HASP Payload Specification and Integration Plan

Payload Title: FLC Ionizing Radiation vs. Solar Insolation (IRSI) Experiment

Payload Class: [✓ Small] Large (circle one)

Payload ID: 2023-04

Institution: Fort Lewis College

Contact Name: Dr. Charles Hakes

Contact Phone: (970)-749-8889

Contact E-mail: hakes_c@fortlewis.edu

Submit Date: 30 June 2023

I. Mechanical Specifications:

A. The estimated weight of the payload, not including the payload plate, is 1711 g. Each of the systems' approximate weights can be seen in Table 1. Measurements were taken from a previous HASP payload with similar systems and through SolidWorks mass properties function.

Subsystems	Mass (g)	Uncertainty (g)	Measured or Estimated
Temperature Management	81 ± 15	15	Estimated
Power Management	77 ± 12	12	Estimated
Altus Metrum TeleMega	24.98 ± 2	2	Measured
Mobius Camera	48.4 ± 0.1	0.1	Measured
Fiberglass Structure	746.4 ± 40	40	Measured
IRSI Experiment	410.84 ± 20	20	Estimated
Misc (hardware, etc.)	300 ± 50	50	Estimated
Total Mass	**1689± 139.1**	**139.1**	

Table 1: Weight of each of the sub-systems. Some measurements were taken from a previous HASP payload with similar systems.

B. Mechanical Drawings and Description

The complete payload utilizes two distinct parts—a sled and an outer case. Both are composed of G10 fiberglass which is generally used in rocketry. The sled holds all electrical components perpendicular to the mounting plate, as seen in Figure 1. The sled consists of two 10x5x1/8-inch-thick fiberglass sheets of which all the components are mounted via screws or standoffs. A pair of ¼-inch rods are threaded through two separate U-shaped rectangular brackets placed in between the sheets. The sheets are screwed into brackets, which are attached to the mounting plate via nuts. The outer case is a rectangular case made of a thinner 1/16-inch fiberglass and held together with 1-inch L-brackets and bolts. The outer case uses the threaded rods from the top of the sled and corner brackets on the bottom of the case to attach to the mounting plate.

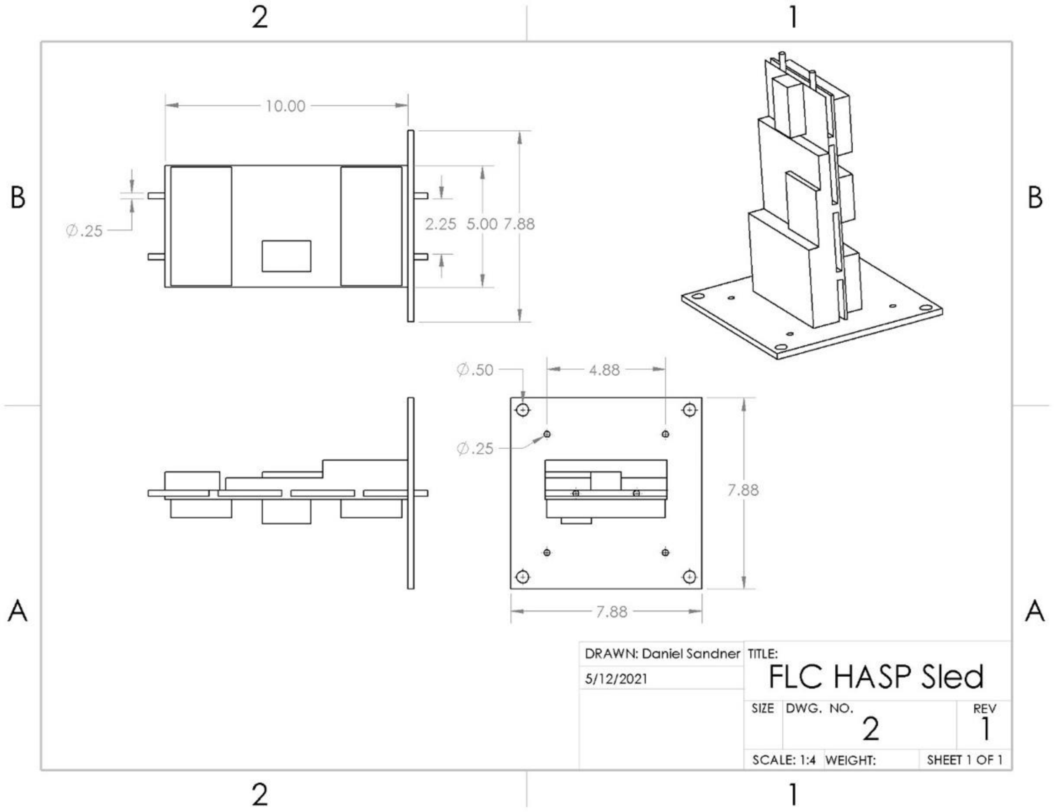


Figure 1: Sled design with dimensions in inches.

For clear radiation readings, there is a rectangular hole in both the top sheet of the case and in the mounting plate to expose the Geiger Counters to radiation (the size of these rectangular holes might change for optimizing). A complete assembly of the payload can be seen in Figure 2, and the rectangular design maximizes the payload's usable volume within the confines of the mounting plate dimension.

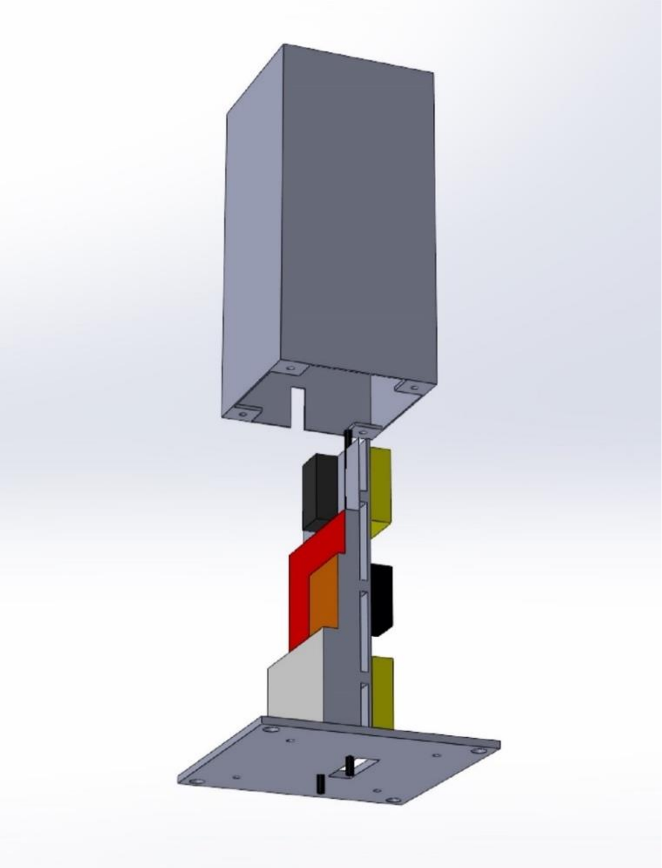


Figure 2: Sled fiberglass cover, with a width of 14 cm (5.51 in) and a height of 29.2 cm (11.5 in) and the sled that has a width of 13.2 cm (5.2 in) and a height of 28.9 cm (11.4 in).

The layout of the electrical components on both sides of the sled are as shown in Figure 3. The sled and case are designed to be slightly smaller than the maximum specified volume of 6x6x12 inches to accommodate any hardware, such as temperature sensors or a camera lens, that may protrude from the outer case.

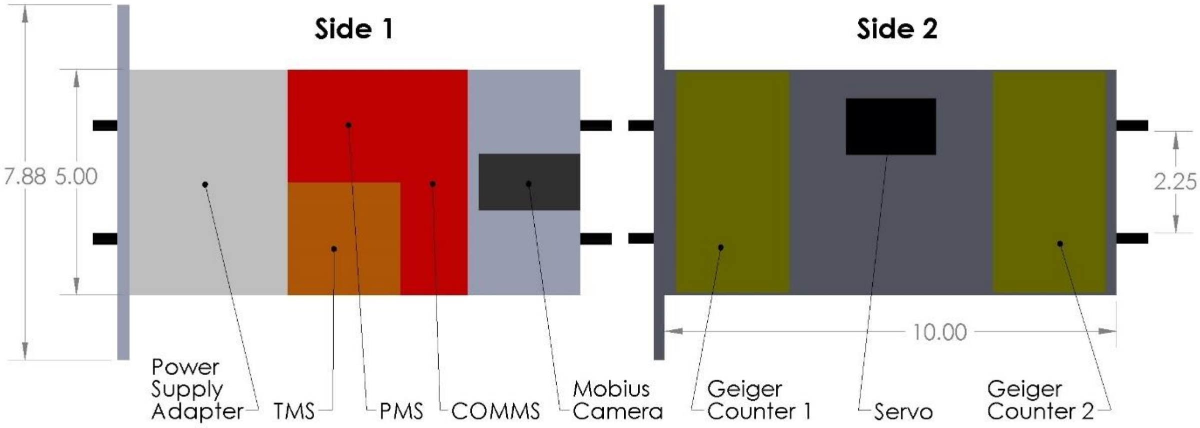


Figure 3: Sled component layout, all dimensions are in inches.

A rectangular box made of fiberglass and reinforced at the corners with rocket epoxy and resin protected subsystems as shown in Figure 4. The box slides over the sleds and secures to the platform with a steel L-bracket and a hole in each corner. A lid covers the opening at the top of the box and is secured with steel nuts.

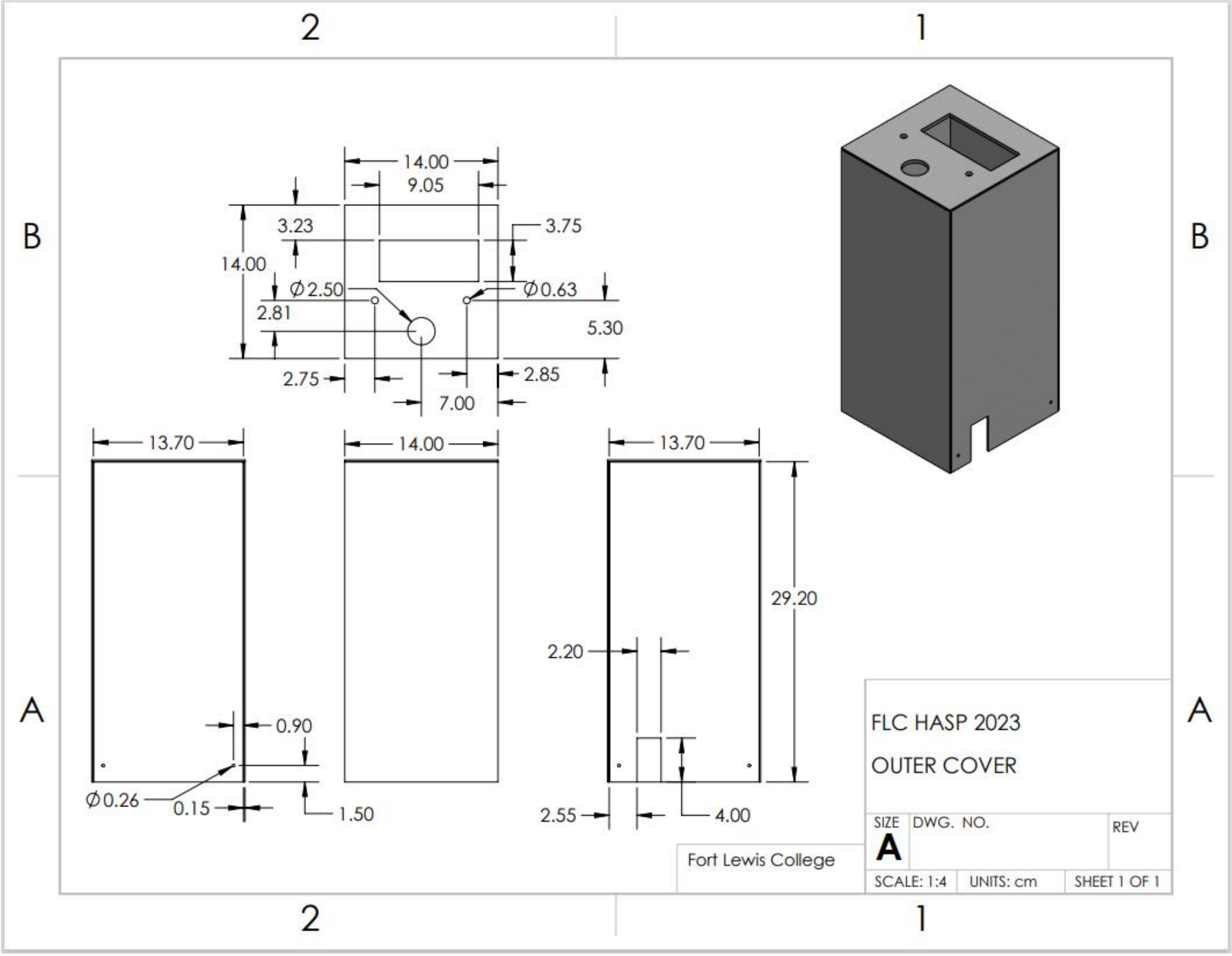


Figure 4: Outer Cover with Mounting Holes, Geiger Slot, and Camera Slot (All dimensions are in cm).

The two fiberglass plates that house the power supply and excess wiring are shown in Figure 5. There are standoffs placed between the fiberglass plates that allow two 12-inch ¼-20 threaded rods to go through them. The two 12-inch steel rods are threaded through the platform, the standoffs, and the fiberglass cover.

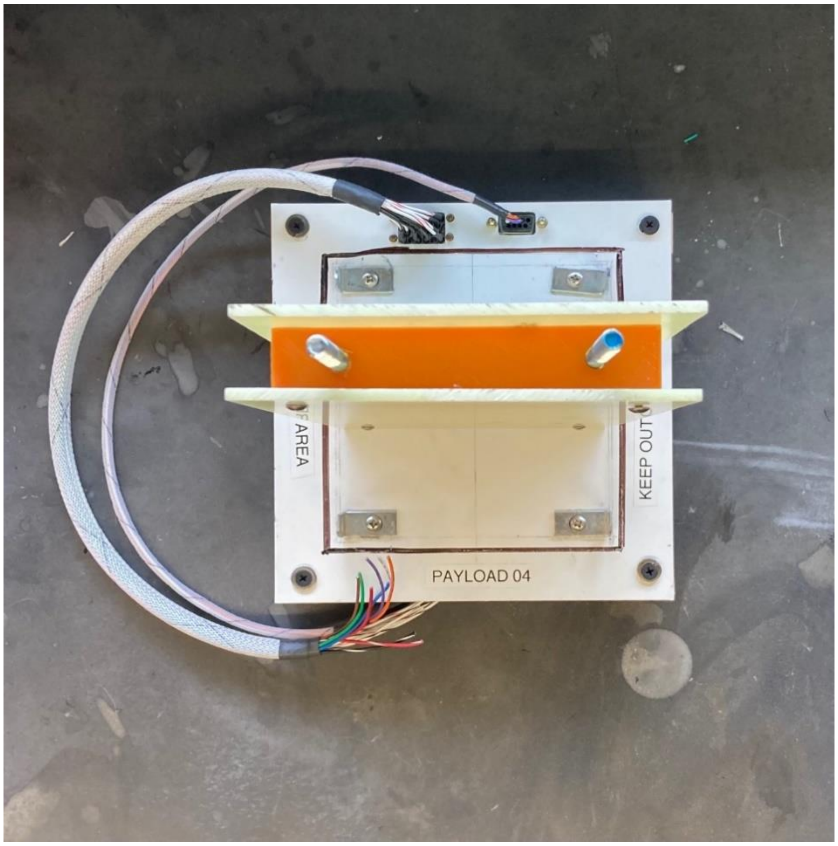


Figure 5: Top View of the sled attached to the platform. Two 12-inch steel threaded rods attach the sled to the platform.

The cover will slide into place around the sled as seen in Figure 6. The cover is within the specified boundaries detailed by the black lines. A lid covers the top and has been cut to allow the Geiger counters to be exposed to radiation.

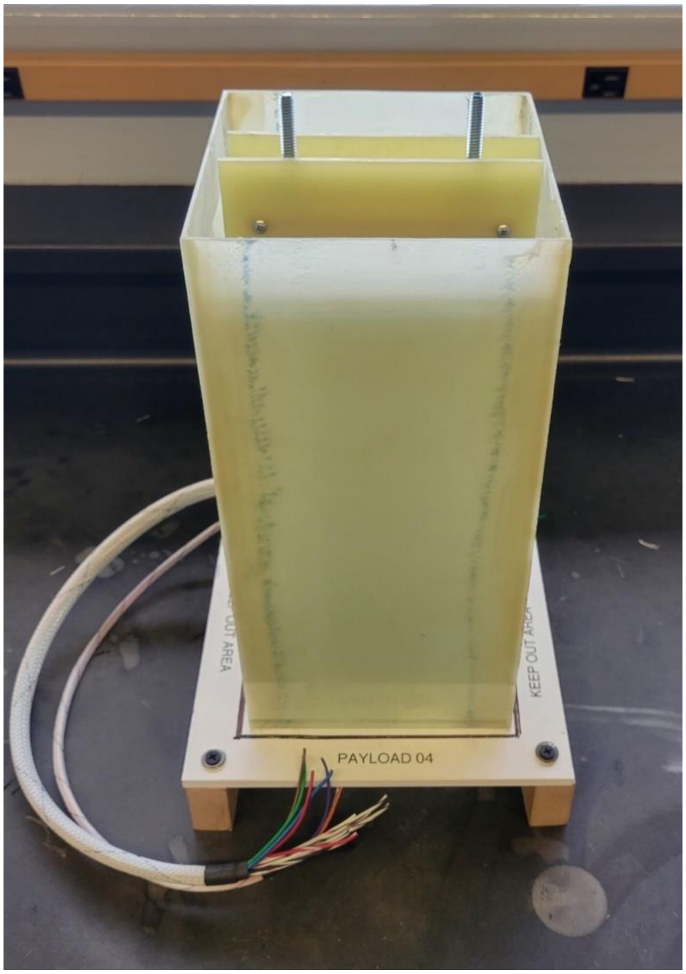


Figure 6: Both cover and sled of the payload on HASP platform.

The location of each subsystem mounted onto the sled is yet to be finalized. However, one side of the sled is occupied by the Geiger subsystem, and the mounting plate on the opposite side houses the PMS subsystem. The exact orientation of the Geiger systems and means of its operation are still being tested to establish optimal data collection.

The radiation detectors use a Geiger-Muller tube to detect ionizing radiation. The model used was a SparkFun Geiger counter seen in Figure 7. The inert gas within the Geiger-Muller tube reacts with particles that enter through a window (shown on the right side of the tube in Figure 7) to generate an electrical pulse. This electrical pulse triggers a buzzer and blinks an LED light when the pulse is detected.

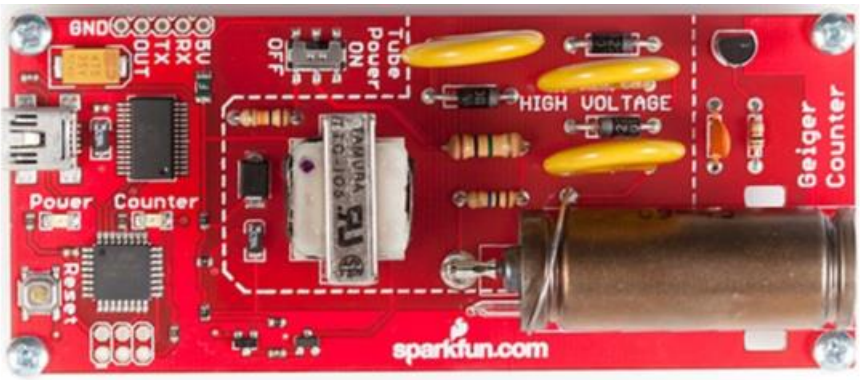


Figure 7: The SEN-10742 Geiger Counter.

Two Geiger Counters are placed in a separate brass case that can block alpha and beta radiation (shown in Figure 8). The Geiger Counters are configured so that one is facing up and the other is facing down. Each brass case has a gate that opens and closes every thirty seconds. A servo motor is utilized to open the gates. The purpose of the gates is to expose the Geiger counters to radiation and differentiate gamma radiation from alpha and beta (shown in Figure 9).

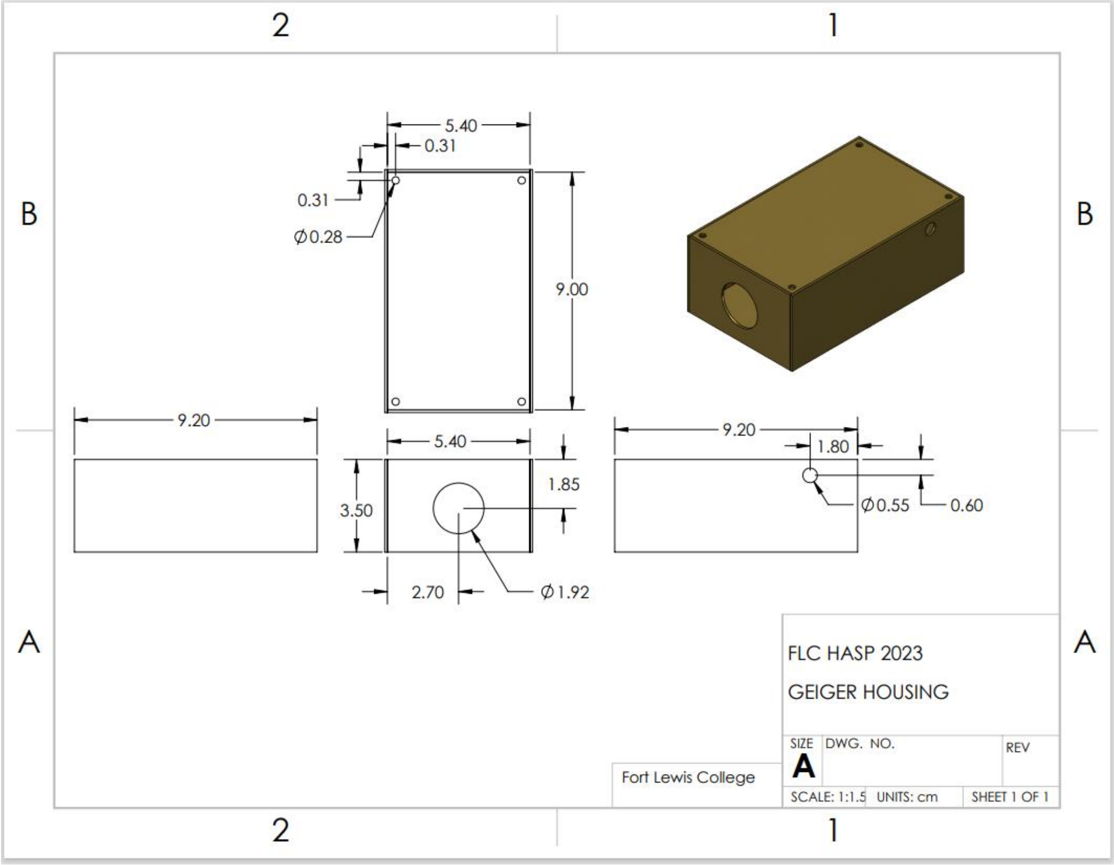


Figure 8: SolidWorks drawing of one of the two Geiger Housings.

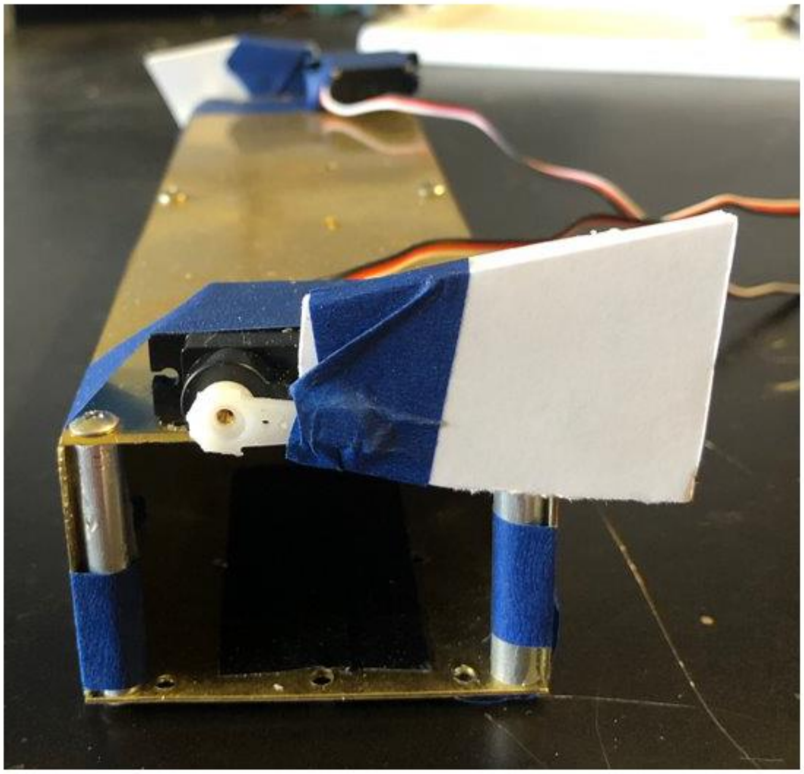


Figure 9: Prototype of brass housing and servo motor for the Geiger counters.

II. Power Specifications:

A. Measured maximum current draw at 28 VDC is 519 mA.

Table 2 below demonstrates the subsystem’s voltages and their individual measured current draws. The LM2596 DC/DC converters have an effective efficiency of 92% when all systems are operating simultaneously. The entire payload draws an effective 519 mA from the 28V HASP power supply.

Table 2. Payload Power Usages.

Subsystem	Max Recorded Draw (mA)	Voltage (V)	Power Draw (mW)	Effective Draw @28V (mA):
Altus Metrum TeleGPS	190	3.7	703	25.1 ± 10
Comms	80	3.7	296	10.6 ± 10
TMS	910	7.4	6734	240.5 ± 10
PMS	20	7.4	148	5.3 ± 10
Geiger Counters	150	7.4	1110	39.6 ± 10
Mobius Camera	330	7.4	2442	87.2 ± 10
DC-DC Conv.	10	30	300	10.7 ± 10
Buffer				100
		Total:	11733	519 ± 26

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 10 displays the power management system diagram. Power supplied by the HASP 20 EDAC connectors is wired directly to two LM3596 DC/DC converters. The supplied 30V is converted to 7.4V and 3.7V power using a DC-DC LM2596 converter which runs directly to the power management system (PMS). Each of the subsystem’s currents are recorded by the PMS to an SD card and downlink (COMMS). The PMS provided the Mobius camera, Geiger counters, TMS, and COMMS with 7.4V. The altimeter, GPS, and 9DoF were supplied 3.7V from the PMS. Power provided by HASP will go to the PMS, which provided LED indication, and recorded using INA169 DC current sensors for the subsystems. The current data from each payload is recorded from the Arduino Pro Mini to a microSD every second and sent via serial to the HASP telemetry.

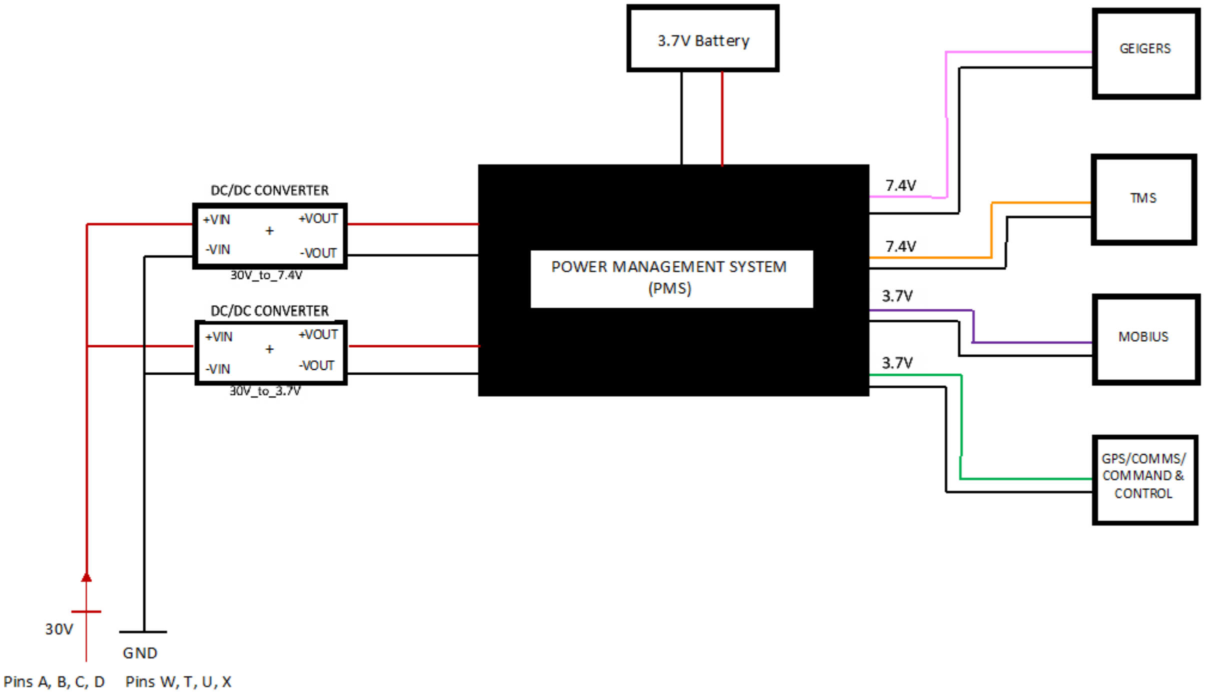


Figure 10: Power Management System Block Diagram.

Figure 11 displays the internal block diagram of the PMS. Power provided by HASP connects to an optical relay system. The optical relay system is controlled by an Arduino pro mini that allows the PMS to enable/disable payload subsystems individually. All currents are measured by INA169 current sensors. The fuses are in line with the current sensors to disable a payload subsystem if it draws too much current. All data is saved to a microSD card. The system illustrated in Figure 10 is repeated for each of the six different current sensors. Each current sensor range is calibrated by resistors.

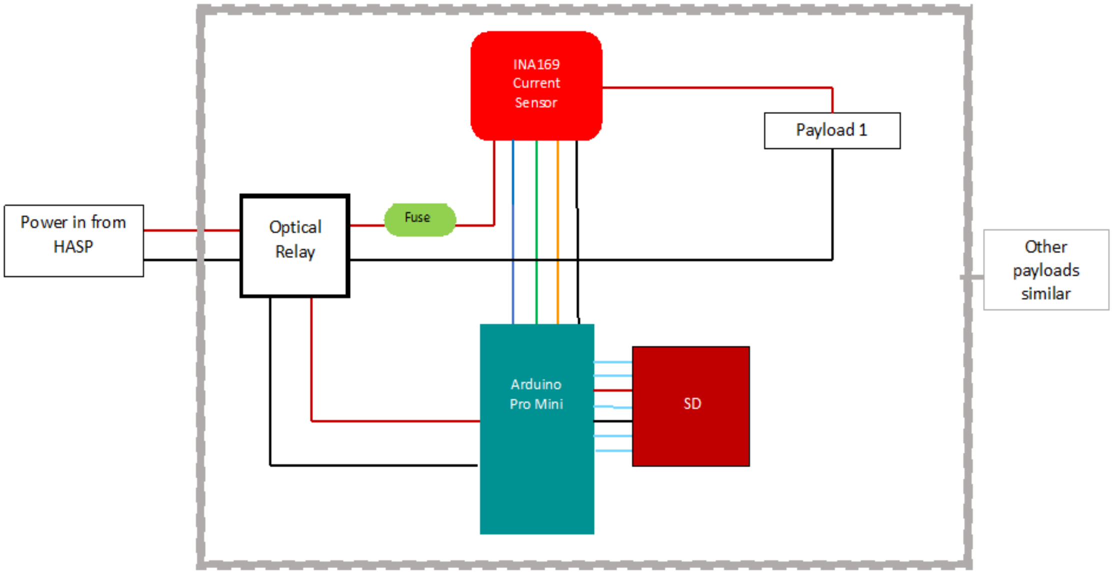


Figure 11: Internal block diagram of the PMS.

III. Downlink Telemetry Specifications:

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

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

The Comms system is designed to regularly downlink an information string of no more than 68 bytes in length on a two-second cycle, for a maximum downlink rate of 544 bps.

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

The information delivered by downlink is a cycling report of subsystem information. This record is printed to the serial communications line by the Comms subsystem as an ASCII string once every 2 seconds, with no more than 68 characters length, and will terminate with a newline character. The Comms subsystem cycles through the four primary information subsystems, and each subsystem has a thirty-second delay in reporting. These commands are based on the Fort Lewis College 2021 HASP payload. The Format seen in the packets below shows the number of digits represented by ‘X’s and additional characters transmitted during each command for each packet.

Packet 1: This packet is only sent on power up.

Downlink Data Transmission- readable ASCII format				
ASCII String Length (Bytes)	Starting Byte Number	Name- Excel Header	Description	Format
49	0		The serial communication has begun and is connecting to the TeleMega.	XXXXXX XX XXXXXX XXXXXXXX XXXXXXXXXX XX XXXXXXXX.
Total	49 Bytes			

Packet 2: This is the data packet for the IRSI.

Downlink Data Transmission- readable ASCII format				
ASCII String Length (Bytes)	Starting Byte Number	Name- Excel Header	Description	Format
4	0	Header	Name of the subsystem that the data is being pulled from.	RSI:
1	4		Comma used for import into Excel.	,
9	5	Time	The time the down link was transmitted.	XX:XX:XX,
5	24	Geiger 1	Record pulse output	XXXX,
5	29	Geiger 2	Record pulse output	XXXX,
5	34	Geiger 3	Record pulse output	XXXX,

5	39	Geiger 4	Record pulse output	XXXX,
			Comma used for import into Excel.	,,,,,,,,,,,,,,,,,
Total Bytes				

Packet 3: This is the data packet for the temperature management system.

Downlink Data Transmission- readable ASCII format				
ASCII String Length (Bytes)	Starting Byte Number	Name- Excel Header	Description	Format
4	0	Header	Name of the subsystem that the data is being pulled from.	TMS:
1	4		Comma used for import into Excel.	,
9	5	Time	The time the down link was transmitted.	XX:XX:XX,
7	14	TemperatureC1	The calculated temperature for probe C1.	±XX.XX,
5	21		Comma used for import into Excel.	,,,,,
7	26	TemperatureC2	The calculated temperature for probe C2.	±XX.XX,
7	33	TemperatureC3	The calculated temperature for probe C3.	±XX.XX,

7	40	TemperatureC4	The calculated temperature for probe C4.	±XX.XX,
7	47	TemperatureC5	The calculated temperature for probe C5.	±XX.XX,
7	54	TemperatureC6	The calculated temperature for probe C6.	±XX.XX,
10	61		Comma used for import into Excel.	,,,,,,,,,,
Total Bytes	71			

Packet 4: This is the data packet for the power management system.

Downlink Data Transmission- readable ASCII format				
ASCII String Length (Bytes)	Starting Byte Number	Name- Excel Header	Description	Format
4	0	Header	Name of the subsystem that the data is being pulled from.	PMS:
1	4		Comma used for import into Excel.	,
9	5	Time	The time the down link was transmitted.	XX:XX:XX,
11	14		Comma used for import into Excel.	,,,,,,,,,,,
5	25	Comms	The calculated current for the coms.	X.XX,

5	35	RAT	The calculated current for the RAT.	X.XX,
5	40	PMS	The calculated current for the PMS.	X.XX,
5	45	TMS	The calculated current for the TMS.	X.XX,
5	50	MoCam	The calculated current for the camera system.	X.XX,
4	55		Commas used for importing into Excel.	,,,,
Total bytes	59			

Packets 5-19: This is a table showing all possible data packets that confirm that the proper command has been received by the communication system. Each row represents a single data packet sent for each command received.

ASCII String Length (Bytes)	Starting Byte Number	Name- Excel Header	Description	Format
29	0		Confirmation that the proper command has been received by the comms system.	Command A0 has been received.
29	0		Confirmation that the proper command has been received by the comms system.	Command A1 has been received.

29	0		Confirmation that the proper command has been received by the comms system.	Command B0 has been received.
29	0		Confirmation that the proper command has been received by the comms system.	Command B1 has been received.
29	0		Confirmation that the proper command has been received by the comms system.	Command C0 has been received.
29	0		Confirmation that the proper command has been received by the comms system.	Command C1 has been received.
29	0		Confirmation that the proper command has been received by the comms system.	Command D0 has been received.
29	0		Confirmation that the proper command has been received by the comms system.	Command D1 has been received.

29	0		Confirmation that the proper command has been received by the comms system.	Command D2 has been received.
29	0		Confirmation that the proper command has been received by the comms system.	Command E0 has been received.
29	0		Confirmation that the proper command has been received by the comms system.	Command E1 has been received.
29	0		Confirmation that the proper command has been received by the comms system.	Command E2 has been received.
29	0		Confirmation that the proper command has been received by the comms system.	Command E3 has been received.
29	0		Confirmation that the proper command has been received by the comms system.	Command E4 has been received.

29	0		Confirmation that the proper command has been received by the comms system.	Command F3 has been received.
Total per Packet	52			

Example:

```
“Serial is begun. Starting connection to TeleMega.
ALT: ,0.00,0.00,0.00,0.00,0.00,0.00,0.00,,,,,,,,,,,,,,,,,
TMS: ,1.00,,,,,,0.00,0.00,0.00,0.00,0.00,0.00,,,,,,,,,,,
PMS: ,2.00,,,,,,,,,,,,0.00,0.00,0.00,0.00,0.00,0.00,,,,,
ALT: ,3.00,,,,,,,,,,,,,,,,,,0.00,0.00,0.00,0.00,0.00
GMD: ,4.00,0.00,0.00,0.00,0.00,0.00,0.00,,,,,,,,,,,,,,,,,
TMS: ,5.00,,,,,,0.00,0.00,0.00,0.00,0.00,0.00,,,,,,,,,,,
PMS: ,6.01,,,,,,,,,,,,0.02,0.02,0.09,0.02,0.01,0.00,,,,,
ALT: ,7.01,,,,,,,,,,,,,,,,,,0.00,0.00,0.00,0.00,0.00
Comms System connected to TeleMega (4366) Flight #1
Command Received: A0
Action Taken: Sent A0 to PMS”
```

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?

N/A

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

The payload has an Altus Metrum TeleMega v4.0 transmitter that broadcasts information upon receiving power. The TeleMega has a GPS that uses a 70cm ham-band TI CC1200 high performance RF transceiver for telemetry. The TeleMega also contains a u-blox MAX-8Q GPS receiver which uses a TaoGlas passive patch antenna and an async serial interface. According to the Altus Metrum System manual, the transmitter has a frequency of 435.250MHz and transmits at 40mW (KE0NCG). The antenna is a simple quarter wave vertically oriented wire

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*)

We expect to uplink fewer than 32 commands during the flight.

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

Command Name	Command Code (ASCII)		Hexadecimal ASCII		Decimal		Binary		Description
TMS heaters On	A	1	0x41	0x31	65	49	01000001	00110001	TMS will turn on heaters.
TMS heaters Off	A	0	0x41	0x30	65	48	01000001	00110000	TMS will turn off heaters.
MoCam Active	B	1	0x42	0x31	66	49	01000010	00110001	Switch MoCam to active recording.
MoCam Passive	B	0	0x42	0x30	66	48	01000010	00110000	Switch MoCam to passive recording.
TMS Primary	C	1	0x43	0x31	67	49	01000011	00110001	Turn TMS heaters on.
TMS Alternate	C	0	0x43	0x30	67	48	01000011	00110000	Turn TMS heaters off.
ALL PWR DN	D	0	0x44	0x30	68	48	01000100	00110000	Power down everything nicely.
ALL PWR DN*	D	1	0x44	0x31	68	49	01000100	00110001	Power down all but MoCam.
All PWR UP	D	2	0x44	0x32	68	50	01000100	00110010	Reverse either of the PWR DN (D0 or D1) commands.
IRSI on	E	0	0x45	0x30	70	48	01000110	00110000	Turn RAT experiment on.
IRSI off	E	1	0x45	0x31	70	49	01000110	00110001	Turn RAT experiment off.
IRSI Door Open	E	2	0x45	0x32	70	50	01000110	01000110	Open servo door.

IRSI Door Closed	E	3	0x45	0x33	70	51	01000110	01000111	Close the servo door.
IRSI Toggle Mode	E	4	0x45	0x34	70	52	01000110	01001000	Initiate Toggle Mode.

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 plan to arrive on the first day of integration on July 24th at 9 am.

B. Approximate amount of time required for integration:

We approximate 5 hours of payload time outside the thermal / vacuum test chamber are needed for a full systems checkout; this includes testing the commands which can be seen in the table of part D, section IV, mentioned above. After this checkout, we estimate that 15 minutes will be required for the pre-integration checks (5 minutes for mechanical checks, and 10 minutes for power and uplink/downlink checks).

For proper integration, we estimate that 45 min will be required as detailed:

1. 10 minutes for mechanical/electrical connection to the platform
2. 20 minutes to verify proper payload operation:
    a. 5 minutes to close power supply circuit / verify payload ON.
    b. 5 minutes to analyze downlink / verify appropriate critical subsystem function.
    c. 10 minutes to cycle all uplink commands / verify appropriate behavior.
3. 15 minutes for administrative functions.

C. Name of the integration team leader: Ismael Hernandez

D. Email address of the integration team leader: imhernandez@fortlewis.edu

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

F.

Participants:	Contact Information:
Ismael Hernandez	imhernandez@fortlewis.edu
Simone Gorman	sbgorman@fortlewis.edu
Jerry Jack Jr.	jjack1@fortlewis.edu
Brandon Engle	bengle@fortlewis.edu
Miles Johnson	majohnson@fortlewis.edu
Charles Hakes	hakes_c@fortlewis.edu

G. Define a successful integration of your payload:

- i. The payload has no difficulty mounting to the HASP platform or provided electrical and data connections.
- ii. All subsystems (Geiger Counters, GPS, MoCam, PMS, TMS, and Comms) begin functioning as designed upon first power cycle.
- iii. The Comms system downlinks appropriate data and receives uplinked commands.
- iv. The Mobius camera, TMS, Geiger, and GPS can be disabled and enabled by serial command.
- v. All systems and components remain securely attached to the structure and function as designed throughout thermal / vacuum testing.

H. List all expected integration steps:

- i. Initialize microSD cards and install them into proper subsystems.
- ii. Secure subsystems on sled, insert sled into housing and align each subsystem.
- iii. Mount payload to HASP platform/Close power supply circuit.
- iv. Check for Comms serial downlink/analyze for proper power activity/LED Indicator display.
- v. Send all commands through uplink to verify uplink. Analyze LED Indicator display for successful command execution.
- vi. Unmount payload/access payload data (subsystem microSD cards).
- vii. Analyze integrity of recorded payload data for all systems.
- viii. Check Mobius data to ensure camera records in correct time intervals.

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

1. Geiger Counters
    - a. Initializes reliably during HASP Integration without requiring any intervention.
    - b. Begins recording the high energy Gamma and Beta rays at proper recording intervals.
2. Mobius Camera
    - a. Initializes reliably during HASP Integration without requiring any intervention.
    - b. Begins recording usable video feed after initialization at proper recording intervals.

3. TMS
    a. Initializes reliably during HASP Integration without requiring any intervention.
    b. Begins recording accurate system temperature data after initialization, standing by to heat as necessary.
4. PMS
    a. Initializes reliably during HASP Integration without requiring any intervention.
    b. Begins monitoring all subsystem power usage data when HASP power supply circuit is closed.
5. Comms
    a. Initializes reliably during HASP Integration without requiring any intervention.
    b. Successfully establishes serial communication, including initializing data downlink and demonstrating successful command uplink.

J. 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…):

None

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

None

VI. Hazards

Identified payload hazards include high voltage in the Geiger Tube. The high voltage (approximately 450V at less than 1 micro-amp) is internal to the Geiger systems which are enclosed in the brass shielded box that acts as a Faraday cage.

High Voltage in Geiger Counters

Manufacture Model	N/A –
Part Number	based on Sparkfun SEN-10742 Geiger Counter
Location of Voltage Source	inside brass enclosure
Fully Enclosed (Yes/No)	Yes
Is High Voltage source Potted?	No
Output Voltage	~450V
Power (W)	<~1 mW
Peak Current (A)	<~1 µA
Run Current (A)	<~1 µA

RF Transmission

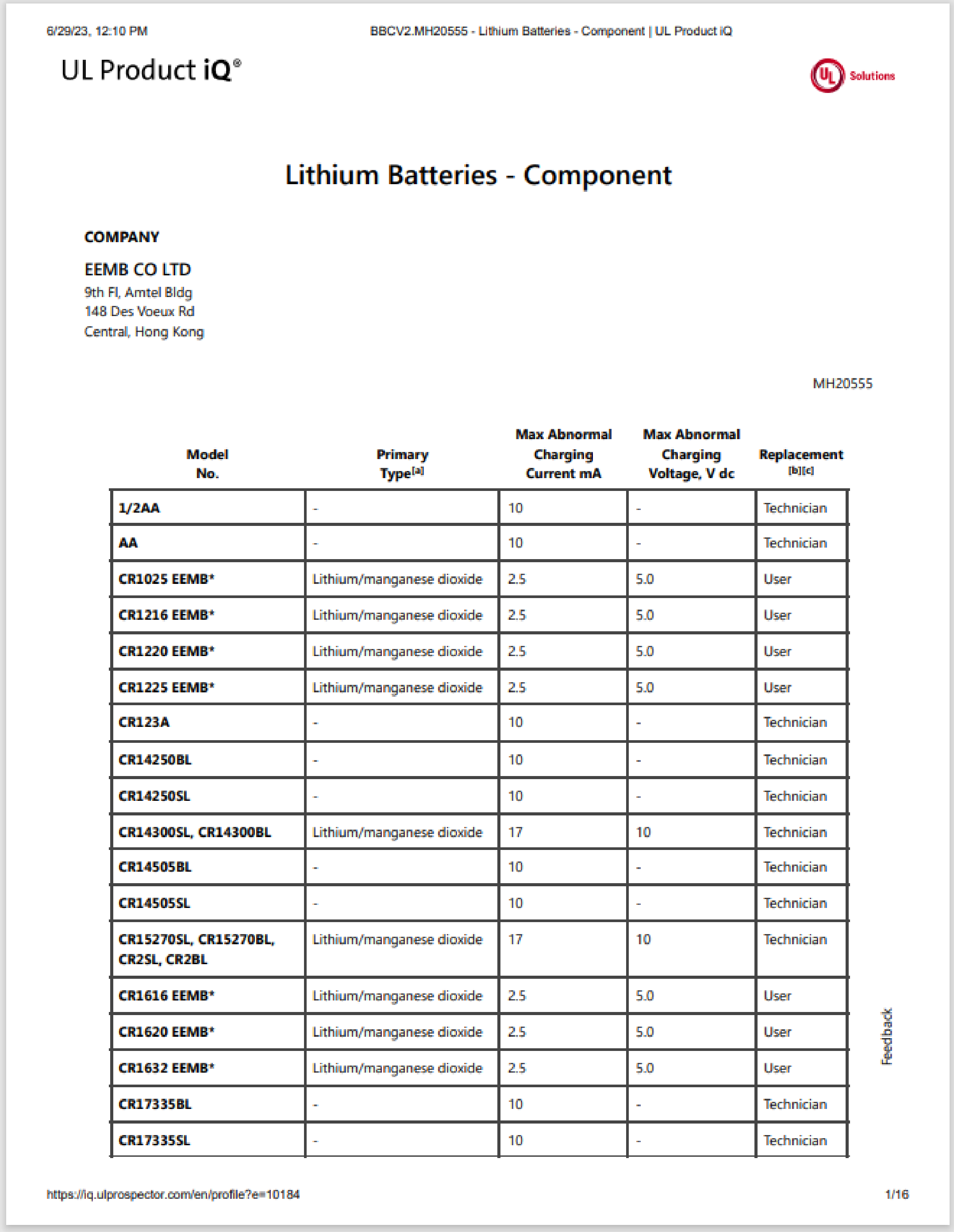
HASP 2022 RF System Documentation	
Manufacture Model	Altus Metrum
Part Number	TeleMega v4.0
Ground or Flight Transmitter	Flight
Type of Emission	RF
Transmit Frequency (MHz)	435.250
Receive Frequency (MHz)	N/A
Antenna Type	17 cm whip antenna (quarter wave)
Gain (dBi)	5.19 (ideal 1/4 wave with ground plane)
Peak Radiated Power (Watts)	0.04
Average Radiated Power (Watts)	0.04

Non-rechargeable Lithium Thionyl Chloride batteries will be used on the payload

HASP 2023 Battery Hazard Documentation	
Battery Manufacturer	EEMB
Battery Type	ER14505-Bobbin
Chemical Makeup	Lithium Thionyl Chloride (Li-SoCL2)
Battery modifications	None

UL Certification for Li-Ion	BBCV2.MH20555
SDS from manufacturer	https://jm.pl/gfx-base/s_1/orgs/18/MSDS-Li-SOCL2-EEMB.pdf
Product information sheet from manufacturer	https://oss.eemb.com//uploads/20230301/5eec27b19b2edb95715d8ebe3f056d02.pdf

A. UL Certification for Li-SoCL2 batteries. Only the first three pages of the UL certification will be shown since there are 16 pages in total.



6/29/23, 12:10 PM BBCV2.MH20555 - Lithium Batteries - Component | UL Product iQ

UL Product iQ®

UL Solutions

Lithium Batteries - Component

COMPANY

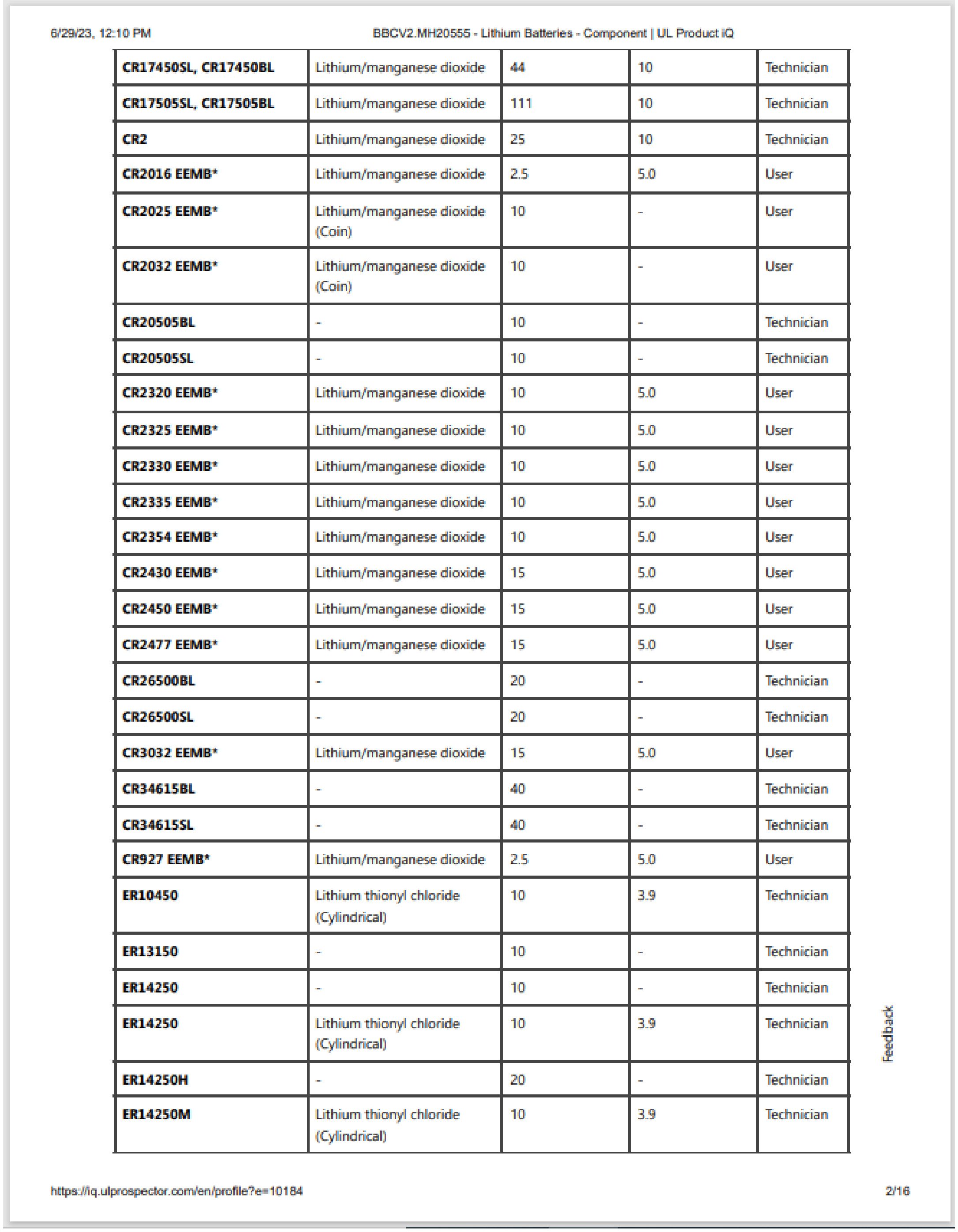
EEMB CO LTD
9th Fl, Amtel Bldg
148 Des Voeux Rd
Central, Hong Kong

MH20555

Model No.	Primary Type[a]	Max Abnormal Charging Current mA	Max Abnormal Charging Voltage, V dc	Replacement [b][c]
1/2AA	-	10	-	Technician
AA	-	10	-	Technician
CR1025 EEMB*	Lithium/manganese dioxide	2.5	5.0	User
CR1216 EEMB*	Lithium/manganese dioxide	2.5	5.0	User
CR1220 EEMB*	Lithium/manganese dioxide	2.5	5.0	User
CR1225 EEMB*	Lithium/manganese dioxide	2.5	5.0	User
CR123A	-	10	-	Technician
CR14250BL	-	10	-	Technician
CR14250SL	-	10	-	Technician
CR14300SL, CR14300BL	Lithium/manganese dioxide	17	10	Technician
CR14505BL	-	10	-	Technician
CR14505SL	-	10	-	Technician
CR15270SL, CR15270BL, CR2SL, CR2BL	Lithium/manganese dioxide	17	10	Technician
CR1616 EEMB*	Lithium/manganese dioxide	2.5	5.0	User
CR1620 EEMB*	Lithium/manganese dioxide	2.5	5.0	User
CR1632 EEMB*	Lithium/manganese dioxide	2.5	5.0	User
CR17335BL	-	10	-	Technician
CR17335SL	-	10	-	Technician

Feedback

https://iq.ulprospector.com/en/profile?e=10184 1/16

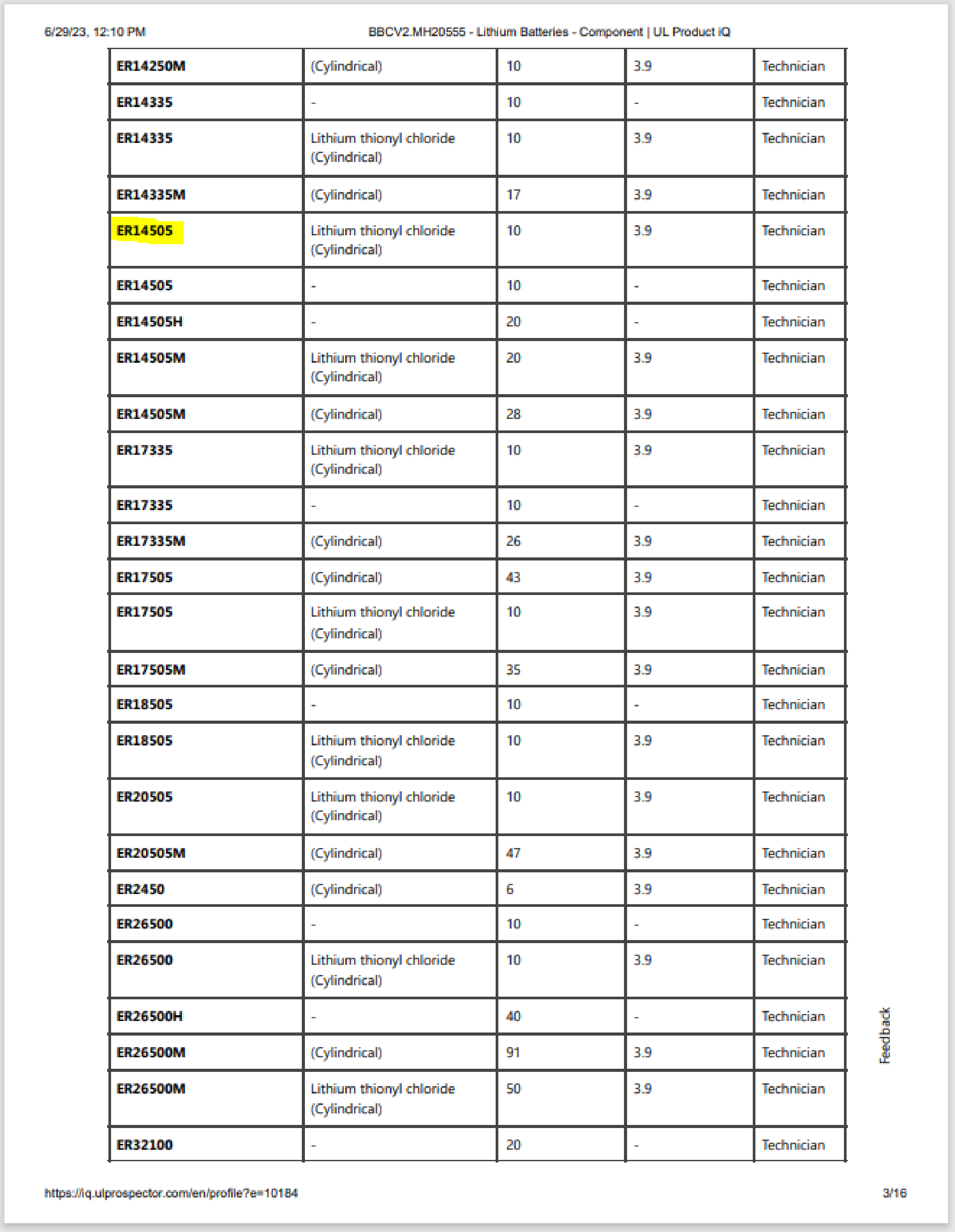


6/29/23, 12:10 PM BBCV2.MH20555 - Lithium Batteries - Component | UL Product iQ

CR17450SL, CR17450BL	Lithium/manganese dioxide	44	10	Technician
CR17505SL, CR17505BL	Lithium/manganese dioxide	111	10	Technician
CR2	Lithium/manganese dioxide	25	10	Technician
CR2016 EEMB*	Lithium/manganese dioxide	2.5	5.0	User
CR2025 EEMB*	Lithium/manganese dioxide (Coin)	10	-	User
CR2032 EEMB*	Lithium/manganese dioxide (Coin)	10	-	User
CR20505BL	-	10	-	Technician
CR20505SL	-	10	-	Technician
CR2320 EEMB*	Lithium/manganese dioxide	10	5.0	User
CR2325 EEMB*	Lithium/manganese dioxide	10	5.0	User
CR2330 EEMB*	Lithium/manganese dioxide	10	5.0	User
CR2335 EEMB*	Lithium/manganese dioxide	10	5.0	User
CR2354 EEMB*	Lithium/manganese dioxide	10	5.0	User
CR2430 EEMB*	Lithium/manganese dioxide	15	5.0	User
CR2450 EEMB*	Lithium/manganese dioxide	15	5.0	User
CR2477 EEMB*	Lithium/manganese dioxide	15	5.0	User
CR26500BL	-	20	-	Technician
CR26500SL	-	20	-	Technician
CR3032 EEMB*	Lithium/manganese dioxide	15	5.0	User
CR34615BL	-	40	-	Technician
CR34615SL	-	40	-	Technician
CR927 EEMB*	Lithium/manganese dioxide	2.5	5.0	User
ER10450	Lithium thionyl chloride (Cylindrical)	10	3.9	Technician
ER13150	-	10	-	Technician
ER14250	-	10	-	Technician
ER14250	Lithium thionyl chloride (Cylindrical)	10	3.9	Technician
ER14250H	-	20	-	Technician
ER14250M	Lithium thionyl chloride (Cylindrical)	10	3.9	Technician

Feedback

https://iq.ulprospector.com/en/profile?e=10184 2/16



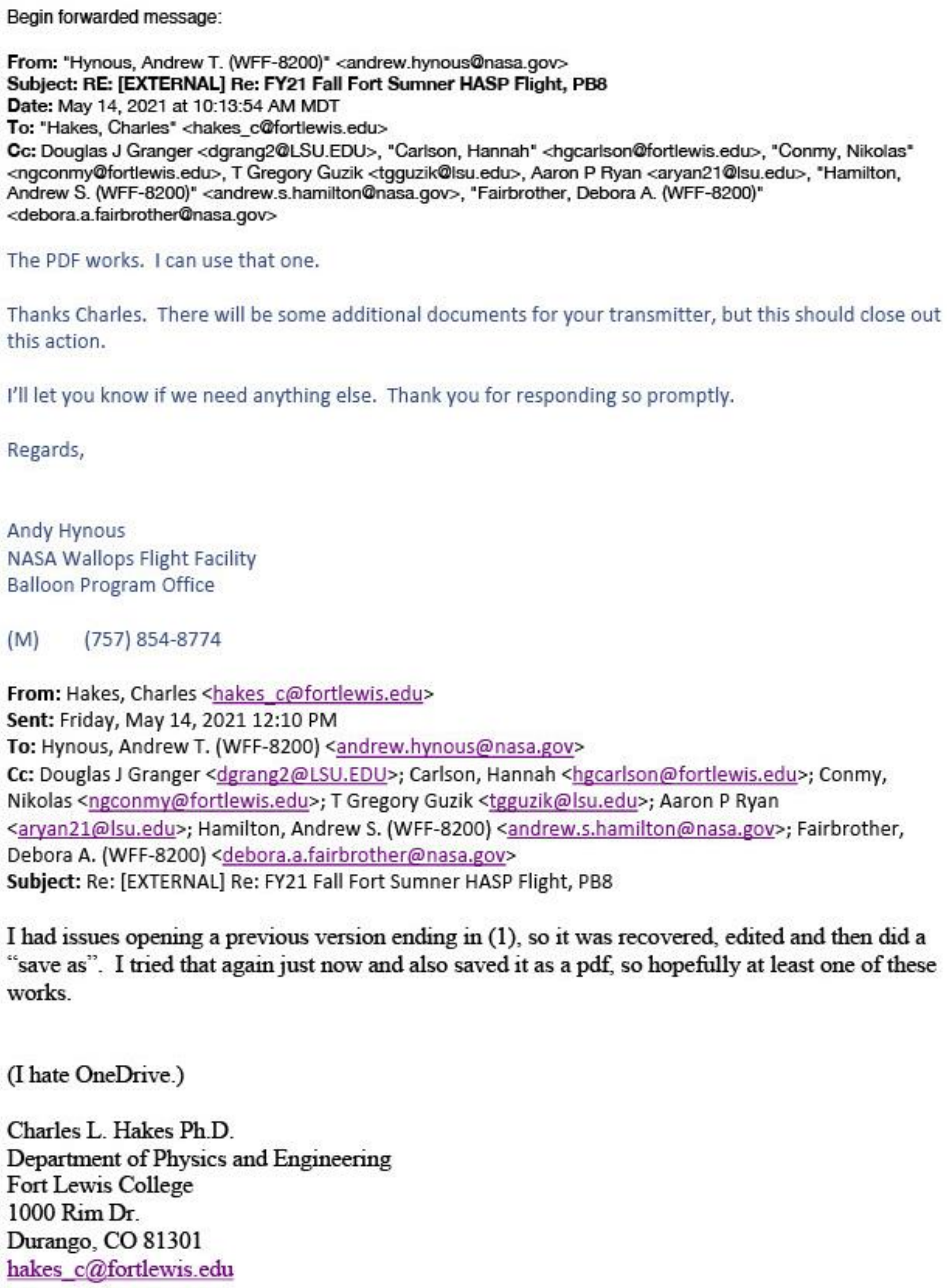
6/29/23, 12:10 PM BBCV2.MH20555 - Lithium Batteries - Component | UL Product iQ

ER14250M	(Cylindrical)	10	3.9	Technician
ER14335	-	10	-	Technician
ER14335	Lithium thionyl chloride (Cylindrical)	10	3.9	Technician
ER14335M	(Cylindrical)	17	3.9	Technician
ER14505	Lithium thionyl chloride (Cylindrical)	10	3.9	Technician
ER14505	-	10	-	Technician
ER14505H	-	20	-	Technician
ER14505M	Lithium thionyl chloride (Cylindrical)	20	3.9	Technician
ER14505M	(Cylindrical)	28	3.9	Technician
ER17335	Lithium thionyl chloride (Cylindrical)	10	3.9	Technician
ER17335	-	10	-	Technician
ER17335M	(Cylindrical)	26	3.9	Technician
ER17505	(Cylindrical)	43	3.9	Technician
ER17505	Lithium thionyl chloride (Cylindrical)	10	3.9	Technician
ER17505M	(Cylindrical)	35	3.9	Technician
ER18505	-	10	-	Technician
ER18505	Lithium thionyl chloride (Cylindrical)	10	3.9	Technician
ER20505	Lithium thionyl chloride (Cylindrical)	10	3.9	Technician
ER20505M	(Cylindrical)	47	3.9	Technician
ER2450	(Cylindrical)	6	3.9	Technician
ER26500	-	10	-	Technician
ER26500	Lithium thionyl chloride (Cylindrical)	10	3.9	Technician
ER26500H	-	40	-	Technician
ER26500M	(Cylindrical)	91	3.9	Technician
ER26500M	Lithium thionyl chloride (Cylindrical)	50	3.9	Technician
ER32100	-	20	-	Technician

Feedback

https://iq.ulprospector.com/en/profile?e=10184 3/16

A. NASA Safety Approvals



Begin forwarded message:

From: "Hynous, Andrew T. (WFF-8200)" <andrew.hynous@nasa.gov>
Subject: RE: [EXTERNAL] Re: FY21 Fall Fort Sumner HASP Flight, PB8
Date: May 14, 2021 at 10:13:54 AM MDT
To: "Hakes, Charles" <hakes_c@fortlewis.edu>
Cc: Douglas J Granger <dgrang2@LSU.EDU>, "Carlson, Hannah" <hgcarlson@fortlewis.edu>, "Conmy, Nikolas" <ngconmy@fortlewis.edu>, T Gregory Guzik <tgguzik@lsu.edu>, Aaron P Ryan <aryan21@lsu.edu>, "Hamilton, Andrew S. (WFF-8200)" <andrew.s.hamilton@nasa.gov>, "Fairbrother, Debora A. (WFF-8200)" <debora.a.fairbrother@nasa.gov>

The PDF works. I can use that one.

Thanks Charles. There will be some additional documents for your transmitter, but this should close out this action.

I'll let you know if we need anything else. Thank you for responding so promptly.

Regards,

Andy Hynous
NASA Wallops Flight Facility
Balloon Program Office

(M) (757) 854-8774

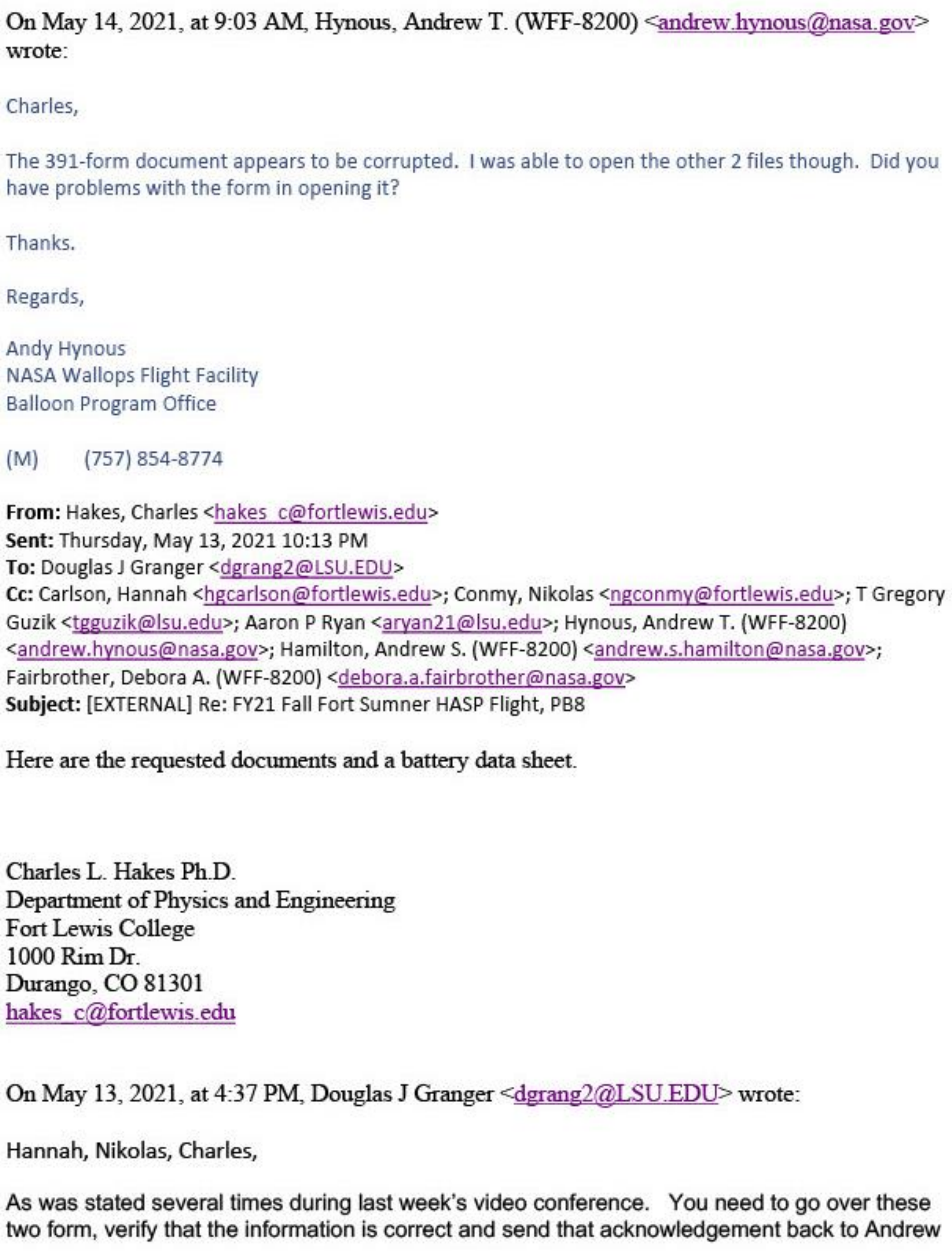
From: Hakes, Charles <hakes_c@fortlewis.edu>
Sent: Friday, May 14, 2021 12:10 PM
To: Hynous, Andrew T. (WFF-8200) <andrew.hynous@nasa.gov>
Cc: Douglas J Granger <dgrang2@LSU.EDU>; Carlson, Hannah <hgcarlson@fortlewis.edu>; Conmy, Nikolas <ngconmy@fortlewis.edu>; T Gregory Guzik <tgguzik@lsu.edu>; Aaron P Ryan <aryan21@lsu.edu>; Hamilton, Andrew S. (WFF-8200) <andrew.s.hamilton@nasa.gov>; Fairbrother, Debora A. (WFF-8200) <debora.a.fairbrother@nasa.gov>
Subject: Re: [EXTERNAL] Re: FY21 Fall Fort Sumner HASP Flight, PB8

I had issues opening a previous version ending in (1), so it was recovered, edited and then did a "save as". I tried that again just now and also saved it as a pdf, so hopefully at least one of these works.

(I hate OneDrive.)

Charles L. Hakes Ph.D.
Department of Physics and Engineering
Fort Lewis College
1000 Rim Dr.
Durango, CO 81301
hakes_c@fortlewis.edu

B.



On May 14, 2021, at 9:03 AM, Hynous, Andrew T. (WFF-8200) <andrew.hynous@nasa.gov> wrote:

Charles,

The 391-form document appears to be corrupted. I was able to open the other 2 files though. Did you have problems with the form in opening it?

Thanks.

Regards,

Andy Hynous
NASA Wallops Flight Facility
Balloon Program Office

(M) (757) 854-8774

From: Hakes, Charles <hakes_c@fortlewis.edu>
Sent: Thursday, May 13, 2021 10:13 PM
To: Douglas J Granger <dgrang2@LSU.EDU>
Cc: Carlson, Hannah <hgcarlson@fortlewis.edu>; Conmy, Nikolas <ngconmy@fortlewis.edu>; T Gregory Guzik <tgguzik@lsu.edu>; Aaron P Ryan <aryan21@lsu.edu>; Hynous, Andrew T. (WFF-8200) <andrew.hynous@nasa.gov>; Hamilton, Andrew S. (WFF-8200) <andrew.s.hamilton@nasa.gov>; Fairbrother, Debora A. (WFF-8200) <debora.a.fairbrother@nasa.gov>
Subject: [EXTERNAL] Re: FY21 Fall Fort Sumner HASP Flight, PB8

Here are the requested documents and a battery data sheet.

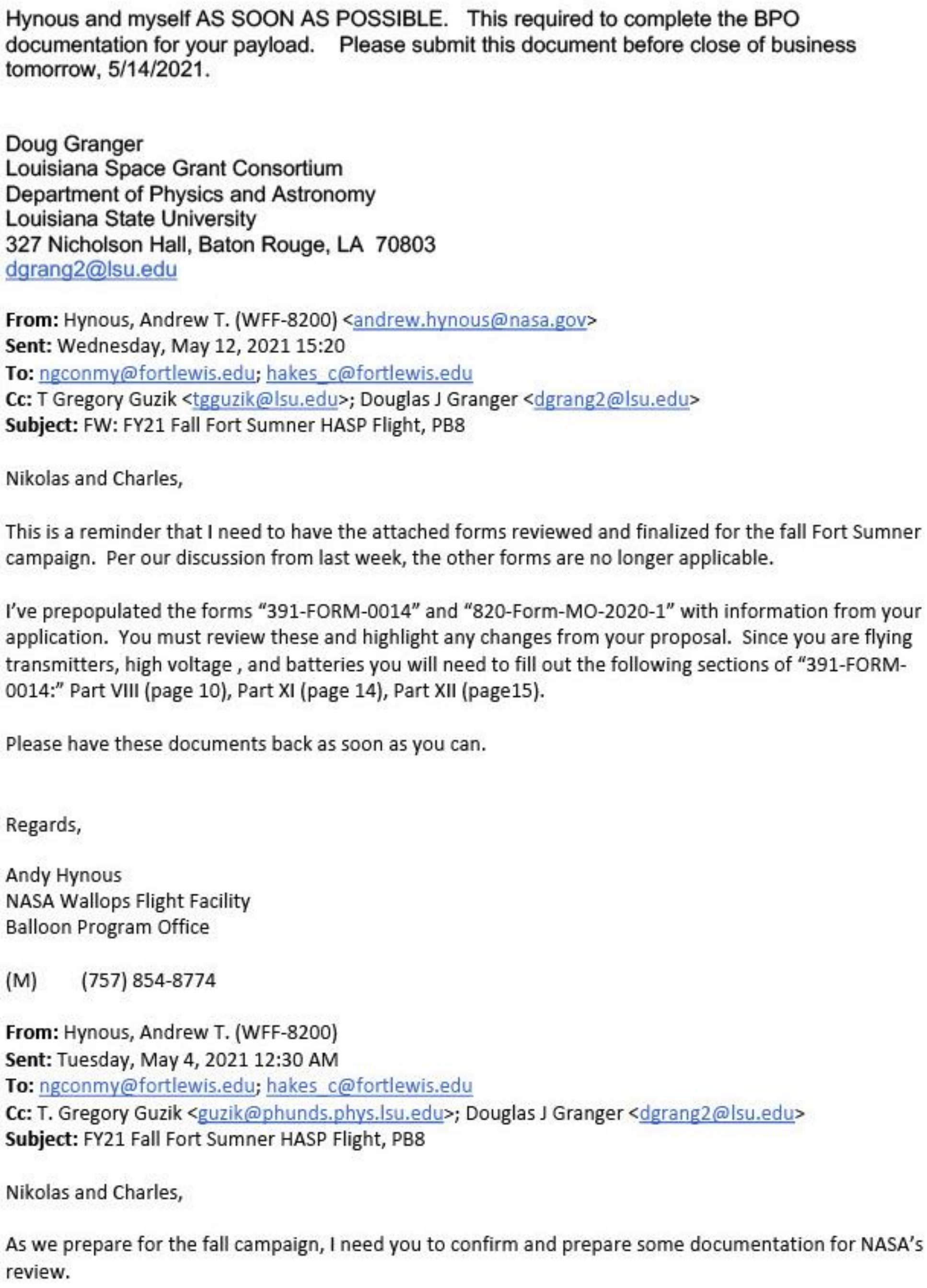
Charles L. Hakes Ph.D.
Department of Physics and Engineering
Fort Lewis College
1000 Rim Dr.
Durango, CO 81301
hakes_c@fortlewis.edu

On May 13, 2021, at 4:37 PM, Douglas J Granger <dgrang2@LSU.EDU> wrote:

Hannah, Nikolas, Charles,

As was stated several times during last week's video conference. You need to go over these two form, verify that the information is correct and send that acknowledgement back to Andrew

C.



Hynous and myself AS SOON AS POSSIBLE. This required to complete the BPO documentation for your payload. Please submit this document before close of business tomorrow, 5/14/2021.

Doug Granger
Louisiana Space Grant Consortium
Department of Physics and Astronomy
Louisiana State University
327 Nicholson Hall, Baton Rouge, LA 70803
dgrang2@lsu.edu

From: Hynous, Andrew T. (WFF-8200) <andrew.hynous@nasa.gov>
Sent: Wednesday, May 12, 2021 15:20
To: ngconmy@fortlewis.edu; hakes_c@fortlewis.edu
Cc: T Gregory Guzik <tgguzik@lsu.edu>; Douglas J Granger <dgrang2@lsu.edu>
Subject: FW: FY21 Fall Fort Sumner HASP Flight, PB8

Nikolas and Charles,

This is a reminder that I need to have the attached forms reviewed and finalized for the fall Fort Sumner campaign. Per our discussion from last week, the other forms are no longer applicable.

I've prepopulated the forms "391-FORM-0014" and "820-Form-MO-2020-1" with information from your application. You must review these and highlight any changes from your proposal. Since you are flying transmitters, high voltage , and batteries you will need to fill out the following sections of "391-FORM-0014:" Part VIII (page 10), Part XI (page 14), Part XII (page15).

Please have these documents back as soon as you can.

Regards,

Andy Hynous
NASA Wallops Flight Facility
Balloon Program Office

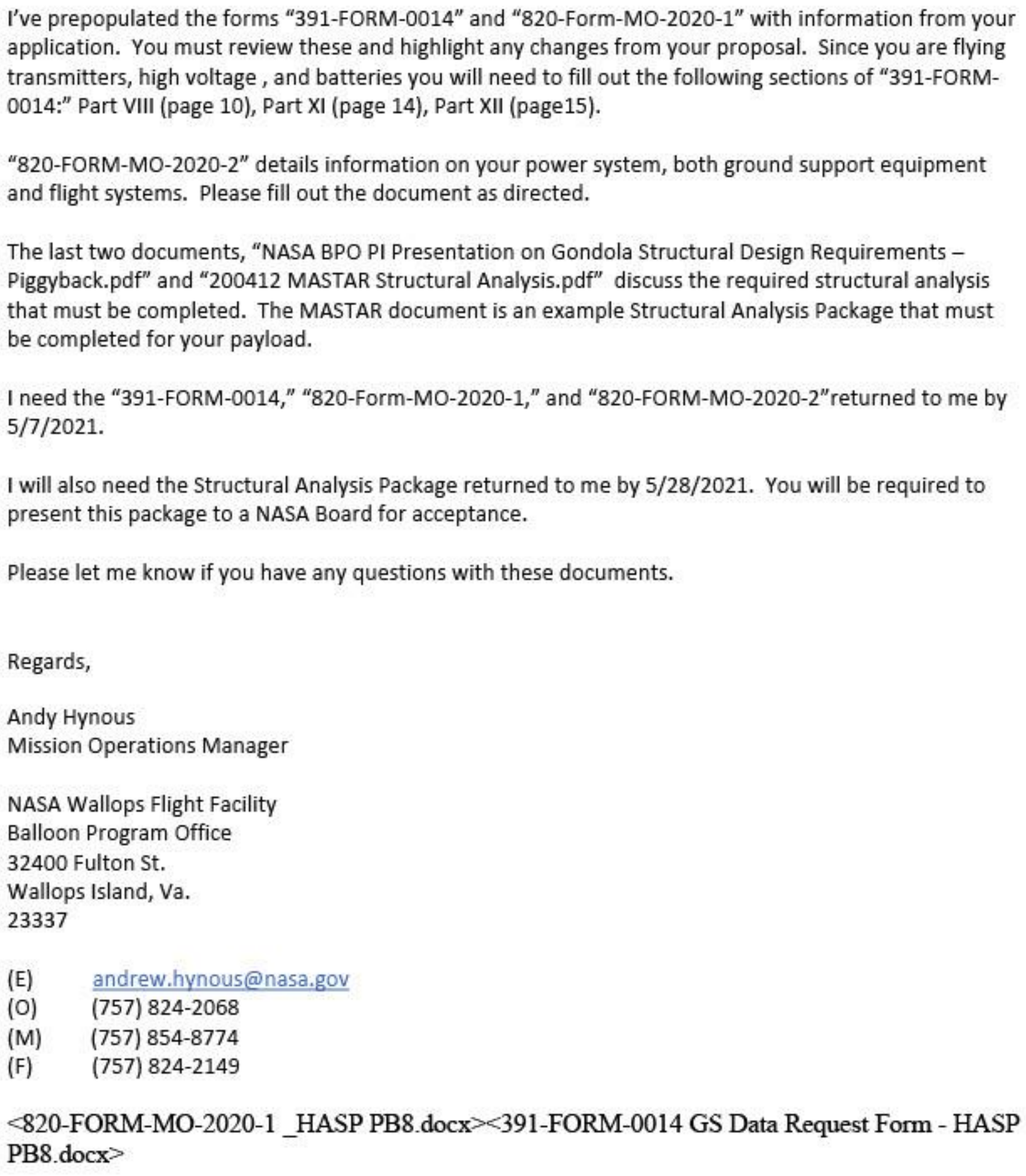
(M) (757) 854-8774

From: Hynous, Andrew T. (WFF-8200)
Sent: Tuesday, May 4, 2021 12:30 AM
To: ngconmy@fortlewis.edu; hakes_c@fortlewis.edu
Cc: T. Gregory Guzik <guzik@phunds.phys.lsu.edu>; Douglas J Granger <dgrang2@lsu.edu>
Subject: FY21 Fall Fort Sumner HASP Flight, PB8

Nikolas and Charles,

As we prepare for the fall campaign, I need you to confirm and prepare some documentation for NASA's review.

D.



I've prepopulated the forms "391-FORM-0014" and "820-Form-MO-2020-1" with information from your application. You must review these and highlight any changes from your proposal. Since you are flying transmitters, high voltage , and batteries you will need to fill out the following sections of "391-FORM-0014:" Part VIII (page 10), Part XI (page 14), Part XII (page15).

"820-FORM-MO-2020-2" details information on your power system, both ground support equipment and flight systems. Please fill out the document as directed.

The last two documents, "NASA BPO PI Presentation on Gondola Structural Design Requirements – Piggyback.pdf" and "200412 MASTAR Structural Analysis.pdf" discuss the required structural analysis that must be completed. The MASTAR document is an example Structural Analysis Package that must be completed for your payload.

I need the "391-FORM-0014," "820-Form-MO-2020-1," and "820-FORM-MO-2020-2"returned to me by 5/7/2021.

I will also need the Structural Analysis Package returned to me by 5/28/2021. You will be required to present this package to a NASA Board for acceptance.

Please let me know if you have any questions with these documents.

Regards,

Andy Hynous
Mission Operations Manager

NASA Wallops Flight Facility
Balloon Program Office
32400 Fulton St.
Wallops Island, Va.
23337

(E) andrew.hynous@nasa.gov
(O) (757) 824-2068
(M) (757) 854-8774
(F) (757) 824-2149

<820-FORM-MO-2020-1 _HASP PB8.docx><391-FORM-0014 GS Data Request Form - HASP PB8.docx>

E.

D. Integration Week Attendees

F.

Attendees	Contact Information
Ismael Hernandez	imhernandez@fortlewis.edu 480-489-4515
Simone Gorman	sbgorman@fortlewis.edu

Jerry Jack Jr.	jjack1@fortlewis.edu
Charles Hakes	hakes_c@fortlewis.edu 970-749-8889

G.