HASP Payload Specification and Integration Plan

Payload Title: High Altitude Tracking Solar Survey (HATS 2.0)

Payload Class: Small [✓ Large] (circle one)

Payload ID: 09

Institution: Arizona State University

Contact Name: Elizabeth Dyer

Contact Phone: 6025702298

Contact E-mail: Elizabeth.Dyer@asu.edu

Submit Date: 06/21/2013

I. Mechanical Specifications:

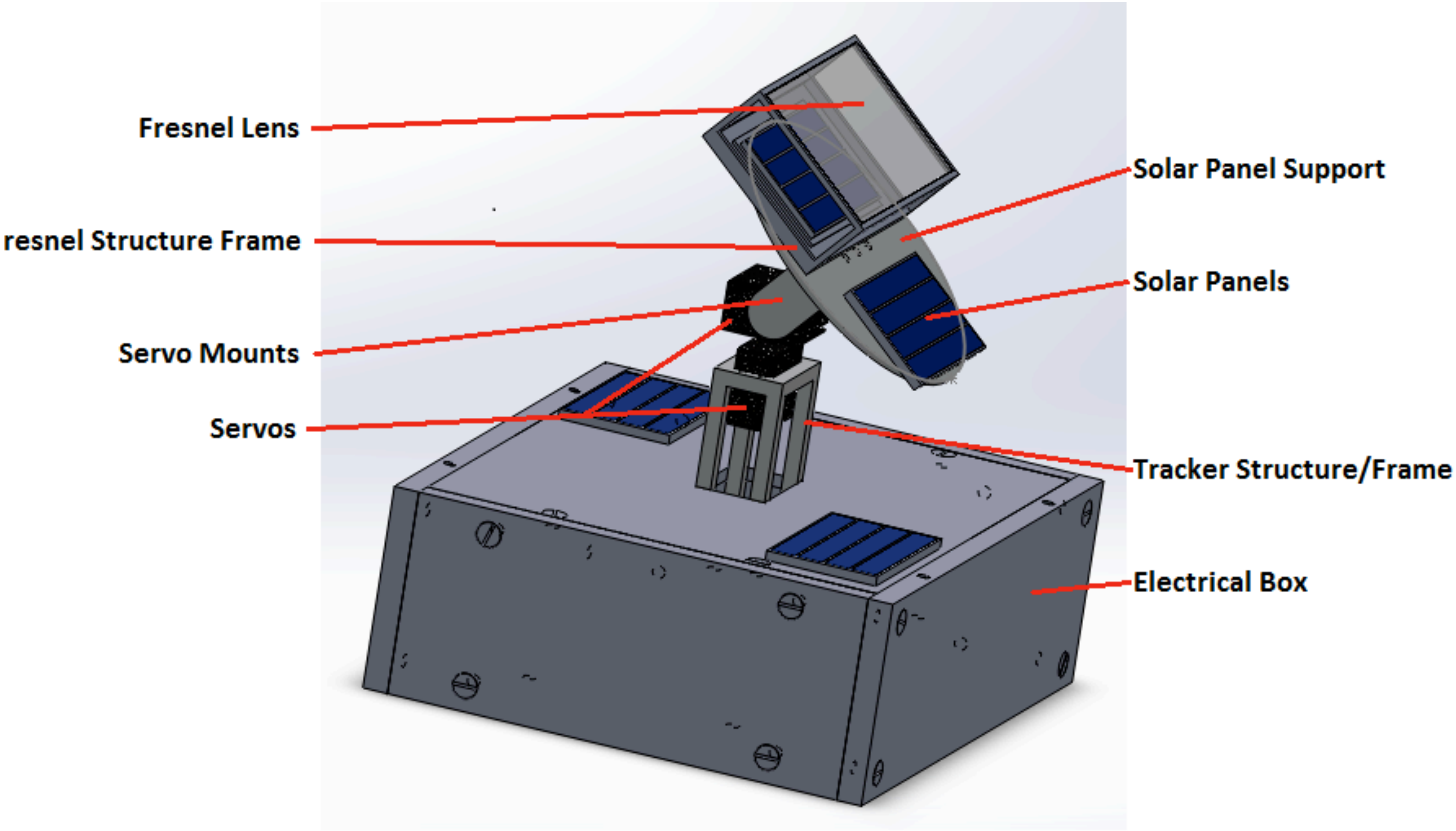
A. Measured weight of the payload (not including payload plate)

Subsystem	***Mass (kg)***
Tracker System w/ servos & solar panels	0.840
Photoresistors (x4)	0.004
Fresnel Lens	0.080
Temperature Sensor	0.001
Pressure Sensor/Altimeter	0.002
Arduino	0.096
Ammeter/Resistor	0.0001
Data Collection	0.006
Base Aluminum Frame	2.900
Communication	0.006
DC Converter	0.170
Electronics Box (empty)	3.900
Gyro	0.0017
Total Mass:	**8.1**

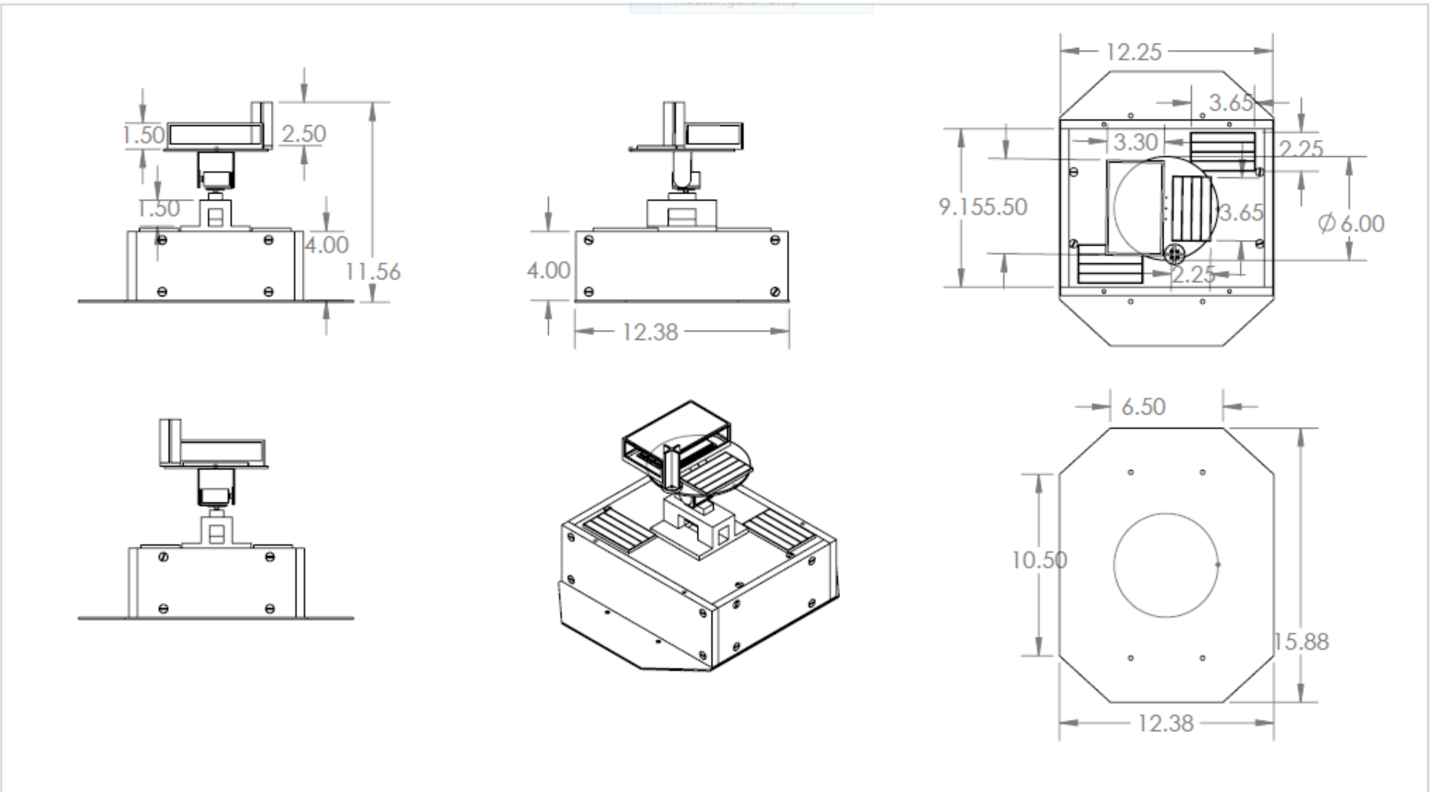
Table 1: *Most of the mass of the HATS 2.0 payload stems from the electronic box and the base aluminum frame.*

i. Provide a mechanical drawing detailing the major components of your payload and specifically how your payload is attached to the payload mounting plate.

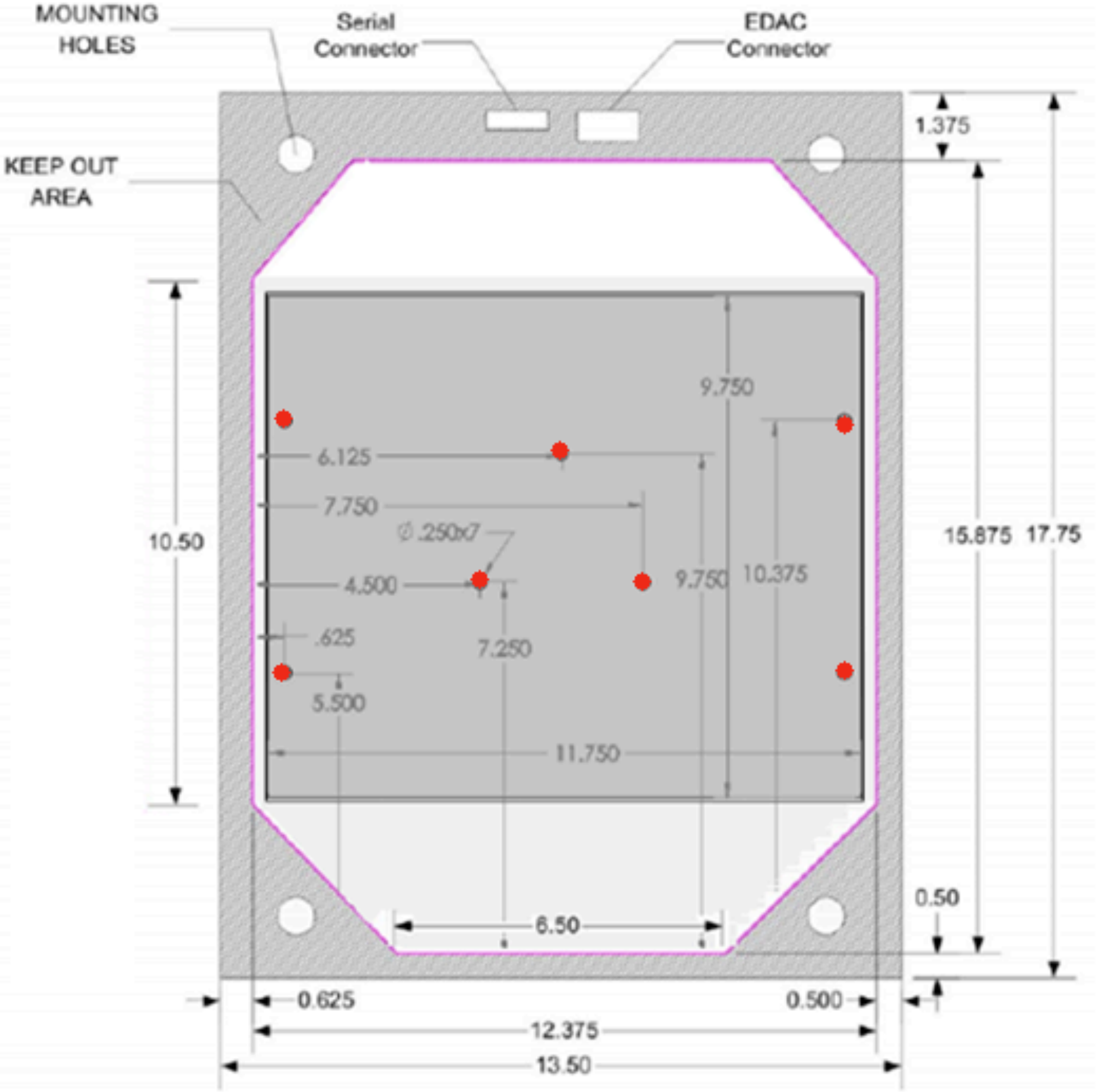
See image below for current isometric view and major components of payload.



i. As seen below, the tracking plate will have 2-axis motion: one that is 180 degrees in motion, and the other that is 120 degrees in motion.



The payload will be attached to the payload mounting plate using exact setup to last year's HATS payload. The base of the HATS 2.0 system is made out of aluminum. It will mount to the HAST integration place via 6 1/4"-20 threaded screws as shown below. None of the fasteners used will interfere with the HASP plate designated clearance areas. See mounting holes (in red) in the image below.



B. If you are flying anything that is potentially hazardous to HASP or the ground crew before or after launch, please supply all documentation provided with the hazardous components (i.e. pressurized containers, radioactive material, projectiles, rockets…)

   i. HASP will *not* be flying any potentially hazardous components.

C. Other relevant mechanical information

   i. HASP will be using the following:

      1. 6061 Aluminum for the electrical box and for the solar tracker structure/frame

      2. SOLARMADE® SPE-50-6 solar panels

      3. Hitec HS-7950TH Servos

II. Power Specifications:

A. Measured current draw at 30 VDC = 2.33A

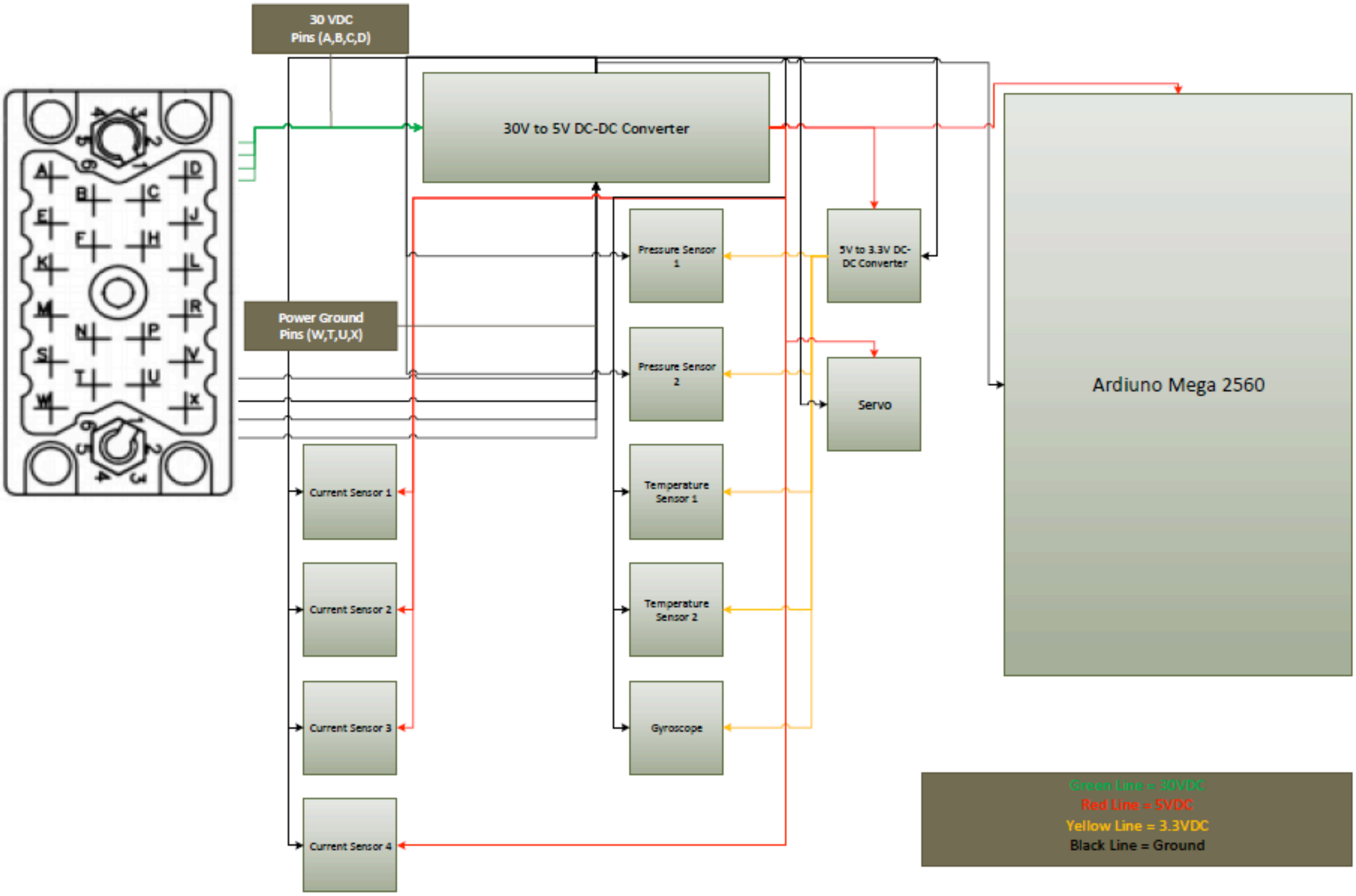
B. Measured nominal current draw at 30 VDC = .3A

Electrical System Specifications Summary

Component	Quantity	Input Voltage (V)	Output Voltage (V)	Current Draw (mA)	Power(W)	Operating Temperature C
Arduino Mega 2560	1	5		110	0.55	-40 to +85
OpenLog	1	3.3	3.3	2 - 6	.006-.02	-40 to +85
Solar Panel (SPE 50-6)	4	0	0-9	200	1.8	-40 to +85
Servo (HS-7950TH)	2	5	0	18- ~2000	.09 - 10	-20 to +60
Pressure Sensor (ASDX015A24R)	2	5	0-4	0.02	0.001	-20 to +105
Temperature Sensor (DS18B20)	2	3.3	2.2-3.3	2 - 3	.0066 - .0099	-55 to +125
Gyro (L3G4200D)	1	3.3	0-3.3	3 - 12.2	.00495 - .02013	-40 to +85
Power Detector (AttoPilot)	4	0-9	0-3.3	0	0	-55 to +125
Total				335 - ~2332	4.25 - 12.4	-20 to +60

C. If HASP is providing power to your payload, provide a power system wiring diagram starting from pins on the student payload interface plate EDAC 516 connector through your power conversion to the voltages required by your subsystems.

HATS 2.0 Power Distribution Diagram



D. Other relevant power information

N/A

III. Downlink Telemetry Specifications:

A. Serial data downlink format: Stream [✓ Packetized] (circle one)

B. Approximate serial downlink rate (in bits per second)

4800 Baud at 1bit per baud which is about 4800 bps

C. Specify your serial data record including record length and information contained in each record byte.

Total Record Length of 22 Bytes – Values will be floating integers for 11 sensors.

All the sensors will have 2 byte integers and a typical string will include:

Solar, Solar, Solar, Current, Current, Current, Current, Temp, Temp, Pressure, Pressure

Represented only by sensor values…

XX,XX,XX,XX,XX,XX,XX,XX,XX,XX,XX,XX,XX

These values will be transmitted constantly at a frequency of - 480 Bytes / 10 Hz

There will be other sensors such as the gyroscope that will be logged but not transmitted.

D. Number of analog channels being used:

None

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

N/A

F. Number of discrete lines being used:

None

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

N/A

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

N/A

I. Other relevant downlink telemetry information.

N/A

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*)

0 – 2 commands strictly for on and off purpose.

D. Provide a table of all of the commands that you will be uplinking to your payload

Command Type	**Systems**	**Type**	**Command**
Serial	Processor	On/Off	0 or 255
Serial	None	Null – No Action	1-254

E. Are there any on-board receivers? If so, list the frequencies being used.

N/A

F. Other relevant uplink commanding information.

N/A

V. Integration and Logistics

A. Date and Time of your arrival for integration: Awaiting information regarding funding, date and time of arrival is to be determined.

B. Approximate amount of time required for integration:

The team approximates the need for 2 to 3 hours to complete full integration

C. Name of the integration team leader:

Josh Lincoln

D. Email address of the integration team leader:

Josh Lincoln: joshuajlincoln@gmail.com

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

1. Josh Lincoln: joshuajlincoln@gmail.com
2. Elizabeth Dyer: elizabeth.dyer@asu.edu
3. Alex Kafka: akafka@asu.edu

F. Define a successful integration of your payload:

- HATS 2.0 system is mounted to the payload plate such that it is structurally sound
- Payload plate is mounted to the HASP structure in a structurally sound manner
- On-board computer and servos are powered
- Arduino is capable of connecting with each of the payload’s sensors.
- Data is being collected
- On-board computer is able to fully communicate with HASP via serial connection
- Solar Tracker is able to operate free of obstruction
- Current draw from servos are within maximum current limits

G. List all expected integration steps:

Step 1: Ensure proper physical mounting of sensors and tracker to HATS 2.0

Step 2: Mount HATS 2.0 to HASP plate

Step 3: Cross-reference all electrical connections with electrical schematic

Step 4: Connect 12V power supply to system and observe effects

Step 5: Use a DMM to measure voltage and current at each sensor, and servo

Step 6: Connect HATS 2.0 to HASP power

Step 7: Measure voltage and current through system

Step 8: Confirm communication link between HATS 2.0 and HASP

Step 9: Ensure data is being written properly and packetized to HASP

Step 10: Test current draw from servos

Step 11: Confirm all mechanical connections

Step 12: Seal box and monitor temperature rise

Step 13: Power down and await launch

H. List all checks that will determine a successful integration:

- All fasteners are attached and tightened to appropriate limits
- Completed Thermal Vacuum testing to assure the payload will withstand flight conditions
- The current and voltages through the system shall be nominally:

Subsystem	Current (mA)	Voltage(V)	Quantity	Power (W)
Arduino	25	5	1	0.125
Servo	1000	5	2	10
Pressure Sensor	0.02	5	2	0.01
Temperature Sensor	2	3.3	5	0.012
Gyroscope	12	3.3	2	0.07
Power Detector	10	5	4	0.2

- Successful demonstration of command through HASP to power off HATS 2.0
- Successful demonstration of data received from HATS 2.0 through HASP

- Monitoring of temperature inside closed box for 5 minute minimum
- No anomalous data for during of the test.

I. 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…):

    i. No addition LSU personnel support will be needed for the HATS 2.0 payload.

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

    i. No additional equipment will be needed for the HATS 2.0 payload.