HASP Payload Specification and Integration Plan

Payload Title: GERM

Payload Class: Large

Payload ID:

Institution: **Metro State College of Denver/CCA**

Contact Name: Shellene Wright

Contact Phone: 720 296 1490

Contact E-mail: sjswright@comcast.net

Submit Date: 7/2/2010

I. Mechanical Specifications:

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

Structural Items	**Mass (g)**	**Electrical**	**Mass (g)**	**Bacterial**	**Mass (g)**
Foam Core	160	Arduino (2)	20	Cryogenic Tubes	80
Aluminum	1360	Heaters(6)	102		
#8 Screws	220	HOBO	40		
Insulation	160	Temp Sensors	20		
Hot Glue	60	Mofset (6)	42		
Brackets(10)	450	Power Supply (2)	208		
Hinge	40				
Plexi-glass	1587				

Total mass budget: 4549g

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

Internal components: All components attached to aluminum, except four cryogenic tubes, internal components will be housed in a foam core box with insulation in the center (allowing room for wiring), an outer ½ inch plexiglass shell will surround the foam core box to ensure the integrity of the payload upon landing

White: heaters (4)

Blue: power supply (2)

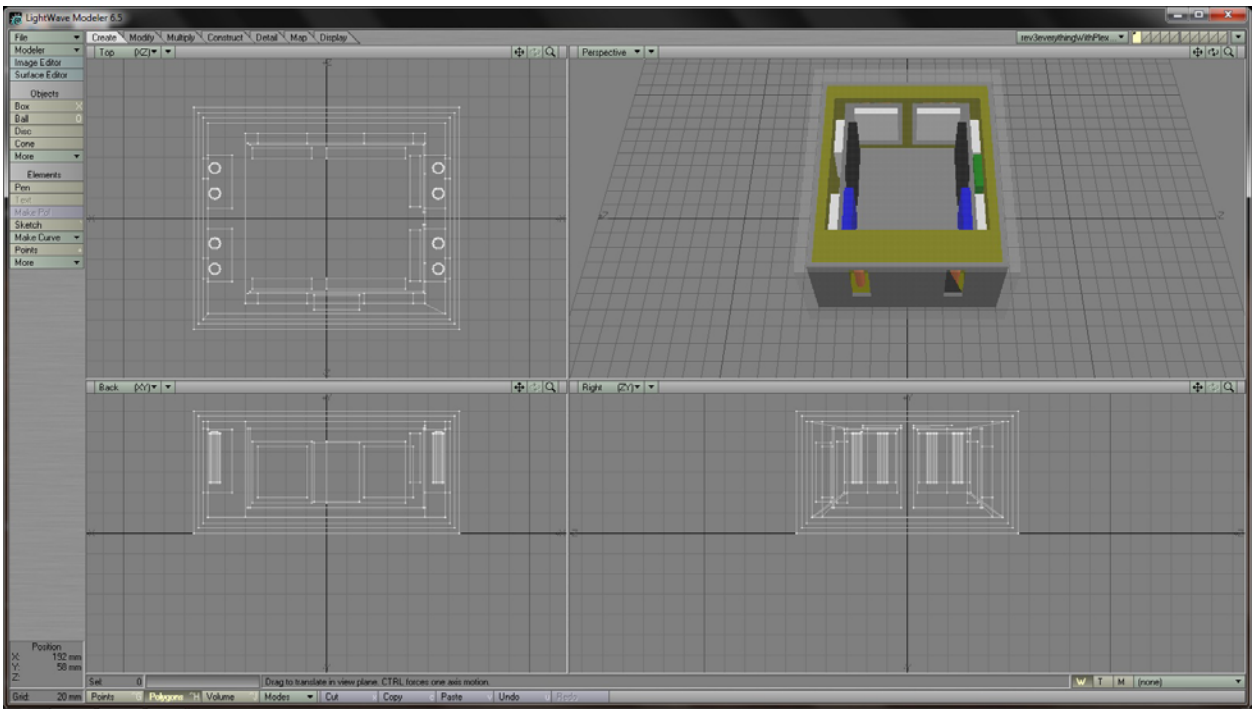
Black: arduino pro boards (2)

Green: HOBO data logger

Not pictured:

temperature sensors on each tube

radiation badges (2)



Figures 1: Upper Left Quadrant: Top down view of payload structure with interior component placement.
Upper Right Quadrant: 3D view including color coding and texture to illustrate cryotube placement.
Lower Left Quadrant: Side view of payload structure with interior component placement.
Lower Right Quadrant: Side view of payload structure with interior component placement.

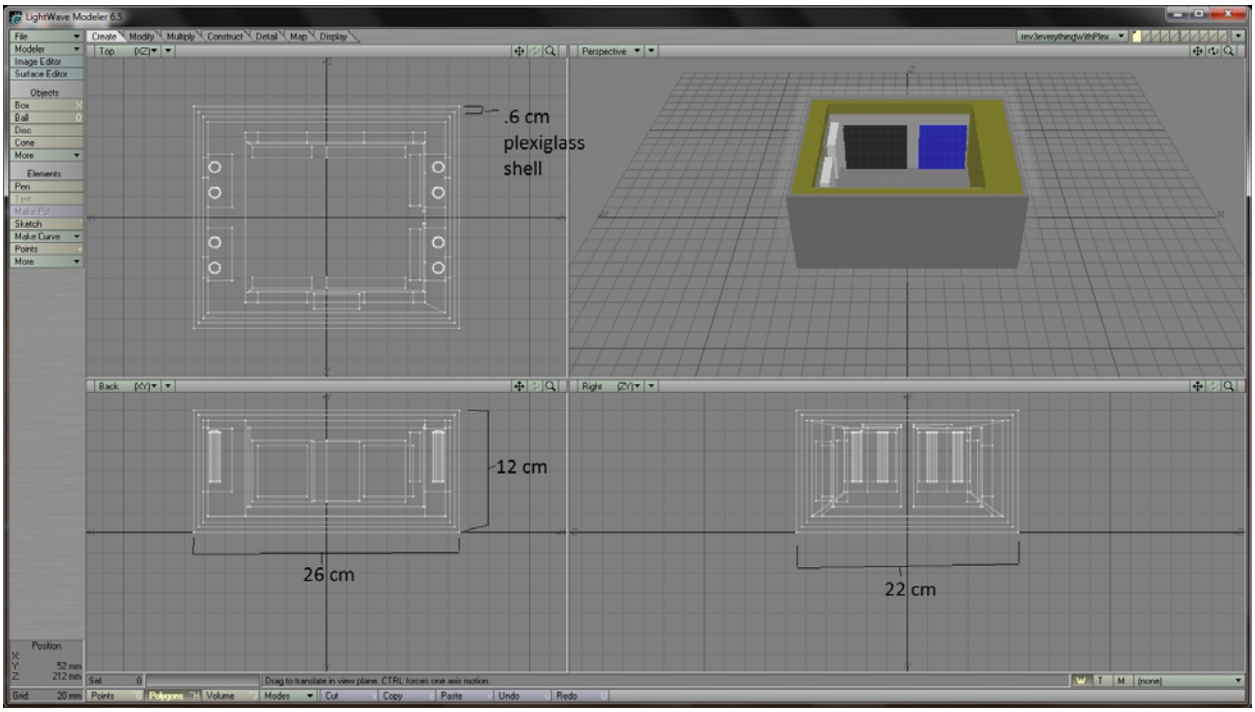


Figure 2: Upper Left Quadrant: Top down view of payload structure with interior component placement.
Upper Right Quadrant: 3D view including color coding and texture to illustrate cryotube placement.
Lower Left Quadrant: Side view of payload structure with interior component placement.
Lower Right Quadrant: Side view of payload structure with interior component placement.

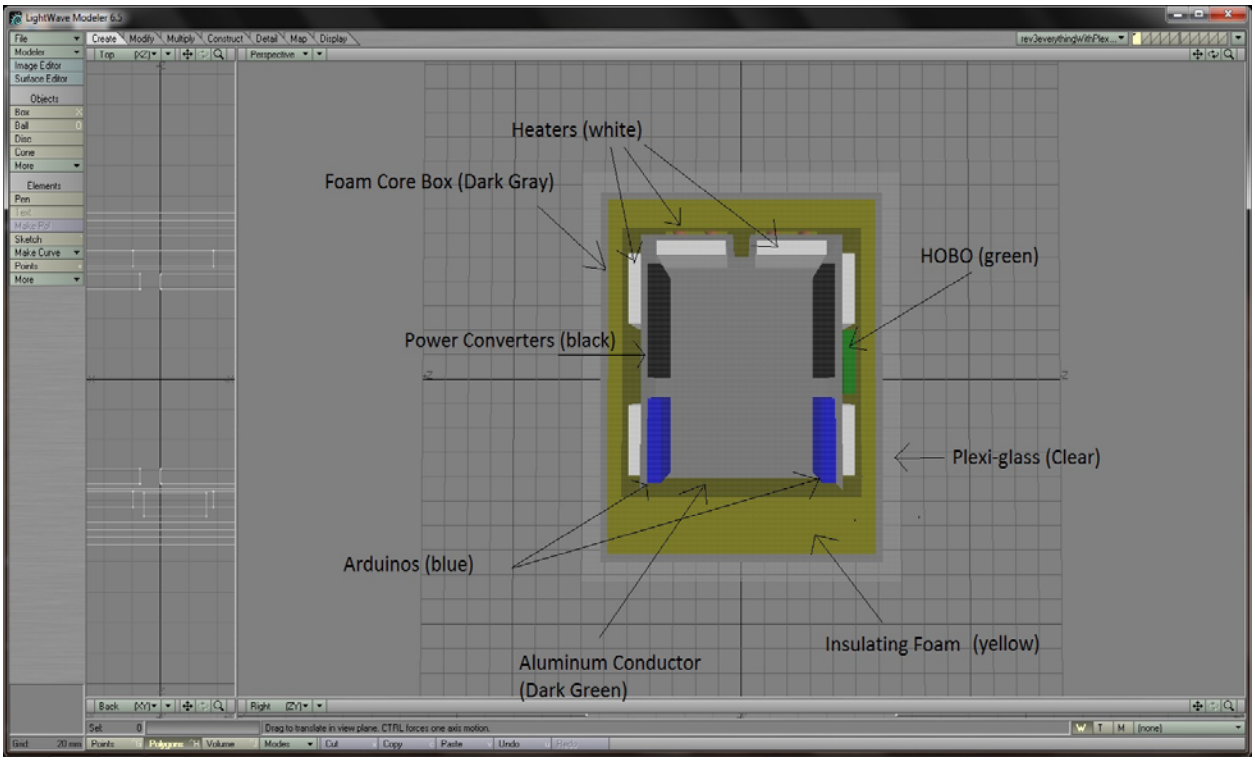


Figure 3: labeled payload diagram

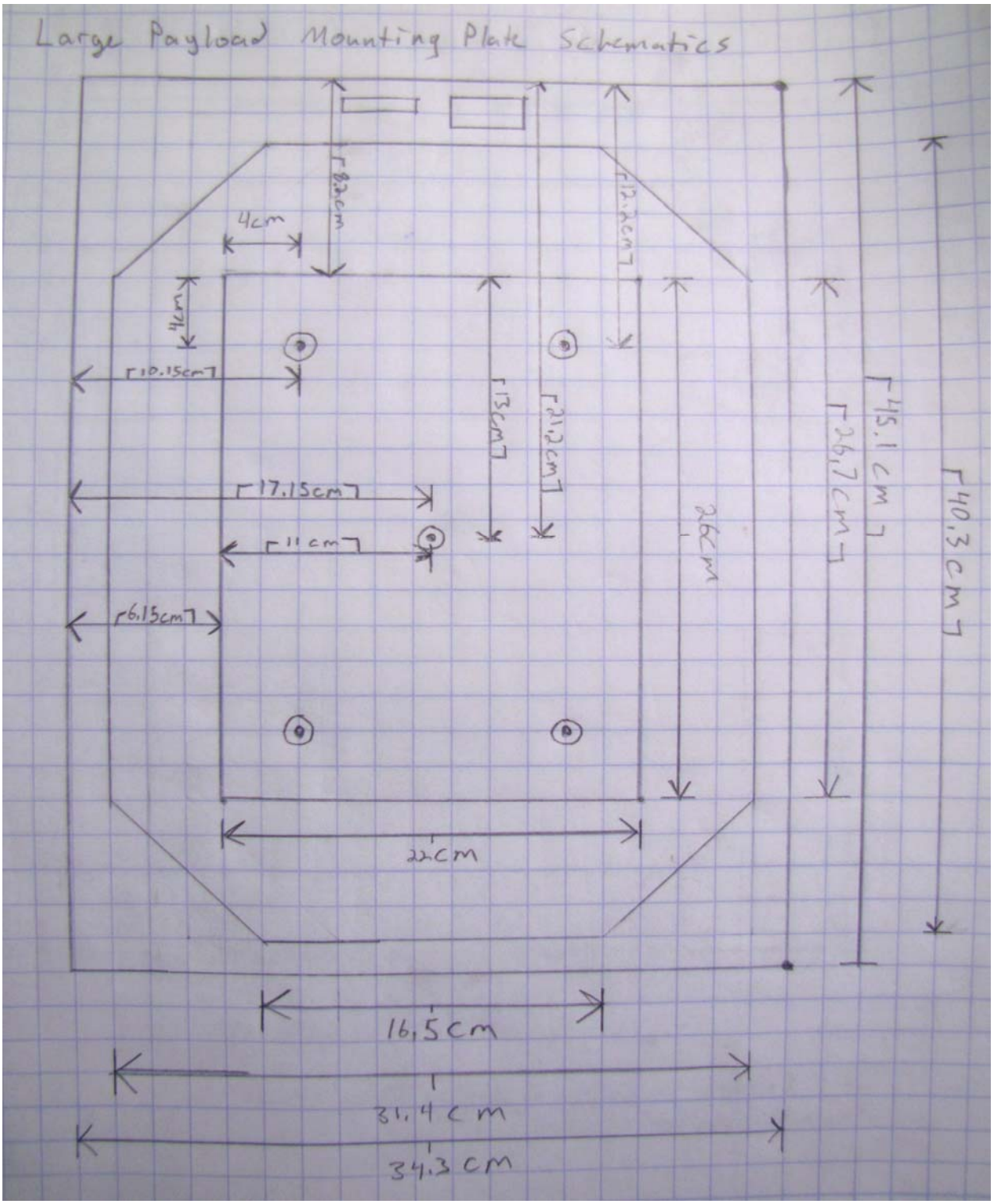


Figure 4: mounting plate and payload attachment diagram

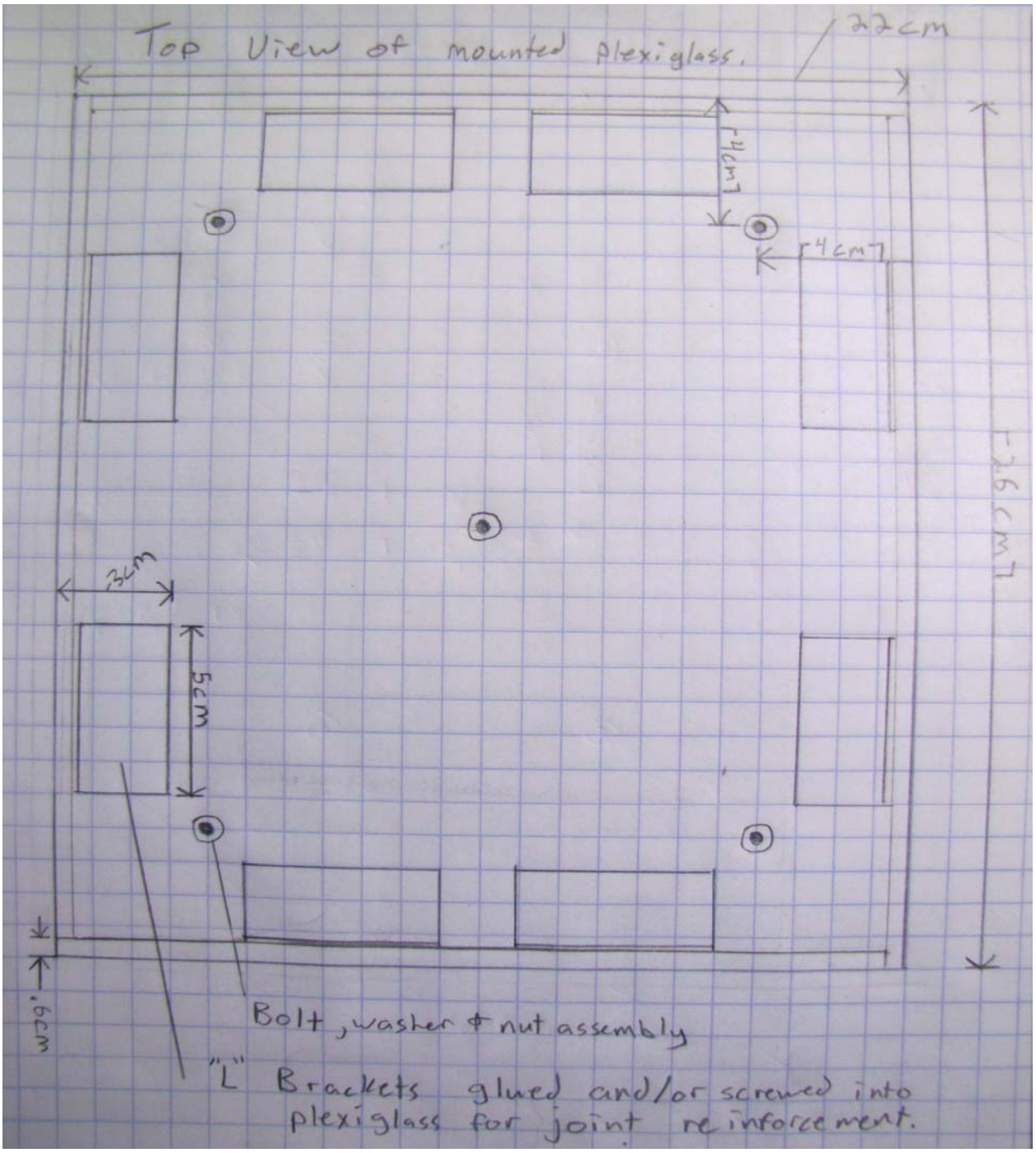


Figure 5

Sketch of mounting plate attachment. We will use 5 screws to mount from the inside of the payload box, through the plexiglass shell and directly through the mounting plate. All sides of the plexiglass will be solvent welded as well as bracketed. The brackets will be attached by screws. The top of the plexiglass box will be hinged to provide access for insertion of the bacterial culture tubes.

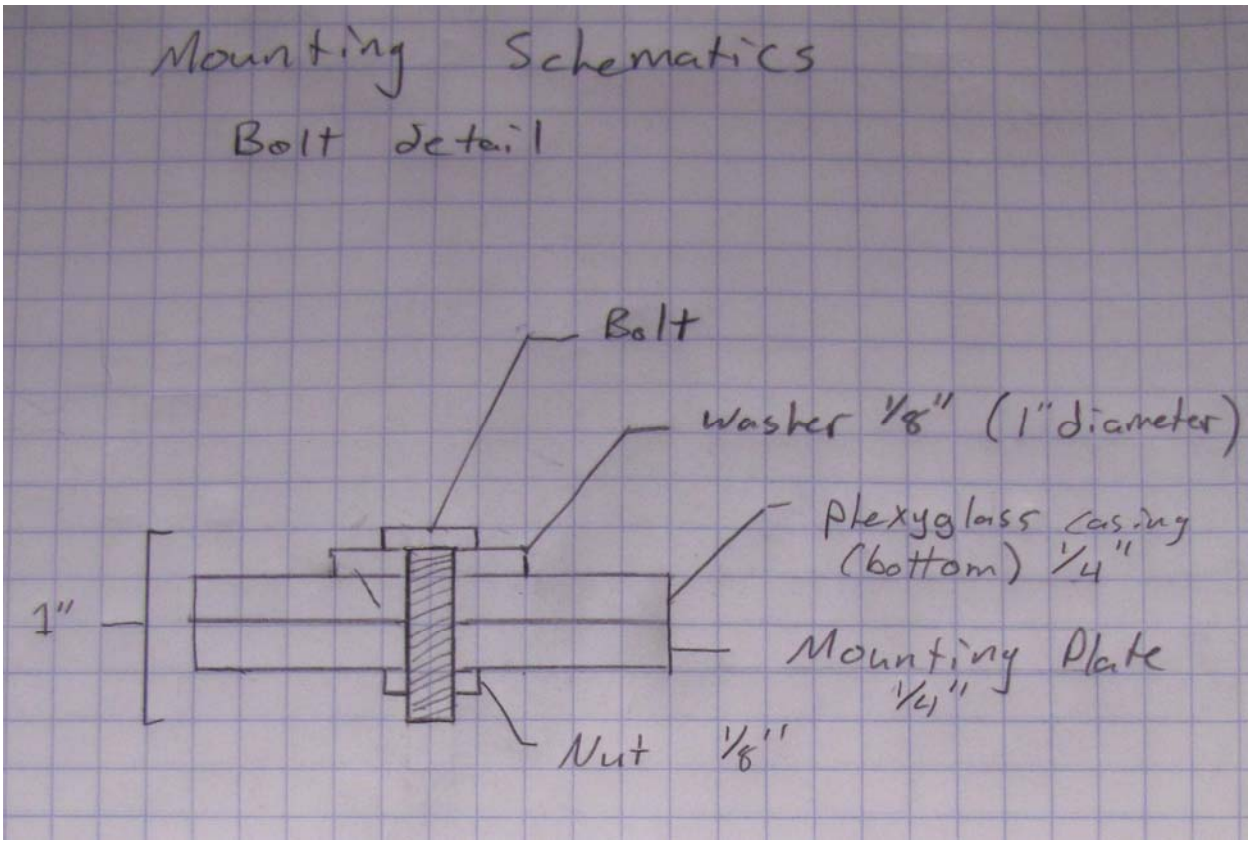


Figure 6: detailed attachment to mounting plate

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…)

The strain of E.coli being flown is of a non-pathogenic variety. It is media dependent and not viable upon any other surface. This bacteria has been modified to resist ampicillin as well, and must be handled with care. Gloves should be worn when handling any containers. (See MSDS below)

MATERIAL SAFETY DATA SHEET

NEW ENGLAND BioLabs Inc.
New England Biolabs
32 Tozer Road
Beverly MA 01915

EMERGENCY TELEPHONE NO. 1-800-632-5227
OTHER INFORMATION CALLS 1-978-927-5054
FAX: 1-978-921-1350
INTERNET e-mail: Info@neb.com

Strain
#E4107S

SECTION 1 - PRODUCT

Product Name: *E. coli* K12 JM109

SECTION 2–COMPOSITION/ INFORMATION ON INGREDIENT

Strains supplied by NEB are all derivatives of *E. coli* K12, *E. coli* B or hybrids of these two strains. *E. coli* K12 and B are nonpathogenic isolates. K12 is the standard nonpathogenic host, exempt from the NIH Recombinant DNA Advisory Committee (RAC) guidelines (1).

E. coli B has also been shown to lack common pathogenicity-related sequences (2).

References:

1. Federal Register, (1986) Vol. V1: 88, 6952–16985.
2. Kuhnert, P., Hacker, I. Muldorfer, A. P. Burnens, J. Nicolet, and J. Frey (1997). Detection system for Escherichia coli-specific virulence genes.: absence of virulence determinants in B and C strains. Appl. Environ. Microbiol. 63(2): 703– 709.

II. Power Specifications:

A. Measured current draw at 30 VDC

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Device	Max current draw (mA)	V in (V)	V out (V)	Max Power Use (W)	Efficiency %
LM 35 (1.1)	10	5	0~1.5	0.015	
LM 35 (1.2)	10	5	0~1.5	0.015	
LM 35 (1.3)	10	5	0~1.5	0.015	
LM 35 (2.1)	10	5	0~1.5	0.015	
LM 35 (2.2)	10	5	0~1.5	0.015	
LM 35 (2.3)	10	5	0~1.5	0.015	
MOSFET (1.1)	30	5		0.15	
MOSFET (1.2)	30	5		0.15	
MOSFET (1.3)	30	5		0.15	
MOSFET (2.1)	30	5		0.15	
MOSFET (2.2)	30	5		0.15	
MOSFET (2.3)	30	5		0.15	
Arduino (1)	150	12	5	0.75	
Arduino (2)	150	12	5	0.75	
Converter (1)	988	30	12	29.63	81
Converter (2)	988	30	12	29.63	81
Heater (1.1)	580	12		6.96	
Heater (1.2)	580	12		6.96	
Heater (1.3)	580	12		6.96	
Heater (2.1)	580	12		6.96	
Heater (2.2)	580	12		6.96	
Heater (2.3)	580	12		6.96	
Total Draw (mA)	1975				

Line	Max Current Draw (mA)	Max Power Draw (W)
30V (1)	988	29.63
30V (2)	988	29.63
12V (1)	1740	22.68
12V (2)	1740	22.68
5V (1)	120	.6
5V (2)	120	.6

The max power draw for the entire system at 30V will be the max power consumed by both DC to DC converters when all devices are their respective max current draw. The max current draw for both systems combined will be 2.12A @ 28V.

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.

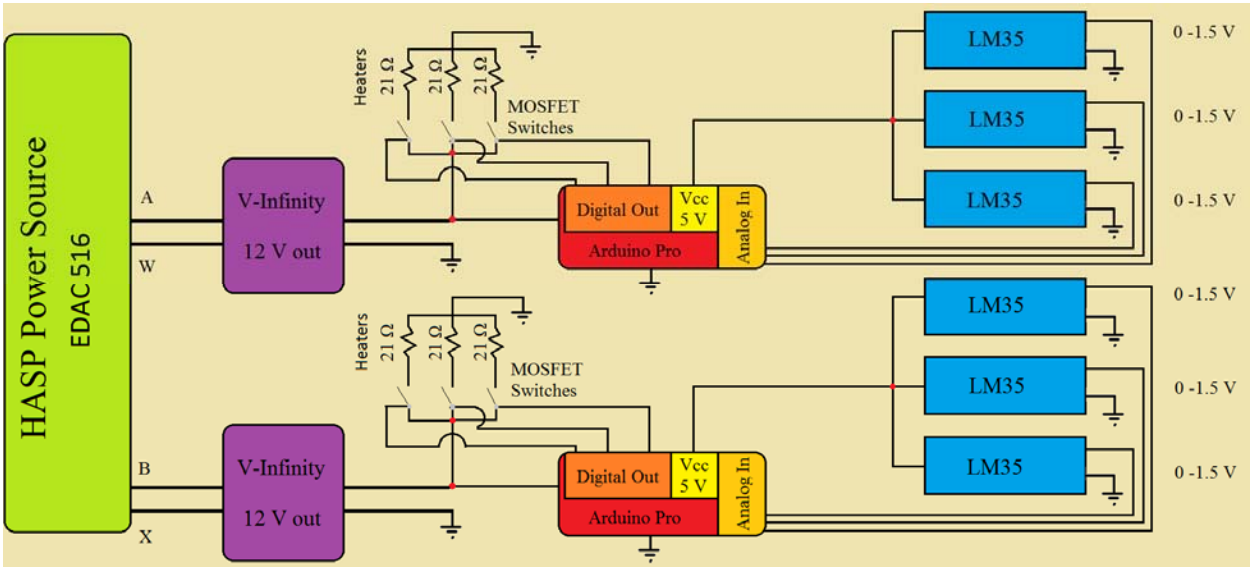

Figure 7

C. Other relevant power information

III. Downlink Telemetry Specifications:

We will not be transmitting data and will not be utilizing any downlink telemetry systems.

IV. Uplink Commanding Specifications:

We will not be utilizing any uplink command systems.

V. Integration and Logistics

A. Date and Time of your arrival for integration:

August 1st

B. Approximate amount of time required for integration:

1 hour

We will integrate to the HASP platform mechanically and electronically only, one hour should be sufficient.

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C. Name of the integration team leader:

Shellene Wright

D. Email address of the integration team leader:

sjswright@comcast.net

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

Shellene Wright sjswright@comcast.net

Cary Caruthers carutherscj@comcast.net

F. Define a successful integration of your payload:

All electrical components will power up and perform as designed, biological samples will be safely inserted, and the payload will be attached securely to the HASP platform ready for launch

G. List all expected integration steps:

As the payload does not contain any hardware that will be actively communicating with the student team, we will only integrate to the HASP platform as a power supply. Connection to the power supply through the HASP mounting plate will complete our integration.

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

Test	Procedure	Results
HASP weight requirement	Weigh payload	4.5 kg estimated weight
HASP power requirement	Measure power draw as connected to HASP platform	Estimated power draw 2.12A @ 28V
Thermal vacuum test	Place payload in thermal vacuum, check system for failures, ensure that cryo tubes are able to withstand pressure fluctuations.	Expect payload to function successfully per research, and published data available
Biological isolation test	Genetically modify bacteria to withstand exposure to ampicillin, isolating wanted specimen from possible contamination upon landing	Successful modification complete, stock of genetically identical bacteria available for research
Bacterial viability test	Expose bacteria to -80 Celsius for a period of 12 hours, sampling every 30 minutes to re-grow and check for cell death rates	Expected bacterial growth of all plates, some retarded growth expected in plates of a longer exposure to cold conditions
Pressure testing of cryogenic tubes	Expose closed tubes to increased pressures in a bell jar	Cryogenic tubes expected to withstand increased pressures, venting is possible if complications arise

Bacterial media temperature test	Expose media of varied concentrations to freezing, thawing, and increased temperatures to ensure media stabilization	Increased agar expected to withstand all variable temperatures
Radiation badge baseline test	Expose and develop radiation badges in thermal vacuum test to establish baseline inside and outside of vacuum chamber	Results expected to be similar between the two badges

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…):

Special consideration at recovery due to the biological nature of the experiment will include a representative from the team to accompany the recovery team to ensure the collection of the biological samples in a timely and safe manner.

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

All additional supplies will be provided by the team, no further equipment is expected at this time.

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