HASP Payload Specification and Integration Plan

Payload Title: SCARLET HAWK I

Payload Class: Small

Payload ID: 2013-05

Institution: Illinois Institute of Technology

Contact Name: Peter Kozak

Contact Phone: 520-400-2577

Contact E-mail: pkozak@hawk.iit.edu

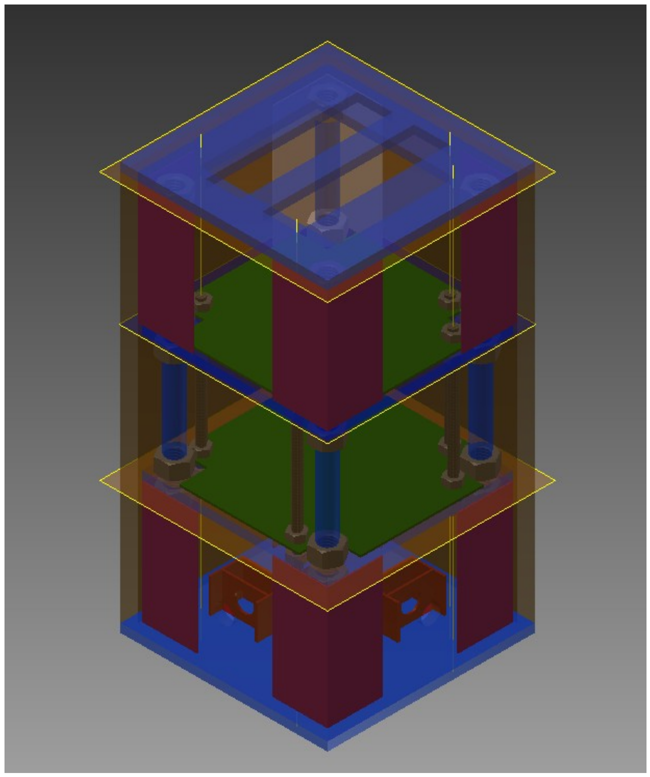
Submit Date: 04/19/2013

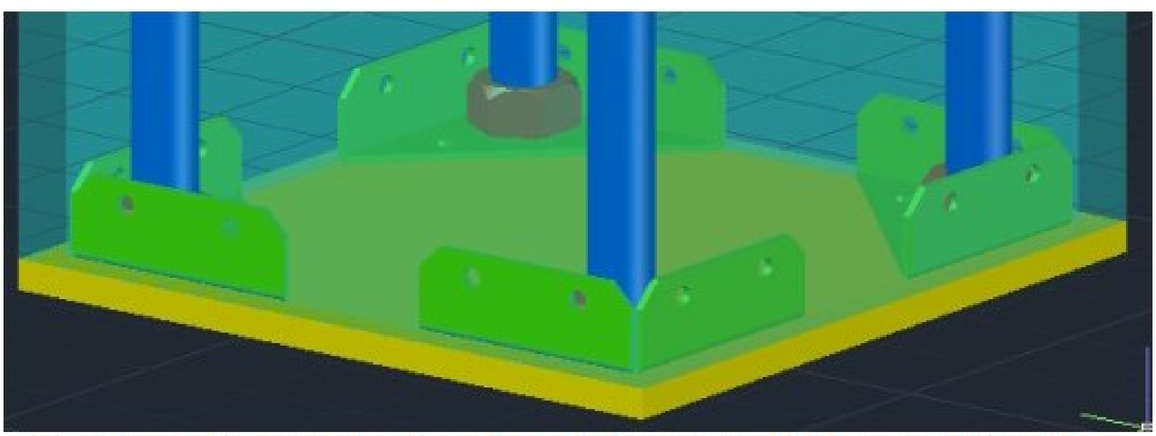
I. **Mechanical Specifications:**

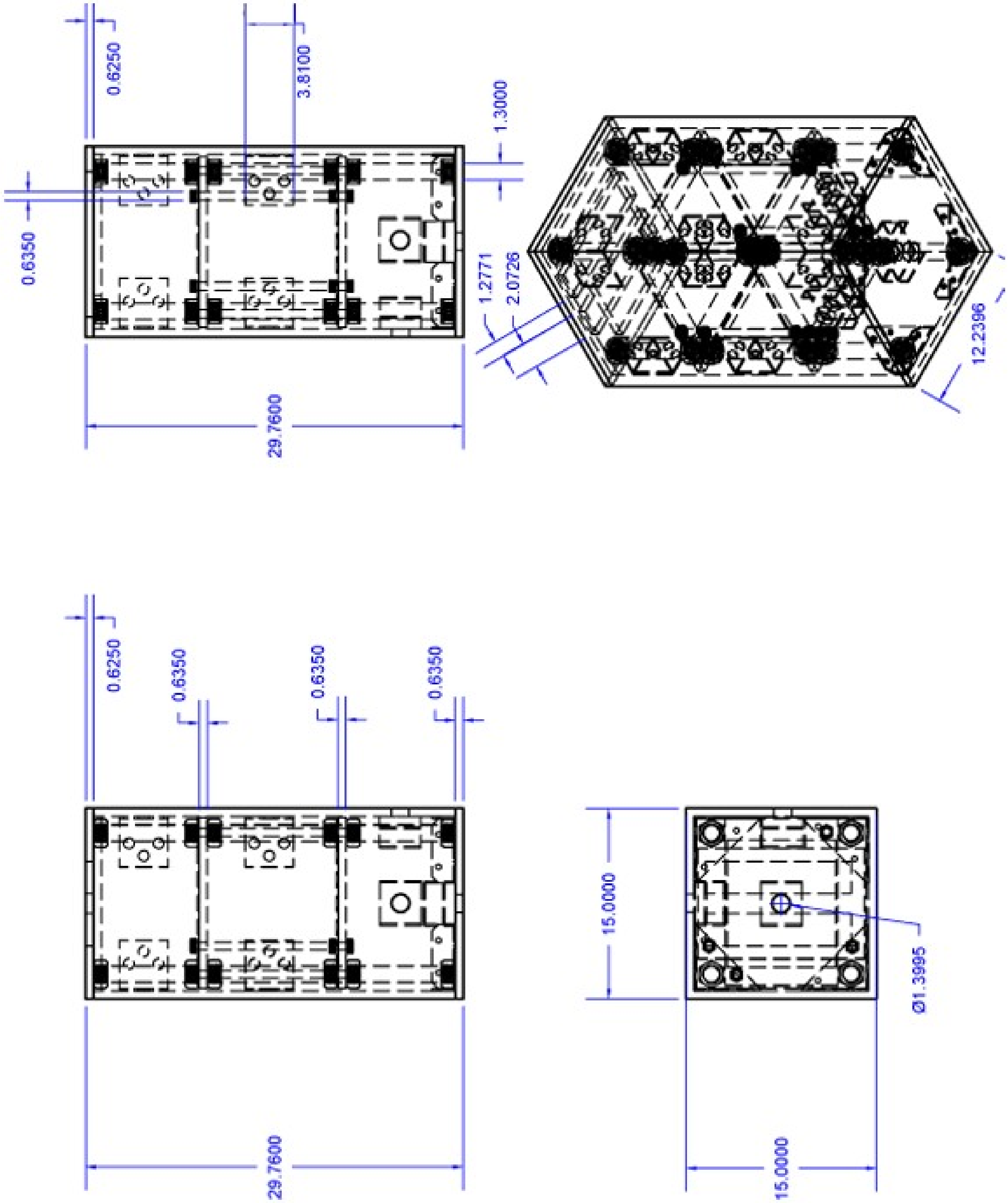
A. Measured weight of the payload (not including payload plate) : **2070 g**

Component	Weight [g]
PCB Stack	459.4
Structure Shell	1224.6
Structure Core	383.7
Total	**2067.7**

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







NOTE: ALL DIMENSIONS PROVIDED ARE IN CENTIMETERS.

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…)

No hazardous components or materials are included on the IIT HASP payload.

D. Other relevant mechanical information

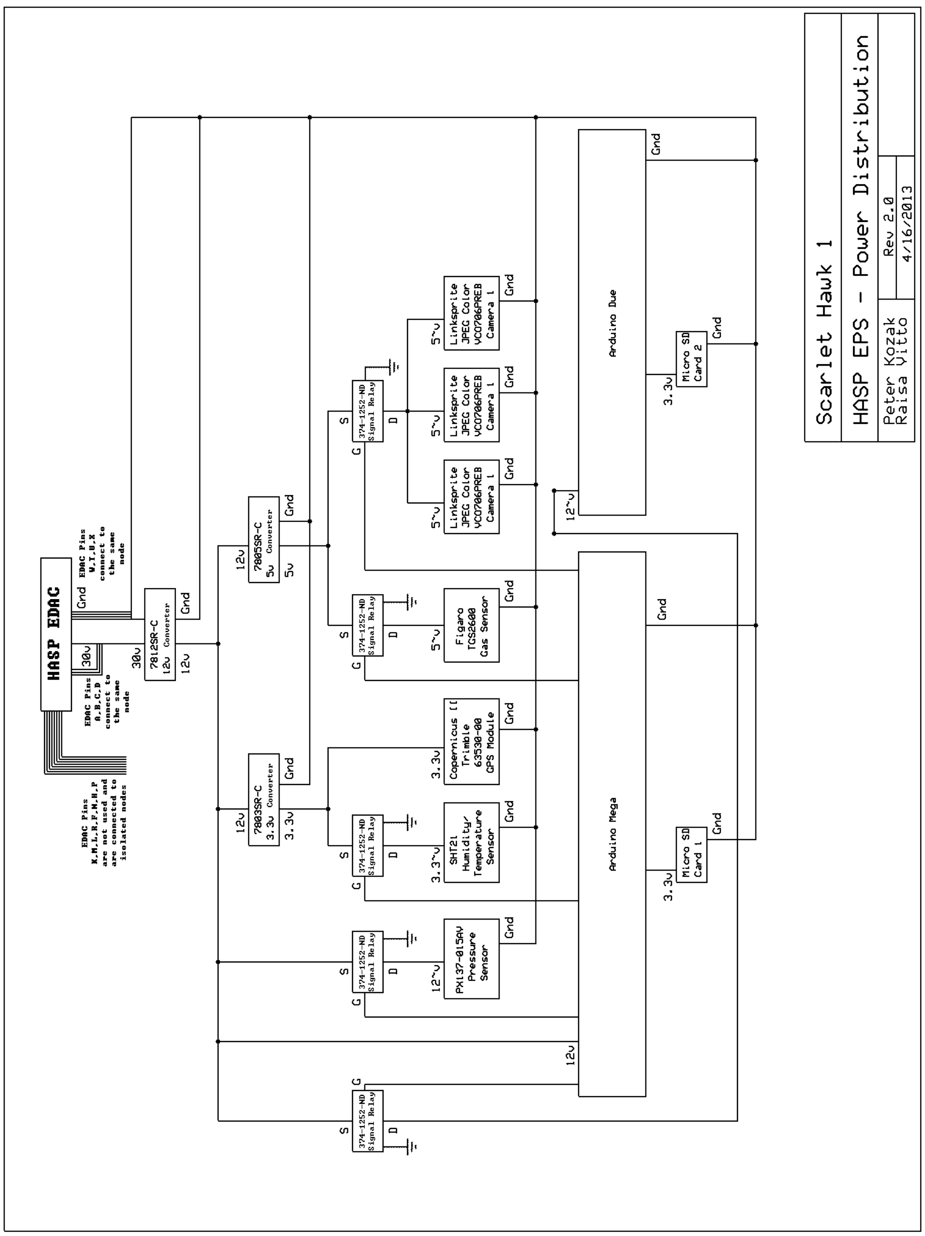
N/A

II. Power Specifications:

A. Measured current draw at 30 VDC:

Nominal Amperage: 185mA **Peak Amperage: 200mA**

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. Power Budget

Note: This power budget reflects values measured under peak conditions:

Sensor Mode		
Component	**Current [mA]**	**Power [W]**
12V Converter	9	0.27
5.0V Converter	4	0.12
3.3V Converter	5	0.15
Pressure Sensor	2	0.06
Humidity/Temp. Sensor	Negligible	0
Gas Sensor	30	0.9
GPS Receiver	45	1.35
Micro SD Slot	25	0.75
Arduino Mega	80	2.4
Total:	**200**	**6**

Camera Mode		
Component	**Current [mA]**	**Power [W]**
12V Converter	10	0.3
3.3V Converter	5	0.15
Camera	20	0.6
GPS Receiver	45	1.35
Micro SD Slot	25	0.75
Arduino Mega	60	1.8
Arduino Due	35	1.05
Total:	**200**	**6**

III. Downlink Telemetry Specifications:

A. Serial data downlink format: **Stream**

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

SENSOR MODE: 480 b/s
CAMERA MODE: 1000 b/s

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

Downlink for Sensors: Transmitted message details

	$#	GPS Time	Pressure 1	Pressure 2	Gas	Humidity	Temp	Lat	Long	Sat	Precision	Alt	Checksum	New Line
Type	character	float	float	float	float	float	float	float	float	float	float	float	integer	character
Bytes	2	4	4	4	4	4	4	4	4	4	4	4	2	1

- Each variable in bullet point two will have a comma separator after it.
    - o Character (1 byte each = 11 bytes total)

Downlink for Cameras: 4000 bytes per picture = 12000 bytes for 3 pictures.

	JPG String	GPS Time	Lat	Long	Alt
Type	character	float	float	float	float
Bytes	255	4	4	4	4

- Each variable in bullet point two will have a comma separator after it.
    - o Character (1 byte each = 4 bytes total)

D. Number of analog channels being used:

No analog channels will be use to downlink data.

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

No analog channels will be use to downlink data.

F. Number of discrete lines being used:

No discrete channels will be use to downlink data.

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

No discrete channels will be use to downlink data.

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

No on-board transmitters will be included on the payload.

I. Other relevant downlink telemetry information.

N/A

IV. Uplink Commanding Specifications:

A. Command uplink capability required: **Yes**

B. If so, will commands be uplinked in regular intervals: **No**

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*)

We will expect to send at most 2 commands per hour, depending on changes in image integrity.

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

The format for the two byte commands is the same as the sample format provided in the HASP - Student Payload Interface Manual. The Command Byte 1 consists of a checksum value as well as the student payload ID and the Command Byte 2 consists of the actual command required for the payload operation.

Command Number	Command Byte 1	Command Byte 2	Decimal Value of byte 2	Command
1	00000101	00000001	1	Switch to sensor mode
2	00000101	10000000	128	Switch to camera mode
3	00000101	00011000	24	Transmit picture (manually)
4	00000101	00001111	15	Lower RS safety
5	00000101	11110000	240	Raise RS safety

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

A Copernicus II GPS receiver will be included on the payload with a frequency of 1575.42 MHz (L1 frequency).

F. Other relevant uplink commanding information.

N/A

V. Integration and Logistics

A. Date and Time of your arrival for integration:

We will arrive at the Columbia Scientific Balloon Facility (CSBF) on July 29, 2013.

B. Approximate amount of time required for integration:

We expect integration and testing of the payload to take two hours, prior to thermal/vac testing.

In the event there are problems, we will suspend integration to make corrections. Integration and testing would then be re-attempted, requiring an aditional hour.

C. Name of the integration team leader:

Peter Kozak

D. Email address of the integration team leader:

pkozak@hawk.iit.edu

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

-Peter Kozak (pkozak@hawk.iit.edu)
-Lou Grimaud (lgrimaud@hawk.iit.edu)
-Shalmik Borate (sborate@hawk.iit.edu)
-David Finol (dfinolbe@hawk.iit.edu)

F. Define a successful integration of your payload:

Successful integration of SCARLET HAWK I with HASP includes connecting power, downlinking sensor and camera data, sending required commands and confirming the functionality of individual sensors. The payload must then function normally while undergoing thermal/vac testing.

G. List all expected integration steps:

1. **Connect the EDAC and DB9 to the SCARLET HAWK I payload.**
2. **Turn on payload power**
3. **Confirm successful downlink of sensor data**
4. **Confirm successful uplink of each serial command**
5. **Turn off the payload power**
6. **Close up the payload and check the mechanical interface between the base plate and the payload structure**
7. **Attach the payload baseplate to the HASP gondola structure**
8. **Turn on the payload power**
9. **Re-confirm successful downlink of sensor data**
10. **Re-confirm the successful uplink of each serial command**

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

TEST ITEM	√ / X
Power ON	
Sensor Output Received	
Command: Camera Mode	
Command: Manual Transmit Image	
Camera Output Received	
Command: Raise RS Safety	
Command: Lower RS Safety	
GPS Output Validation	
Temperature/Humidity Output Validation	
Pressure Output Validation	
Gas Sensor Output Validation	

Sensor output validation will be conducted by comparing sensor outputs to values recorded previously during calibration. This validation will be done during the initial integration and, if possible, during thermal/vac testing.

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…):

No other support is needed.

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

No other equipment is needed.