HASP Payload Specification and Integration Plan

Payload Title: High Altitude Turbine Survey (HATS)

Payload Class: Small Large (circle one)

Payload ID: 09

Institution: Arizona State University

Contact Name: Patrick McGarey

Contact Phone: 602-300-5441

Contact E-mail: aeropat@gmail.com

Submit Date: 6/22/12

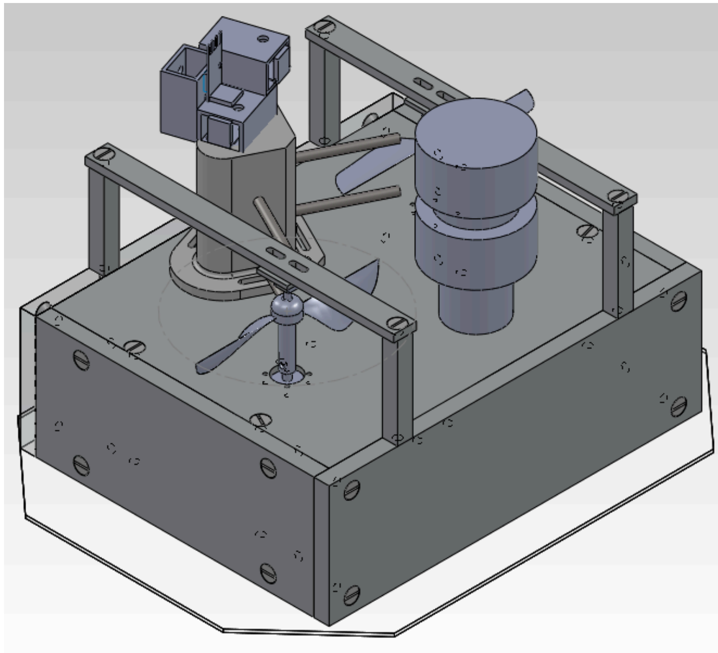
I. Mechanical Specifications:

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

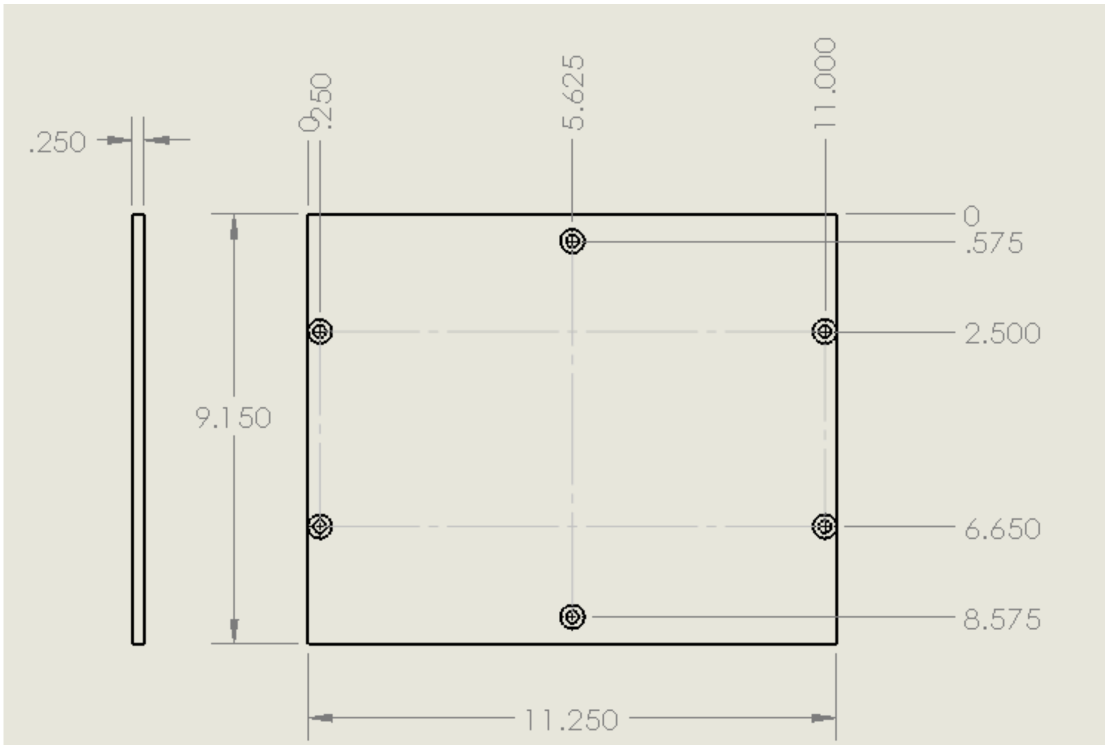
Component	Mass (kg)
Motors (measured)	0.444
Propellers (measured)	0.028
Airmar Weatherstation (measured)	0.284
Pandaboard Computer (measured)	0.085
Arduino Mega (measured)	0.036
Pressure Tower (measured)	0.156
Electrical Components (estimated)	0.200
Aluminum Frame (measured)	7.400
Current Net Total	8.633
Margin	+/- 0.500
Total Estimate	9.000

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

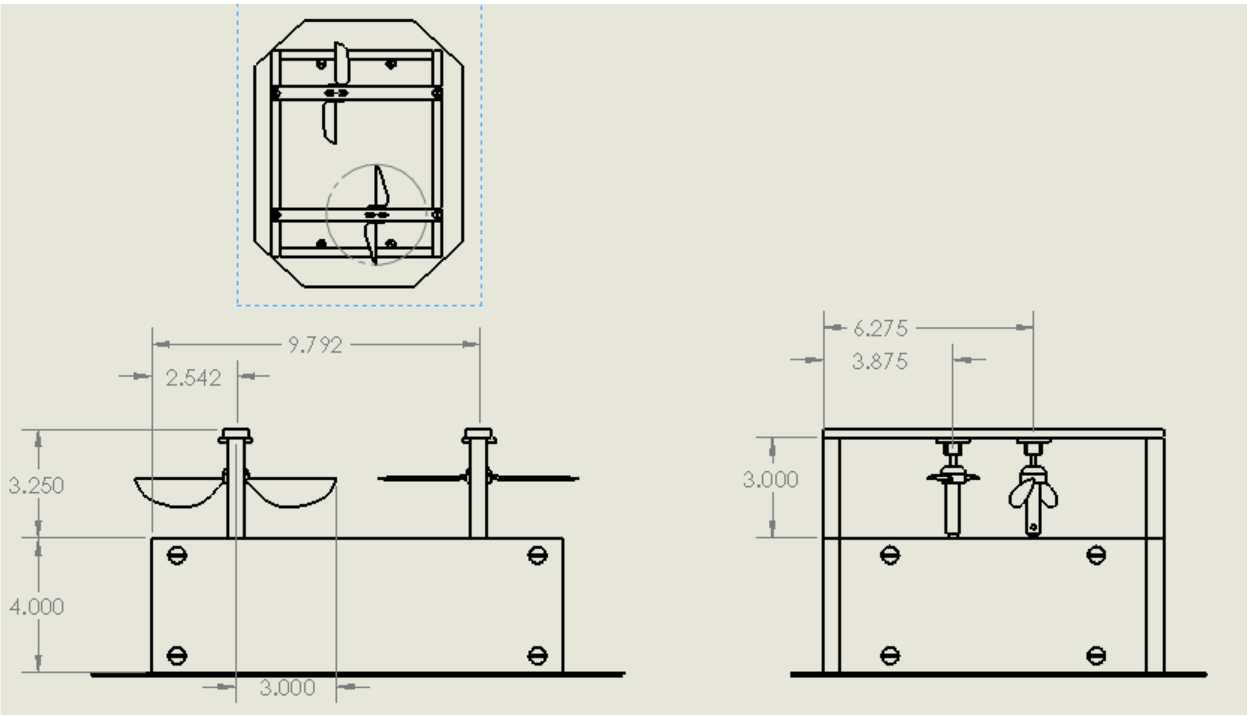
The current isometric view of the payload is as follows:



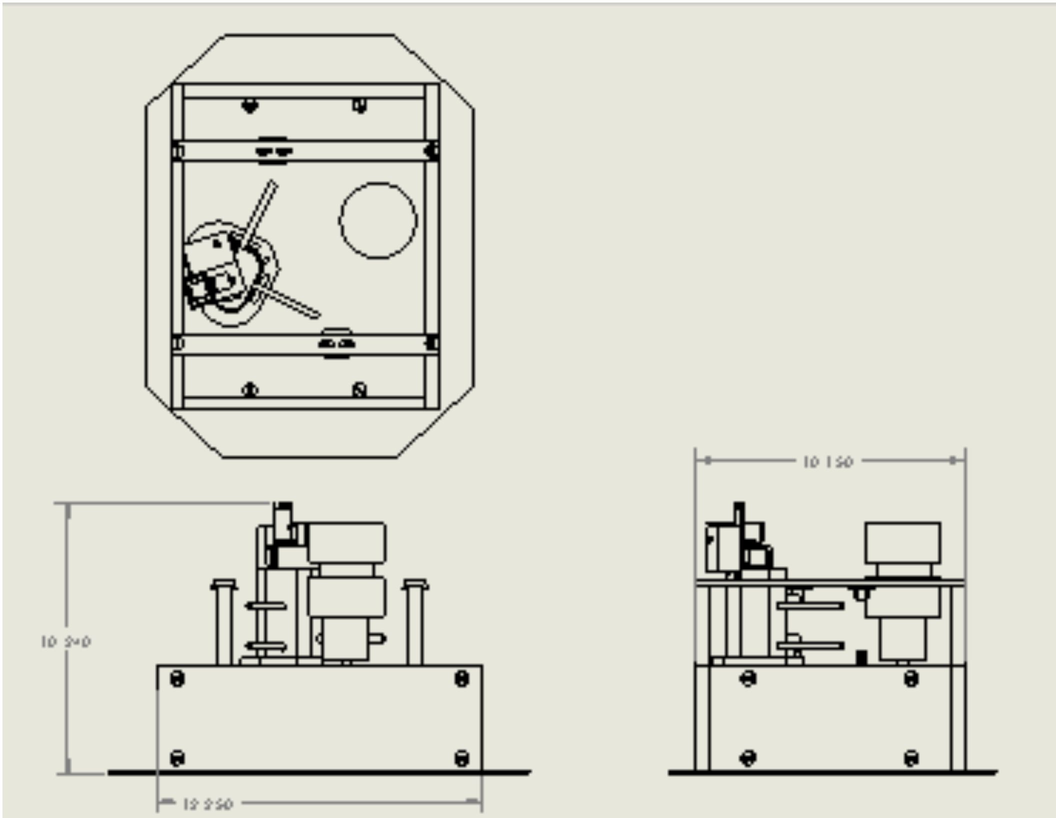
The base of the HATS system is a large aluminum box that contains all of the electronics. The bottom plate of the HATS system is made out of ¼”6061 aluminum. It will mount to the HASP integration plate via 6 1/4”-20 threaded screws as shown below. Please note that the 4 fasteners will slightly protrude beneath the plate for mounting purposes (the fasteners are not countersunk). None of these fasteners will interfere with the HASP plate designated clearance areas.



HATS will house two propellers operating at 1140 rpm. The propeller mount is approximately 3.25” tall and mounts between the top plate and the upper bars. A strain gauge mount is also included between the upper bars and propellers to measure thrust.



The major external sensors are mounted on two elevated towers. These include the pressure sensors, wind sensors, and ultrasonic anemometer



C. 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…)

   This payload will include two rotating propellers with blunt edges, which could pose a cutting hazard during their operation. The team will also use the TT300 Strain Gauge Adhesive by Omega. The MSDS for this high grade adhesive can be found here: http://www.omega.com/msds/msdspdf/MSDS0370.pdf

D. Other relevant mechanical information

   N/A

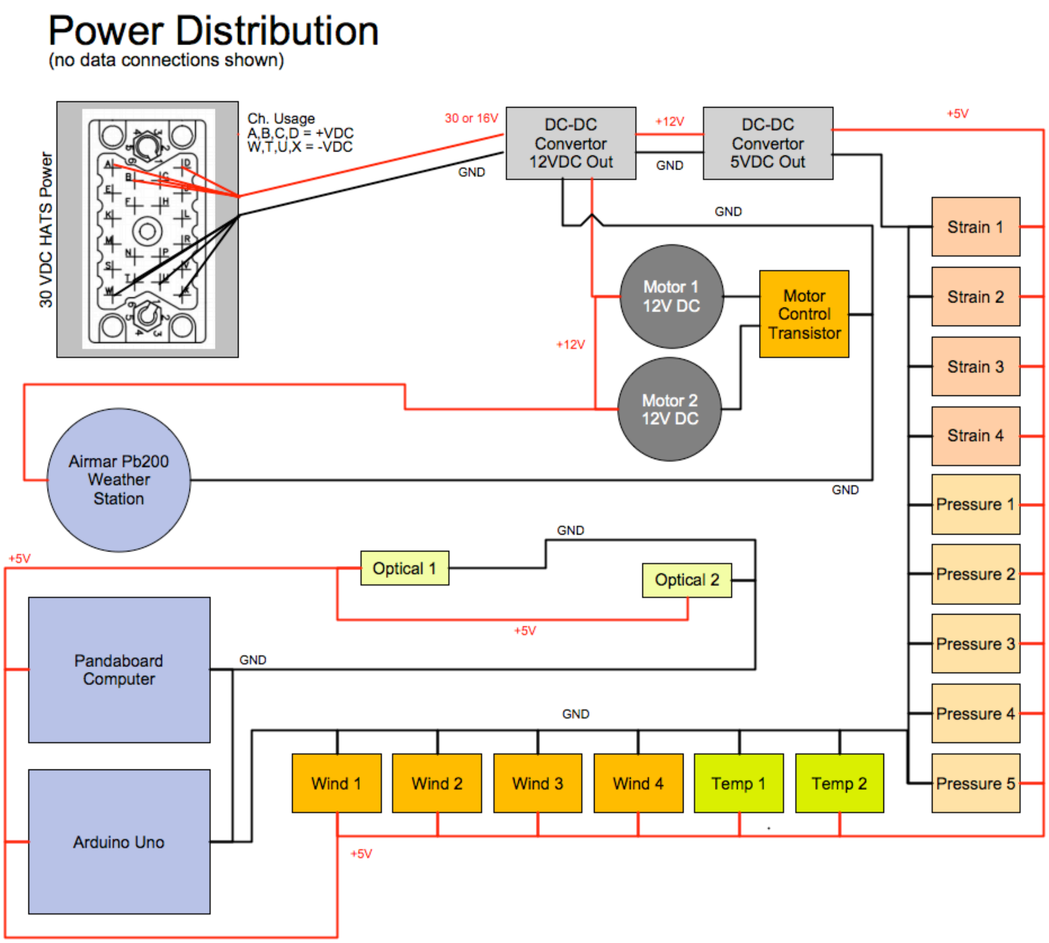
II. Power Specifications:

A. Current draw at 30 VDC

The measured current draw at 30 VDC is 2 to 2.5 A

High current systems (like motors) will utilize slow blow fuses to insure the amperage remains below the 2.5A maximum at all times.

B. 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.



C. 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 2bits per baud – 9600 b/s

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

Total Record Length of 32Bytes – Values will be floating integers for nine sensors. With the exception of two temperature sensors, which will have 2 byte integers, all other sensors will have 4 byte integers.

A typical string will include…

Strain,Strain,Temp,Temp,Presure,Pressure,Pressure,Pressure,Pressure

Represented only by sensor values…

XXXX,XXXX,XX,XX,XXXX,XXXX,XXXX,XXXX,XXXX

These values will be transmitted constantly at a frequency of - 960 Bytes / 25 Hz

Some sensors values will be stored within the payload computer and not transmitted. Specifically, wind direction measurements and Weather Station data will not be downlinked.

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?

Formally HATS required a battery to collect data on decent. HATS will no longer require a battery provided that HASP has agreed to provide power on decent. The caveat to using HASP power for decent is that the payload will remain powered until the ground crew recovers the payload, or the HASP batteries no longer hold a charge. This is an acceptable arrangement.

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 per hour

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

* Serial commands will be prefaced by a checksum and payload id (09 in this case)

Command Type	System	Type	Command
Serial	Motor	Change RPM function	100-199
Serial	Internal Heater	On/Off function	0 or 255
Serial	none	null – no action	1-99 and 200-254

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:

6/30/12 Flight leaves Phoenix, AZ at 9:50am arriving Dallas F.W. 2:00pm. Arrival in Palestine, TX CSBF Facility at 5:00pm.

B. Approximate amount of time required for integration:

The team approximates needing three to five hours to complete full integration.

C. Name of the integration team leader:

Patrick McGarey

D. Email address of the integration team leader:

aeropat@gmail.com

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

Patrick McGarey aeropat@gmail.com
Alexander Kafka Alexander.Kafka@asu.edu

F. Define a successful integration of your payload:

- HATS system is mounted to the payload plate such that it is structurally sound
- Payload plate is mounted to the HASP structure in a structurally stable manner
- Sensors and propellers are properly mounted to the HATS structure

- On-board computer is powered
- Arduino is capable of connecting with each of the sensors
- Data is being collected
- On-board computer is able to fully communicate with HASP via serial connection
- Propellers are able to be operated free of obstructions
- Current draw from the motors is within maximum current limits

G. List all expected integration steps:

Step 1: Ensure proper physical mounting of sensors to HATS
Step 2: Mount HATS to HASP Plate
Step 3 Cross reference all electrical connections with electrical schematic.
Step 4: Connect 12 V power supply to system and observe effects
Step 5: Use a DMM to measure voltage and current at each sensor
Step 6: Connect HATS to HASP Power
Step 7: Test voltage and current through system
Step 8: Confirm communication link between HATS and HASP
Step 9: Ensure data is being written properly and packetized to HASP
Step 10: Test current draw from motors
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
- The current and voltages through the system shall be nominally:

Subsystem	Current (mA)	Voltage (V)	Quantity	Power (W)
Optical Encoders	57 (nom.)	5	2	0.57
Strain Gauges	15 (nom.)	5	4	0.30
Pressure Sensors	0.006 (nom.)	5	5	0.15
Temperature Sensors	1.5 (max)	5	2	0.015
Weather Station	200 (max)	12	1	2.4

Chip Wind Sensor	40 (max)	5	4	0.8
Motors	800 (nom.)	12	2	19.2
**Motors at stall*	*3170 (max)*	*12*	*2*	*76.08*
Arduino Mega	25 (nom.)	5	1	0.125
PandaBoard Computer	500 (nom)	5	1	2.5

- Successful demonstration of a command through HASP to stop a motor
- Successful demonstration of data received from HATS through HASP
- Monitoring of temperature inside closed box for 5 minute minimum
- No anomalous data for duration 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…):

Please provide information regarding hotel reservations in the area.

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

No additional LSU equipment will be needed.