HASP Payload Specification and Integration Plan

Payload Title: Single Event Effect Detector (SEED)

Payload Class: Small Large (circle one)

Payload ID: 2013-04

Institution: Montana State University

Contact Name: Raymond Weber

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Submit Date: 06/21/2013

I. Mechanical Specifications:

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

   i. Payload weight estimate: 1.7-kg.

   ii. See Appendix I Figure 1 for detailed weight budgets.

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

   i. Appendix I Figures 2-3 provide mechanical drawings of the payload.

   ii. Appendix I Figures 4-5 provide renderings of the payload and an exploded view of the enclosure.

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…)

   i. Payload contains no hazardous materials.

D. Other relevant mechanical information

   i. No other information at this time.

II. Power Specifications:

A. Measured current draw at 30 VDC

   i. Nominal Current draw estimate: 265-mA.

   ii. Peak Current draw estimate: 340-mA

   iii. Payload current draw is depicted in Appendix I Figure 6.

iv. Current draw at 30 VDC will be measured at integration, if necessary, to demonstrate satisfaction of requirements.

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.

i. Power system wiring diagram included in Appendix I Figure 7.

C. Other relevant power information

i. No other relevant power information at this time.

III. Downlink Telemetry Specifications:

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

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

i. Nominal: 851 bytes per minute – 113.5 bps @ 1200 baud.

ii. Maximum: 893 bytes per minute – 119.1 bps @ 1200 baud

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

i. Nominal record length: 851 bytes, maximum record length: 893 bytes. Length may vary based on event-driven system response and issued payload commands. See Appendix I Figure 8 for details telemetry packet details.

D. Number of analog channels being used:

i. No analog channels used.

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

i. N/A

F. Number of discrete lines being used:

i. No discrete lines used.

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

i. N/A

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

i. No on-board transmitters.

I. Other relevant downlink telemetry information.

i. No other downlink telemetry information at this time.

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*)

   i. One command early in ascent to verify correct power-up and operation

   ii. Other commands only on as-needed basis during flight. (No commands during nominal operation)

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

   i. Table of all payload commands included in Appendix I Figure 9.

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

   i. No on-board receivers.

F. Other relevant uplink commanding information.

   i. No other relevant uplink command information at this time.

V. Integration and Logistics

A. Date and Time of your arrival for integration:

   i. 0800 July 29, 2013

B. Approximate amount of time required for integration:

   i. Aiming for a plug-and-play integration, but wish to reserve 1-2 hours for testing and troubleshooting if necessary.

C. Name of the integration team leader:

   i. Justin Hogan

D. Email address of the integration team leader:

   i. justin.hogan@msu.montana.edu

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

   i. Raymond Weber, raymond.weber@msu.montana.edu

   ii. Justin Hogan, justin.hogan@msu.montana.edu

F. Define a successful integration of your payload:

   i. Payload weight $\leq$ 3kg

   ii. Current @ 30 VDC $\leq$ 0.5A

   iii. Nominal system start-up after power on

   iv. Payload telemetry packet arrival is verified

   v. Payload response to each available command is verified
   vi. Payload demonstrates proper operation under thermal and vacuum testing.

G. List all expected integration steps:
   i. If required, measure weight of payload to demonstrate satisfaction of weight requirements.
   ii. Attach payload to mounting plate and attach connectors
   iii. If required, measure payload current draw to demonstrate satisfaction of power requirements.
   iv. Observe proper payload operation by monitoring the downlink stream.
   v. Issue all available commands and observe response in downlink stream.
   vi. Power down payload

H. List all checks that will determine a successful integration:
   i. Measured weight ≤ 3kg
   ii. Measured current @ 30 VDC ≤ 0.5A
   iii. Check telemetry to verify proper power-on sequence
   iv. Check telemetry to verify proper telemetry packet contents and transmission frequency.
   v. Check telemetry to verify proper response to each command.
   vi. Verify local memory storage contents to ensure proper local archival.
   vii. Demonstrate proper operation during thermal and pressure 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…):
   i. No additional personnel support anticipated at this time.

J. List any LSU supplied equipment that may be needed for a successful integration:
   i. Anticipate use of standard lab measurement equipment including:
      1. Oscilloscope
      2. Multimeter (Ohmmeter, Voltmeter, Ammeter)
      3. Payload attachment tools (Philips screwdriver, hex drivers)
   ii. If not already available on-site, we can arrange to bring this equipment.

APPENDIX I

PAYLOAD FIGURES

MSU RTC PAYLOAD_04 WEIGHT SUMMARY						
CIRCUIT CARD ASSEMBLY						
Part Name	**Part Number**	**Quantity**	**Weight/Piece (g)**	**Total Weight (g)**	**Description**	**Notes**
POWER CCA	U1MSUA1	1	139.7424	139.7424	Estimated weight based on POWER CCA components	
EXPERIMENT CCA	U1MSUA2	0	0	0	No separate experiment CCA to be used on	Experiment CCA reserved for future use
FPGA CCA	U1MSUA3	1	128.4543	128.4543	Estimated weight based on FPGA CCA components	
SENSOR_2 CCA	U1MSUA4	1	89.811	89.811	Measured weight of SENSOR CCA with radiation sensor	
SENSOR_1 CCA	U1MSUA5	1	89.811	89.811	Measured weight of SENSOR CCA with radiation sensor	
			CCA STACK TOTAL:	447.8187		
MECHANICAL						
Part Name	**Part Number**	**Quantity**	**Weight (g)**	**Total Weight (g)**	**Description**	**Manufacturer/Notes**
Mechanical Components	U1MSU_ENC	1	1230.134	1230.134	Includes all mounting hardware	Estimate based on material datasheets
			MECHANICAL TOTAL:	1230.134		
ELECTRICAL						
Part Name	**Part Number**	**Quantity**	**Weight (g)**	**Total Weight (g)**	**Description**	**Manufacturer/Notes**
Electrical Components		1	40	40	Includes all system-level electrical hardware	
			ELECTRICAL TOTAL:	40		
			PAYLOAD WEIGHT ESTIMATE:	1717.9527		

Figure 1: Payload Weight Budget

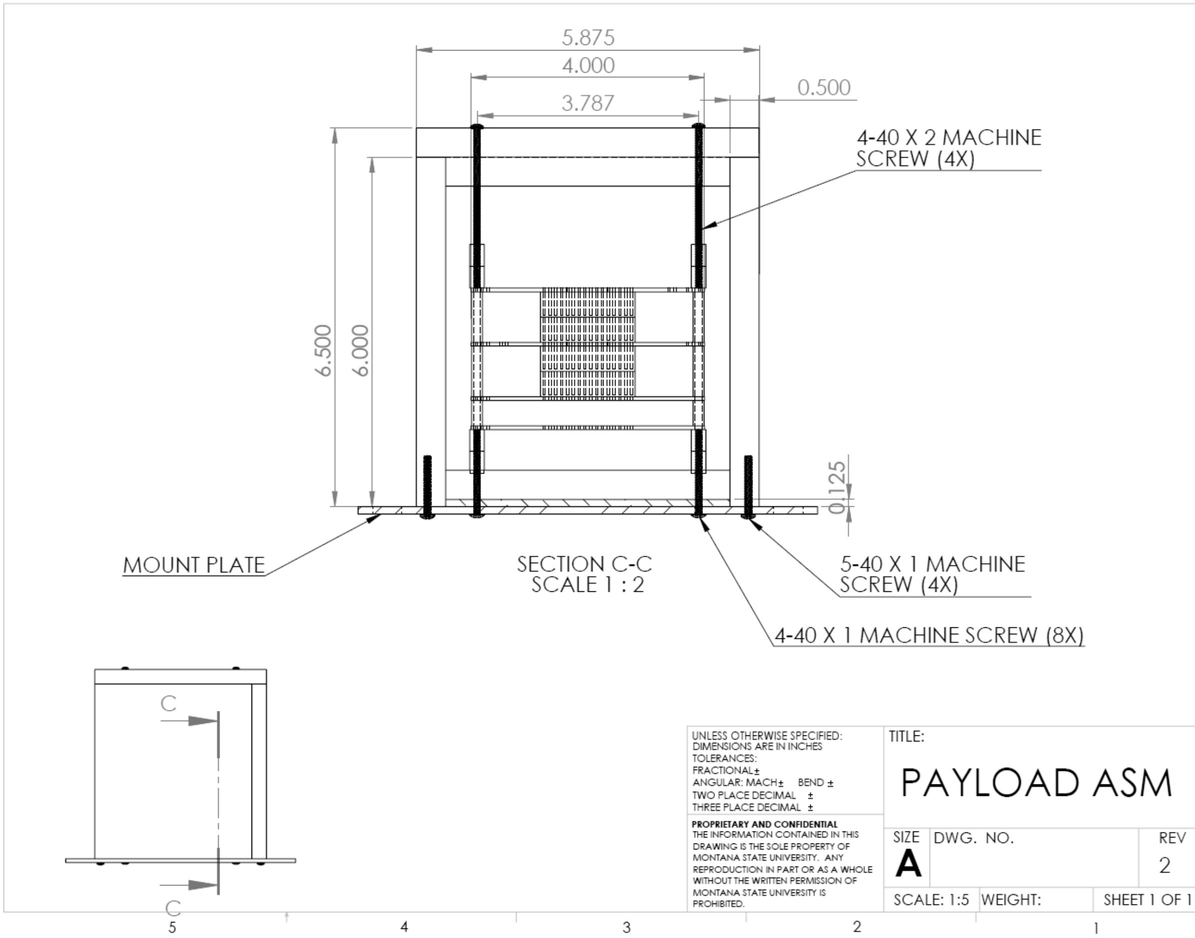

Figure 2: Payload Mechanical Drawing

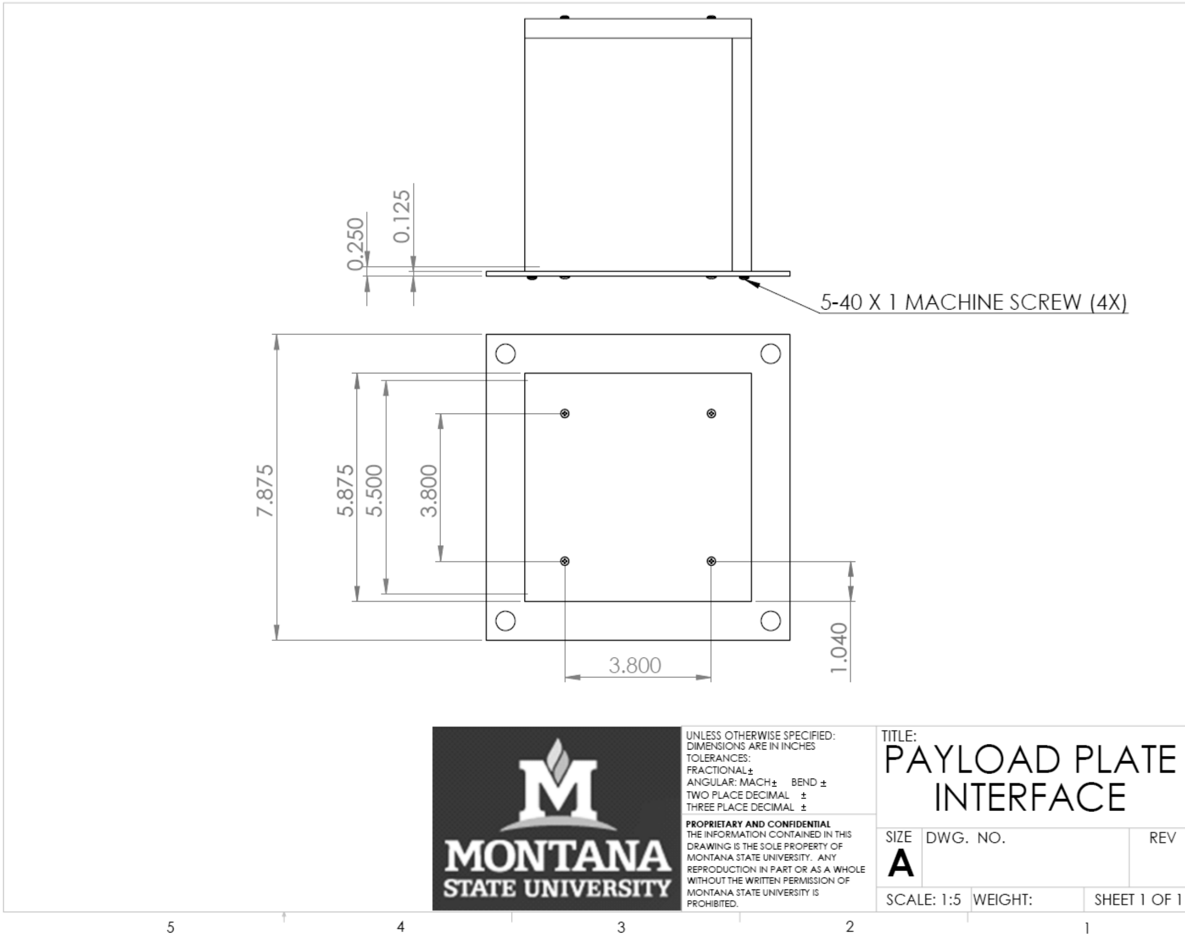

Figure 3: Payload Mounting Interface

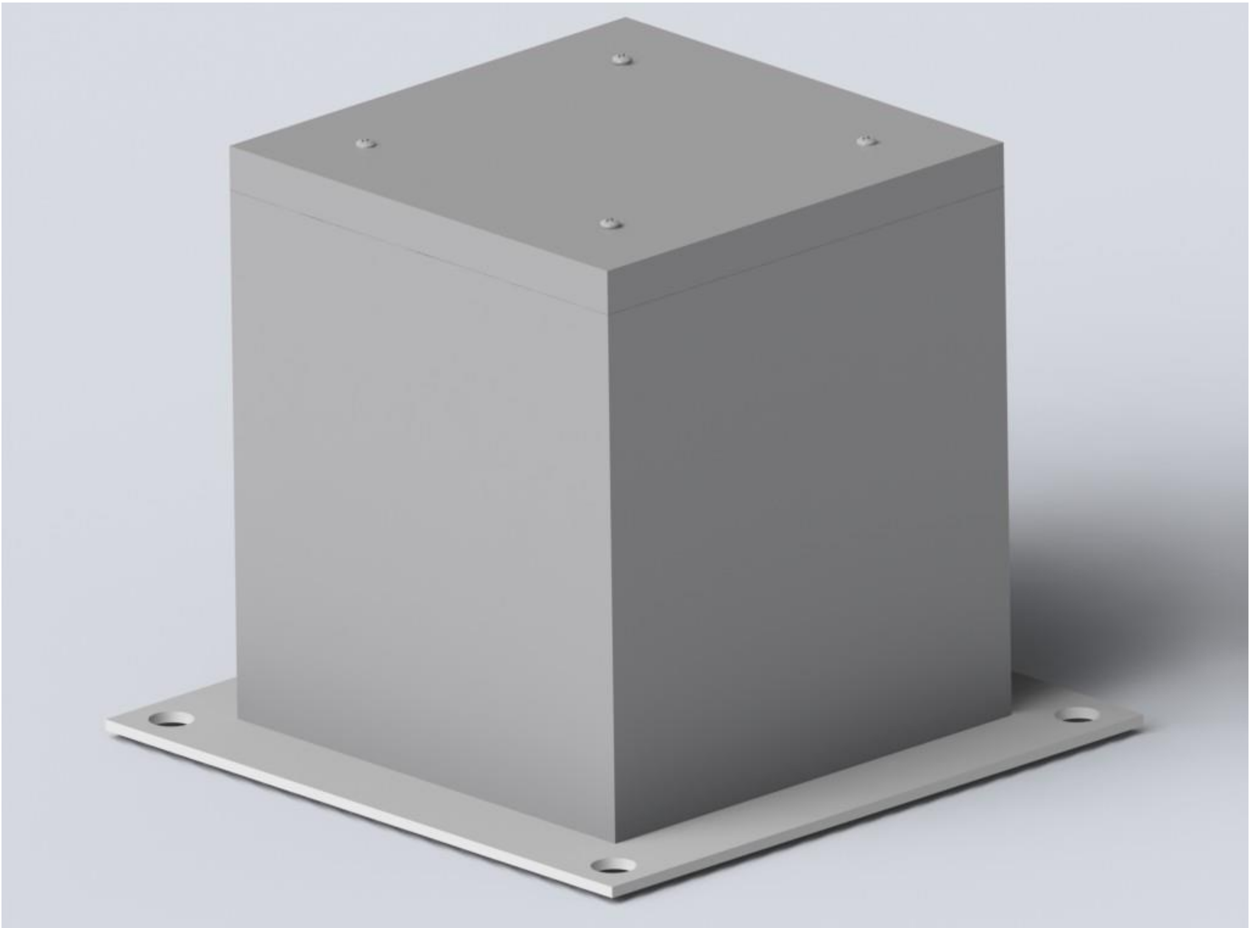

Figure 4: Complete Enclosure Rendering

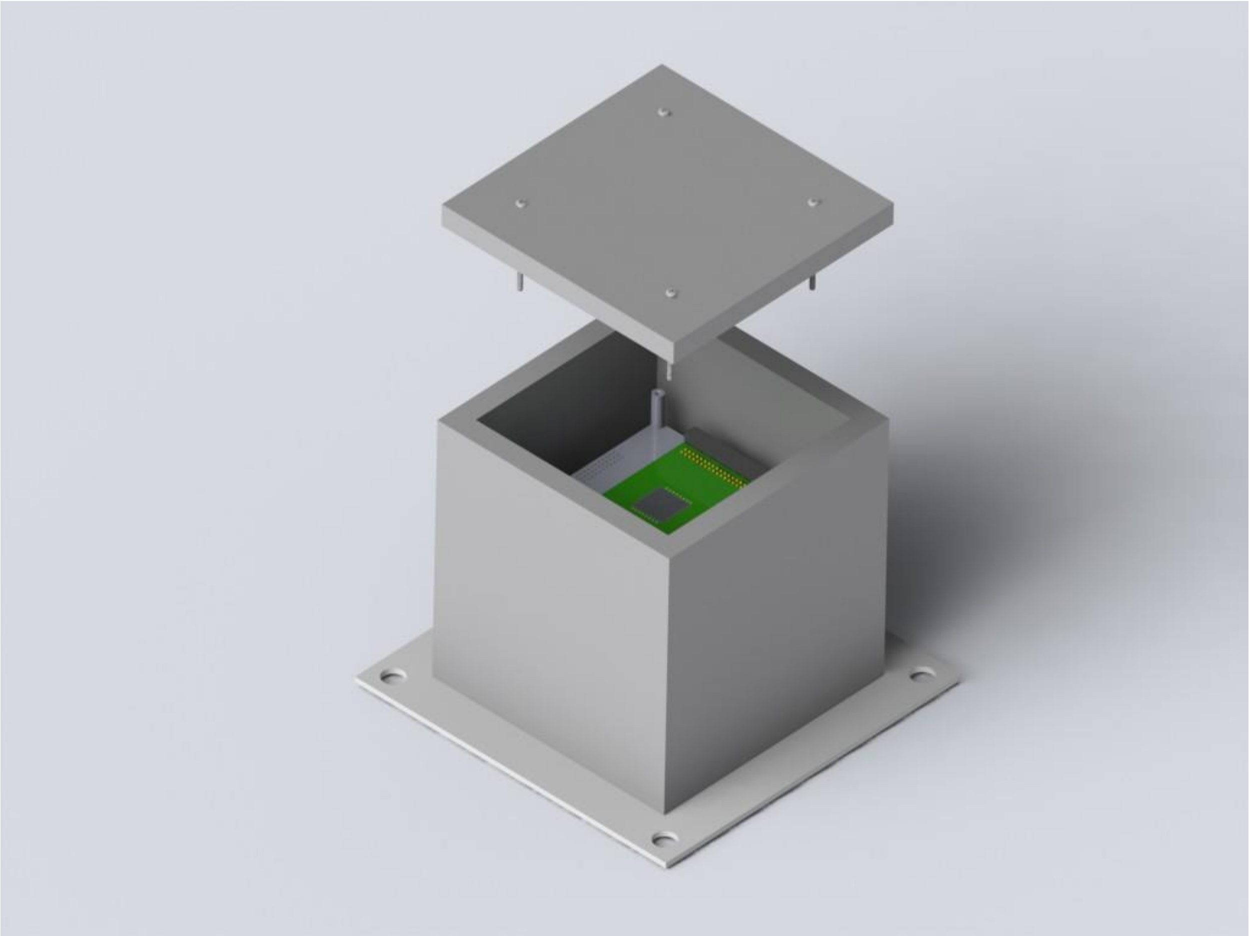

Figure 5: Payload access point

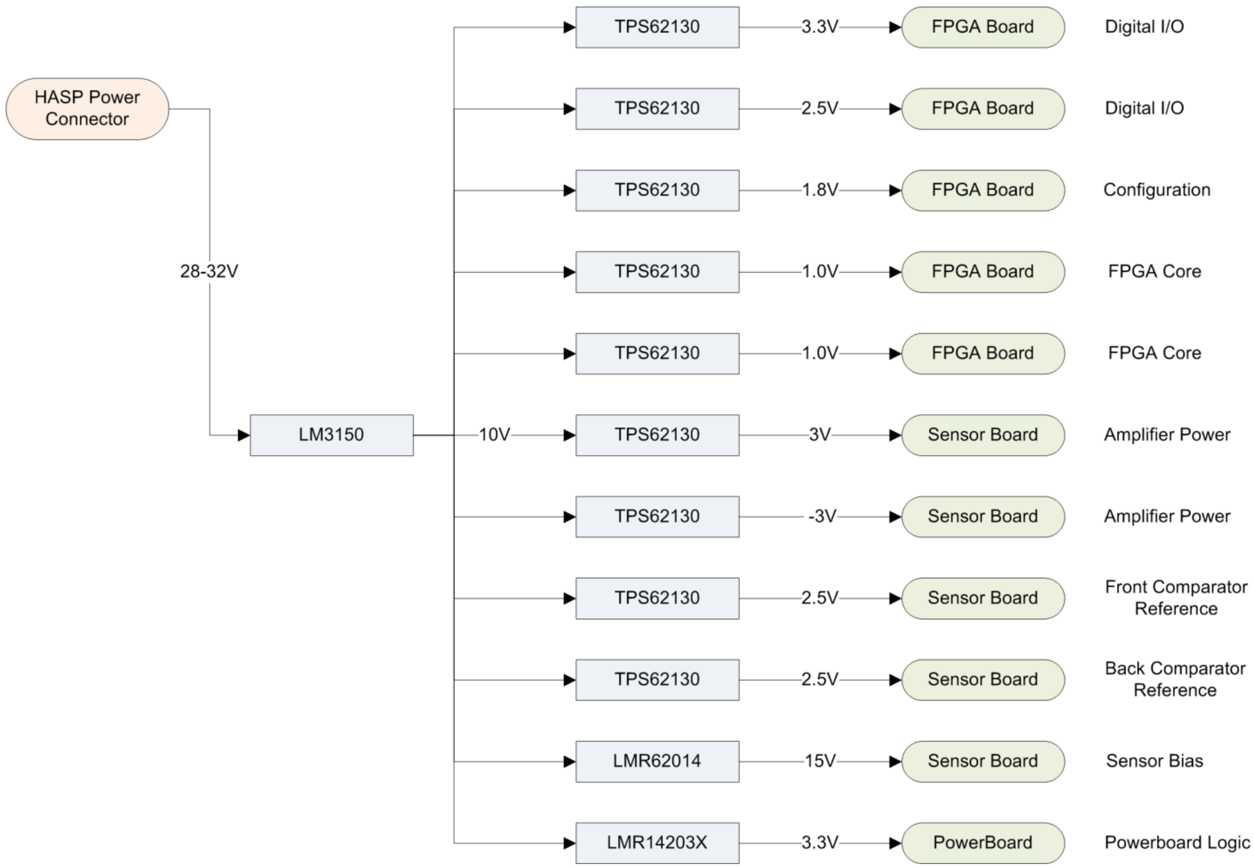

Figure 6: Payload Power Conversion Chart

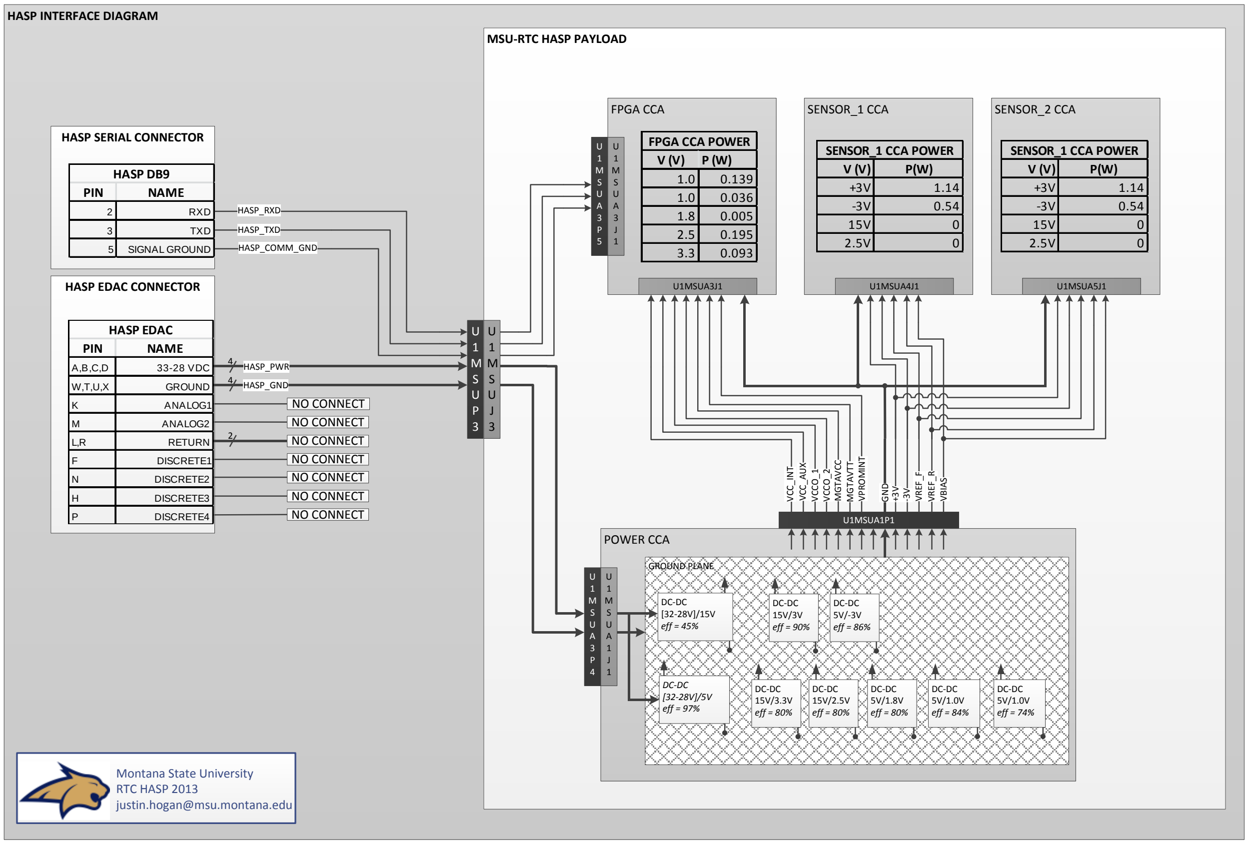

Figure 7: Payload Power Wiring Diagram

Packet Name		Packet Start	Packet Type	Length	Data [Byte Locations]					CRC	CRLF
TLM_STATUS		0xF35F	0xC001	8	TLM_ON [0-5]	START_STATUS[6-7]				CRC	0x0D0A
TLM_TIME		0xF35F	0xC002	10	TIMESTAMP[0-15]	SYS_CNT [16-23]				CRC	0x0D0A
TLM_LOCATION		0xF35F	0xC003	35	UTC_TIME[0-7]	LAT [8-16]	LON [17-26]	ALT [27-33]	FIX [34]	CRC	0x0D0A
TLM_NUM_STRIKES		0xF35F	0xC004	1152	S1_STRIKE_COUNTS[0-575]	S2_STRIKE_COUNTS [576-1151]				CRC	0x0D0A
TLM_PB_STATUS		0xF35F	0xC005	45	TEMPERATURES[0-31]	POWER_GOOD [32-44]				CRC	0x0D0A

Figure 8: Payload Telemetry Packet Description

Packet Name		Start Of Heading	Start of Text	1st Command Byte		2nd Command Byte	End Of Text	CRLF
UP_CLK_CNTS		0x01	0x02	0x1	0x0	0x00	0x03	0x0D0A
UP_ADJ_VOLT		0x01	0x02	0x2	VOLTAGE_RAIL	NEW_VOLTAGE	0x03	0x0D0A
UP_RESTART		0x01	0x02	0x3	0x0	0x00	0x03	0x0D0A
UP_RECONFIGURE		0x01	0x02	0x4	0x0	0x00	0x03	0x0D0A

Figure 9: Payload Command List