HASP Payload Specification and Integration Plan

Payload Title: SPARTAN-V

Payload Class: Small (Large) (circle one)

Payload ID: 11

Institution: Colorado Space Grant Consortium - University of Colorado at Boulder

Contact Name: Christopher Nie

Contact Phone: (505) 315-8748

Contact E-mail: Christopher.nie colorado.edu

Submit Date: 29 Apr 11

I. Mechanical Specifications:

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

i. The total mass of the payload in its current state is 13.91 g. The payload structure is sub ect to change upon completion of system testing however the final mass of the payload is e pected to be within 1 g of its current mass and will not e ceed the HASP re uirement of 20 g.

Table 1. Mechanical component masses.

Component	Mass (Kilograms)
Side Panels	1.25
Top Plate	1.77
Rotary Table	0.96
Rotary Table Freefall Collar	0.10
Pitch Arms (Both)	0.92
Pitch Bearing (Both)	.04
Yaw Bearing	0.068
Yaw Motor Assembly (Includes both plates coupling Slider Shafts Flange Mounts Spring Spring Housing Third Point Support)	0.29
Telescope Couplings (Both)	0.11

Solenoid	0.07
Solenoid Mate Flange	0.03
Screws Bolts Washers Set screws Standoffs heliocoils	0.5
Telescope	4.7
Electrical Components (PCB's and wiring)	2
Stepper Motors	1.1
Total Structural Mass	13.91

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

Mechanical Drawings

The "static" part of the structure (which encompasses everything ***not*** on the rotary table) lies entirely within the dimensional constraints found in the HASP Student Payload Interface Manual. Figure 1 on the following page was copied directly from the manual. The height dimension (coming out of the page) was originally 12 inches. Be sure to note reference corner "A" and "B" as they have been called out in the figure, these will be useful throughout the document.

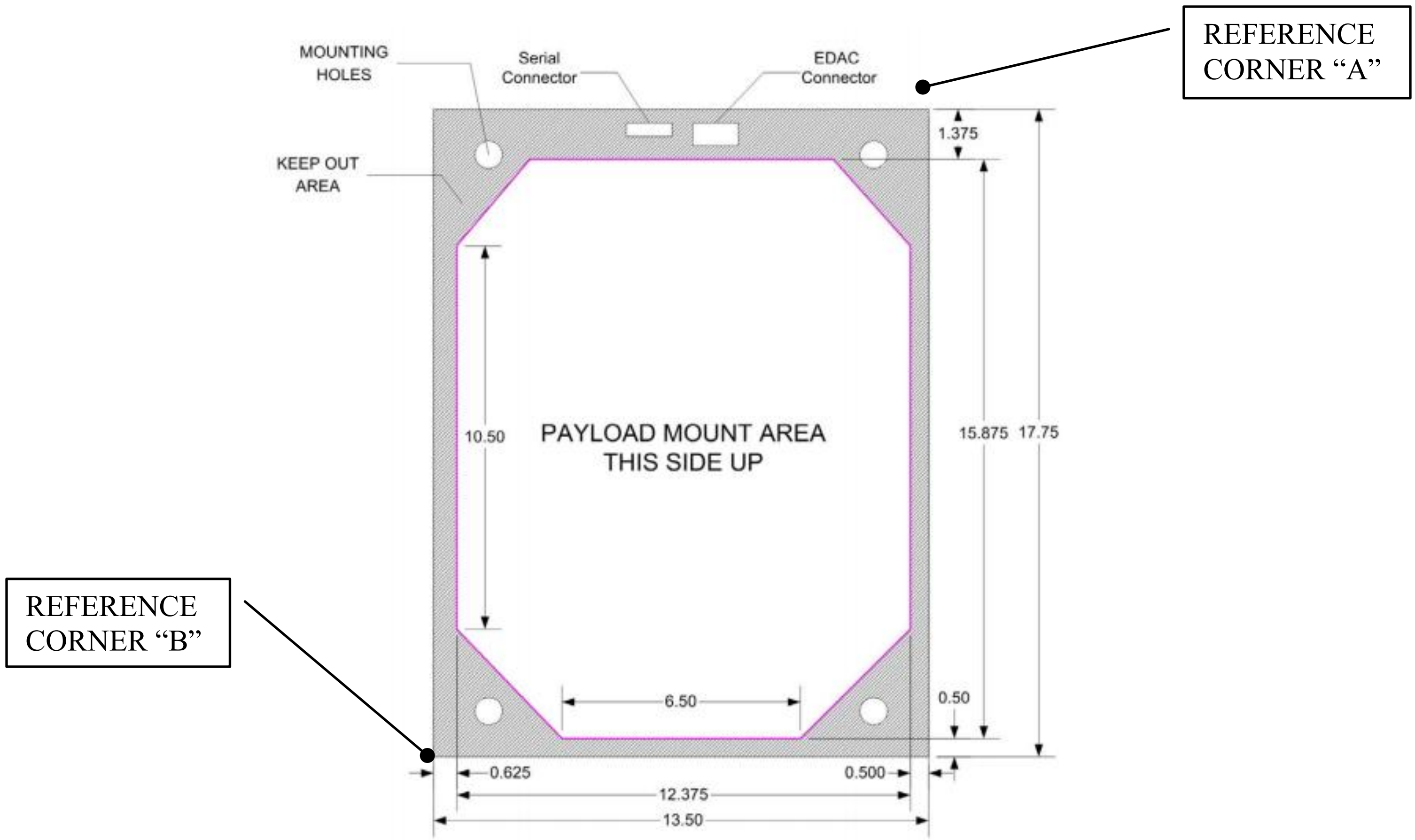


Figure 2: Large student payload mechanical interface plate

Figure 1: Large student payload mechanical interface plate

The SPARTAN V team re uested 5 inches of height (up to 17 inches) and 2 inches of width (e tending the 12.375 inches to 14.375 inches) at 5 inches above the PVC plate this was granted by the HASP program. These dimensions are shown in the following Solidwor s Graphics by a semitransparent outlined region.

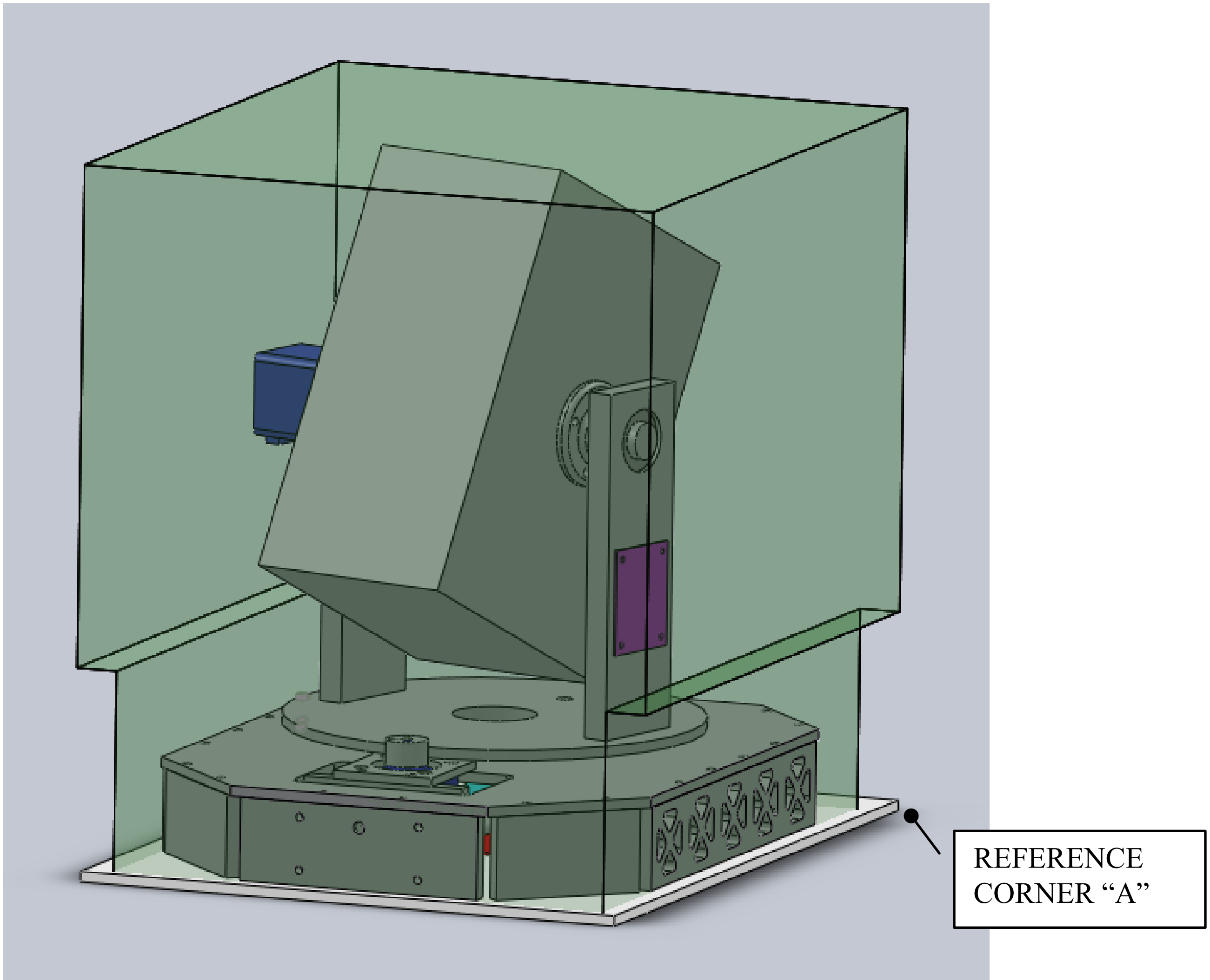


Figure 2: Overall Payload Perspective

Figure 2 shows dimensions relative to the HASP provided PVC plate (shown in white). The semi-transparent green volume is the HASP approved dimensional envelope to which the payload is restrained.

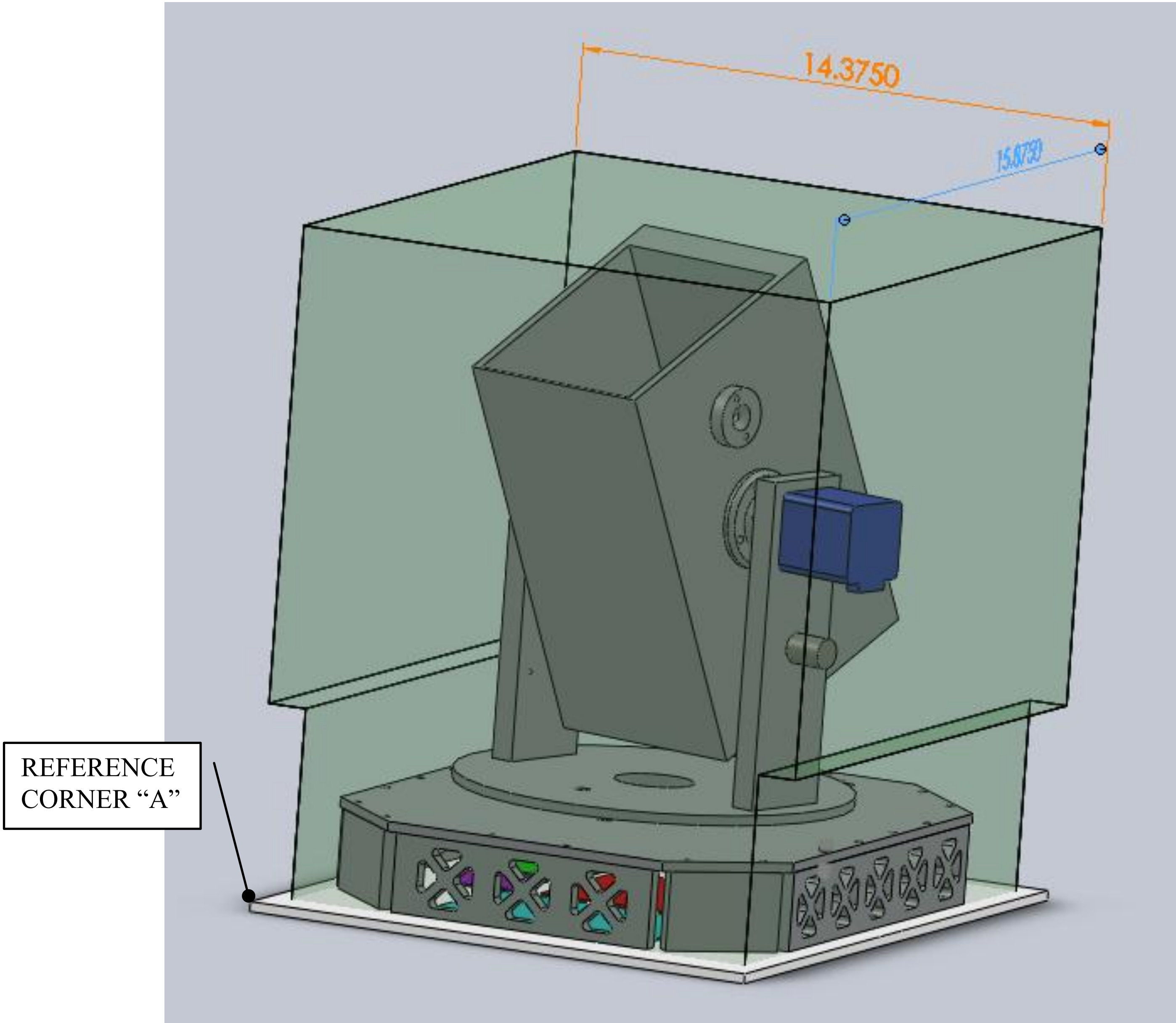


Figure 3: 3D Perspective of Extended Dimensional Constraints

Figure 3 displays the e tended 14.375 inch width in orange and the original 15.875 inch length in blue.

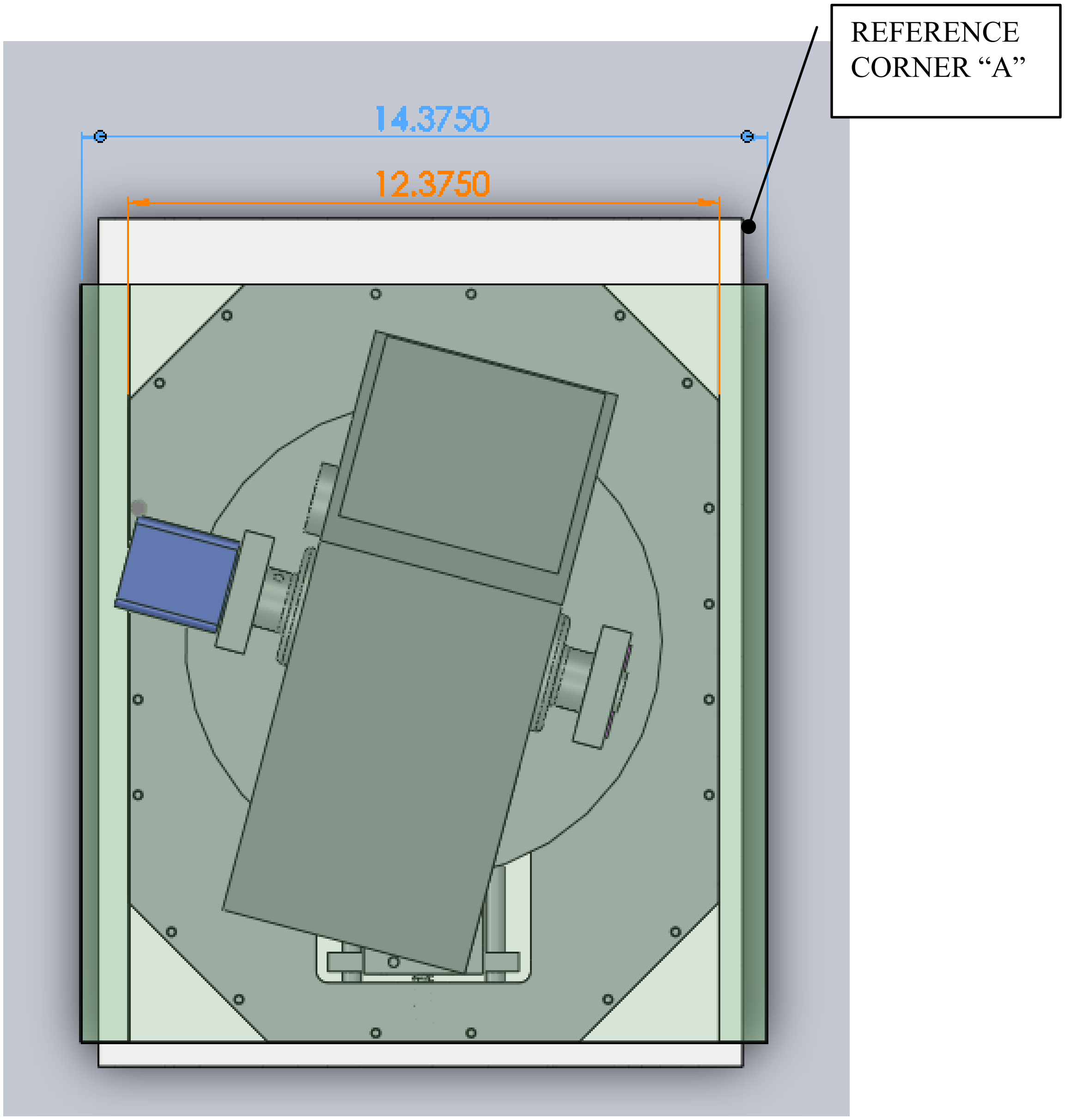


Figure 4: Top Perspective

Figure 4 shows the e tended 14.375 inch width in blue which begins at a height of 5 inches from the PVC plate. The original width of 12.375 inches shown in orange is the width of the envelope below this height. It is also worth noting that the electronics casing (the static structure) *always* remains within the 12.375 inch width constraint.

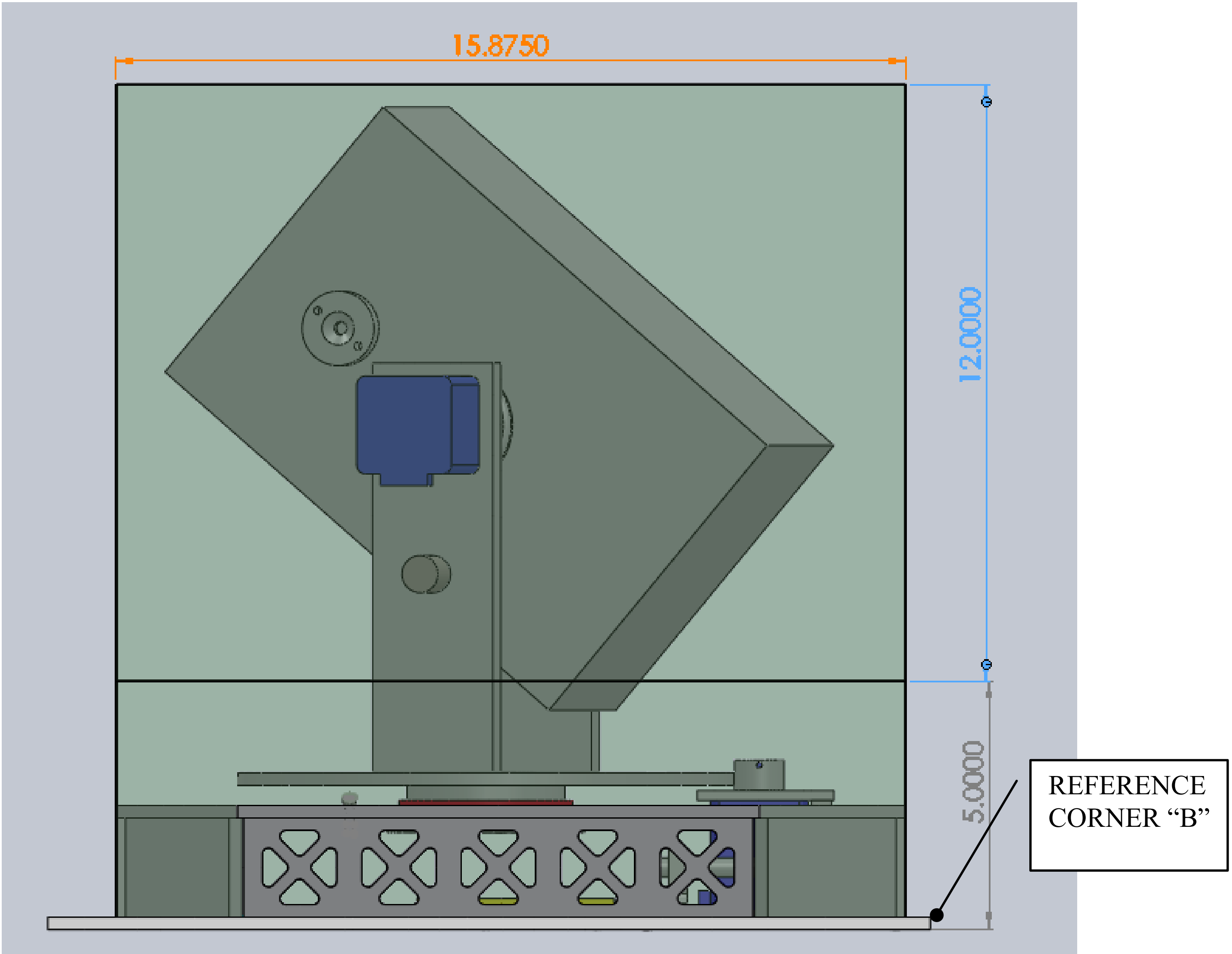


Figure 5: Side Perspective

The reader should note the detail on 15.875 inch length shown in orange as well as the height (5 inches shown in grey) at which the width e tends to 14.375 inches. The remaining height of the dimensional envelope is denoted by the blue dimension (bringing the total height to 17 inches as was re uested for and approved from HASP. Finally it is worth noting that the static structure lies entirely within the 15.875 inch length re uirement.

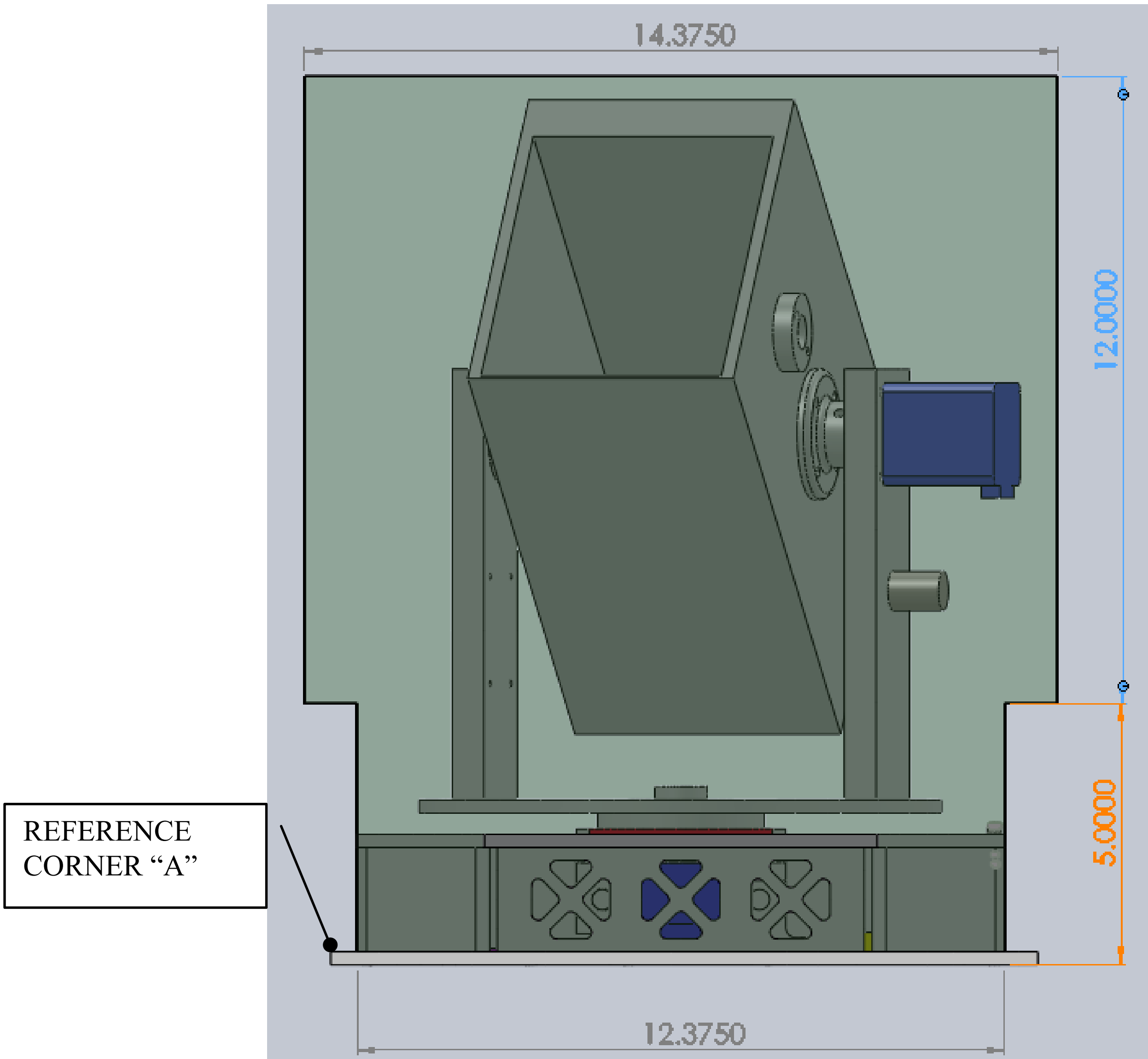


Figure 6: Front Perspective

This figure shows the final perspective of the payload. One can see the original width of 12.375 inches lead into the 14.375 inch width e tension starting at 5 inches from the PVC plate. Included in Appendi A is the Solidwor s schematic of the payload.

Interfacing and integration of the payload to HASP

The following figures show the components that will be directly interfaced with the PVC plate which interfaces with HASP. All of these components will be mounted by bolts through the PVC plate. The bolt heads will therefore protrude "below" the PVC plate as they did in the BOWSER payload from HASP 2009.

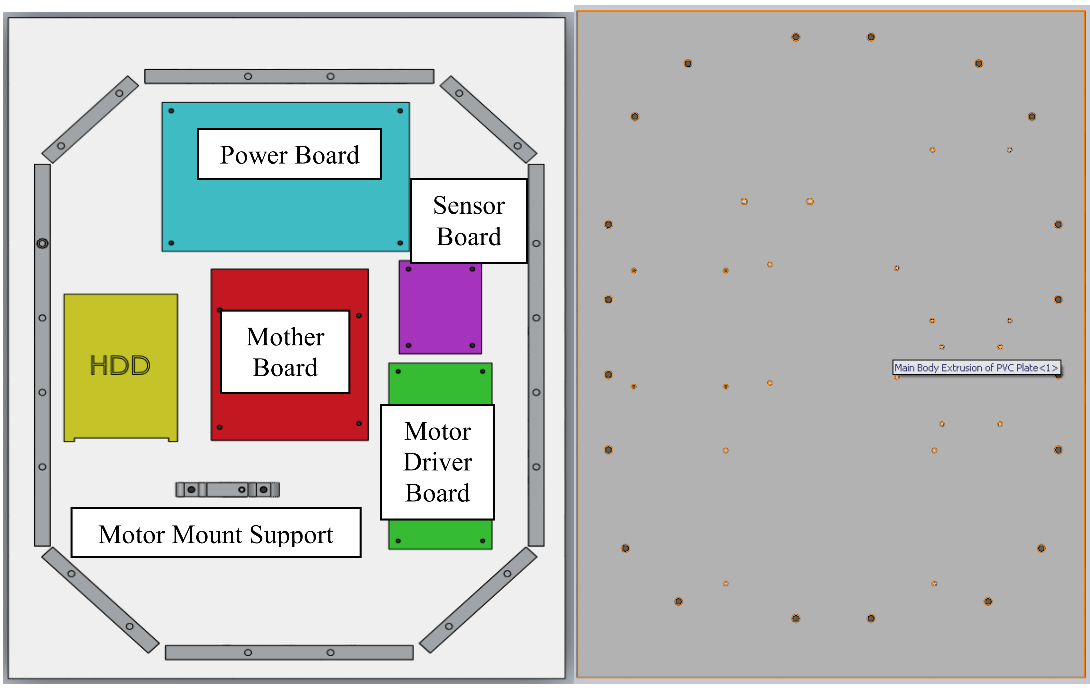


Figure 7a: Side-paneling and electrical mountings to PVC plate (left). Specific mounting holes to PVC (right).

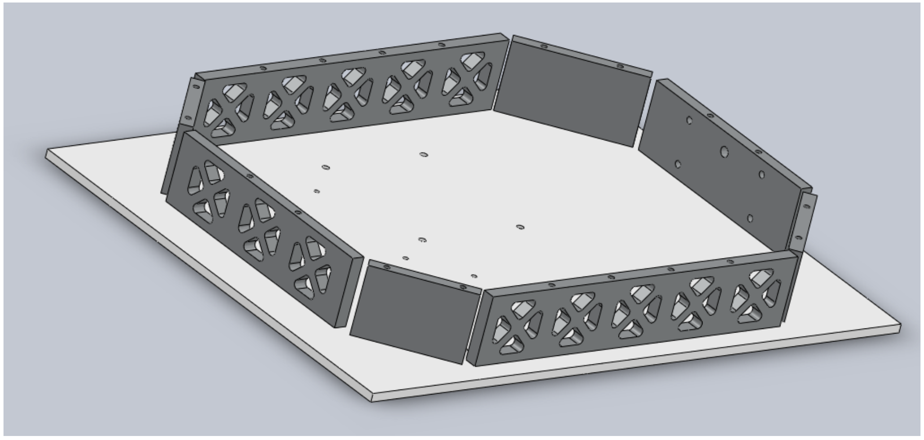


Figure 8. Isolated view of PVC plat integration.

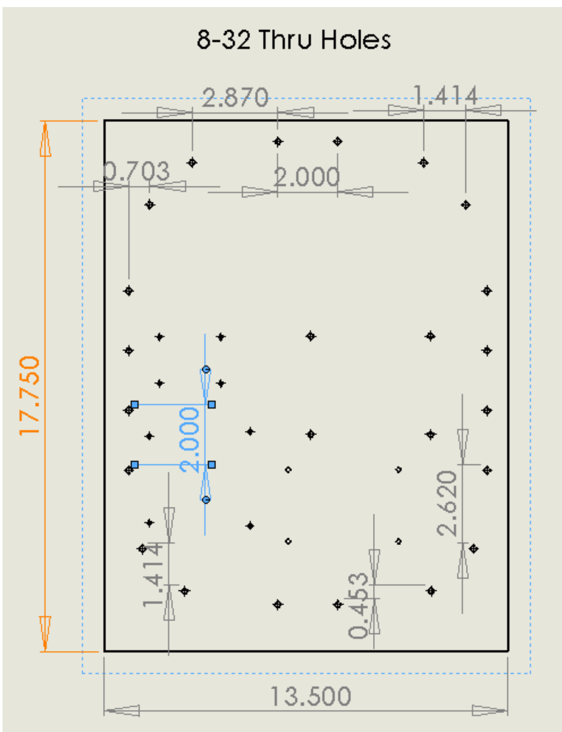


Figure 9. Dimensions of interface.

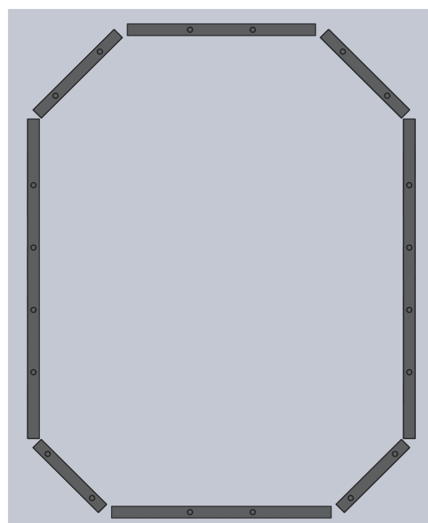


Figure 10. Bottom side of payload plates.

Figure 8 9 and 10 display a more detailed picture of the interfacing to the HASP platform. The interface is composed of 20 holes made for 8-32 size bolts. The PVC plate was made with through holes in this bolt pattern (Fig. 9) and the bottom side of the side plates of the payload assembly were made to match this hole pattern with threaded holes so that the bolts will screw in from the bottom (Fig. 10).

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…)

SPARTAN-V is not flying any material that will be hazardous to HASP or the ground crew.

C. Other relevant mechanical information

SPARTAN-V does have a motional telescope capable of full 360 degrees rotation and 180 degrees elevation ad ustment.

The stepper motors that will be used have a high current draw and will heat up at a very fast rate. Since they will only be functional at night we will need to verify that they will remain functional during the low temperatures e perienced during nighttime flight. Testing will be done to determine if any heating method is needed.

II. Power Specifications:

The Power Specifications section will display a summary of all the electrical components within the SPARTAN-V system as well as the voltage current and power draw of each component. This section will also address how SPARTAN-V is regulating power throughout the payload interfacing with the EDAC connector and the number of analog and discrete lines being used and for what purpose. The following three uestions will be fully addressed in the sections below:

A. Measured current draw at 30 VDC

i. The ma imum e pected current draw is 2.1 Amps.

The power board on the SPARTAN-V ta es input from the HASP EDAC-516 connector and converts into the following different voltages of 3 5 6.5 and 12 Volts. The power drawn by the system is bro en down by each voltage level and the total power drawn.

Table 2. Summary of power drawn.

Voltage (in volts)	Current Drawn (in Amperes)	Power(in watts)	Power with regulator efficiency (in watts)
3.3	0.087	0.288	0.3024
5	2.5	12.5	14.37
6.5	4	26	28.6
12V	1.5	18	19.8

		Total Power Consumed	**63.07**
		Power Available	**75**
		Available Power Margin	**11.93 (15.09%)**

The 6.5 V is used to drive the stepper motors the 12V supply is used to power the CCD the 3.3V powers the two sensor boards and the 5V line powers motherboard.

The power of 63.07 Watts is drawn at 30V power input lines from HASP EDAC-516 platform. The current drawn is therefore 2.10 A. This is the ma imum current drawn (with factor of safety and worst case scenarios) considering the fact that all the components are in operation simultaneously which is not the planned case.

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 re uired by your subsystems.

We will use a one sided 20 pin EDAC-516 connector. The side of the EDAC with the connector is used to interface with the HASP platform EDAC. The other side of the EDAC cable with open leads will be connected to screw terminals on the power board of SPARTAN-V. The power and ground lines will be combined into two lines as seen in Fig. 8 below. We do not use an EDAC connector on both sides but instead solder onto the SPARTAN-V board.

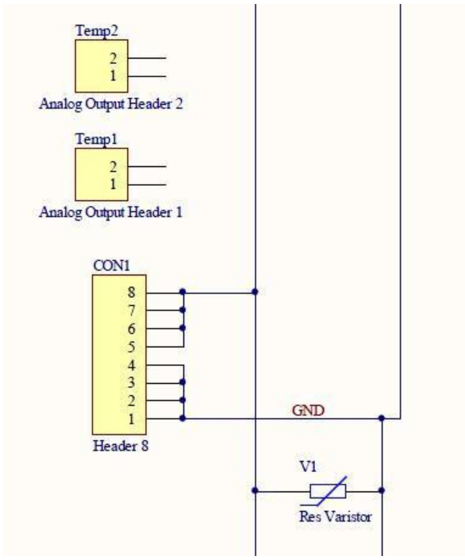


Figure 11. Connection to EDAC.

SPARTAN-V will be using the power provided by the HASP platform and converting that voltage internally into 12V 6.5V 5V 3.3V and 1.8V. The distribution diagram for the voltages and the current is as shown in Figure 9 on the following page.

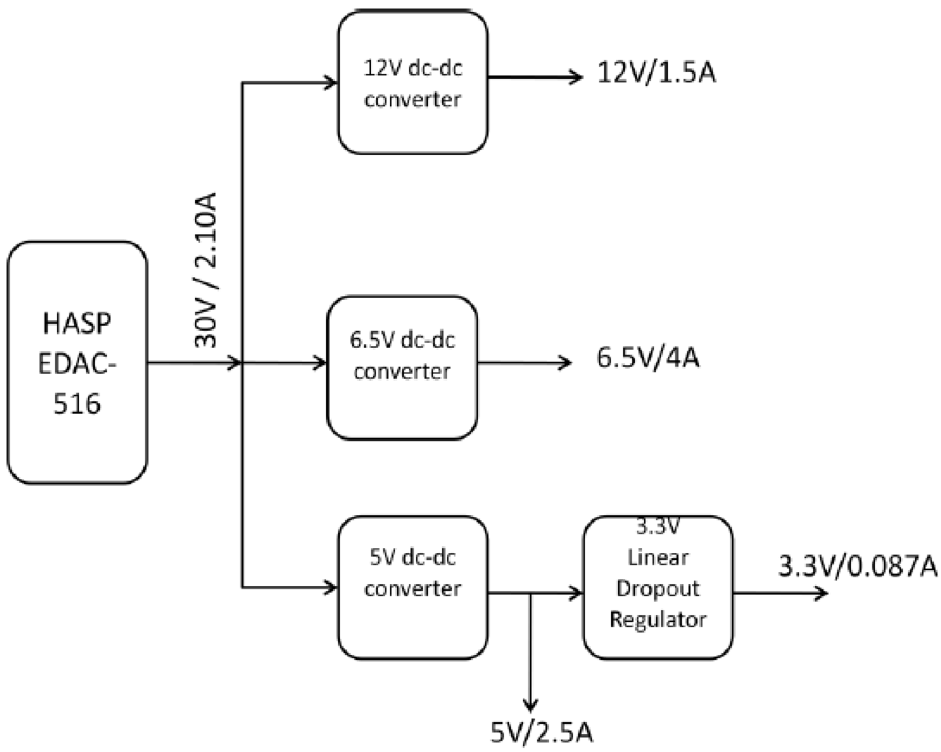


Figure 12. Diagram of voltage and current distribution.

The power converters that will be used consist of V-Infinity converters a 12V DC-DC converter a 6.5V DC-DC converter a 5V DC-DC converter and a 3.3V Linear Dropout Regulator. Off the output of the 3.3V LDO there is another 1.8 LDO on our e ternal sensor board. Table 4 shows the part numbers for each device.

Table 3. Part numbers for converters used.

Converter Used	Part Number
12V DC-DC	PTK25-D24-S12
6.5V DC-DC	LM2678
5V DC-DC	PTK15Q24S5
3.3V Linear Regulator	LP3981
1.8V Linear Regulator	LPM3919

Included in the attached Appendi   B is a complete power schematic.

C. Other relevant power information

None at this time.

III. Downlink Telemetry Specifications:

A. Serial data downlin format: Stream Pac etized (circle one)

B. Appro imate serial downlin rate (in bits per second):

i. 1775 bits/sec (on average)

The SPARTAN-V system will brea the downlin process up into small and large pac ets. Table 4 displays the number of bytes and time interval that the two pac ets will be downlin with.

Table 4. Downlink packets.

Pac et	of bytes	Time interval
Small	2048	Every 15 seconds
Large	2560	Every 30 seconds

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

The record format for downlin is:

HEADER H and S information TIMESTAMP

E ample:

PROCESS No. process running: 5 Last process reset: Power   MDT Apr 10 20:54:15
EXPOSURE E posure rate: 0.2 MDT Apr 10 20:54:15

We do not have a specific data length hence the record length is variable.

D. Number of analog channels being used:

SPARTAN-V will use **two** of the analog lines provided by the HASP platform.

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

The analog lines are used for measuring the temperature on the logic board. We connect the temperature sensor output to these analog lines. The temperature sensors have output that do not e ceed 3.3V. Therefore the range of voltage e perienced on the analog line is between 0 to 3.3V DC. The temperature sensors are connected on the analog lines available on the HASP EDAC-516 connector. The connection diagrams for the sensors are shown in Figure 10.

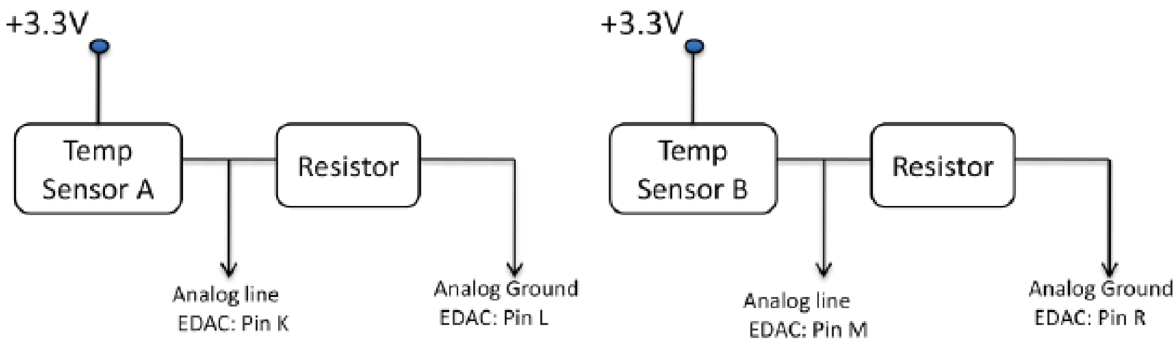


Figure 13. Connection diagrams for temperature sensors using analog lines.

These lines will be monitored through analog channels to allow the team to shutdown the processor as necessary if the temperature readings grow too high. These could be run through the standard sensor interfacing but that would allow only one minute interval chec s of the temperature. Although large and sudden variances in temperature are not e pected the analog lines allow for further mitigation of ris s which could cripple our mission and thus the SPARTAN-V team hopes to ma e use of them.

F. Number of discrete lines being used:

SPARTAN-V will use **one** discrete line.

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

The line is connected to the EDAC-516 pin F and is used to reset the logic board of the SPARTAN-V by controlling the power switch that powers the logic board. The line will be used to cycle power to the motherboard by switching a mosfet relay on the power line to the motherboard. This discrete line is re uired as all other power cycling (through mosfet relays) is handled by code on the motherboard thus if the motherboard is malfunctioning a hardware level reset will be re uired.

H. Are there any on-board transmitters   If so list the fre uencies being used and the transmitted power.

SPARTAN-V will have no onboard transmitters or receivers.

I. Other relevant downlin   telemetry information.

None.

IV. Uplink Commanding Specifications:

A. Command uplin   capability re uired: (Yes) No (circle one)

B. If so will commands be uplin ed in regular intervals: Yes (No) (circle one)

C. How many commands do you e pect to uplin   during the flight (can be an absolute number or a rate i.e. *n commands per hour*)

With no errors nominally only two commands will be issued during the flight:

Initiate Photo Capture (0 31)
Kill Photo Capture (0 32) .

Additional uplin ed commands will be used primarily for error handling and re uesting additional information (beyond what is provided by downlin ed pac ets).

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

All the received types (i.e. byte 1) would be TYPE_INF (01). Commands on this category would either be handled by hasp_init(byte2 13 to 18) or hasp_watchdog(byte2 00 to 12). Table 5 on the following page displays the byte 2 definitions where WD stands for “watch dog,” a system used to check the status of the payload and H and S stands for “health and status,” the packets that will update the ground team with information about the payloads condition throughout flight.

Table 5. Uplink commands.

Byte2		Action
00	WD---	Kill all processes
1 - 9		Kill individual process (HASP_INF(01) to HASP_PWR(04) others are reserved)
0A		Inc WD timer for HASP_INF for 5s
0B		Inc WD timer for HASP_CTL
0C		Inc WD timer for HASP_IMG
0D		Inc WD timer for HASP_PWR
0E		Dec WD timer for HASP_INF for 5s
0F		Dec WD timer for HASP_CTL
10		Dec WD timer for HASP_IMG
11		Dec WD timer for HASP_PWR
12		Return watchdog status (process or subsystem status
		process timer info no. of processes running last process reset time which one)
13	Init---	Storage status (Amount of data stored in HDD(used free) how many files were created CPU utilization temperature)
14		Uplin /Downlin status (Number of commands parsed successfully/failed parse attempts last 2 commands received h_and_s_data_read_size)
15		Decrement the value of h_and_s_data_read_size by 512 bytes
16		Increment the value of h_and_s_data_read_size by 512 bytes
17		Decrement num_serial_attempts by 1
18		Increment num_serial_attempts by 1
19		Decrement H and S filesize by 1 b
1A		Increment H and S filesize by 1 b

E. Are there any on-board receivers If so list the fre uencies being used.

SPARTAN-V will have no on-board receivers.

F. Other relevant uplin commanding information.

There is no other relevant uplin commanding information.

V. Integration and Logistics

A. Date and Time of your arrival for integration:

SPARTAN-V is planning to arrive in Palestine Te as in early August to integrate and test the payload. E act dates are not yet nown as the plan for integration has not be set.

B. Appro imate amount of time re uired for integration:

The SPARTAN-V team will be participating in the entire wee -long integration schedule. All available time will be used accordingly.

C. Name of the integration team leader: Brian Ibeling

D. Email address of the integration team leader: bibeling gmail.com

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

The current team planning on participating at integration includes:

Christopher Nie: Christopher.nie colorado.edu

Brian Ibeling: bibeling gmail.com

Sushia Rahimizadeh: sushia.rahimi gmail.com

Possible fourth: A ash Agrawal a ash.agrawal colorado.edu

F. Define a successful integration of your payload:

A successful integration of the payload re uires that the SPARTAN-V meet all the HASP specifications. SPARTAN-V must meet all weight power draw physical interfacing and communication downlin and uplin functionality re uirements that HASP sets. This will be done using the chec s specified in Section H.

G. List all e pected integration steps:

SPARTAN-V must connect to the serial and EDAC connectors correctly in order to meet the power and communications re uirements from HASP. The SPARTAN-V plate must be securely mounted to HASP. Once this has been completed all the necessary testing (see Table 9 below) can be done to complete a successful integration of the SPARTAN-V payload.

H. List all chec s that will determine a successful integration:

Table 6. Successful integration checklist.

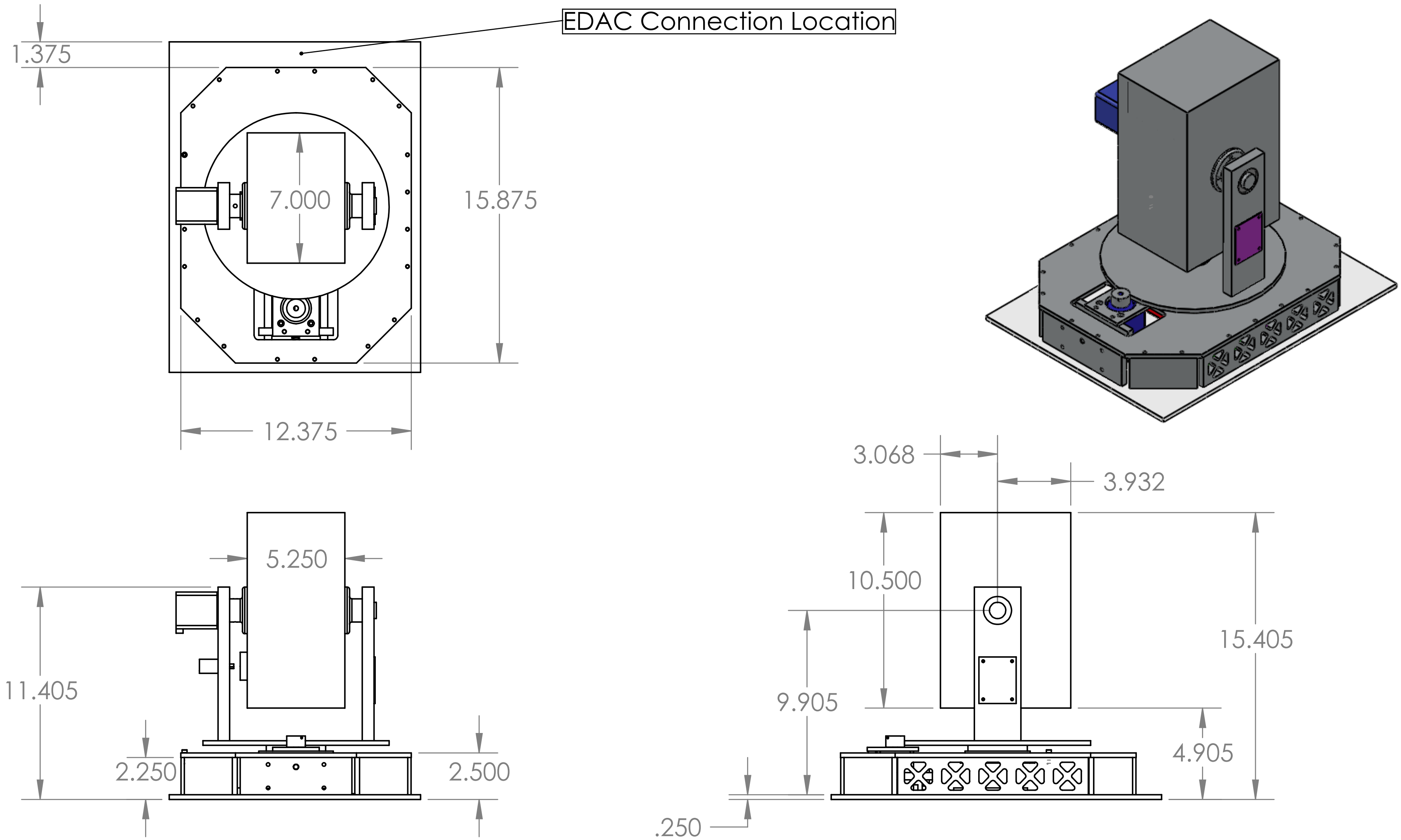
Test	Procedure	Expected Results
Name: Weight Re uirement Purpose: Ensure HASP Compliance E uipment: Scale	Weigh Payload	E pected Weight: 13.91 g
Name: Power Re uirement Purpose: Ensure HASP Compliance E uipment: HASP Power Interface	Connect SPARTAN-V to HASP power interface. Measure power drawn from HASP.	E pected Power Draw: 2.1 A at 30 VDC at pea usage
Name: Uplin Re uirement Purpose: Ensure HASP Compliance E uipment: HASP Communications Interface	Connect SPARTAN-V to HASP communications interface. Uplin a command. Chec SPARTAN-V's computer status to ensure command was received and e ecuted.	E pect that all commands meet the HASP uplin re uirements and function as they are supposed to.
Name: Downlin Re uirement Purpose: Ensure HASP Compliance E uipment: HASP Communications Interface	Connect SPARTAN-V to HASP communications interface. Downlin a data pac age. Chec with HASP to ensure that data pac age was received correctly.	E pect that all pac ages meet the HASP downlin re uirements and are received successfully.
Name: SPARTAN-V Thermal Vacuum Test Purpose: Ensure SPARTAN-V Functionality at Flight Conditions E uipment: HASP Communications Interface	Place SPARTAN-V in Thermal Vacuum. Ta e data from computer and temperature sensors. Chec for system functionality and failures.	E pect SPARTAN-V to function successfully at e treme low pressure and varying thermal conditions.
Name: SPARTAN-V Functionality Purpose: Ensure SPARTAN-V Data Collection E uipment: HASP Communications Interface	Data shall be collected between SPARTAN-V and our personal computers to determine if all scientific sensors are correctly functioning.	E pect SPARTAN-V's sensors to be ta ing and storing data successfully.

I. List any additional LSU personnel support needed for a successful integration other than directly related to the HASP integration (i.e. lifting moving e uipment hotel information/arrangements, any special delivery needs…):

Any additional LSU assistance cannot be foreseen at this time. It would be convenient to have bloc   reservations made at local hotels but it is not necessary.

. List any LSU supplied e uipment that may be needed for a successful integration:

Team SPARTAN-V will re uire power outlets and an area to wor   and lay out e uipment. All other necessary e uipment will be brought with the SPARTAN-V team.



Project Manager: Brian Ibeling
Structures Lead: Jeff Byrne

Payload Name:

SPARTAN-V

DWG. NO.

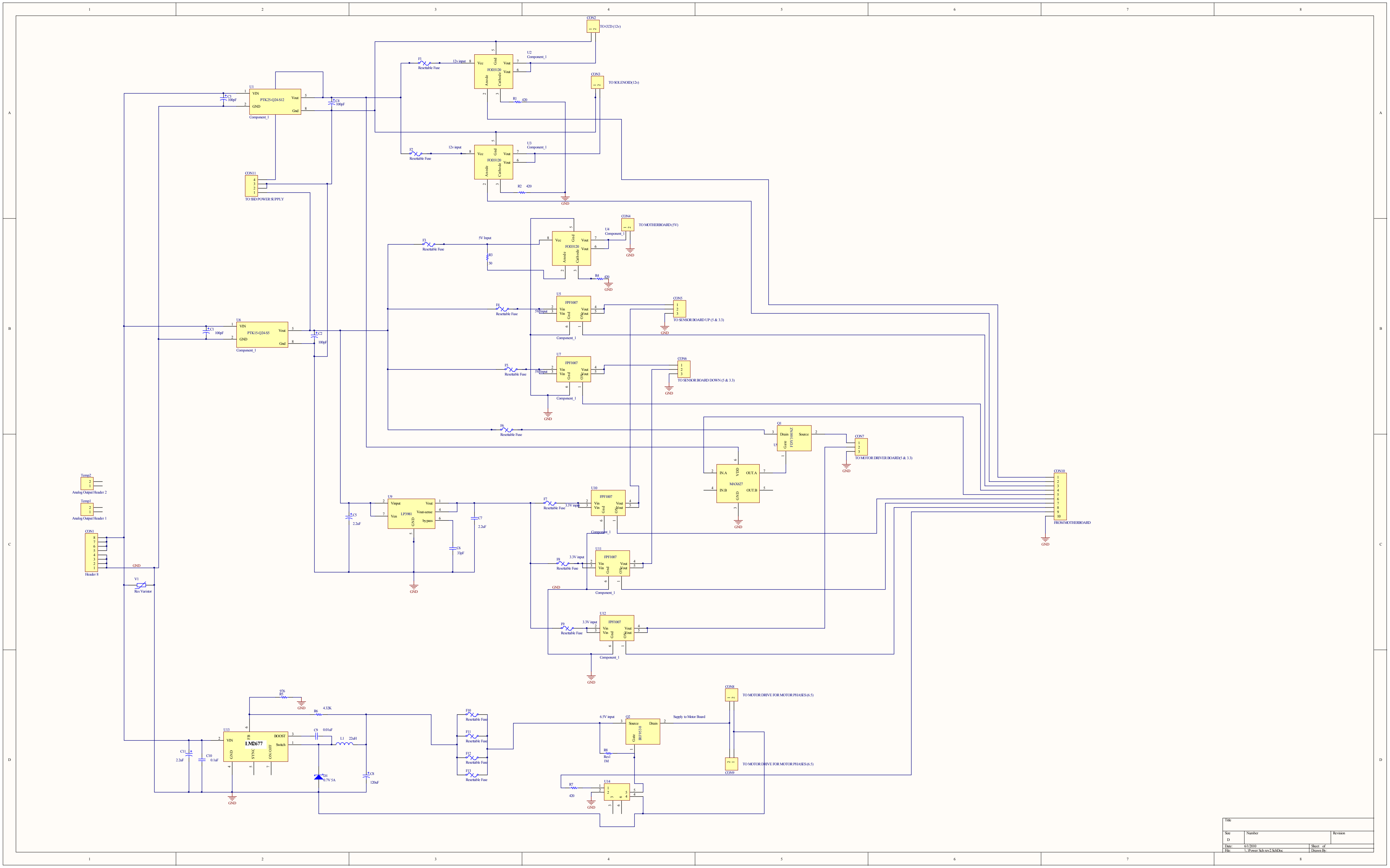
Full Assembly

SCALE: 1:8 | SHEET 1 OF 1

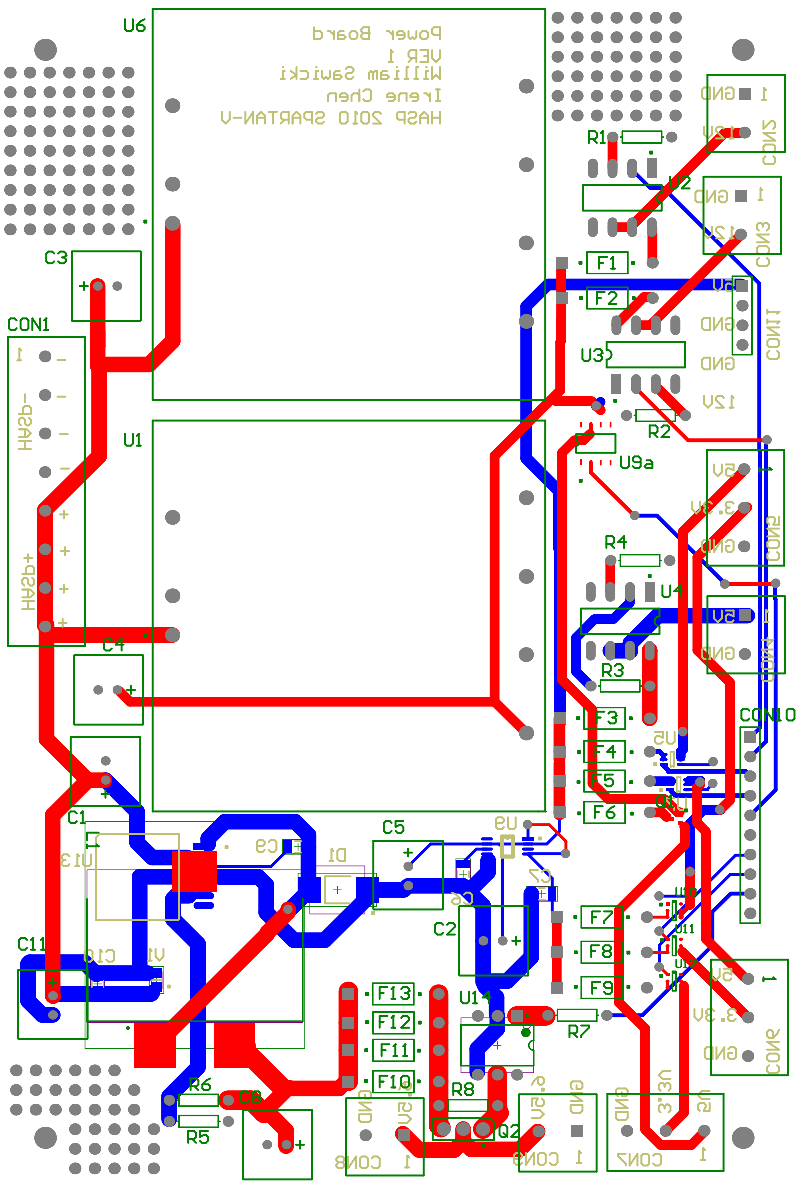
Drawing Notes:

- All dimensions are in inches
- Structure is primarily composed of Aluminum 6061-T6
- The 0.25 inch PVC plate provided by HASP is included in this drawing
- In all views the payload is in the "stowed" position
  (i.e. during operation the rotary table and telescope will be in motion)

5 4 3 2 1



CON2
TO CCD (12v)
CON3
TO SOLENOID (12v)
U1
PTK25-Q24-S12
VIN
GND
Vout
Gnd
Component_1
C3
100pF
C4
100pF
F1
Resettable Fuse
12v input
U2
Component_1
FOD3120
Vcc
Gnd
Vout
Anode
Cathode
R1
420
F2
Resettable Fuse
12v input
U3
Component_1
FOD3120
R2
420
CON11
TO SSD POWER SUPPLY
GND
CON4
TO MOTHERBOARD (5V)
U4
Component_1
F3
Resettable Fuse
5V Input
R3
50
R4
420
U5
FPF1007
Vin
Vout
ON
Component_1
F4
Resettable Fuse
5V input
CON5
TO SENSOR BOARD UP (5 & 3.3)
U6
PTK15-Q24-S5
C1
100pF
C2
100pF
U7
FPF1007
F5
Resettable Fuse
CON6
TO SENSOR BOARD DOWN (5 & 3.3)
F6
Resettable Fuse
Q1
FDP3682NZ
Drain
Source
Gate
CON7
TO MOTOR DRIVER BOARD (5 & 3.3)
U8
MAX627
IN.A
IN.B
VDD
OUT.A
OUT.B
CON10
FROM MOTHERBOARD
Temp2
Analog Output Header 2
Temp1
Analog Output Header 1
CON1
Header 8
V1
Res Varistor
U9
LP3961
Vinput
Vout
Ven
Vout-sense
bypass
C5
2.2uF
C6
33pF
C7
2.2uF
F7
Resettable Fuse
3.3V input
U10
FPF1007
U11
FPF1007
F8
Resettable Fuse
3.3V input
U12
FPF1007
F9
Resettable Fuse
3.3V input
R5
976
R6
4.32K
U13
LM2677
VIN
FB
BOOST
Switch
SYNC
ON/OFF
C9
0.01uF
L1
22uH
C11
2.2uF
C10
0.1uF
D1
0.7V 5A
C8
120uF
F10
Resettable Fuse
F11
Resettable Fuse
F12
Resettable Fuse
F13
Resettable Fuse
6.5V input
Q2
IRF9510
Supply to Motor Board
R8
Res1
1M
R7
420
U14
CON8
TO MOTOR DRIVE FOR MOTOR PHASES (6.5)
CON9
TO MOTOR DRIVE FOR MOTOR PHASES (6.5)
Title
Size
D
Number
Revision
Date:
6/1/2010
Sheet of
File:
Drawn By:



U6
Power Board
VER 1
William Sawicki
Irene Chen
HASP 2010 SPARTAN-V
C3
CON1
HASP-
HASP+
U1
C4
C1
C5
C2
C11
R6
R5
R8
Q2
U14
R1
U2
CON2
CON3
F1
F2
U3
CON11
R2
U9a
R4
U4
R3
CON10
F3
F4
F5
F6
F7
F8
F9
R7
F10
F11
F12
F13
CON8
CON5
CON7
CON9
D1

Bill of Materials

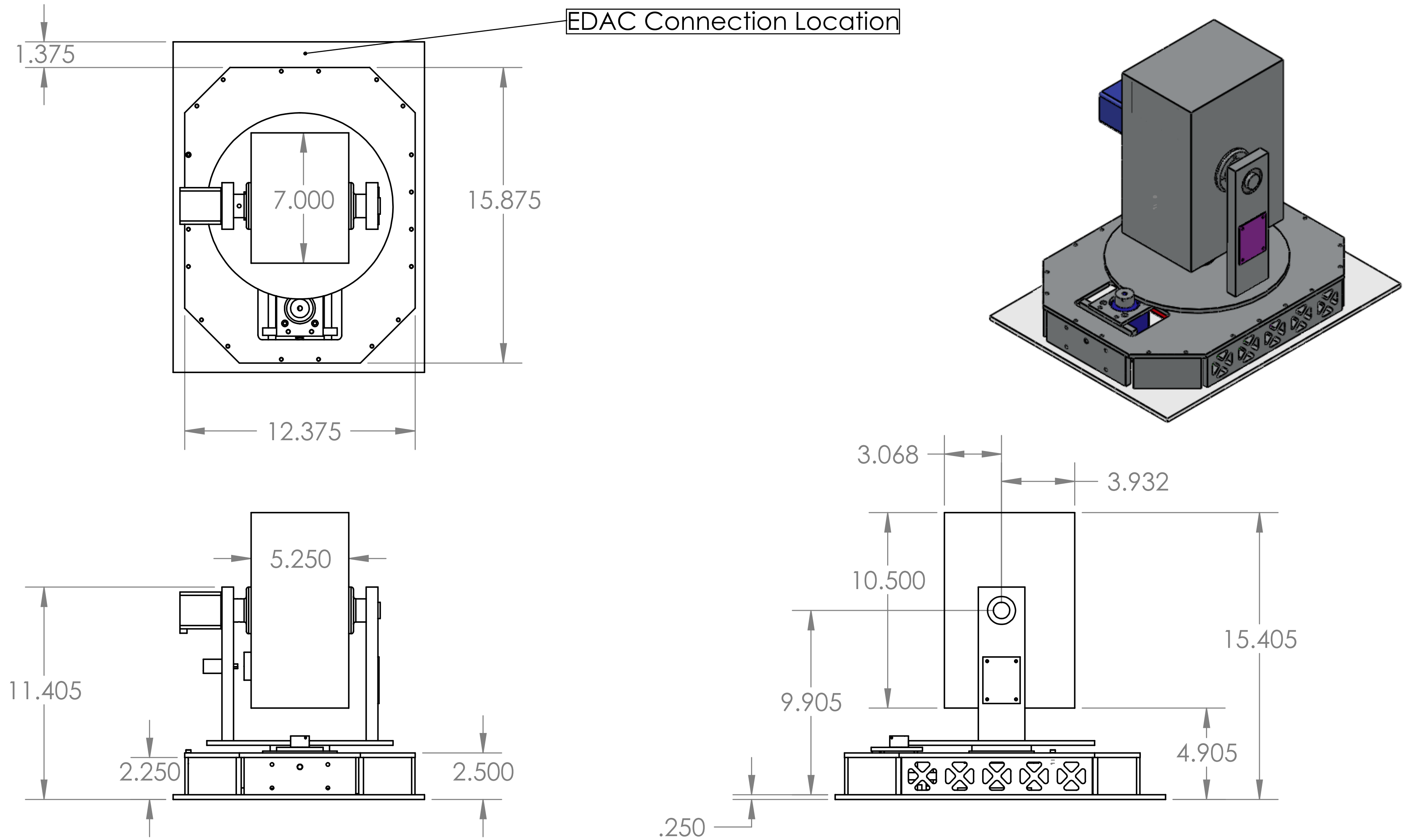
Bill of Materials For Project [FINALr2.PrjPcb] (No PCB Document Selected)

Source Data From:	**FINALr2.PrjPcb**
Project:	**FINALr2.PrjPcb**
Variant:	**None**

Creation Date:	6/1/2010	3:16:42 PM
Print Date:	40330	40330.63662

Footprint	Comment	LibRef	Designator	Description	Quantity
Capacitor	100pF	Cap Pol1	C1, C2, C3, C4	Polarized Capacitor (Radial)	4
Capacitor	Cap Pol1	Cap Pol1	C5	Polarized Capacitor (Radial)	1
CAPC3216L	33pF	Cap Semi	C6	Capacitor (Semiconductor SIM Model)	1
CAPC3216L	Cap Semi	Cap Semi	C7	Capacitor (Semiconductor SIM Model)	1
Capacitor	120uF	Cap Pol1	C8	Polarized Capacitor (Radial)	1
CAPC3216L	0.01uF	Cap Semi	C9	Capacitor (Semiconductor SIM Model)	1
CAPC3216L	0.1uF	Cap Semi	C10	Capacitor (Semiconductor SIM Model)	1
Capacitor	2.2uF	Cap Pol1	C11	Polarized Capacitor (Radial)	1
PCBComponent_1	Header 8	Header 8	CON1	Header, 8-Pin	1
PCBComponent_1	TO CCD (12v)	Header 2	CON2	Header, 2-Pin	1
PCBComponent_1	TO SOLENOID(12v)	Header 2	CON3	Header, 2-Pin	1
PCBComponent_1	TO MOTHERBOARD (5V)	Header 2	CON4	Header, 2-Pin	1
PCBComponent_1	TO SENSOR BOARD UP (5 & 3.3)	Header 3	CON5	Header, 3-Pin	1
PCBComponent_1	TO SENSOR BOARD DOWN (5 & 3.3)	Header 3	CON6	Header, 3-Pin	1
PCBComponent_1	TO MOTOR DRIVER BOARD(5 & 3.3)	Header 3	CON7	Header, 3-Pin	1
PCBComponent_1	TO MOTOR DRIVE FOR MOTOR PHASES (6.5)	Header 2	CON8, CON9	Header, 2-Pin	2
HDR1X10	FROM MOTHERBOARD	MHDR1X10	CON10	Header, 10-Pin	1
HDR1X4	TO SSD POWER SUPPLY	Header 4	CON11	Header, 4-Pin	1
CAPCP6959X26N	0.7V 5A	D Schottky	D1	Schottky Diode	1
PIN-W2/E2.8	Resettable Fuse	Fuse Thermal	F1, F2, F3, F4, F5, F6, F7, F8, F9, F10, F11, F12, F13	Thermal Fuse	13
TO774P2794X1536-3N	22uH	Inductor	L1	Inductor	1
FDY300NZ	Component_1	Component_1	Q1		1
IRF9530	Component_1	Component_1	Q2		1
AXIAL-0.3	420	Res1	R1	Resistor	1
AXIAL-0.3	Res1	Res1	R2, R3, R4, R7, R8	Resistor	5
AXIAL-0.3	976	Res1	R5	Resistor	1
AXIAL-0.3	4.32K	Res1	R6	Resistor	1
HDR1X2	Analog Output Header 1	Header 2	Temp1	Header, 2-Pin	1
HDR1X2	Analog Output Header 2	Header 2	Temp2	Header, 2-Pin	1
PTK15-Q24-S5	Component_1	Component_1	U1, U6		2
fod3120	Component_1	Component_1	U2, U3, U4		3
FPF1007	Component_1	Component_1	U5, U7, U10, U11, U12		5
lp3981	U4	Component_1	U9		1
max627	Component_1	Component_1	U9a		1
lm2677		Component_1	U13		1
DIP-6	Component_1	Component_1	U14		1
RESC2012N	Res Varistor	Res Varistor	V1	Varistor (Voltage-Sensitive Resistor)	1
					64

Approved **Notes**



Project Manager: Brian Ibeling
Structures Lead: Jeff Byrne

Payload Name:

SPARTAN-V

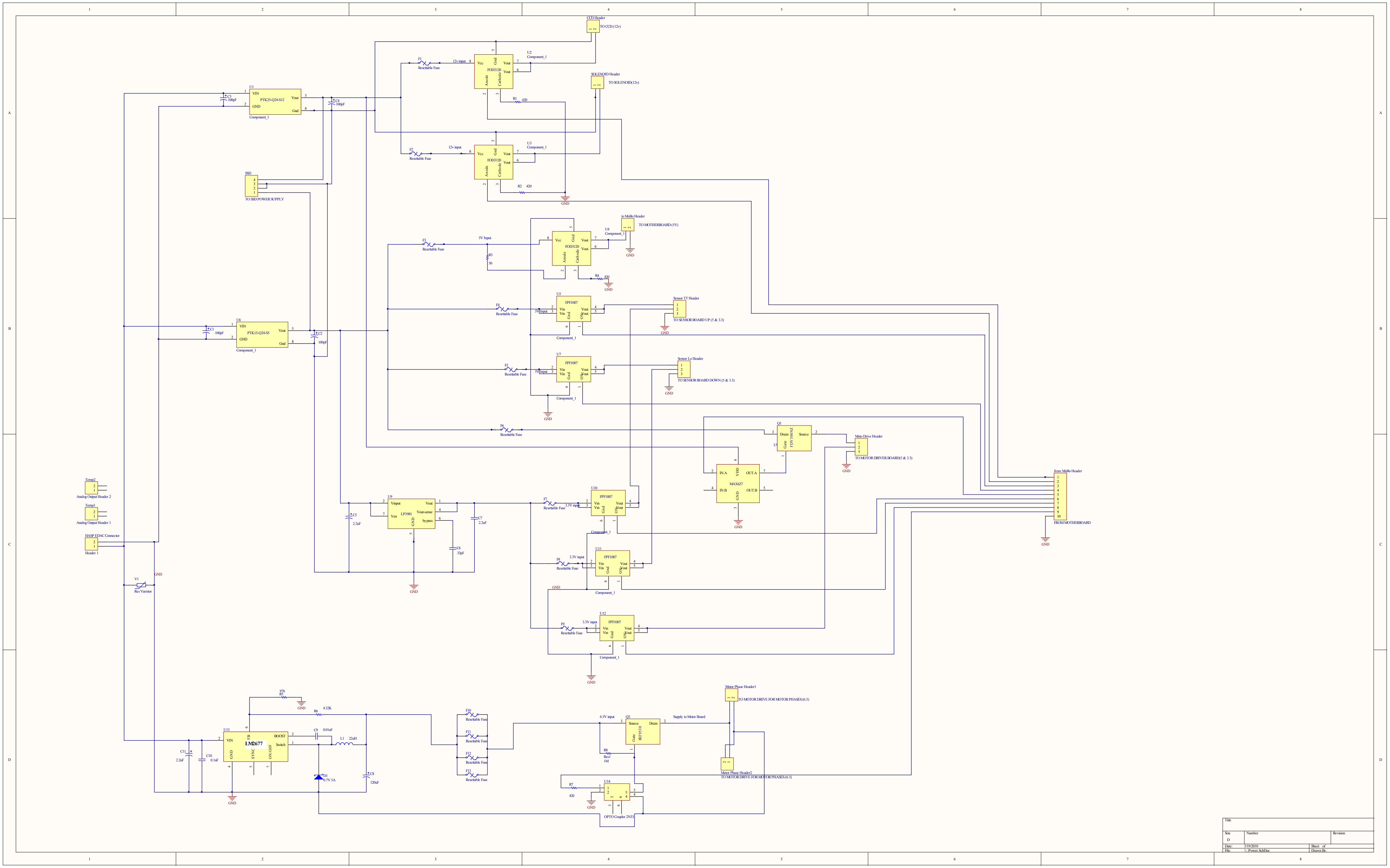
DWG. NO.

Full Assembly

SCALE: 1:8 | SHEET 1 OF 1

Drawing Notes:

- All dimensions are in inches
- Structure is primarily composed of Aluminum 6061-T6
- The 0.25 inch PVC plate provided by HASP is included in this drawing
- In all views the payload is in the "stowed" position (i.e. during operation the rotary table and telescope will be in motion)



CCD Header
TO CCD (12v)
SOLENOID Header
TO SOLENOID(12v)
PTK25-Q24-S12
PTK15-Q24-S5
FOD3120
Resettable Fuse
12v input
5V Input
SSD
TO SSD POWER SUPPLY
to MoBo Header
TO MOTHERBOARD (5V)
FPF1007
Sensor TT Header
TO SENSOR BOARD UP (5 & 3.3)
Sensor Lo Header
TO SENSOR BOARD DOWN (5 & 3.3)
Moto Drive Header
TO MOTOR DRIVER BOARD(5 & 3.3)
MAX627
from MoBo Header
FROM MOTHERBOARD
LP3961
3.3V input
Analog Output Header 2
Analog Output Header 1
HASP EDAC Connector
Rev Varistor
LM2677
Motor Phase Header1
TO MOTOR DRIVE FOR MOTOR PHASES (6.5)
Motor Phase Header2
6.5V input
Supply to Motor Board
IRF9530
OPTO Coupler 2N35
GND
Component_1
Title
Size
Number
Revision
Date:
5/19/2010
Sheet of
File:
Drawn By: