 1 byte | 36-44 | Monochrome Camera Scope Temperature |
| 1 byte | 45-53 | Raspberry Pi Temperature |
| 1 byte | 54-62 | Teensy 4.1 Temperature |
| 2 bytes | 63-75 | Amount of images taken |
| 2 bytes | 76-88 | Amount of times it acquire the sun |
| 2 bytes | 89-101 | Amount of times it restarts |

| | | |
|---|---|---|
| 1 byte | 102-110 | Ending Symbol |

Sample Data Record:

\tabcdefghikjl\n

D. Number of analog channels being used: 0

E. If analog channels are being used, what are they being used for?

No

F. Number of discrete lines being used: 0

G. If discrete lines are being used what are they being used for?

H. Are there any on-board transmitters? If so, list the frequencies being used and the transmitted power.

| Transmitter Model | Frequency | Transmitting Power |
|---|---|---|
| N/A | N/A | N/A |
| N/A | N/A | N/A |
| N/A | N/A | N/A |

I. Other relevant downlink telemetry information. None

## IV. Uplink Commanding Specifications:

A. Command uplink capability required: Yes No (circle one)

B. If so, will commands be uplinked in regular intervals: Yes No (circle one)

C. How many commands do you expect to uplink during the flight (can be an absolute number or a rate, i.e. *n commands per hour*): Expect one every three hours if needed.

D. Provide a table of all uplink commands for your payload

| Command Name | 2-Byte Command (Hex Format) | Command Description |
|---|---|---|
| Reset | RS | This will be used to reset the tracking |

E. Are there any on-board receivers? If so, list the frequencies being used. No

F. Other relevant uplink commanding information. None

## V. Integration and Logistics

A. Date and Time of your arrival for integration: 8:00AM on 7/24/202

A. Approximate amount of time required for integration: 10 -12 hours

B. Name of the integration team leader: Drake Lovelady

C. Email address of the integration team leader: drlovelady@my.canyons.edu

D. List **ALL** integration participants (first and last names) who may be present for integration with their email addresses:

| Name | E-Mail Address | Phone Number |
|---|---|---|
| Teresa Ciardi | teresa.ciardi@canyons.edu | (661) 313-6015 |
| Gregory Poteat | gregory.poteat@canyons.edu | (661) 670-9108 |
| Clarissa Zuo | cyzuo@my.canyons.edu | (925) 368-0541 |
| Drake Lovelady | drlovelady@my.canyons.edu | (661) 607-1560 |
| Derek Peraza | daperaza@my.canyons.edu | (818) 634-0303 |
| Isaiah Romero | iromero@my.canyons.edu | (805) 990-4553 |
| Logan Jambe | loganjambe@gmail.com | (661) 964-8056 |

| | | |
|---|---|---|
| Robrindra Mukherjee | astromuk@g741.org | (818) - 326 - 0237 |
| David Flynn | engrdave@imac.com | (661) - 644 - 0708 |
| Glenn Basore | qpb91384@hotmail.com | (661) - 644 - 5487 |

F. Define a successful integration of your payload:

A fully assembled and operational payload will be brought to CSBF on integration day. Success through integration will first require a successful power on and systems check including sample data to show that the payload is functioning as expected prior to thermal/vacuum testing.

For testing, circuits will be run back-to-back and current tested to assure everything is functioning correctly and that the payload remains under maximum power draw.

Using onboard sensory data in compliance with the readout of testing conditions confirmation that the sensors are working as expected can be observed. The payload will be run through various electrical cycles to verify that these systems operate under the prescribed conditions. Materials will perform as expected while exposed to the wide temperature range. Final success will be determined upon a visual inspection of the payload. Criteria for passing visual inspection will include no warping, melting, cracking, or fracturing on any aspect of the payload external structure.

E. List all expected integration steps:

➔ Deliver the integration plate with mounted Sol Seeker payload to HASP officials for integration check, including power draw and weight check.
➔ Integrate Sol Seeker payload onto the gondola platform.
➔ Perform a test on the cameras, and motors.
➔ Verify functionality of the software algorithms.
➔ Test onboard sensor equipment.

F. List all checks that will determine a successful integration:
➔ Payload is safely secured to the HASP integration plate with all electrical connections secured.
➔ Payload powers on and off successfully during thermal vacuum chamber testing.
➔ Flight computer data logger (integrated in Teensy & Raspberry-Pi) logs data successfully.

➔ Cameras is functional at the temperature extremes.
➔ No fractures or strains observed in the dynamic mission-critical components during thermal vacuum chamber testing. Dynamic mission-critical components include the cameras.

G. List any additional LSU personnel support needed for a successful integration other than directly related to the HASP integration (i.e. lifting, moving equipment, hotel information/arrangements, any special delivery needs…):

None

H. List any LSU supplied equipment that may be needed for a successful integration:

None

## VI. Hazards

A. Are you flying anything that is potentially hazardous, as listed in the Call for Proposal and the HASP Student Manual, to HASP or the ground crew before or after launch: Yes No (Circle one)

### Appendix A: NASA Hazard Tables

If you intend to fly a listed hazard on HASP, you must **fully complete** the appropriate hazard form and include the form on **both** the Preliminary PSIP and the Final PSIP. This documentation is required for NASA safety to clear your payload for flight. Be specific and as detailed as possible with the information requested.

### Appendix A.1 Radio Frequency Transmitter Hazard Documentation N/A

| HASP 2022 RF System Documentation | |
|---|---|
| **Manufacture Model** | |
| **Part Number** | |
| **Ground or Flight Transmitter** | |
| **Type of Emission** | |
| **Transmit Frequency (MHz)** | |
| **Receive Frequency (MHz)** | |
| **Antenna Type** | |
| **Gain (dBi)** | |
| **Peak Radiated Power (Watts)** | |
| **Average Radiated Power (Watts)** | |

## Appendix A.2 High Voltage Hazard Documentation N/A

| HASP 2022 High Voltage System Documentation | |
|---|---|
| **Manufacture Model** | |
| **Part Number** | |
| **Location of Voltage Source** | |
| **Fully Enclosed (Yes/No)** | |
| **Is High Voltage  source Potted?** | |
| **Output Voltage** | |
| **Power (W)** | |
| **Peak Current (A)** | |
| **Run Current (A)** | |

## Appendix A.3 Laser Hazard Documentation N/A

| HASP 2022 Laser System Documentation | | | |
|---|---|---|---|
| **Manufacture Model** | | | |
| **Part Number** | | | |
| **Serial Number** | | | |
| **GDFC ECN Number** | | | |
| **Laser Medium** | | | |
| **Type of Laser** | | | |
| **Laser Class** | | | |
| **NOHD (Nominal Ocular Hazard Distance)** | | | |
| **Laser Wavelength** | | | |
| **Wave Type** | | *(Continuous Wave, Single Pulsed, Multiple Pulsed)* | |
| **Interlocks** | | *(None, Fallible, Fail-Safe)* | |
| **Beam Shape** | | *(Circular, Elliptical, Rectangular)* | |
| **Beam Diameter (mm)** | | **Beam Divergence (mrad)** | |
| **Diameter at Waist (mm)** | | **Aperture to Waist Divergence (cm)** | |
| **Major Axis Dimension (mm)** | | **Major Divergence (mrad)** | |
| **Minor Axis Dimension (mm)** | | **Minor Divergence (mrad)** | |
| **Pulse Width (sec)** | | **PRF (Hz)** | |
| **Energy (Joules)** | | **Average Power (W)** | |
| **Gaussian Coupled (e-1, e-2)** | | *(e-1, e-2)* | |

| | |
|---|---|
| **Single Mode Fiber Diameter** | |
| **Multi-Mode Fiber Numerical Aperture (NA)** | |
| **Flight Use or Ground Testing Use?** | |

**Appendix A.5 Battery Hazard Documentation N/A**

| HASP 2022 Battery Hazard Documentation | |
|---|---|
| **Battery Manufacturer** | |
| **Battery Type** | |
| **Chemical Makeup** | |
| **Battery modifications** | *(Must be NO)* |
| **UL Certification for Li-Ion** | |
| **SDS from manufacturer** | |
| **Product information sheet from manufacturer** | |