HASP Payload Specification and Integration Plan

Payload Title: High Altitude Infrared Device for Research and Analysis (HIDRA)

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

Payload ID: 01

Institution: Arizona State University: School of Earth & Space Exploration

Contact Name: John McCulloch

Contact Phone: 602-565-6209

Contact E-mail: jpmccull@asu.edu

Submit Date: Preliminary: 4/22/16 Final: 6/24/16

I. Mechanical Specifications:

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

System	Mass (g)	Measurement Method
Power System and Wiring	241 ± 10	Estimated
Control System	128 ± 0.01	Measured
Camera Systems	133 ± 0.01	Measured
Temperature Monitor System	30 ± 0.01	Measured
Mechanical Structure	1500 ± 100	Estimated
Total	2032 ± 110.04	

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. See attached mechanical drawings and figures at end of document.

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. None of HIDRA's components or operations should pose potential hazard to HASP, other HASP payloads, or the ground crew.

D. Other relevant mechanical information

   i. N/A

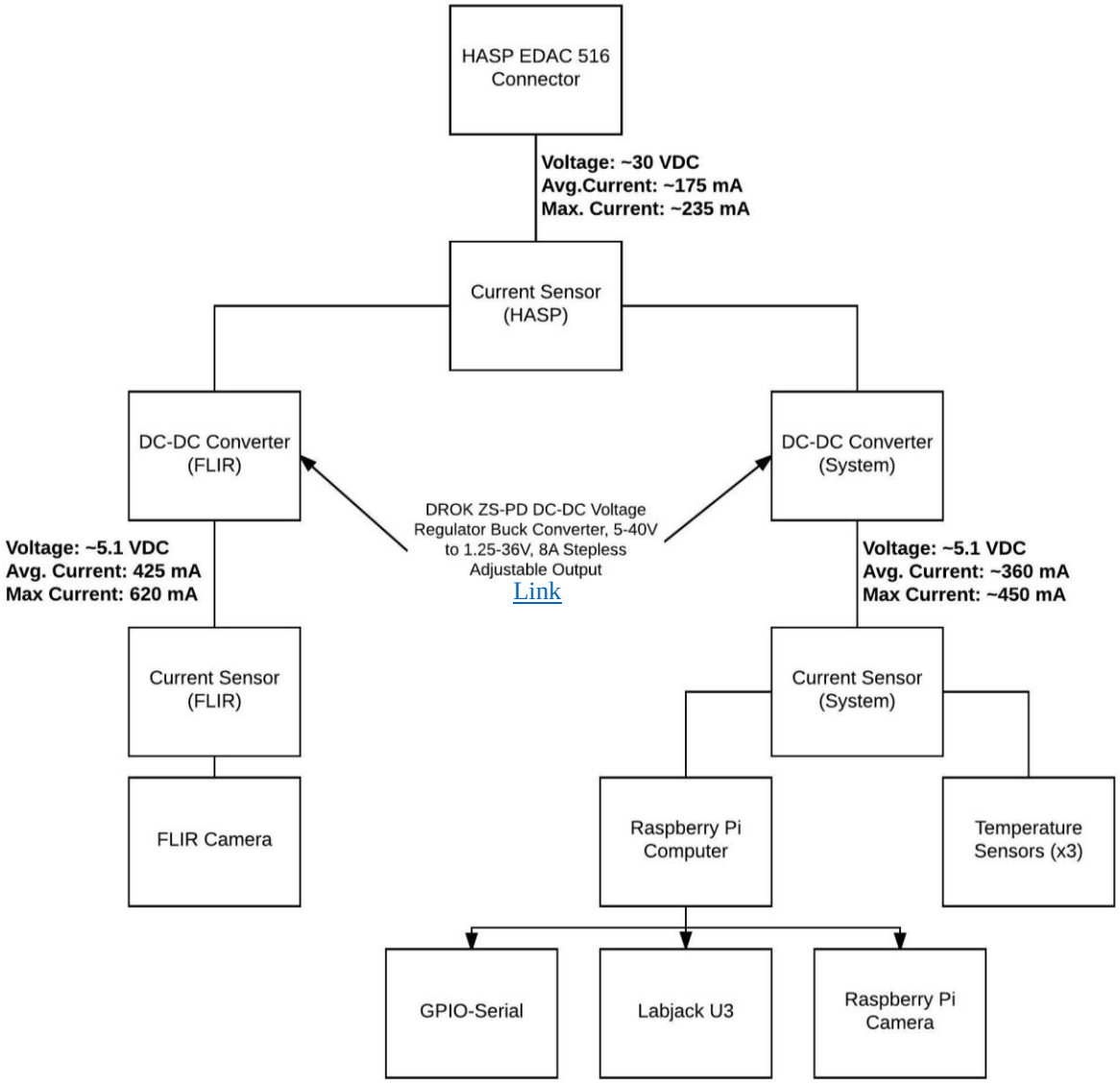
II. Power Specifications

A. Measured current draw at 30 VDC

i. Current (non-recalibration/non-boot-up): ~175 mA

ii. Current (recalibration/boot-up): ~235 mA

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. Other relevant power information

i. N/A

III. Downlink Telemetry Specifications:

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

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

i. HIDRA shall have a serial downlink rate of approximately 240 bps.

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

Byte	Title	Description
2	Header	Beginning of data record
14	CPU Timestamp	CPU µsec since startup
14	UTC Timestamp	Time according to UTC
2	tempDC1	Temp sensor on DC1
2	tempDC2	Temp sensor on DC2
2	tempRPi	Temp sensor on RPi
2	tempFLIR	Temp sensor on FLIR
2	tempLJ	Internal temp of LabJack
2	currHASP	Current value to HASP
2	currDC1	Current value of DC1
2	currDC2	Current value of DC2
4	visLast	Data used by last visible image
4	nVis	# of visible images triggered
4	rVis	# of visible images written
4	nFLIR	# of FLIR images triggered
2	Footer	End of data record
64	**Total**	**Total Bytes sent**

D. Number of analog channels being used:

i. HIDRA will not be utilizing any of the HASP supplied analog channels.

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

i. N/A

F. Number of discrete lines being used:

i. HIDRA will not be utilizing any of the HASP supplied discrete lines.

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. HIDRA has not on-board transmitters.

I. Other relevant downlink telemetry information.

i. N/A

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)

   i. N/A

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. HIDRA will not be utilizing the HASP command lines.

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

   i. HIDRA will not be utilizing the HASP command lines.

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

   i. HIDRA has no on-board receivers.

F. Other relevant uplink commanding information.

   i. In the event that the downlink data indicates that the HIDRA system is reaching an overheat point, we will ask that power to the HIDRA system be turned off. After 10 minutes of power off, we will ask that power be restored to the HIDRA system.

V. Integration and Logistics

A. Date and Time of your arrival for integration:

i. The HIDRA integration team will be driving from Tempe, AZ to Palestine, TX.

ii. Date: Sunday, July 31, 2016

iii. Time: Late afternoon/evening

B. Approximate amount of time required for integration:

i. Two and a half hours should be enough time to run through the pre-TV chamber integration tests.

C. Name of the integration team leader:

i. John McCulloch

D. Email address of the integration team leader:

i. jpmccull@asu.edu

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

i. John McCulloch – jpmccull@asu.edu

ii. Bradley Karas – bkaras1@asu.edu

iii. Jacob Trahan – jrtrahan@asu.edu

iv. Srinidhi Ravi – sravi13@asu.edu

F. Define a successful integration of your payload:

i. A successful integration shall be defined when the HIDRA payload and mounting plate have been attached to HASP and all of the checks listed below have passed.

G. List all expected integration steps:

i. Pre-TV Chamber

1. Bolt payload to the mounting plate.
2. Connect payload EDAC to HASP.
3. Connect payload DB9 to HASP.
4. Supply power to payload and ensure all status LEDs are on and FLIR camera is beeping at the predefined interval.
5. Connect FLIR App to FLIR camera via Bluetooth to verify settings are correct.

6. Confirm that data packets are received and in correct format with correct information.
7. Connect FLIR camera to laptop to confirm that the correct number of infrared images had been taken.
8. Connect laptop to Raspberry Pi via Ethernet jack to confirm that data and visual images we properly stored.
9. Have power cycled to the payload
10. Repeat steps 6-8
11. Power off entire payload.

ii. TV Chamber Test:

1. Supply power to payload via HASP.
2. Confirm that data packets are received and in correct format with correct information.
3. Monitor received data on temperature and current.
4. When platform is removed from TV chamber:
    a. Connect FLIR camera to laptop to confirm that the correct number of infrared images had been taken.
    b. Connect laptop to Raspberry Pi via Ethernet jack to confirm that data and visual images we properly stored.
    c. Power off entire payload.

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

i. Pre-TV Chamber:

1. Are status LED indicator lights on?
    a. “Yes” - proper power is being provided to system
    b. “No” - power connection is faulty
2. Is the FLIR camera beeping at the prescribed interval?
    a. “Yes” - FLIR camera interface functioning
    b. “No” - FLIR camera interface not functioning
3. Does the FLIR App have the correct settings?
    a. “Yes” - FLIR camera is ready
    b. “No” - FLIR settings need to be properly set
4. Are the data packets being down-linked from HASP?

a. "Yes" - data system functioning properly
b. "No" - serial port connection error

5. Do the data packets contain the proper information in the correct format (current, temperature, etc)?
    a. "Yes" - systems functioning normally
    b. "No" - systems not functioning normally
6. Did the FLIR camera record and store the expected number of infrared images?
    a. "Yes" – FLIR functioning normally
    b. "No" – FLIR camera error
7. Did the FLIR camera record and store the same number of images as times it was triggered by the Labjack?
    a. "Yes" – FLIR functioning normally
    b. "No" – FLIR camera error
8. Did the Raspberry Pi record and properly store the temperature, current, visual images, and other data?
    a. "Yes" – system functioning normally
    b. "No" – system error
9. Did the number of Raspberry Pi (visual) images match the number of FLIR (infrared) images?
    a. "Yes" – system functioning normally
    b. "No" – system error

ii. TV Chamber/Post TV Chamber:

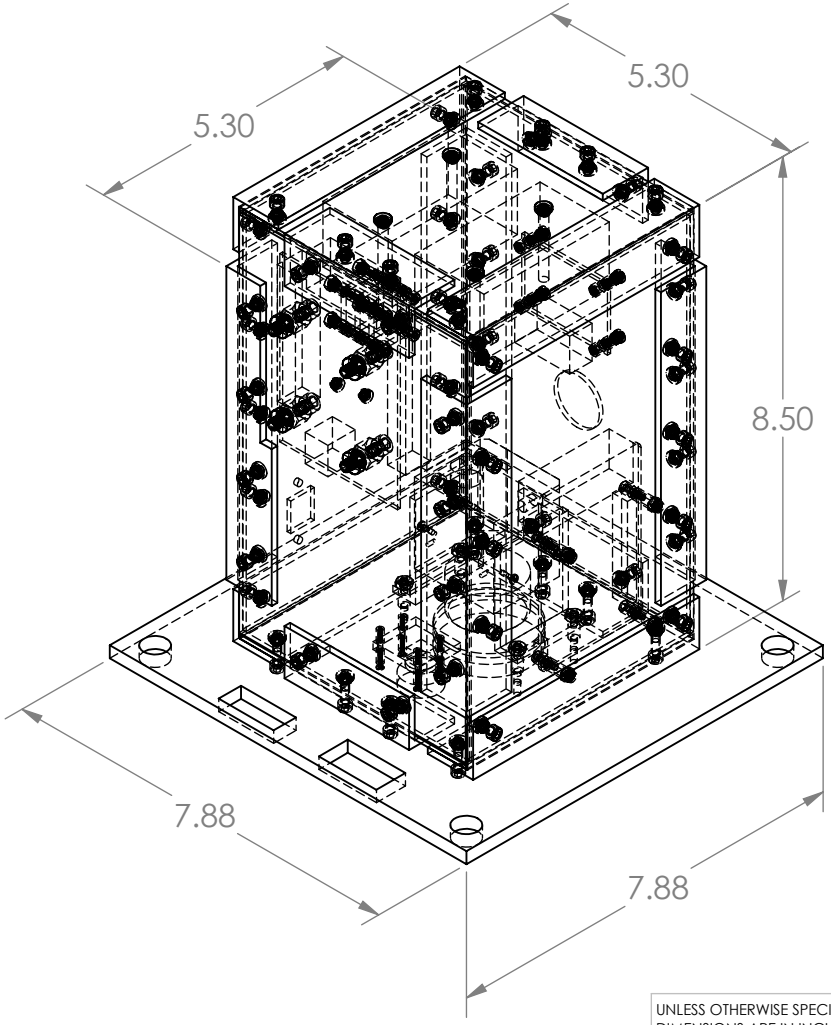
1. Are the data packets being down-linked from HASP?
    a. "Yes" - data system functioning properly
    b. "No" - serial port connection error
2. Do the data packets contain the proper information in the correct format (current, temperature, etc)?
    a. "Yes" - systems functioning normally
    b. "No" - systems not functioning normally
3. Did the FLIR camera record and store the expected number of infrared images?
    a. "Yes" – FLIR functioning normally

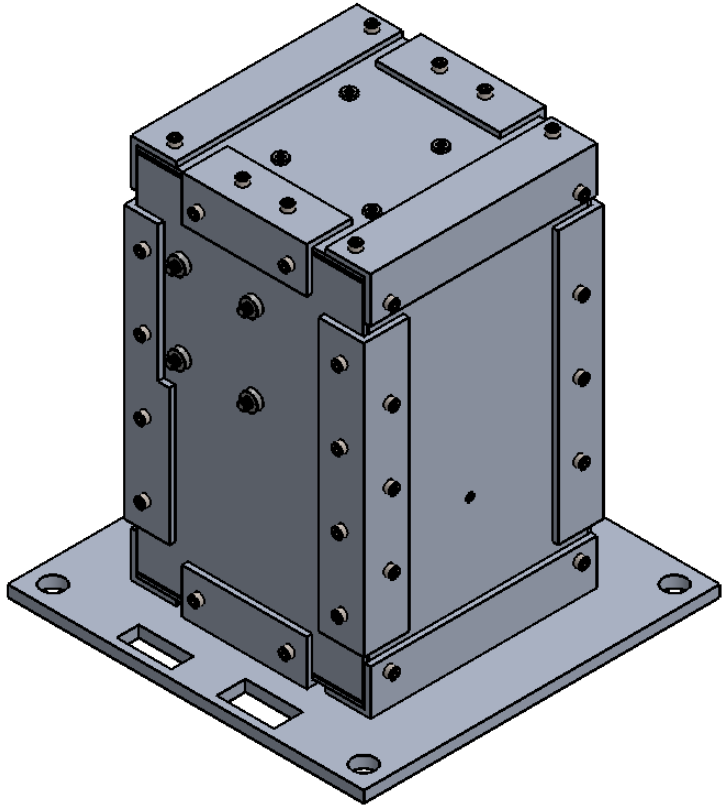
b. "No" – FLIR camera error

4. Did the FLIR camera record and store the same number of images as times it was triggered by the Labjack?
    a. "Yes" – FLIR functioning normally
    b. "No" – FLIR camera error
5. Did the Raspberry Pi record and properly store the temperature, current, visual images, and other data?
    a. "Yes" – system functioning normally
    b. "No" – system error
6. Did the number of Raspberry Pi (visual) images match the number of FLIR (infrared) images?
    a. "Yes" – system functioning normally
    b. "No" – system error

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. We will need two hotel rooms with two double beds each.

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





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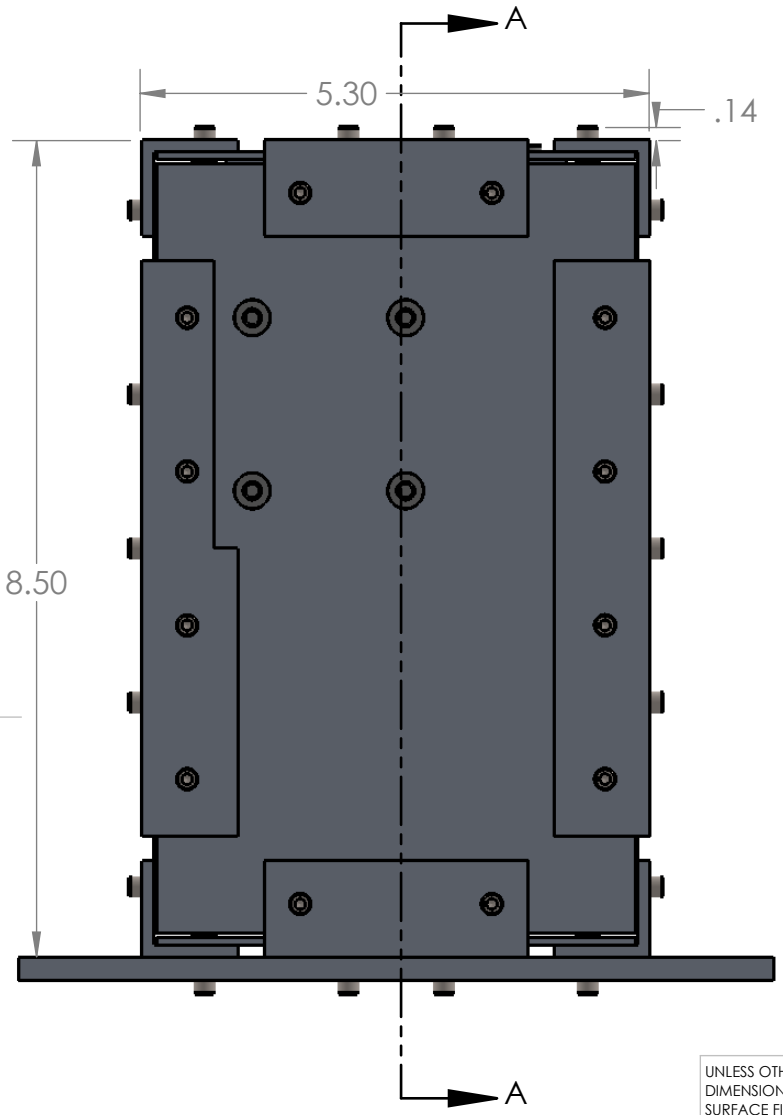
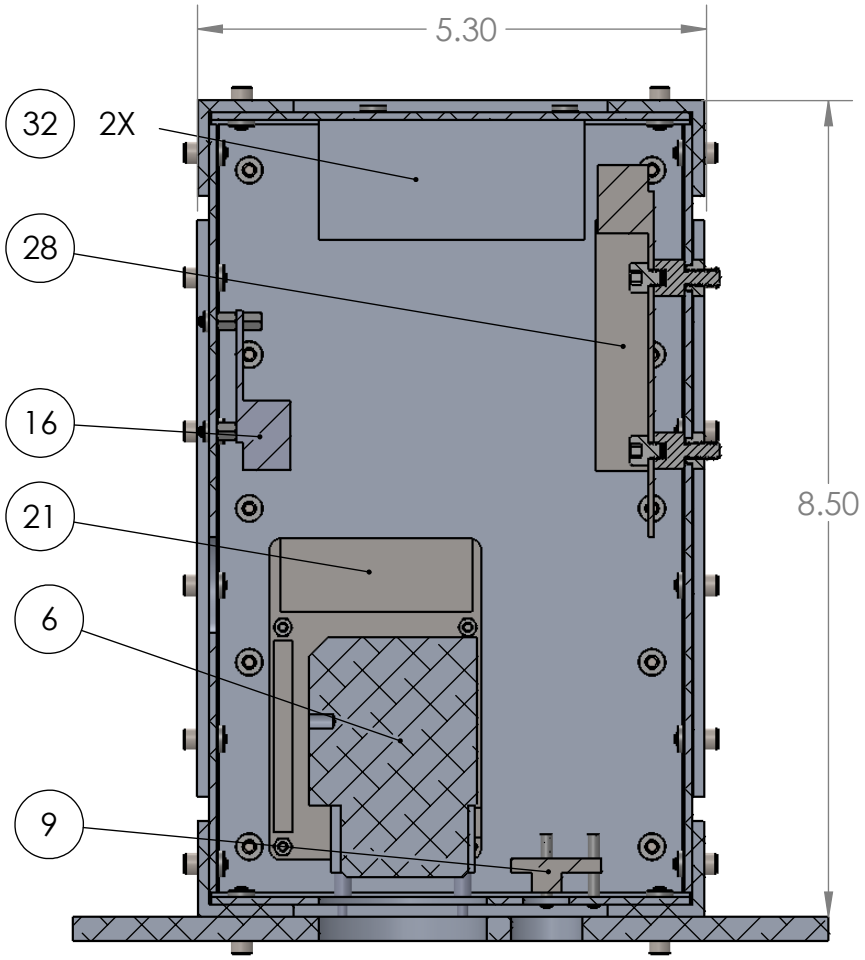
	NAME	SIGNATURE	DATE		TITLE:	
DRAWN					HIDRA_PAYLOAD	
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL:	DWG NO.	A4
				WEIGHT:	SCALE:1:3	SHEET 1 OF 7

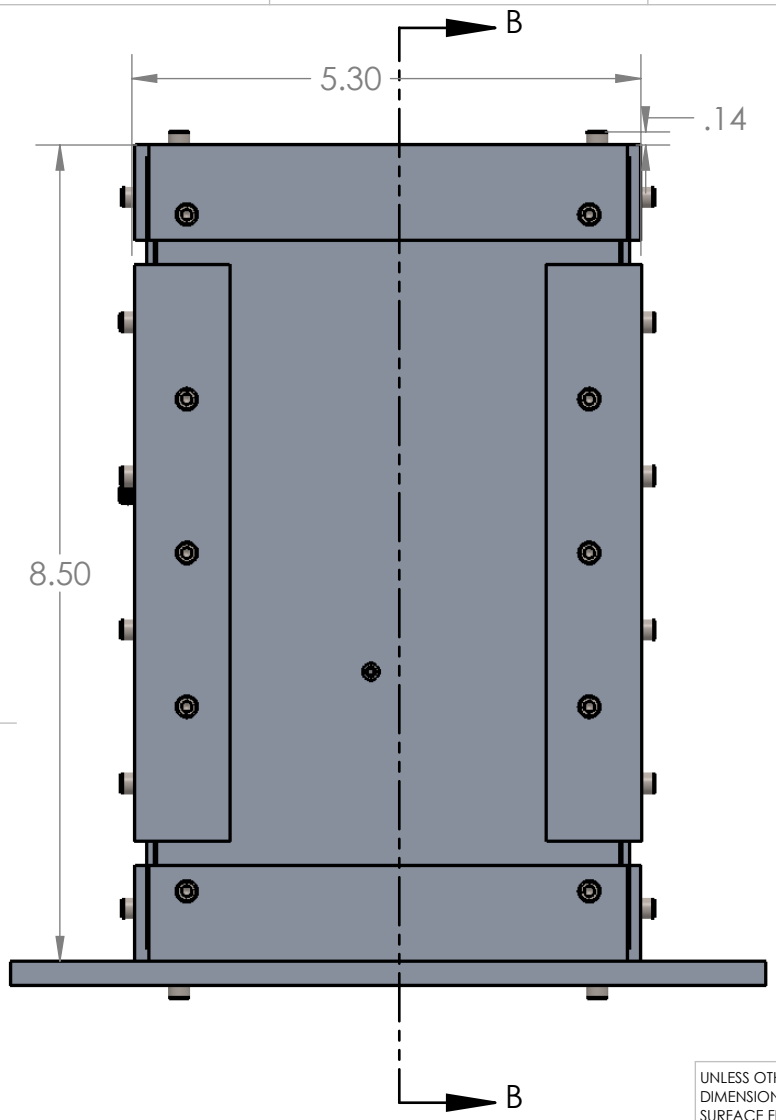


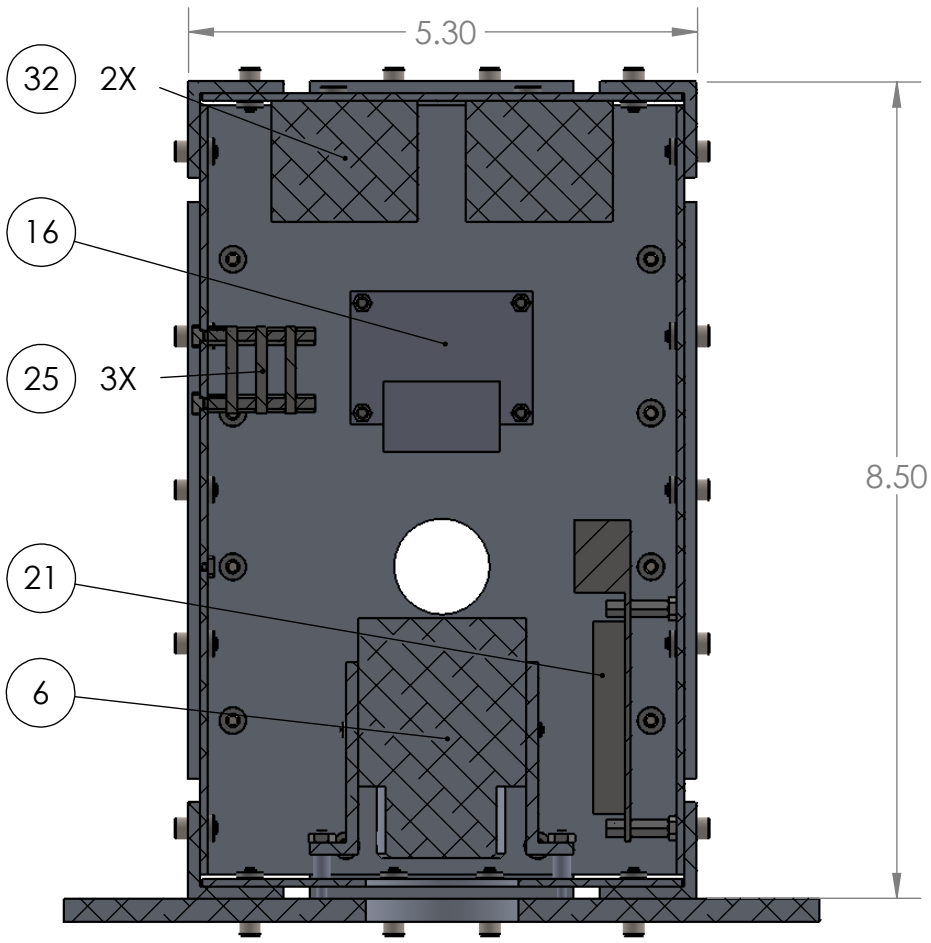


SECTION A-A

6	FLIR Camera
9	Raspberry Pi Camera
16	DB9 to GPIO
21	Raspberry Pi CPU
25	Current Sensors
28	LabJack U3
32	DC-DC Converters

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:	FINISH:	DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION	
	NAME	SIGNATURE	DATE	TITLE:	
DRAWN				HIDRA_PAYLOAD_FRONT	
CHK'D					
APPV'D					
MFG					
Q.A			MATERIAL:	DWG NO.	A4
			WEIGHT:	SCALE:1:2	SHEET 2 OF 7

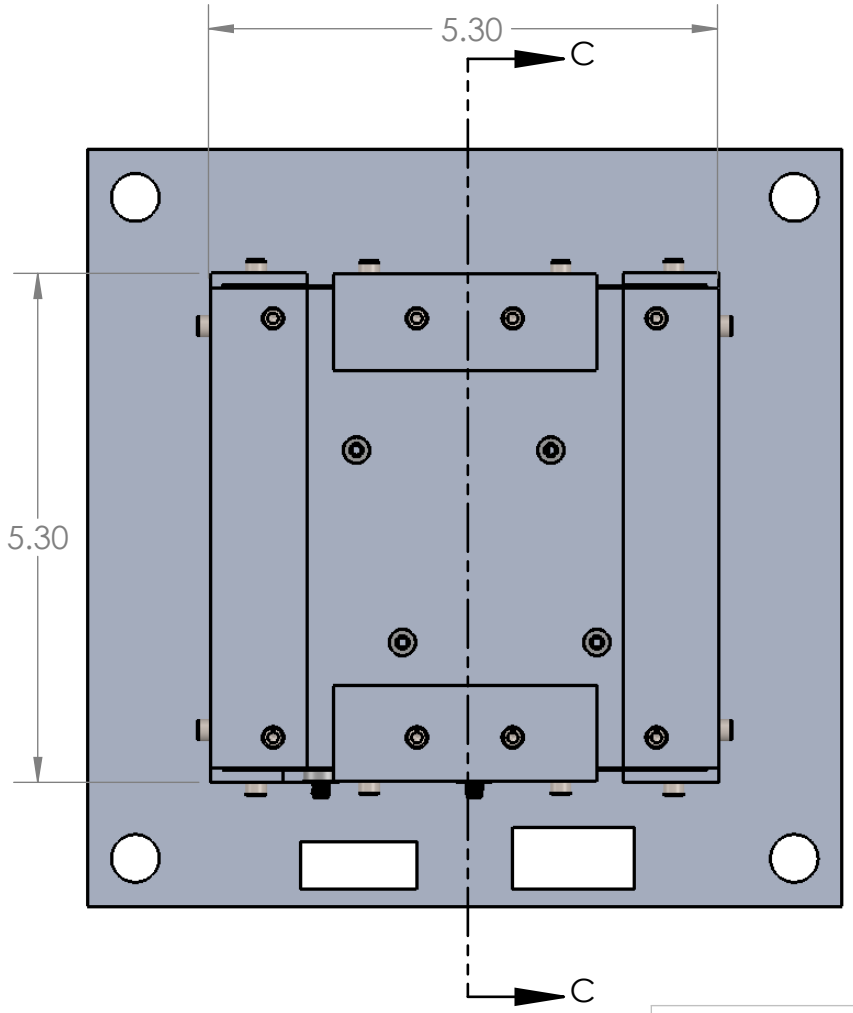


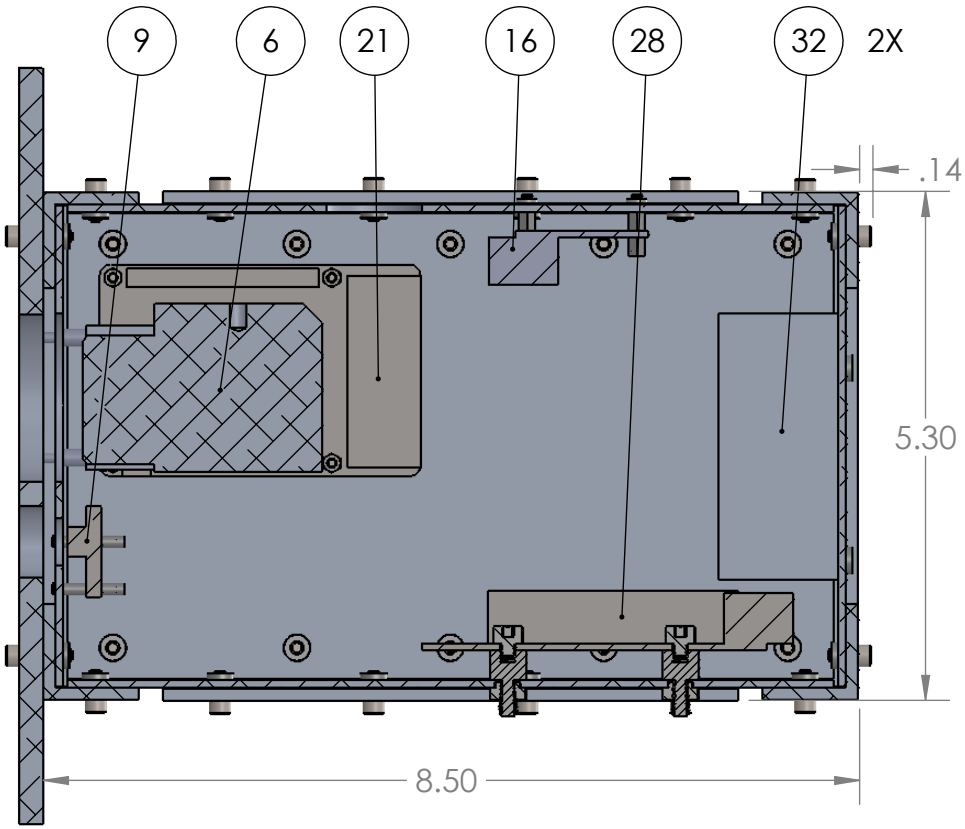


SECTION B-B

6	FLIR Camera
16	DB9 to GPIO
21	Raspberry Pi CPU
25	Current Sensors
32	DC-DC Converters

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:	FINISH:	DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION		
	NAME	SIGNATURE	DATE			TITLE:
DRAWN						HIDRA_PAYLOAD_RIGHT
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL:	DWG NO.	A4
				WEIGHT:	SCALE:1:2	SHEET 3 OF 7

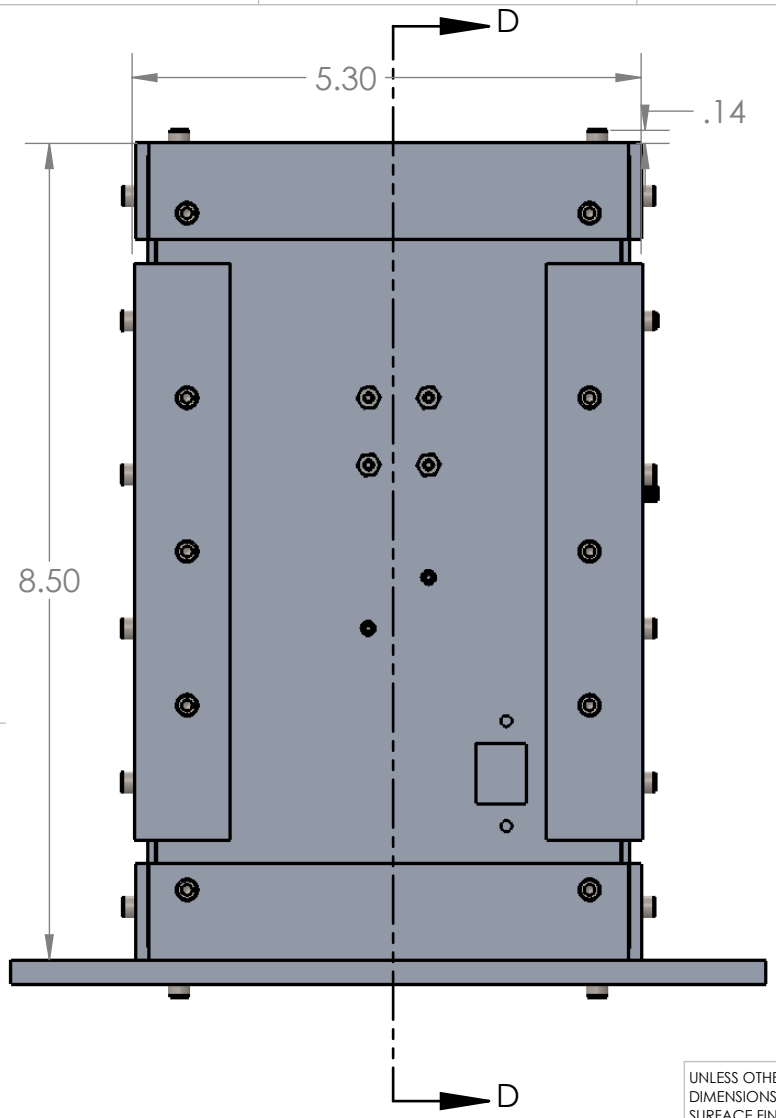


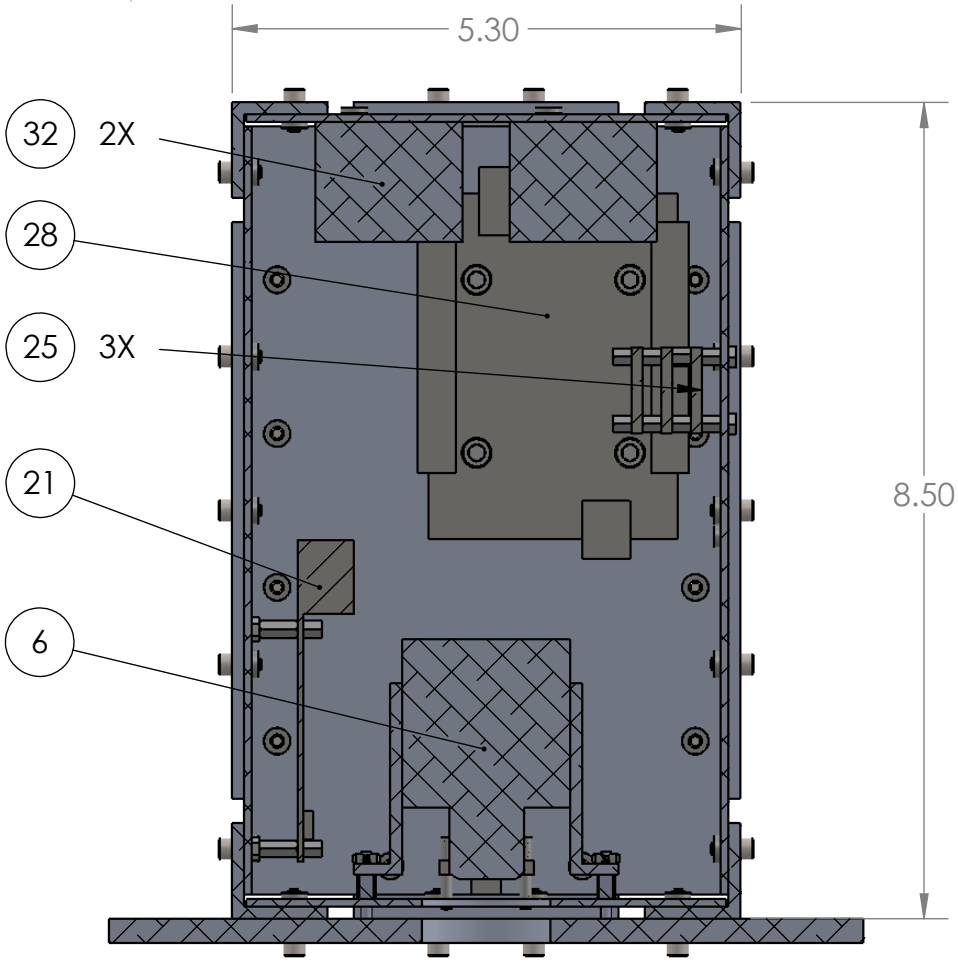


SECTION C-C

6	FLIR Camera
9	Raspberry Pi Camera
16	DB9 to GPIO
21	Raspberry Pi CPU
28	LabJack U3
32	DC-DC Converters

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:	FINISH:	DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION		
	NAME	SIGNATURE	DATE	TITLE:		
DRAWN				HIDRA_PAYLOAD_TOP		
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL:	DWG NO.	A4
				WEIGHT:	SCALE:1:2	SHEET 4 OF 7

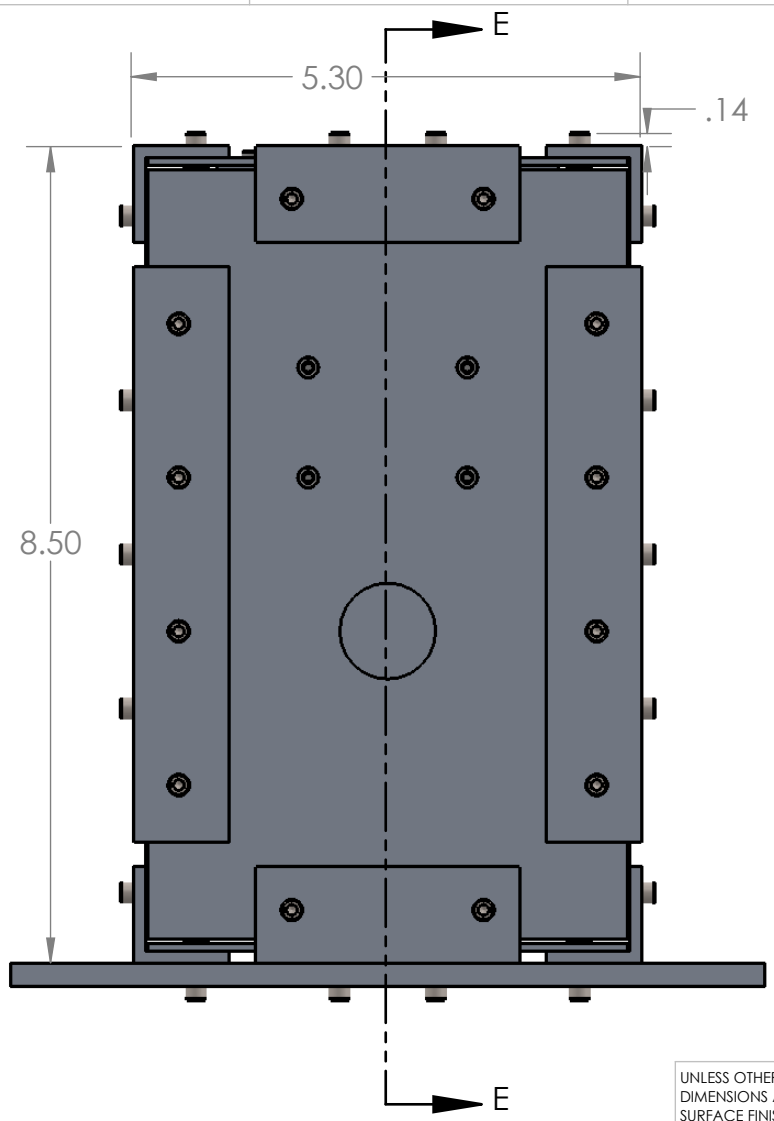


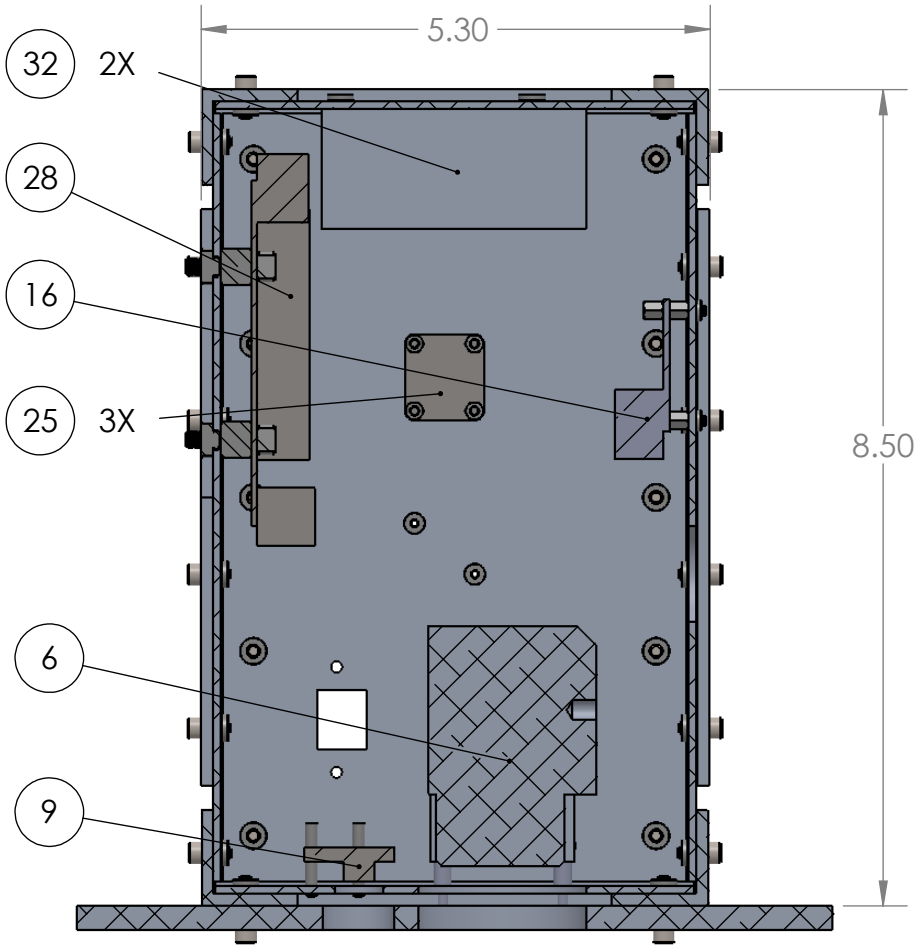


SECTION D-D

6	FLIR Camera
21	Raspberry Pi CPU
25	Current Sensors
28	LabJack U3
32	DC-DC Converters

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:		FINISH:		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
	NAME	SIGNATURE	DATE		TITLE:	
DRAWN					HIDRA_PAYLOAD_LEFT	
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL:	DWG NO.	A4
				WEIGHT:	SCALE:1:2	SHEET 5 OF 7

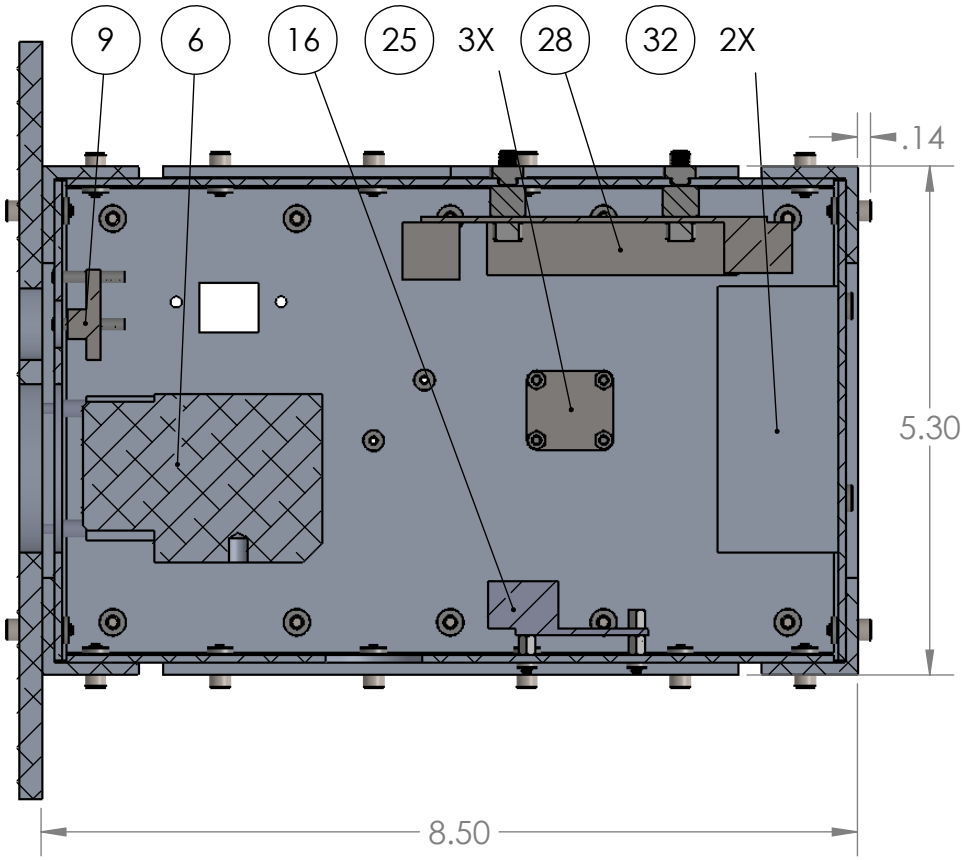




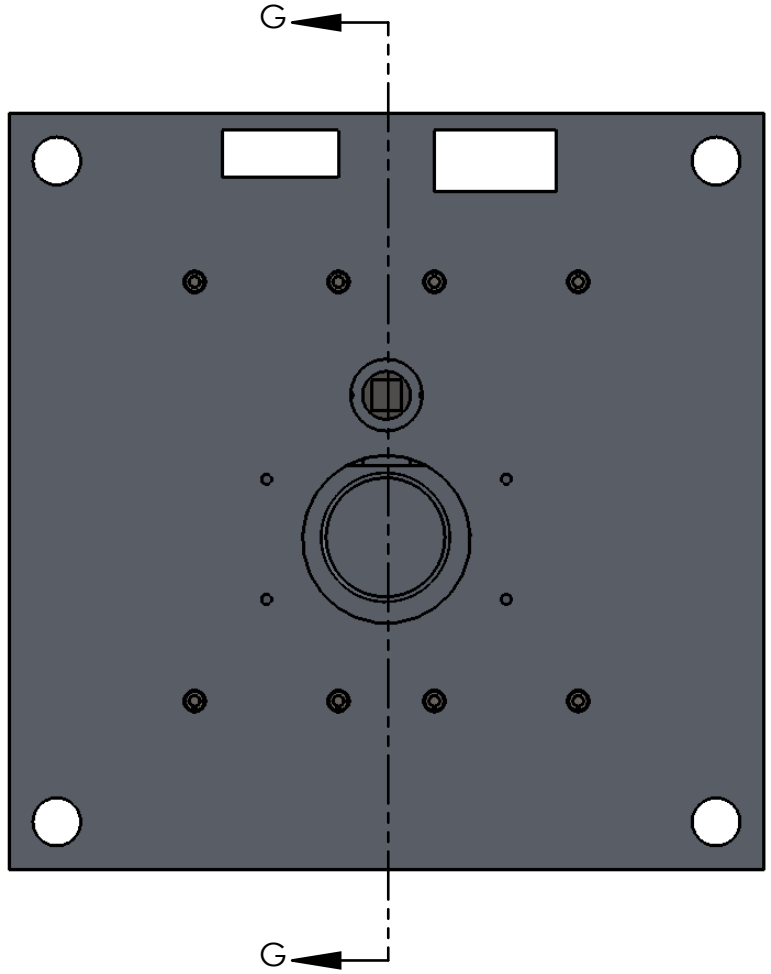
SECTION E-E

6	FLIR Camera
9	Raspberry Pi Camera
16	DB9 to GPIO
25	Current Sensors
28	LabJack U3
32	DC-DC Converters

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:	FINISH:	DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION	
	NAME	SIGNATURE	DATE	TITLE:	
DRAWN				HIDRA_PAYLOAD_BACK	
CHK'D					
APPV'D					
MFG					
Q.A				MATERIAL:	DWG NO. A4
				WEIGHT:	SCALE:1:2 SHEET 6 OF 7



SECTION G-G



6	FLIR Camera
9	Raspberry Pi Camera
16	DB9 to GPIO
25	Current Sensors
28	LabJack U3
32	DC-DC Converters

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
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ANGULAR:

FINISH:

DEBUR AND BREAK SHARP EDGES

DO NOT SCALE DRAWING

REVISION

	NAME	SIGNATURE	DATE
DRAWN			
CHK'D			
APPV'D			
MFG			
Q.A			

MATERIAL:

WEIGHT:

TITLE:

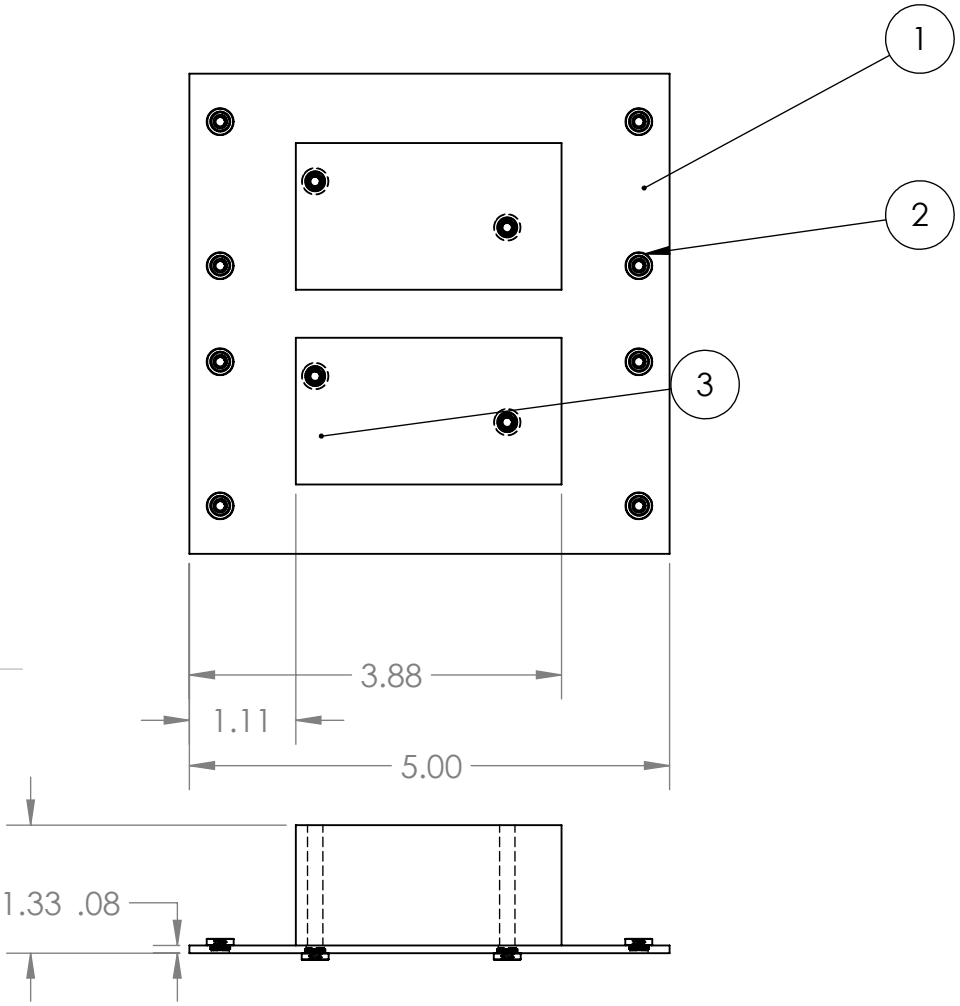
HIDRA_PAYLOAD_BOTTOM

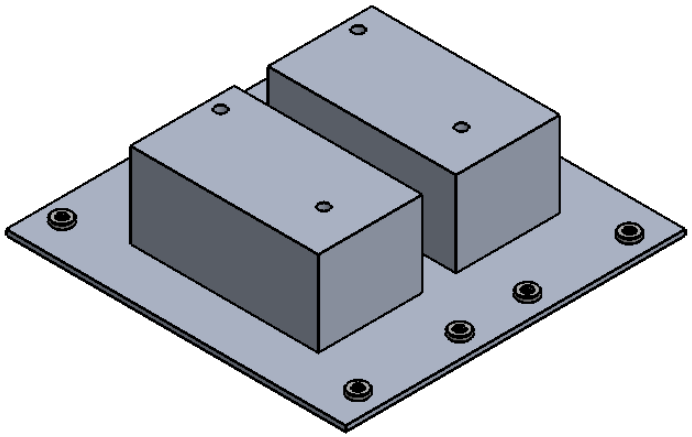
DWG NO.

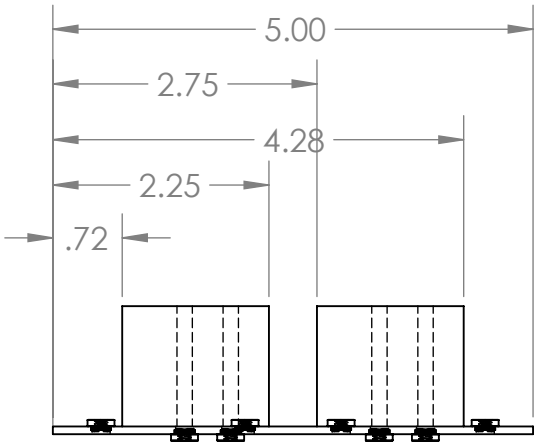
A4

SCALE:1:2

SHEET 7 OF 7







1	Frame_Top
2	#6-32 Press In Nut
3	DC-DC Converter

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
SURFACE FINISH:
TOLERANCES:
LINEAR:
ANGULAR:

FINISH:

DEBUR AND BREAK SHARP EDGES

DO NOT SCALE DRAWING

REVISION

	NAME	SIGNATURE	DATE
DRAWN			
CHK'D			
APPV'D			
MFG			
Q.A			

MATERIAL:

WEIGHT:

TITLE:

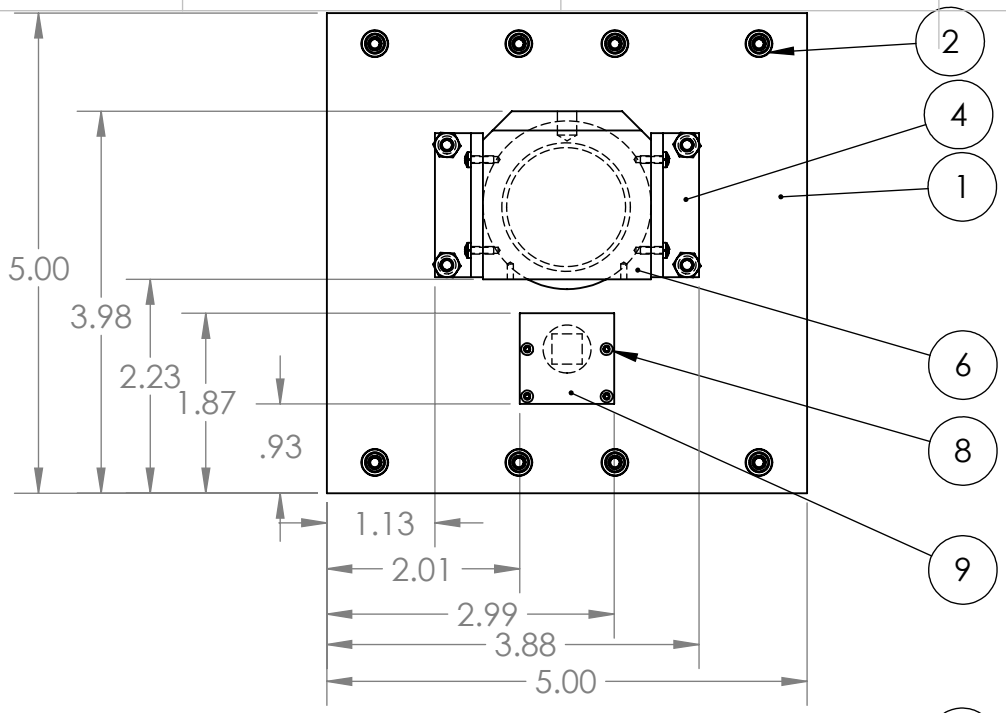
Frame_Top_PIN

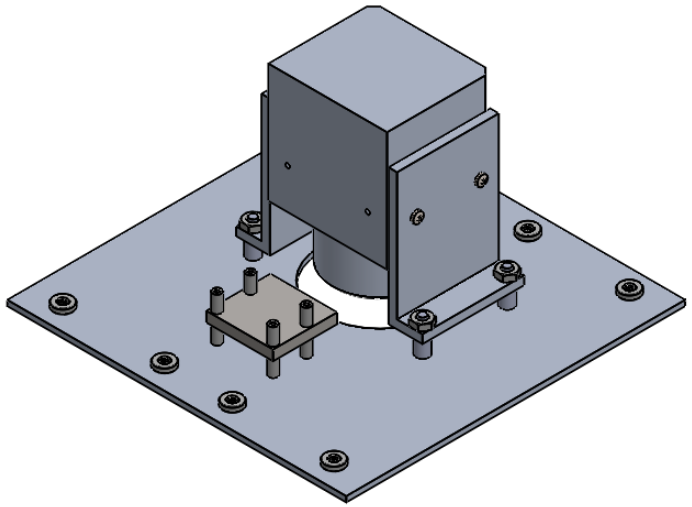
DWG NO.

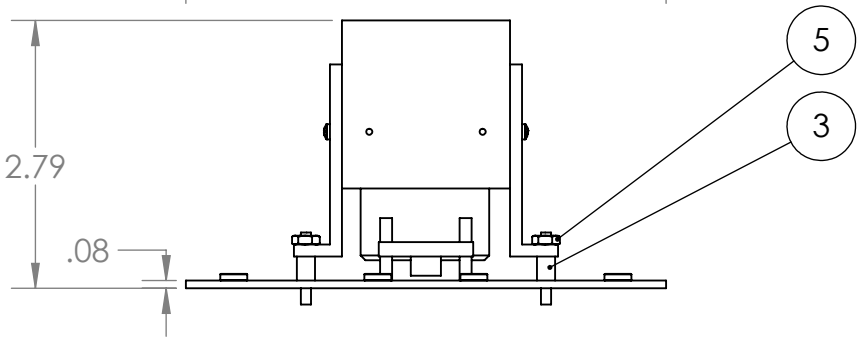
A4

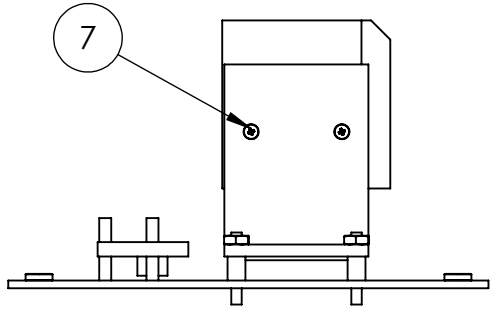
SCALE:1:2

SHEET 1 OF 1









1	Frame_Bottom
2	#6-32 Press In Nut
3	Vibration Mount
4	FLIR Mount
5	Nut
6	FLIR VUE PRO 640
7	M2 Screw
8	Standoff
9	Raspberry Pi Camera

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
SURFACE FINISH:
TOLERANCES:
LINEAR:
ANGULAR:

FINISH:

DEBUR AND BREAK SHARP EDGES

DO NOT SCALE DRAWING

REVISION

	NAME	SIGNATURE	DATE
DRAWN			
CHK'D			
APPV'D			
MFG			
Q.A			

MATERIAL:

WEIGHT:

TITLE:

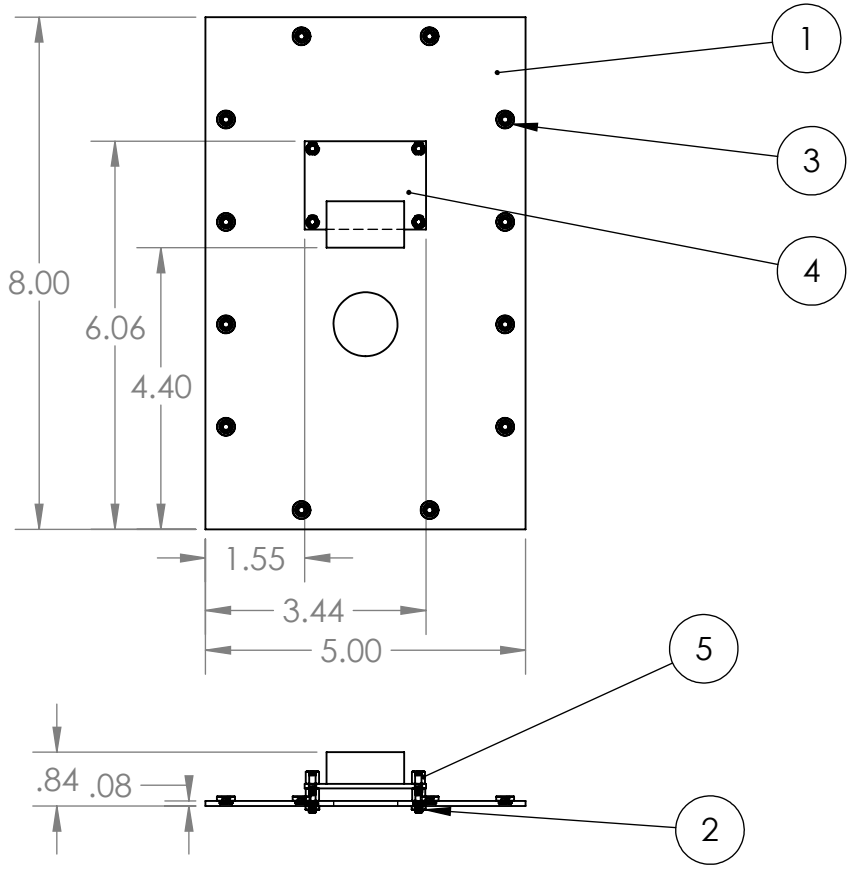
Frame_Bottom_PIN

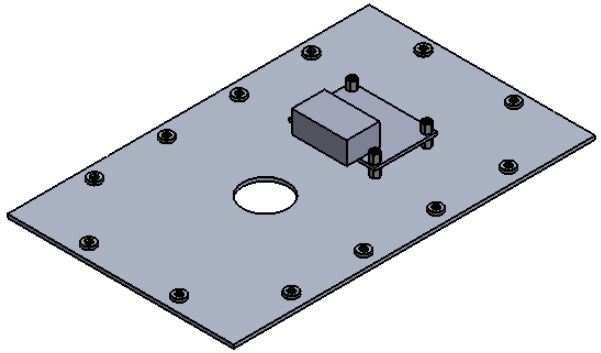
DWG NO.

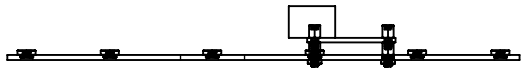
A4

SCALE:1:2

SHEET 1 OF 1







1	Frame_Side
2	M3 Press In Nut
3	#6-32 Press In Nut
4	GPIO to Serial
5	Standoff

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:		FINISH:		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
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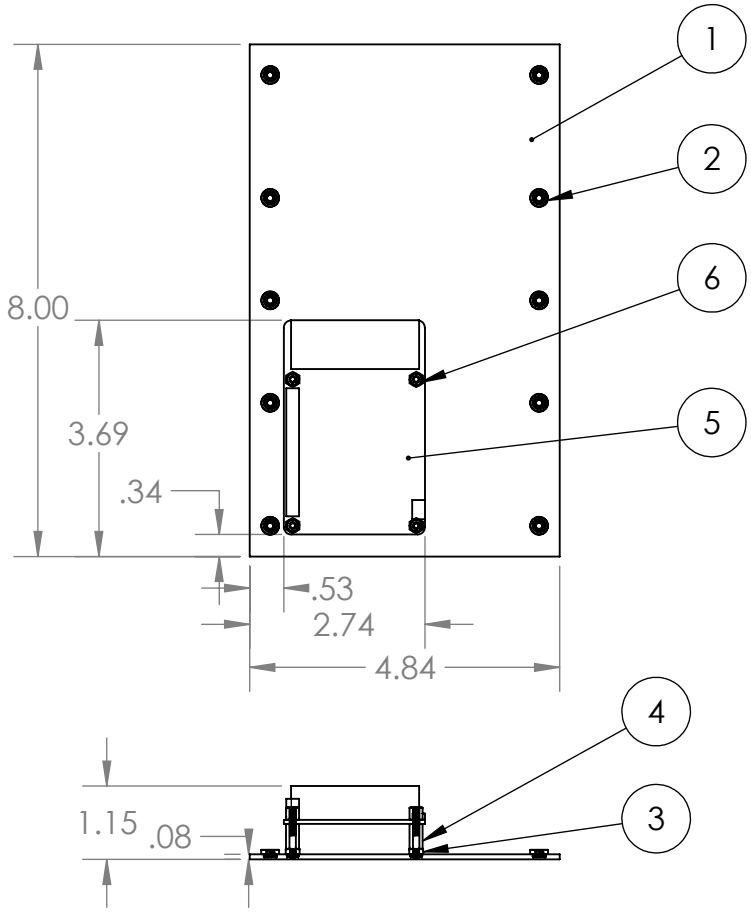
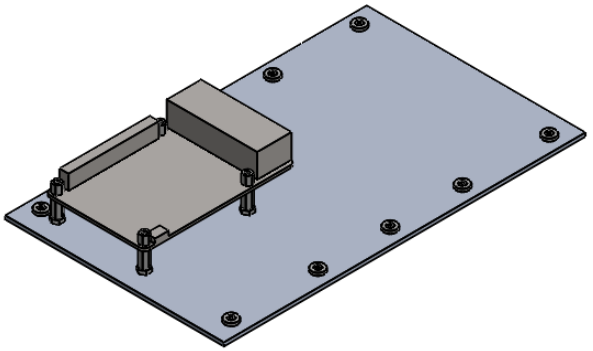
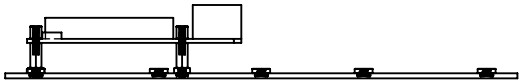
DRAWN					Frame_Side_Long_1_PIN	
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL:	DWG NO.	A4
				WEIGHT:	SCALE:1:3	SHEET 1 OF 1







1	Frame_Side_Long_2
2	#6-32 Press In Nut
3	M2.5 Press In Nut
4	Standoff
5	Raspberry Pi CPU
6	Standoff

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
SURFACE FINISH:
TOLERANCES:
LINEAR:
ANGULAR:

FINISH:

DEBUR AND BREAK SHARP EDGES

DO NOT SCALE DRAWING

REVISION

	NAME	SIGNATURE	DATE
DRAWN			
CHK'D			
APPV'D			
MFG			
Q.A			

MATERIAL:

WEIGHT:

TITLE:

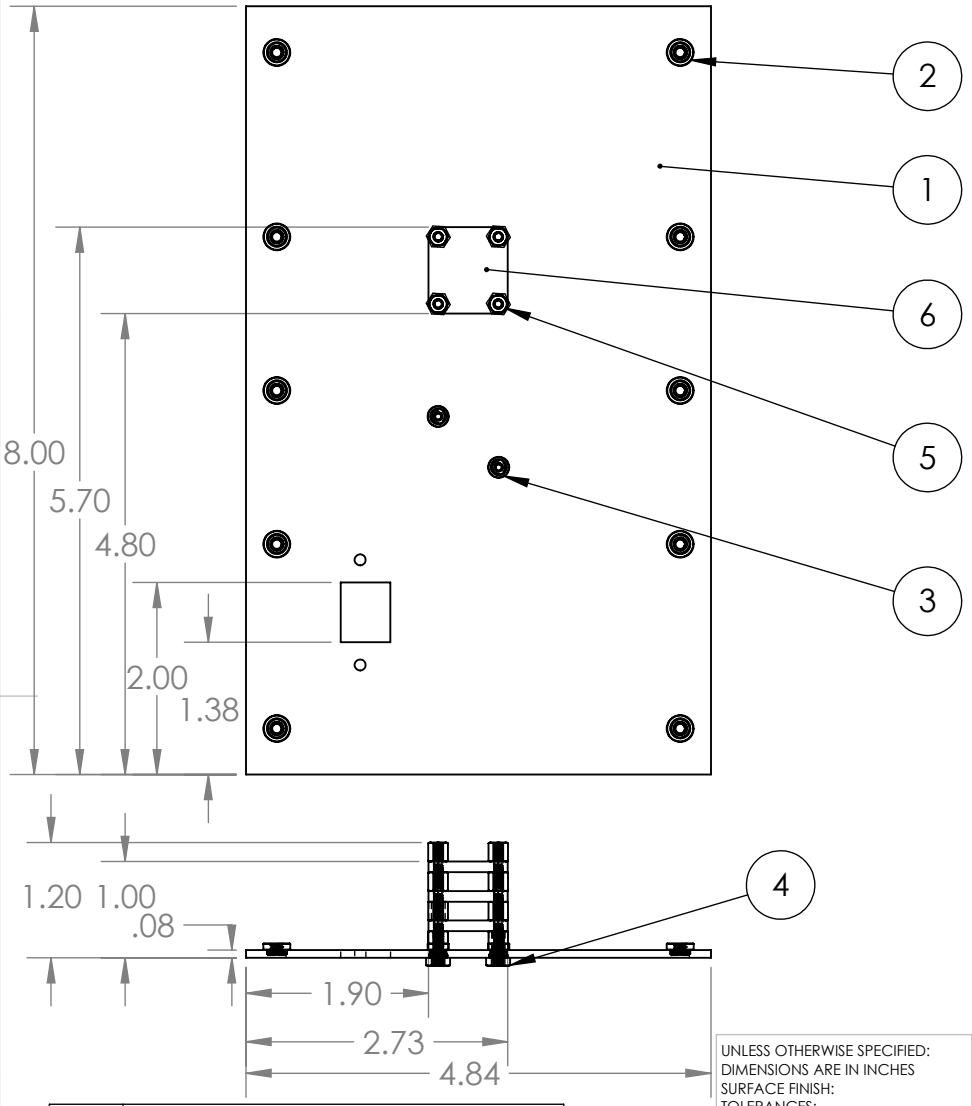
Frame_Side_Long_2_PIN

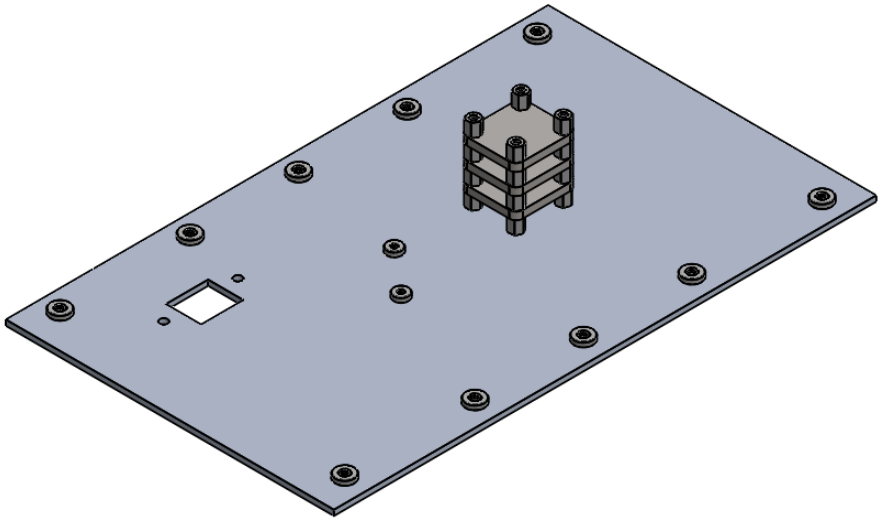
DWG NO.

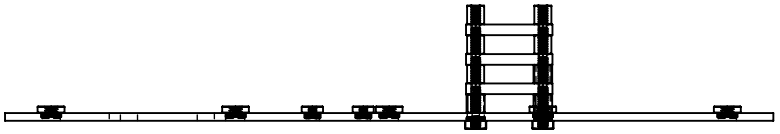
A4

SCALE:1:3

SHEET 1 OF 1







1	Frame_Side_Long_3
2	#6-32 Press In Nut
3	#2-56 Press In Nut
4	M2.5 Press In Nut
5	Standoff
6	Current Sensors x3

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
SURFACE FINISH:
TOLERANCES:
LINEAR:
ANGULAR:

FINISH:

DEBUR AND BREAK SHARP EDGES

DO NOT SCALE DRAWING

REVISION

	NAME	SIGNATURE	DATE
DRAWN			
CHK'D			
APPV'D			
MFG			
Q.A			

MATERIAL:

WEIGHT:

TITLE:

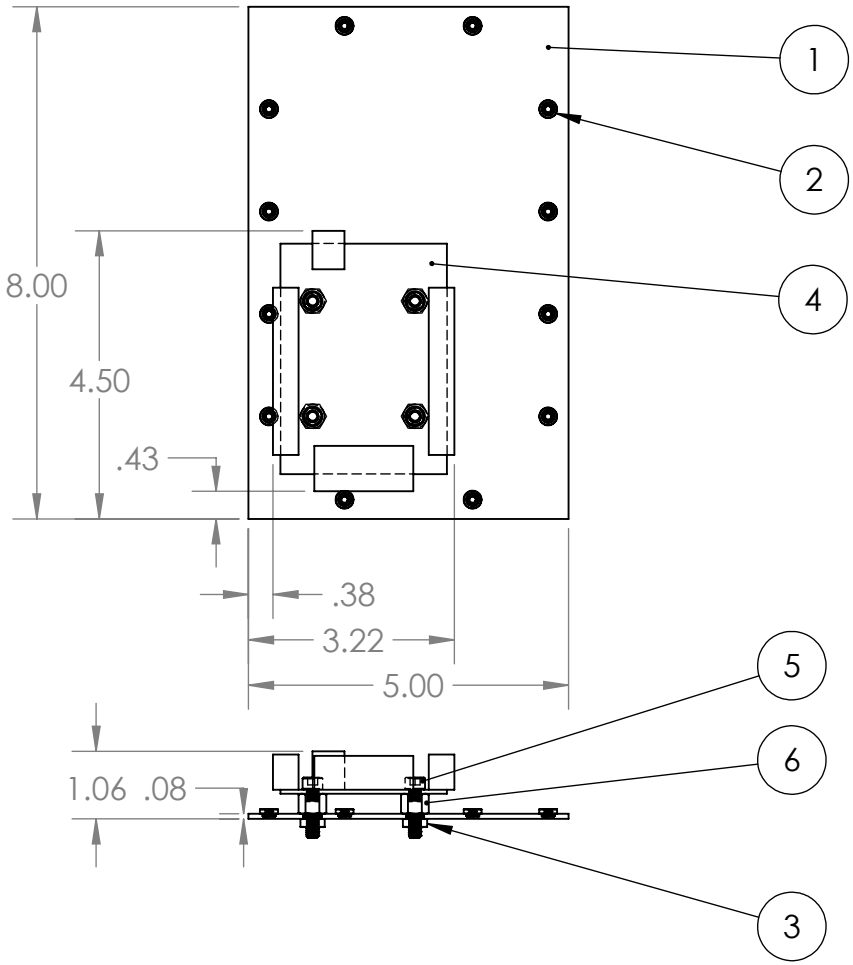
Frame_Side_Long_3_PIN

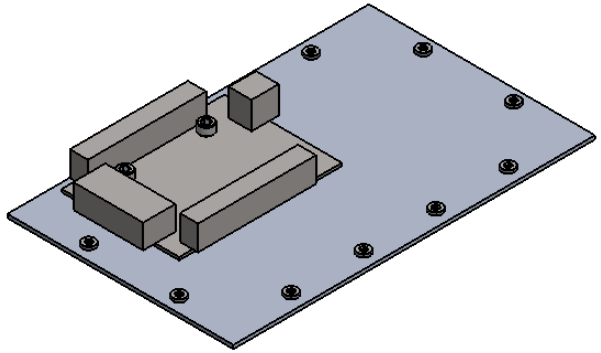
DWG NO.

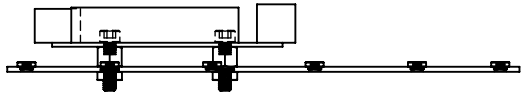
A4

SCALE:1:2

SHEET 1 OF 1







1	Frame_Side_Long_4
2	#6-32 Press In Nut
3	#10-32 Press In Nut
4	Labjack U3
5	Standoff
6	Standoff

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:	FINISH:		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
	NAME	SIGNATURE	DATE	TITLE:	
DRAWN				Frame_Side_Long_4_PIN	
CHK'D					
APPV'D					
MFG					
Q.A			MATERIAL:	DWG NO.	A4
			WEIGHT:	SCALE:1:3	SHEET 1 OF 1