HASP Payload Specification and Integration Plan

Payload Title: Wide Field Camera

Payload Class: (Small) Large (circle one)

Payload ID: 04

Institution: Salish Kootenai College

Contact Name: Tim Olson

Contact Phone: 406-275-4898

Contact E-mail: tim_olson@skc,edu

Submit Date: 1 June 2010

I. Mechanical Specifications:

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

camera interface board	86 grams
camera headboard	46 grams
housing and baffle	303 grams
EDAC cable with interface board connect	60 grams
serial cable	15 grams
fasteners (mounting bolts, washers, standoffs)	60 grams
insulation	25 grams
total	595 grams

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

Attached

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…)

Nothing hazardous

D. Other relevant mechanical information

Based on the results from the 26 May 2010 preliminary thermal vacuum test (described in the May status report) the planned additional radiator mounted below the payload plate has been removed. The metal strips for heat sinking the PCBs to the housing and baffle

have also been removed. The interface board and headboard will be packed in insulation inside the housing.

II. Power Specifications:

A. Measured current draw at 30 VDC

maximum power (occurs at power on)	0.140 A @ 30 VDC
image detector suspend mode	0.094 A @ 30 VDC
image detector resume mode	0.097 A @ 30 VDC
SRAM write	0.107 A @ 30 VDC
serial write	0.115 A @ 30 VDC

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.

Attached

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)

serial downlink rate = (2 x 42130 bytes x 8 bits/byte)/3600 sec = 187 bits/sec

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

Byte	Description
1	Record type (value = 0x01)
2-7	Timestamp (lowest six base-10 digits of the ten base-10 digits specifying the number of integer seconds of the last Unix timestamp received from the HASP system, ASCII hex values from 0x30 to 0x39)
8	Image line number (value from 0x01 to 0x80)
9-328	Pixel data (two bytes per pixel, 160 pixels in one line, values from 0x00 to 0xFF)
329	Line checksum (8 least significant bits of the sum of the values of bytes 1-328)
330-42112	Bytes 1-329 repeated 128 times for one complete image

Serial Data Record for a 160 x 128 Thumbnail Image Downlink

Byte	Description
1	Record type (value = 0x02)
2-7	Timestamp (lowest six base-10 digits of the ten base-10 digits specifying the number of integer seconds of the last Unix timestamp received from the HASP system, ASCII hex values from 0x30 to 0x39)
8-15	Temperature data in order from sensor 1 to 8, one byte from each sensor (values from 0x00 to 0xFF)
16	Command number of the last uplinked command (value from 0x00 to 0xFF)
17	Last uplinked command status (value from 0x00 to 0xFF, the interpretation of the value is customized for each command)
18	Checksum (8 least significant bits of the sum of the values of bytes 1-17)

Serial Data Record for Temperature Data Downlink

D. Number of analog channels being used:

Two

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

Channel 1 (EDAC Pins K and L): Used as a warning flag to indicate when the temperature of the FPGA on the interface board is outside the safe range of -10ºC to 50ºC . 0 V applied to Pin K indicates the FPGA temperature is within the safe range, 5 V indicates the FPGA temperature is outside of the safe range.

Channel 2 (EDAC Pins M and R): Used as a general system status flag. 0 V applied to Pin M indicates the image acquisition flag in the onboard C code is TRUE , 5 V indicates the image acquisition flag is FALSE. There is no way to tell for sure in flight that uncorrupted image data is being written to the SD card other than viewing the image post flight. A proxy measure is the reception by the FPGA of all I2C ACK bits in the commands to the image detector, SRAM, and SD card device during the attempted acquisition of an image. The image acquisition flag is set TRUE for the latest attempted image acquisition when the all these ACK bits are received, and FALSE otherwise.

F. Number of discrete lines being used:

None other than the overall payload power on/power off.

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.

None

I. Other relevant downlink telemetry information.

Downlink of a 160 x 128 thumbnail image and temperature data from eight sensors will be requested twice each hour for verification of correct camera operation. (Full resolution still images will be archived at one minute intervals to the onboard SD card for post flight retrieval and will not be downlinked. Temperature data will also be archived to the SD card at one minute intervals.) More frequent downlink of thumbnails and/or temperature data may be requested temporarily at an increased frequency if the analog channel data indicates problems. (For diagnosis of camera operation problems the uplink command list includes on demand serial downlink of a thumbnail image together with temperature data, or image data alone, or temperature data alone.)

The SKC HASP team requests that the GPS time and position record from the HASP flight system be sent via serial with a period of 60 seconds. GPS time information will be included in the thumbnail and temperature serial records, and the full GPS record will be included with the archived image and temperature data.

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*)

If the payload is operating as expected 3-4 uplink commands are anticipated each hour during the daylight portion of the flight, 6-8 during the night (for experimentation with longer exposure times).

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

Byte	Bits	Description
1	0-3	Checksum (4 least significant bits of the sum of the value of Byte 2 and the four highest bits of Byte 1)
1	4-7	Payload ID number (value = 0x04)
2	0-7	Command (value from 0x00 to 0xFF)

Serial Uplink Command Format

Command	Description
0x00	Reset image detector
0x01	Place image detector in low-power suspend mode
0x02	Place image detector in resume mode
0x03-0x0F	Future expansion
0x10	Place FPGA in low-power mode
0x11	Place FPGA in resume mode
0x12-0x1F	Future expansion
0x20	Downlink last thumbnail and latest temperature data
0x21	Downlink last thumbnail only
0x22	Downlink latest temperature data only
0x23-0x2F	Future expansion
0x30-0x4F	Set still image exposure time (32 different exposure times)
0x50-0x6F	Set still image acquisition period (32 different periods)
0x70-0x8F	Future expansion
0x90-0xAF	Acquire video (32 different durations/resolutions)
0xB0-0xFF	Future expansion

Serial Uplink Command List

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:

The SKC integration team will arrive in Palestine on 1 August 2010, and will be ready for integration activities beginning the morning of 2 August 2010.

B. Approximate amount of time required for integration:

Two hours if everything works at first power on.

C. Name of the integration team leader:

Mathew Friedlander

D. Email address of the integration team leader:

mathewjfriedlander@gmail.com

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

Mathew Friedlander	mathewjfriedlander@gmail.com
Bradley Lehuta	lehuta.bradley@gmail.com
Sean Shriner	shrineman66@yahoo.com
Thomas Trickel	thomas_trickel@skc.edu

A. Define a successful integration of your payload:

Success criteria: the payload will successfully acquire imagery in cold soak and hot soak conditions in thermal vac, and when powered on in its payload position on the HASP chassis.

B. List all expected integration steps:

1. Attach the payload mounting plate to the HASP chassis with the four mounting bolts.

2. Connect the EDAC and serial connectors to the bottom of the payload plate.

3. Apply 30 VDC through the EDAC connector.

4. Perform system checks by exercising all uplink commands, monitoring the two analog lines, and verifying recovery from a system reset (by toggling the EDAC 30 VDC off and on). Verify image acquisition by examination of thumbnail images retrieved via serial and full resolution images written to the SD card.

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

1. Camera headboard and interface boards securely attached to the housing.

2. Insulation packed in the housing and the housing closed and secure.

3. Housing and baffle secured to each other and secured to the mounting plate.

4. Mounting plate secured to the HASP chassis.

5. EDAC and serial connectors attached to the interface board and mounting plate.

6. Interface board and headboard powered on.

7. The payload responds correctly to all uplink commands.

8. The payload recovers correctly from a power off/power on toggle.

9. GPS records are correctly received by the payload via serial.

10. Valid temperature is acquired and transmitted via serial.

11. Valid thumbnail images are acquired and transmitted via serial.

12. Analog Channel One indicates the FPGA temperature is in the safe range (Pin K is at 0 V).

13. Analog Channel Two indicates the image acquisition flag is TRUE (Pin M is at 0 V).

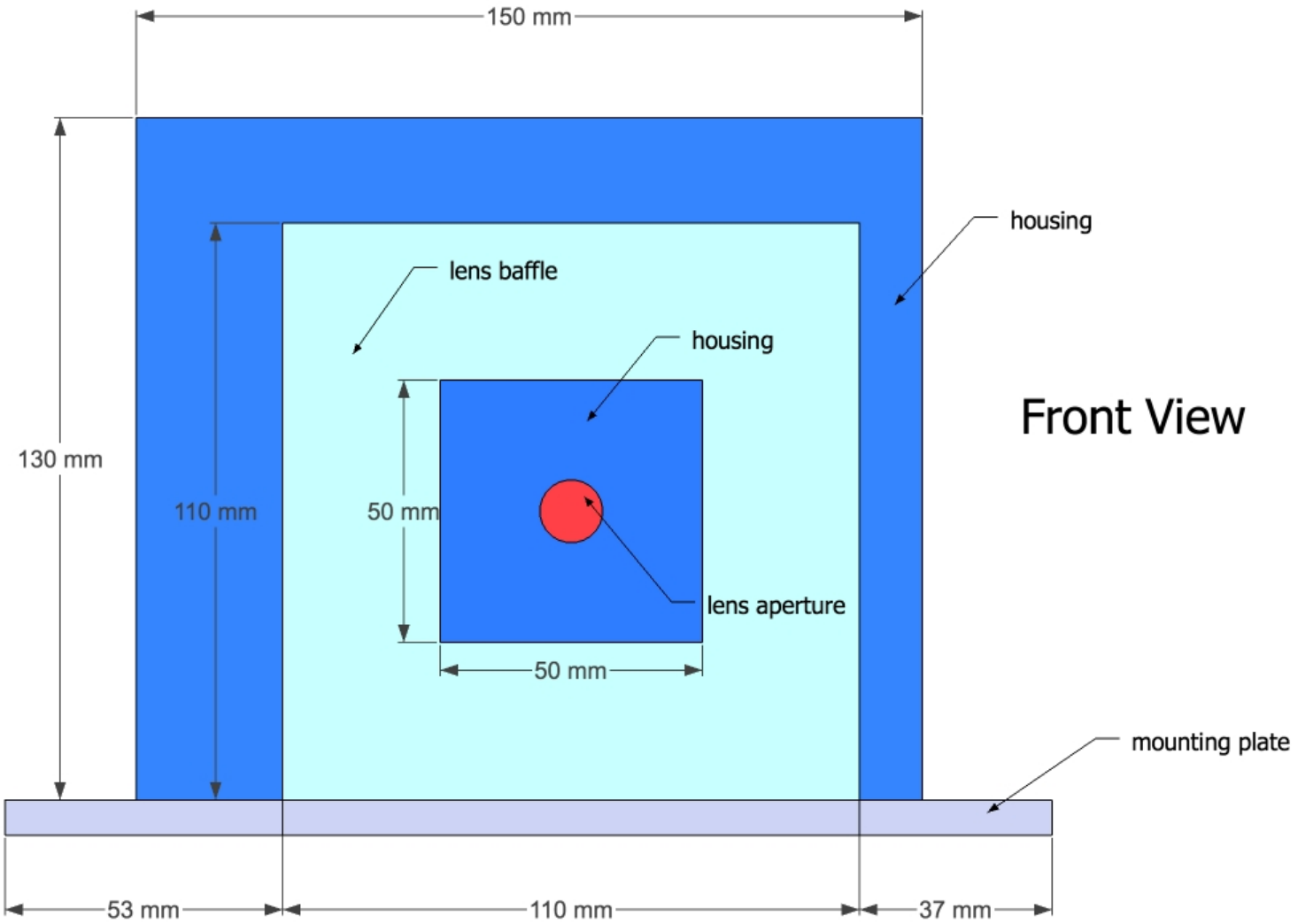
14. Valid full resolution images and temperature data are written to the SD card.

D. 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…):

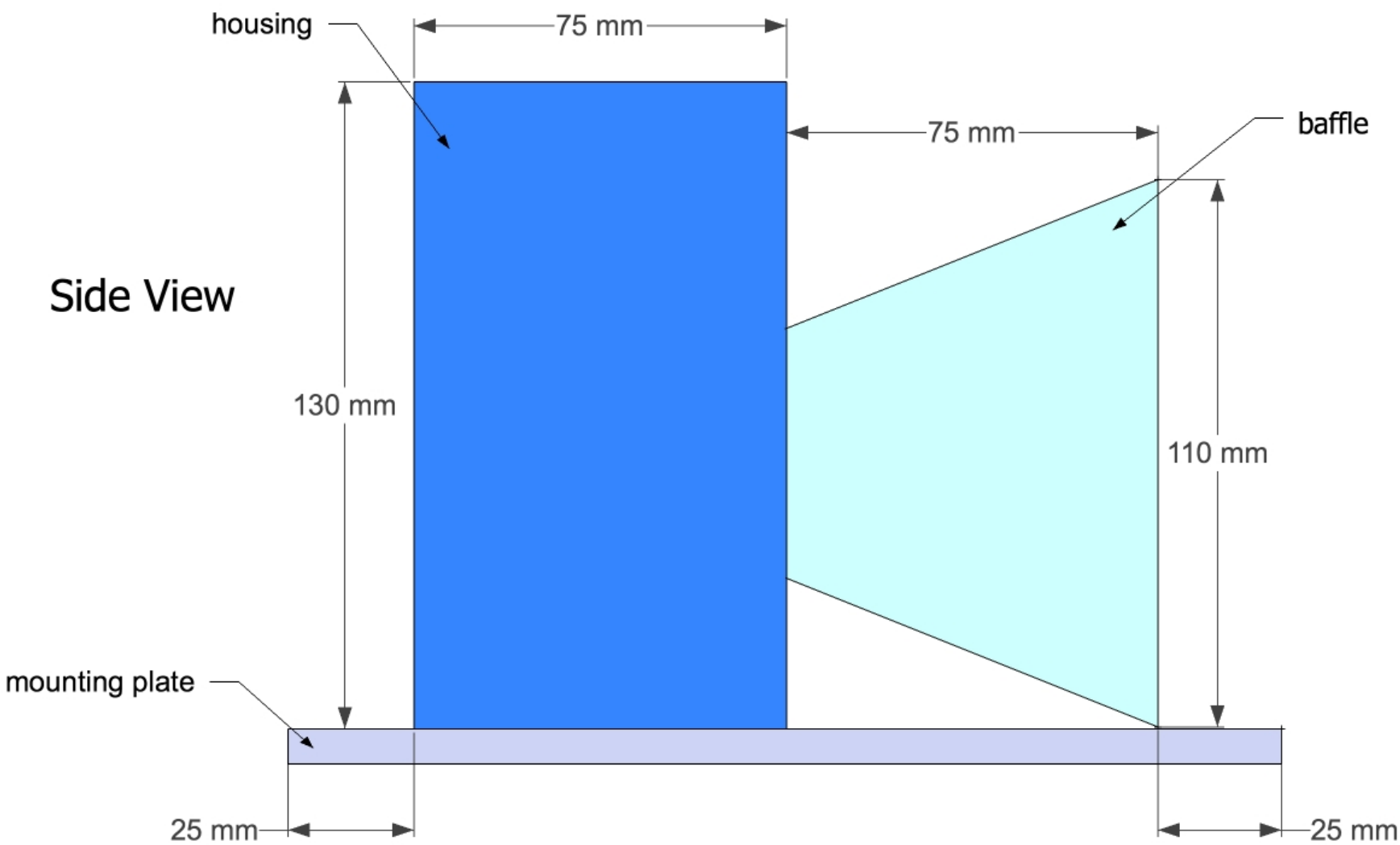
None

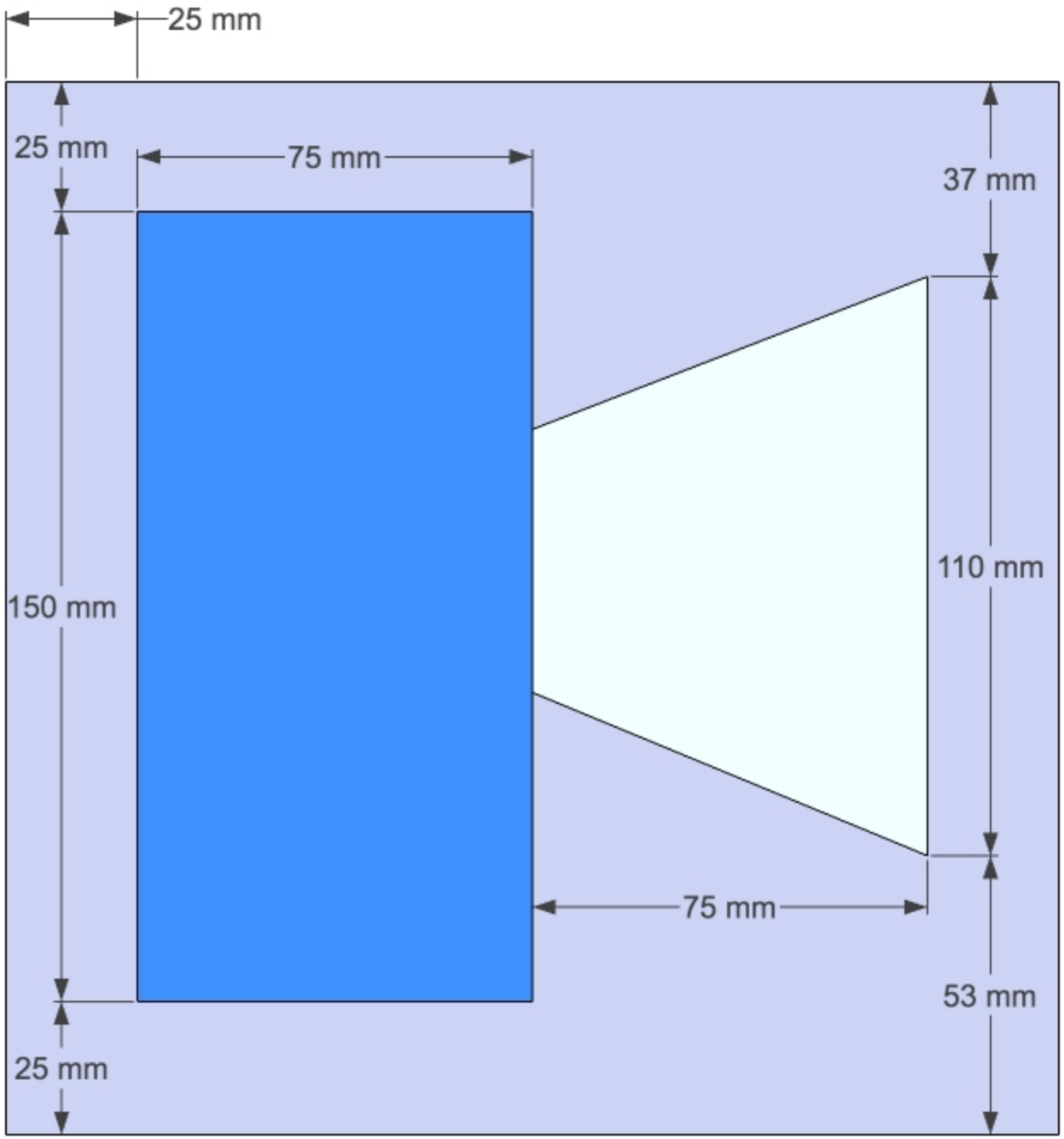
E. List any LSU supplied equipment that may be needed for a successful integration:

None


150 mm
housing
lens baffle
housing
130 mm
110 mm
50 mm
lens aperture
50 mm
mounting plate
53 mm
110 mm
37 mm

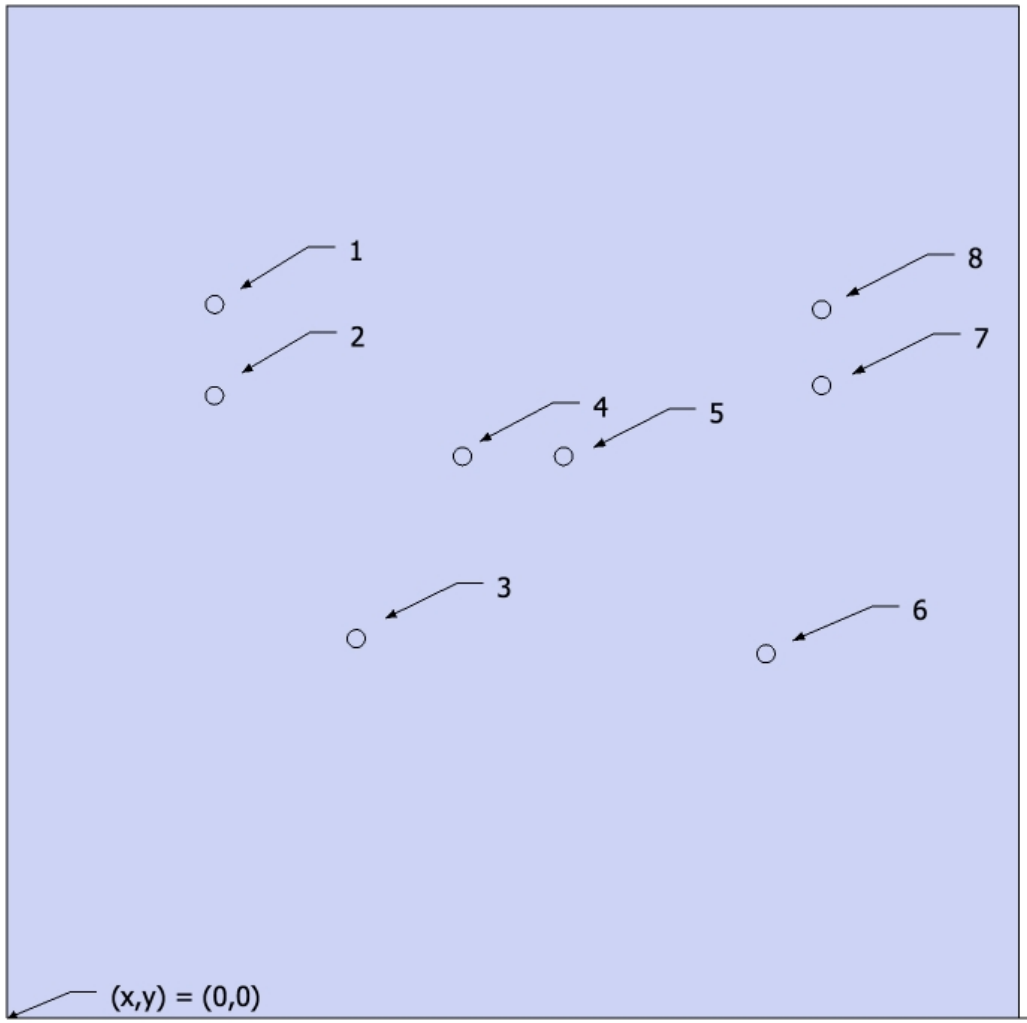
Front View


housing
75 mm
75 mm
baffle
Side View
130 mm
110 mm
mounting plate
25 mm
25 mm



Top View

Bottom View



8 x 6-32 fastener hole locations

1 at (x,y) = (41 mm, 141 mm)

2: (41 mm, 123 mm)

3: (69 mm, 75 mm)

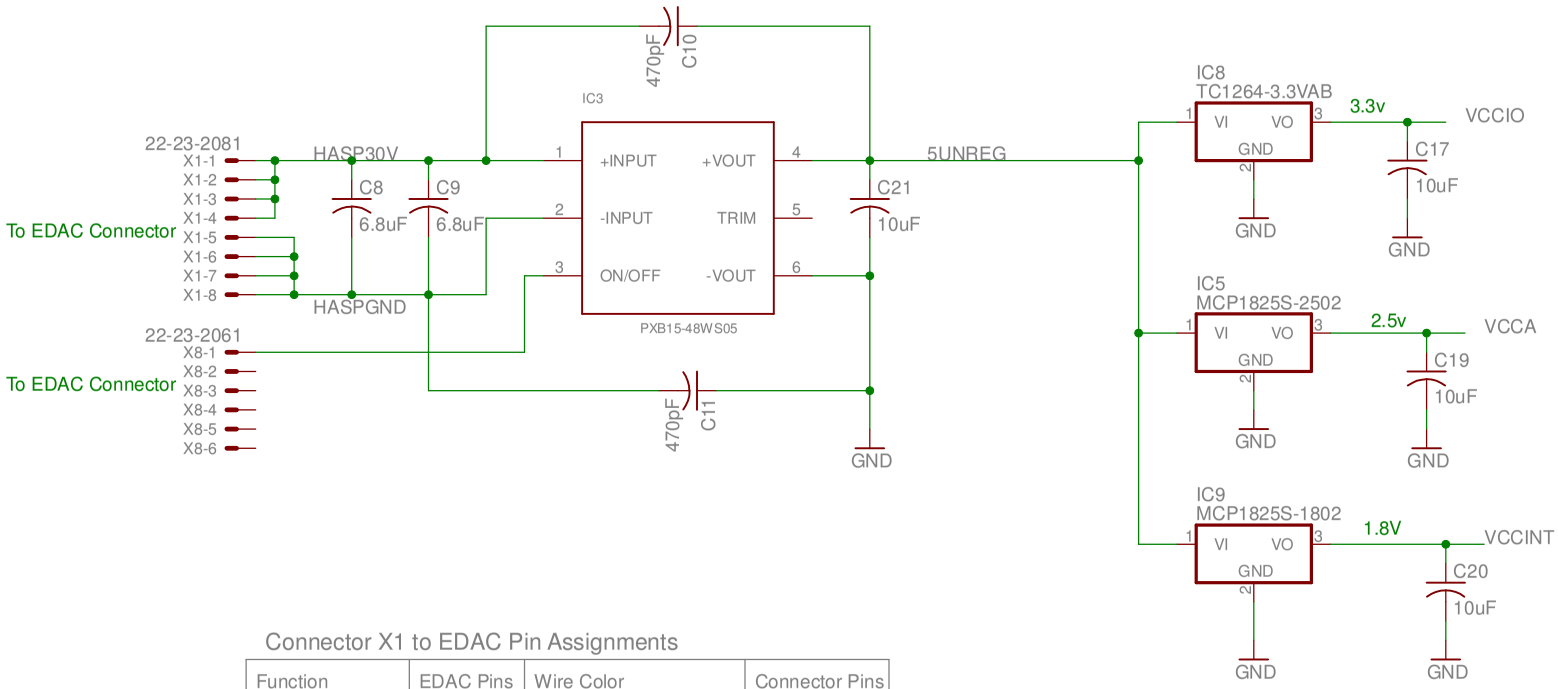
4: (90 mm, 111 mm)

5: (110 mm, 111 mm)

6: (150 mm, 72 mm)

7: (161 mm, 125 mm)

8: (161 mm, 140 mm)



Connector X1 to EDAC Pin Assignments

Function	EDAC Pins	Wire Color	Connector Pins
+30vDC	A, B, C, D	White with Red Stripe	X1 - 1, 2, 3, 4
Power Ground	W, T, U, X	White with Black Stripe	X1 - 5, 6, 7, 8
Discrete 1	F	Brown	X8 - 1
Discrete 2	N	Green	
Signal Return	L, R	Black	
Analog 1	K	Blue	
Analog 2	M	Red	

Power Subsystem	
X2	
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