HASP Payload Specification and Integration Plan

Payload Title: PLEASE LSU

Payload Class: Small Large (circle one)

Payload ID: 12

Institution: **Louisiana State University**

Contact Name: Joel Taylor

Contact Phone: (985) 788-5384

Contact E-mail: jet.taylor10@gmail.com

Submit Date: 6/21/2013

I. Mechanical Specifications:

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

Component	Estimated Weight (g)	Uncertainty (g)
Sun camera + lens	1020	0.5
Tiltmeter	555	0.5
Arduino + shields	145	0.5
Housing Structure	8000	1000
Foam insulation	100	50
Electronics	500	100
Temp Sensor Array	10	2.5
Total	**10852**	**1006**

Table 1: Weight Budget

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

System Design Layout

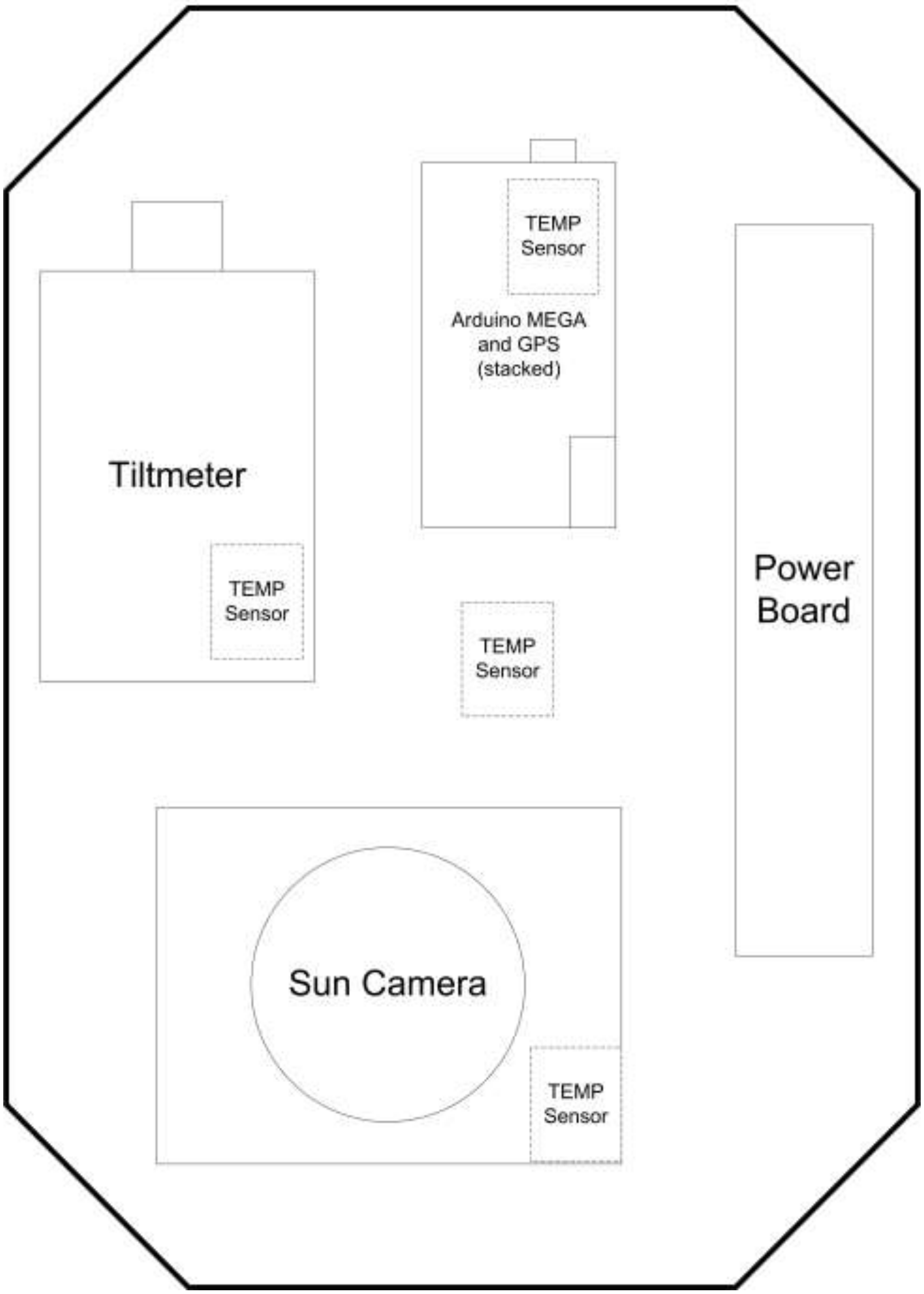

Figure 1: Layout of components within housing, drawn to scale

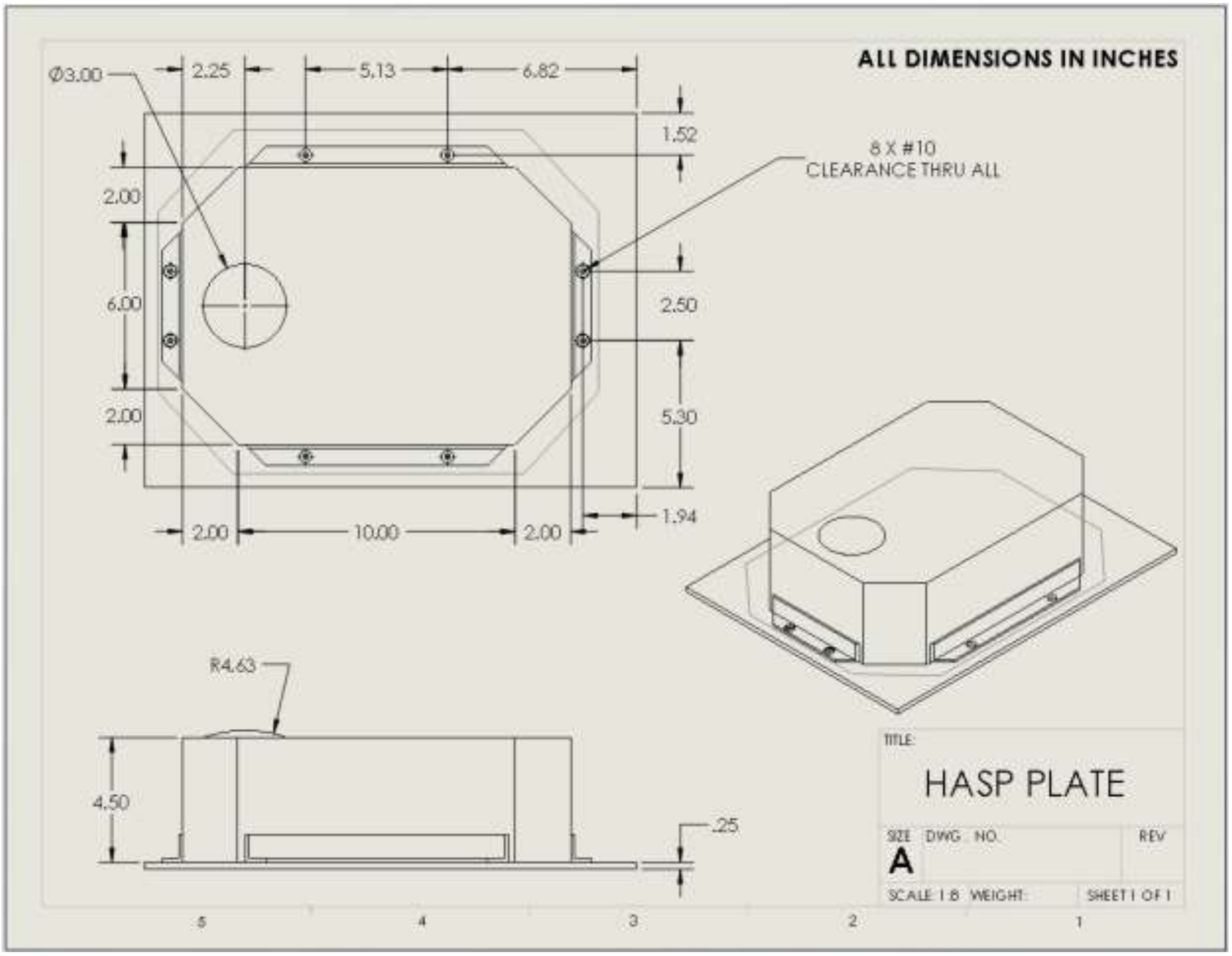

Figure 2: Completed and assembled housing, drawn to scale

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…)

   none

D. Other relevant mechanical information

   none

II. Power Specifications:

A. Measured current draw at 30 VDC

Component	Part #	Voltage (V)	Current Draw (mA)	Duty Cycle (%)	Power (W)	Power Consumed (Amp-hrs)
Tiltmeter	A904-T	9	7	100	0.063	0.112
Sun Camera	Nikon D3200	7	500	65	2.275	7.886
GPS	Trimble Copernicus II	5	40	100	0.2	0.64
Arduino Mega	ATmega2560	9	40	100	0.36	0.64
Temp Sensor Array	DS18S20+	5	4	100	0.02	0.064
Minimum Current (30VDC)			21.4			
Max Current (30VDC)			138.1			
Total					4.143	9.284

Table 2: Power Budget

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.

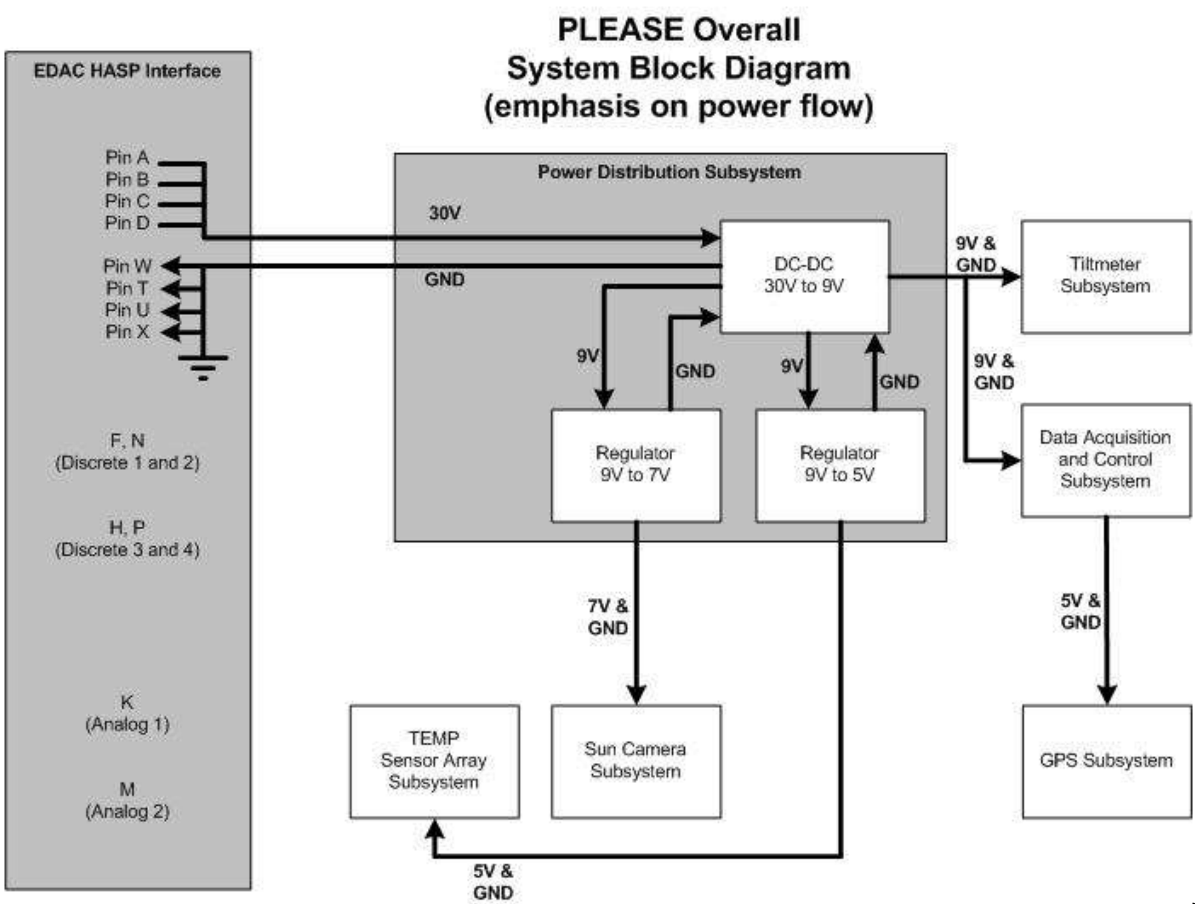

Figure 3: Power Flow

C. Other relevant power information

The Data Acquisition and control system is controlled by the Arduino Mega with 3 shields on top: the GPS shield, tiltmeter shield, and Triggertrap shield. The DC-DC converters and regulators have not been selected.

The heater has been removed from the design.

III. Downlink Telemetry Specifications:

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

B. Approximate serial downlink rate (in bits per second) 20bps

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

Data	Bytes
Temperature of Sun Camera	1
Temperature of tiltmeter	1
Temperature of electronics	1
Temperature of housing	1
GPS postion data	8
Tilt data	2
Pulse number	1
Photo number	1
Total	16

Table 3: Record to be sent every minute

The two bytes from the tiltmeter refer to the x and y readouts.

D. Number of analog channels being used: 2

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

Temperature sensor readout for the Sun Camera and the electronics stack

F. Number of discrete lines being used: 4

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

Discrete lines F and N will be used to turn on or off the Sun Camera

Discrete lines H and P will turn on or off the entire system

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

no

I. Other relevant downlink telemetry information.

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*)

0-1 commands per hour

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

	Byte 1	Byte 2	Command
Sun Camera	02	00	force snapshot
	02	01	increase exposure (reserved)
	02	02	decrease exposure (reserved)
	02	03-10	reserved
GPS	03	00	read instantaneous position data
	03	01-10	reserved
Tiltmeter	04	00	read tilt data x
	04	01	read tilt data y
	04	02	read tilt temp
Temp Sensor Array	05	00	read temperature of sensor array
Arduino	06	00	read pulse number
	06	01	force reading of full system
	06	02-10	reserved

Table 4: Commands

Table 4 shows the telemetry commands used for the flight. The first byte designates the component receiving the command and the second byte is the command. For some components above, telemetry commands are reserved up to byte 10 to ensure enough command slots are available if needed.

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

GPS receiver → 2.4 GHz

F. Other relevant uplink commanding information.

N/A

V. Integration and Logistics

A. Date and Time of your arrival for integration: July 20 – 10 am

B. Approximate amount of time required for integration: Approximately 6 hours

C. Name of the integration team leader: Joel Taylor

D. Email address of the integration team leader: jet.taylor10@gmail.com

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

Joel Taylor – jet.taylor10@gmail.com

Nick Cannady – nick.cannady@gmail.com

Ching-Cheng Hsu – sunny.reis@gmail.com

Nick Chason – nchaso1@tigers.lsu.edu

F. Define a successful integration of your payload:

i. Payload is securely bolted to HASP mounting plate
ii. Payload is receiving power from HASP's EDAC connector
iii. System powers on and begins functioning
iv. Camera CCD alignment is calibrated
v. Camera position secured
vi. Tiltmeter is calibrated
vii. GPS is receiving a signal
viii. Data is written to appropriate SD cards
ix. Subsystem timing is correct
x. Thermal vac testing ensure payload will survive flight
xi. Downlink and uplink work as expected
xii. System is enclosed and flight ready

G. List all expected integration steps:

i. Bolt payload to HASP plate
ii. Connect payload to EDAC and verify power
   1. Power system on/off
iii. Mount camera inside camera housing
   1. Calibrate camera using LED plate
   2. Secure camera in place
iv. Calibrate tiltmeter so it reads 2.5V when mounted onto HASP plate by zeroing output using the Arduino
v. Power on system and allow data to be collected for short time
vi. Power off system and remove all SD cards to verify that system is fully operational

vii. Check all connections and finish make sure everything is secured to plate
viii. Power on system
ix. Test discrete and analog downlinks
x. Verify uplink
xi. Enclose payload with insulated housing
xii. Pray

H. List all checks that will determine a successful integration:
i. Ensure that payload is mounted securely to the plate
ii. Test voltage at each component
iii. Power down system with discrete command
iv. Allow system to run for a short time to collect data.
v. Remove SD cards and verify that data is being recorded properly
vi. Replace SD cards and power system back on with discrete command
vii. Verify analog downlink and uplink
viii. Ensure that housing is secured around payload securely

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…):

Hotel arrangements

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

Power Supply

Solder Station

Tools → Phillips screwdriver, allen wrench, duct tape, wire, wire cutter/stripper