HASP Payload Specification and Integration Plan

Payload Title: High Altitude Radiation Detector

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

Payload ID: GU-HARD-PL02

Institution: Gannon University

Contact Name: Nichole McGuire and Dr. Wookwon Lee

Contact Phone: 412-519-5347 (Nichole), 814-871-7630(Dr. Lee)

Contact E-mail: mcguire013@gannon.edu, lee023@gannon.edu

Submit Date: 4/20/12

I. Mechanical Specifications:

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

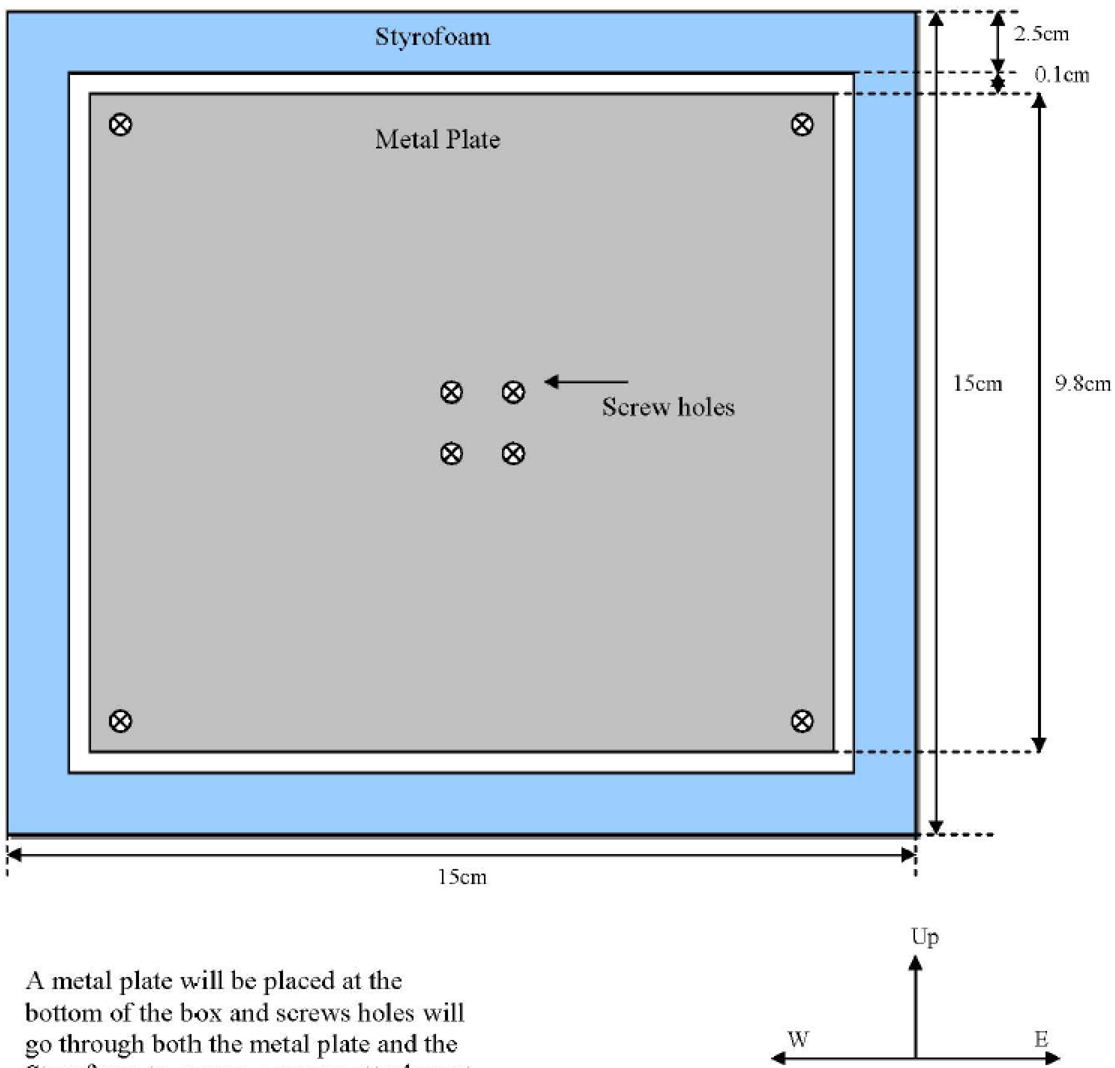
4.4lbs = 2 kg

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

Refer to Figures 1 ~ 3 below:

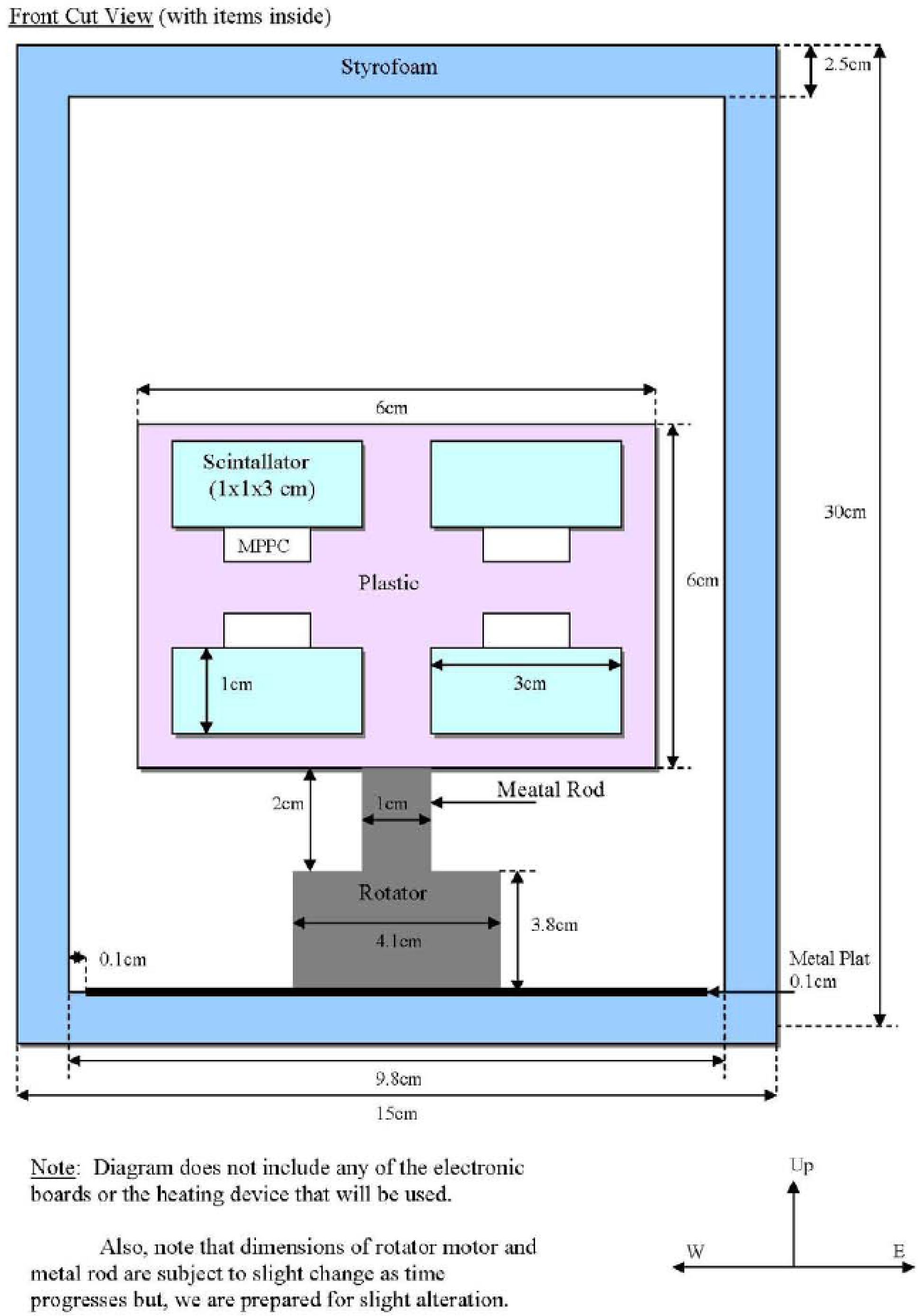
Figure 1

Top View (Empty Payload)



A metal plate will be placed at the bottom of the box and screws holes will go through both the metal plate and the Styrofoam to ensure a secure attachment to the rest of the payload

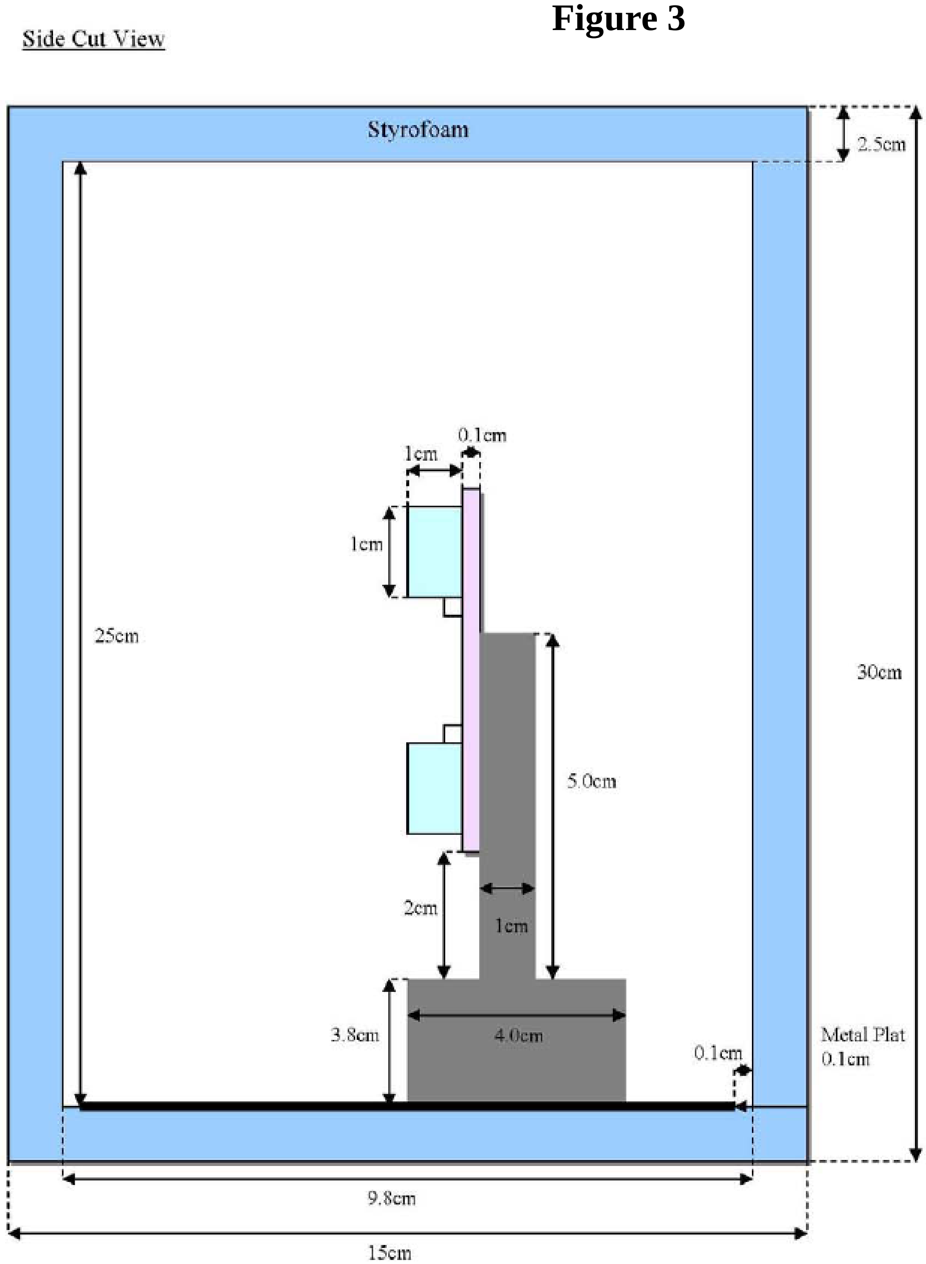
Figure 2



Note: Diagram does not include any of the electronic boards or the heating device that will be used.

Also, note that dimensions of rotator motor and metal rod are subject to slight change as time progresses but, we are prepared for slight alteration.

Figure 3



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

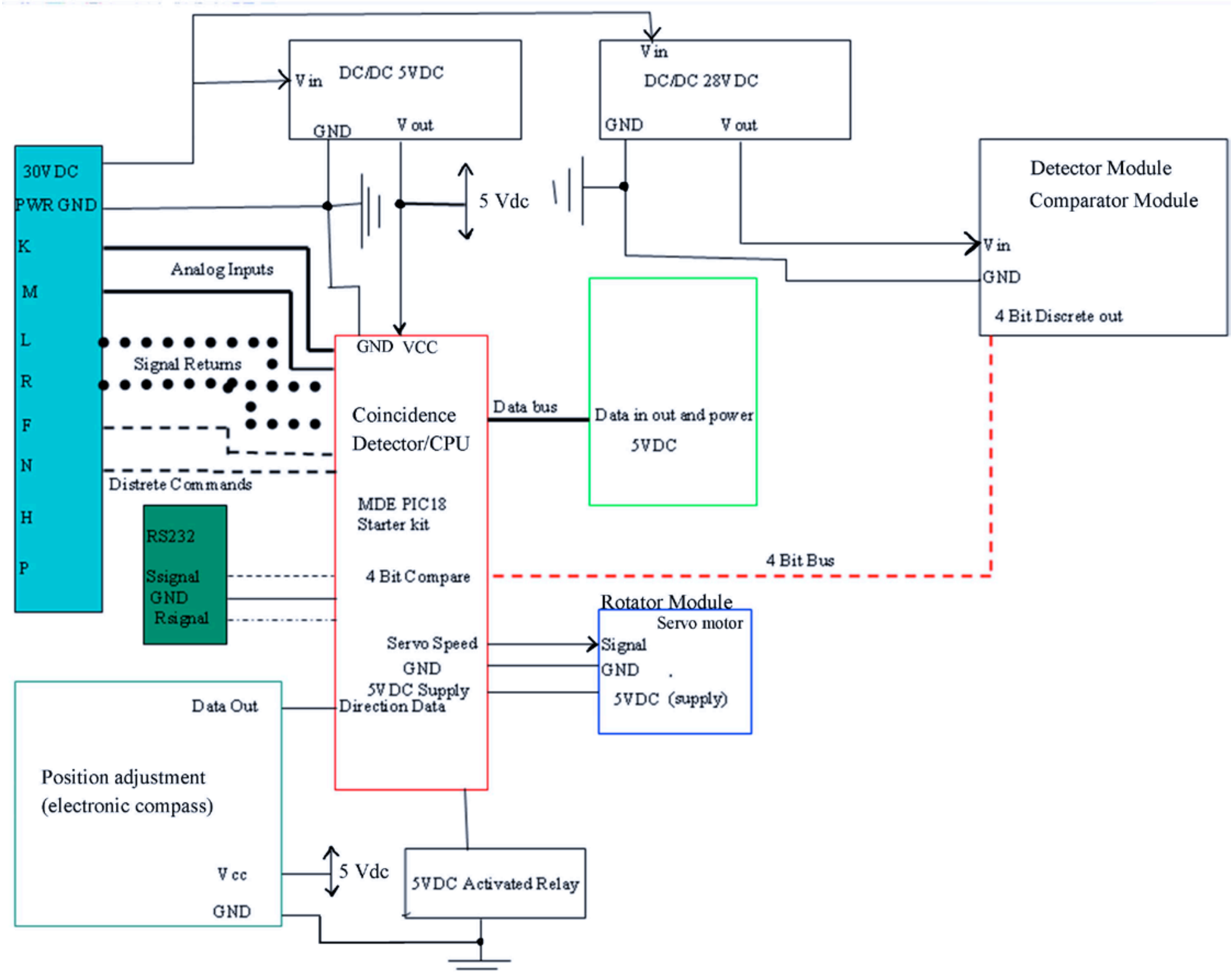
II. Power Specifications:

A. Measured current draw at 30 VDC

The power budget outlined below can easily fit within the 15 W (0.5 Amps @ 30 VDC) limit for the small payload class as outlined in the "Call for Payloads." - Additional power may be required for heating elements to maintain payload temperature, but will not exceed the maximum allotted.

Component	Current (mA)	Voltage (V)	Power (W)
Power converters	68.2	~6-9	.61
Detector module	8	32	0.26
Comparator module	158.7	22	3.5
Coincidence module	65.6	~6-9	.59
Micro-processor/CPU	56.8	~6-9	0.51
Rotator	177	~5	.89
Total Power	---	---	**6.36**

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.



EDAC Connection Diagram

C. Other relevant power information

None

III. Downlink Telemetry Specifications:

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

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

1200 bps

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

For the header of the data packet, the HASP guidelines shown below are used. For the Data Field (i.e., after the Checksum Field), the following info will be collected per minute.

Table 3: Suggested Student Payload Data Format

Byte	Bits	Description
1	0-7	Record Type Indicator
2-5	0-31	Timestamp (seconds since January 1, 1970)
6-9	0-31	Timestamp (nanoseconds past the last second)
10-11	0-15	Record Size
12	0-7	Least significant 8 bits of the record checksum
13-n		Data

<u>Data Field:</u>

- **Counts of Coincidences: 2 bytes (integer), max. count = 2^{16}-1**
- **Position of Rotator Module: 1 byte (integer)**
- **Altitude (km): 4 bytes (double precision float)**
- **Any onboard voltage voltages we can monitor (TBD, max. 4 bytes)**

<u>Total bytes per data packet:</u> 49 bytes (excl. the packet header)

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:

2

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

To power ON and OFF the payload

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.

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*)

Around 3-5 commands per hour during the first couple of hours of flight to ensure payload's operation.

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

Command	Description	Hexadecimal Value
Reboot	Reboot the Microprocessor	TBD
Auto-rotation OFF	Turn off auto-rotation	TBD
Auto-rotation ON	Turn on auto-rotation	TBD
Rotate X	Rotate the rotator by X degrees	TBD

All commands will be two bytes in hexadecimal, as required in the Interface Manual.

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

None

F. Other relevant uplink commanding information.

None

V. Integration and Logistics:

A. Date and Time of your arrival for integration:

We will arrive the day before – the arrival date will likely be finalized in late June or early July.

B. Approximate amount of time required for integration:

2 hours

C. Name of the integration team leader:

Nichole McGuire

D. Email address of the integration team leader:

mcguire013@gannon.edu

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

Nichole McGuire	**mcguire013@gannon.edu**
Joseph Veneri	**veneri001@gannon.edu**
Aaron Neiman	**neiman001 @gannon.edu**
Dr. Wookwon Lee	**lee023@gannon.edu**
Dr. Nicholas Conklin	**conklin003@gannon.edu**

F. Define a successful integration of your payload:

Successful integration of our payload requires:

1) Mounting the payload onto the HASP frame

2) Connection of EDAC 516 and DB9 connectors

3) System running from HASP power

4) Payload uplink and downlink communication with the SIP

5) Detector operates as expected at ground level

G. List all expected integration steps:

The payload will not be sealed until integration is successfully completed. All unit and integration tests for payload components will be successfully completed before shipping the payload to the launch site.

- **Connect the EDAC 516 connector to the payload.**
- **Connect the DB9 Serial Connector to the payload.**
- **Test power on and off of the payload through the Discrete Command Interface, i.e., EDAC516 pins F and H**
- **Test serial communication through DB9 pins 2 and 3**
- **Seal the payload with Kapton tape.**

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

- **Ensure proper operation of Detector Module by collecting cosmic-ray events for ~5 minutes to ensure the rate is consistent with previous measurements.**
- **Ensure operation of rotator module and electronic compass through uplink commands.**

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…):

To be communicated as appropriate

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

- **30 Volt DC power supply**
- **5 Volt DC power supply**
- **4 Multimeters**
- **1 Oscilloscope with cables**
- **Tools for securing payload to the HASP frame**