HASP Payload Specification and Integration Plan

Payload Title: Passive High Altitude Capture Experiment

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

Payload ID: 10

Institution: **Montana State University, Bozeman**

Contact Name: Nate Martin

Contact Phone: 307-389-1176

Contact E-mail: Nathan.Martin@myportal.montana.edu

Submit Date: June 1, 2007

I. Mechanical Specifications:

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

Our experiment is still being constructed so we do not have a final weight. Our experiment will be less than the allowable limit of 10 kg.

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

A mechanical drawing of our experiment is attached. We intend to drill through the mounting plate so that we can bolt the mounting brackets to the HASP mounting plate. Only the bolt heads will extend beyond base of HASP 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 pneumatic arms that open and close the particle collection box require are a high pressure gas. We intend to use a 1.1 L compressed gas cylinder to contain the gas used to power the pneumatic arms. The cylinder and associated regulator are rated to 4500 psi and are described in the attached National Scientific Balloon Facility Payload Pressure Vessels Certification form. The maximum pressure during flight will be 3500 psi. The cylinder will be empty prior to landing.

D. Other relevant mechanical information

II. Power Specifications:

A. Measured current draw at 28 VDC

We are just finishing the construction of electronics package and so cannot provide a measured current draw at this time. Based on the component specifications we estimate the maximum current load to be 1.2 Amps.

Control Board: 0.03 Amps

4 way Solenoid: 0.3 Amps

2 way Solenoid: 0.3 Amps

Heating circuit: 0.55 Amps

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.

See the attached drawing. Our system connects to the HASP EDAC via DB9 Connector soldered to our control board. For our control circuitry we regulate the voltage to 5V. For the 2-Way solenoid valve we will regulate the power to 24V. All other systems utilize 28V input directly.

C. Other relevant power information

III. Downlink Telemetry Specifications:

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

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

4800 baud

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

We will be receiving one of the following three strings:

“OPEN”

“CLOSED”

“NEITHER”

D. Number of analog channels being used:

None

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

F. Number of discrete lines being used:

None

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

None

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

No

I. Other relevant downlink telemetry information.

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 will use less than ten commands and at least two (one for opening the capture box and one to close the capture box).

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

Command	***Purpose***
"OP"	*Opens the box*
"CL"	*Closes the box*

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

No

F. Other relevant uplink commanding information.

V. Integration and Logistics

A. Date and Time of your arrival for integration:

July 26th, 9:00 A.M.

B. Approximate amount of time required for integration:

6 hours

C. Name of the integration team leader:

Nate Martin

D. Email address of the integration team leader:

nathan.martin@myportal.montana.edu

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

Nate Martin- nathan.martin@myportal.montana.edu

Kyle Crawford- kyle.crawford87@gmail.com

Berk Knighton- bknighton@chemistry.montana.edu

F. Define a successful integration of your payload:

A successful integration would conclude after the box has been mounted on the HASP platform and after we are able to successfully open and close the capture box via serial uplink command.

G. List all expected integration steps:

1) *Connect to HASP platform*
2) *Use serial uplink to open and close the box*
3) *Retrieve payload*
4) *Clean the box, add the silicone fluid, and seal payload for flight in a clean room.*
5) *Pack payload for shipping or reinstall it on the HASP platform*

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

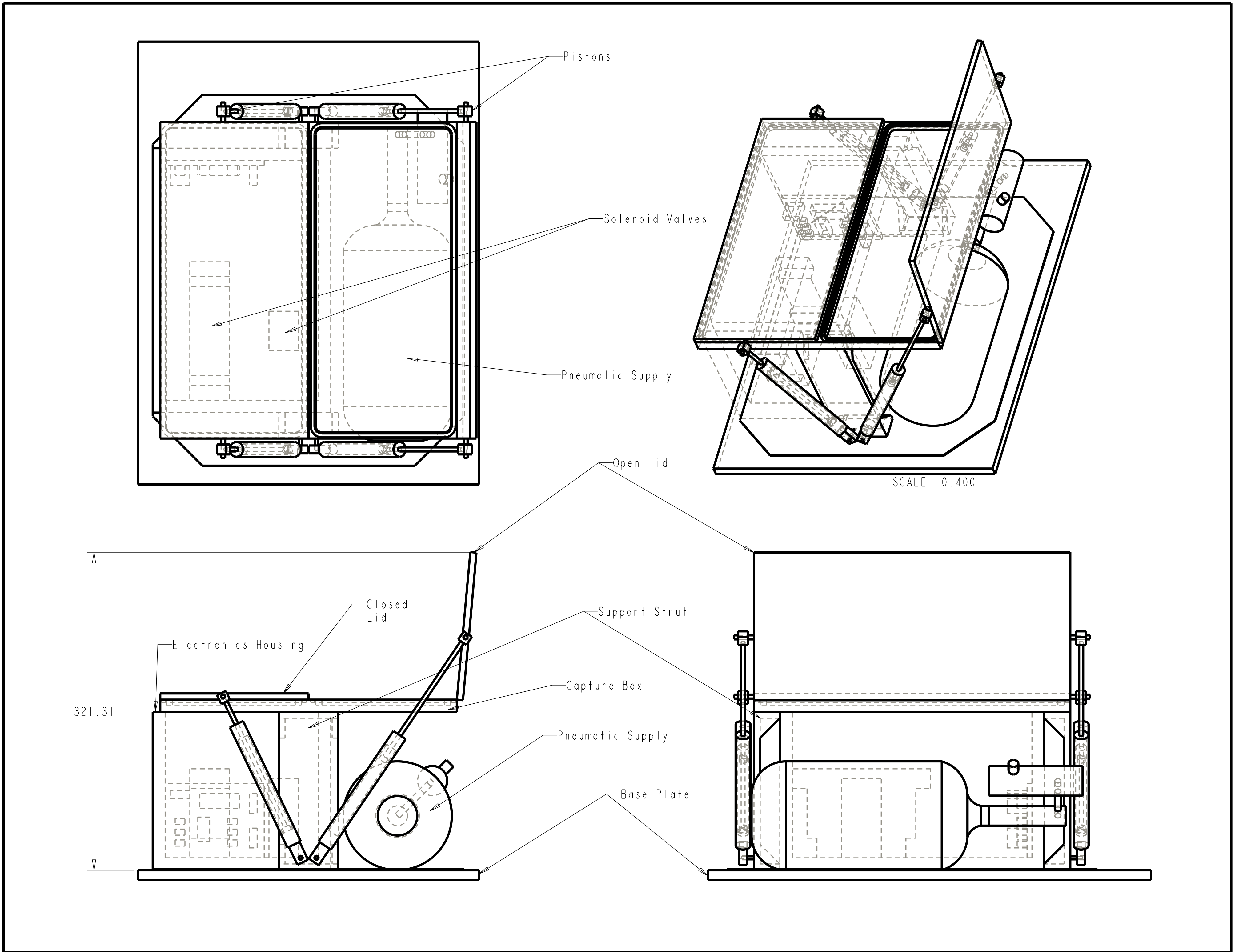
1) Successful opening and closing of the box

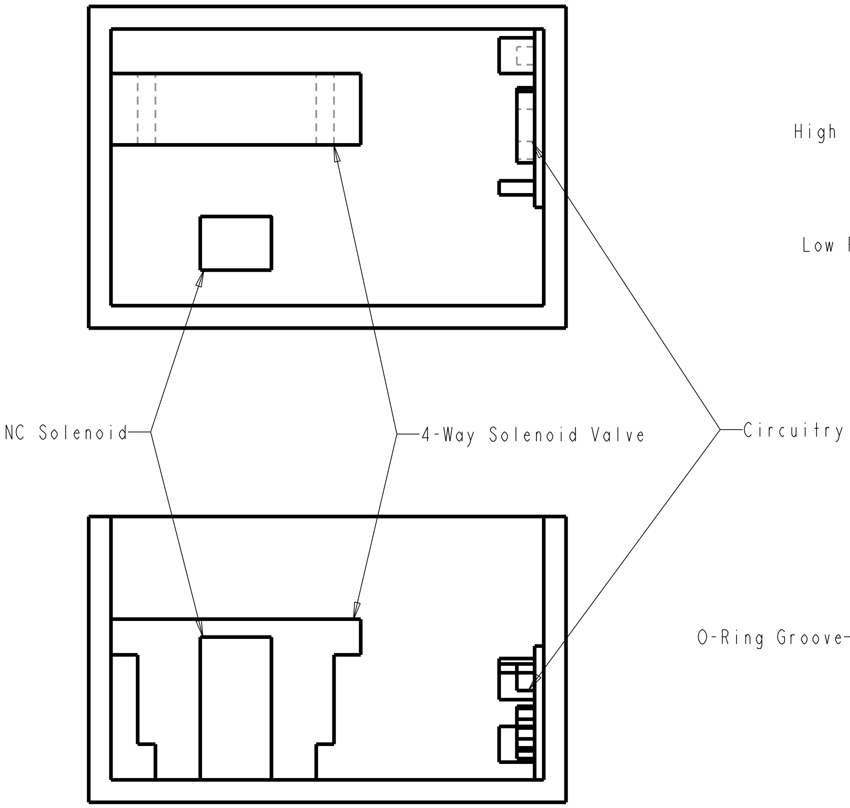
I. List any additional LSU personnel support needed for a successful integration other than directly related to the HASP integration (i.e. lifting, moving equipment, hotel information/arrangements, any special delivery needs…):

None

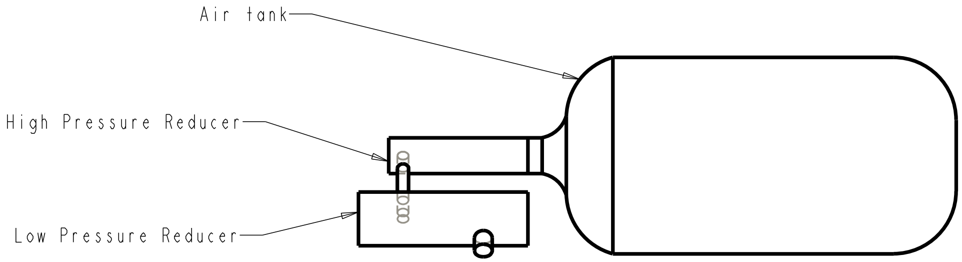
J. List any LSU supplied equipment that may be needed for a successful integration:

Access to a ‘clean room’ to prepare payload for flight

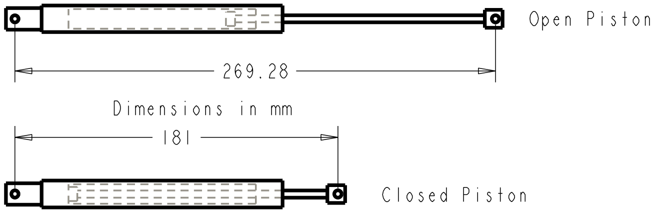

Pistons
Solenoid Valves
Pneumatic Supply
SCALE 0.400
Open Lid
Closed Lid
Support Strut
Electronics Housing
Capture Box
321.31
Pneumatic Supply
Base Plate

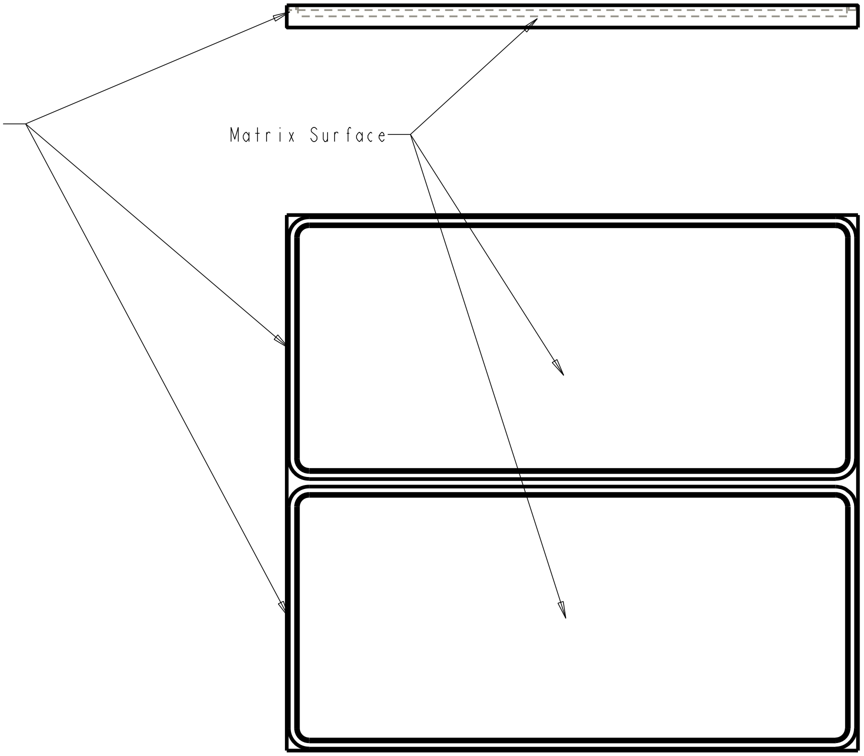


Electronic Housing



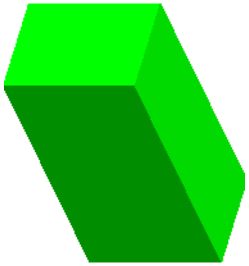
Pneumatic Supply





Capture Box

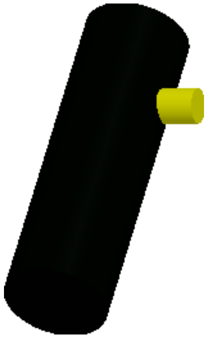
4-Way Solenoid



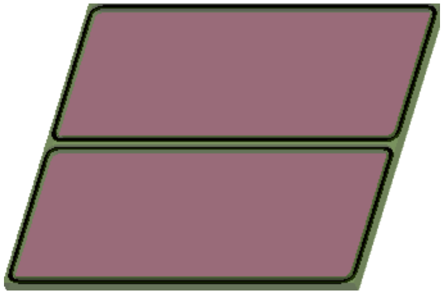
NC Solenoid

Circuitry

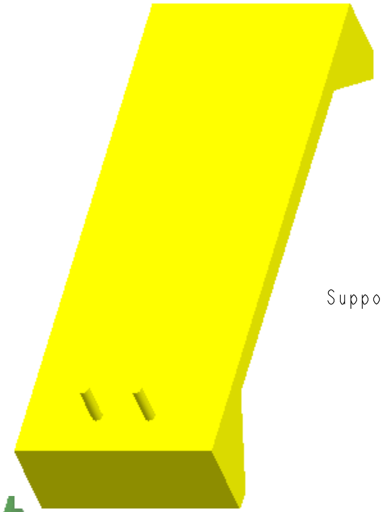
Low Pressure Reducer



High Pressure Reducer

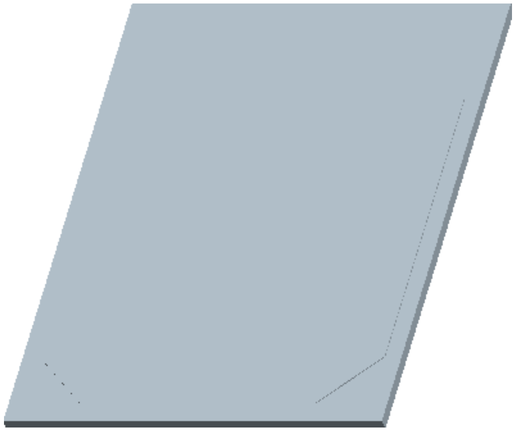


Capture Box



Support

Air Tank

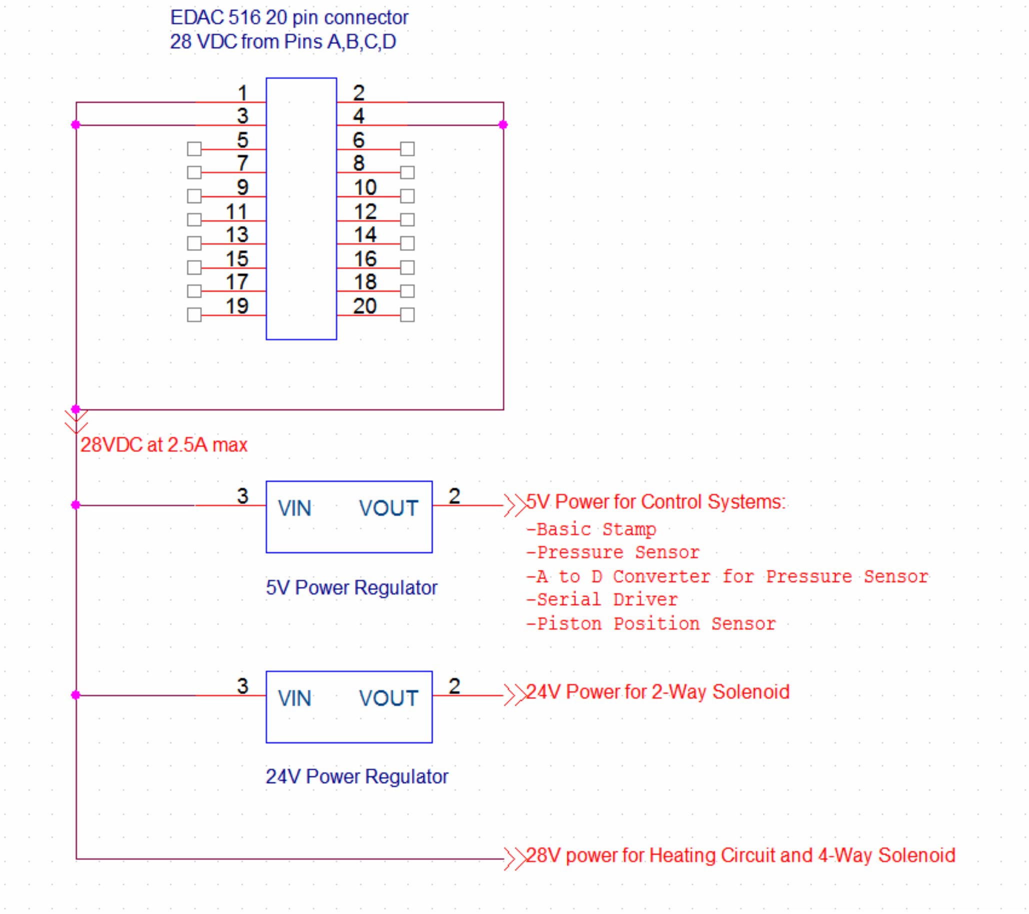


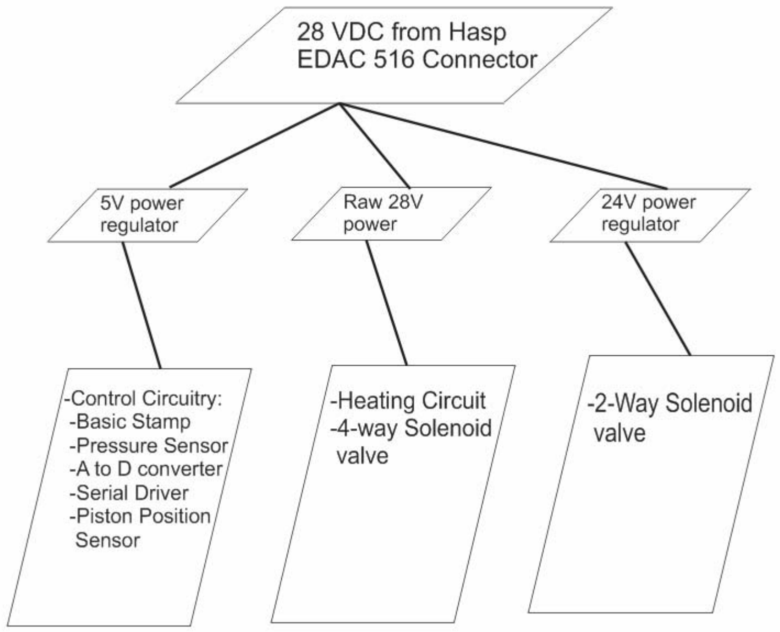
Base Plate

Lid

Piston

Power Wiring Diagram for High Altitude Cosmic Dust Capture Experiment:





National Scientific Balloon Facility Payload Pressure Vessels Certification
OF-600-22-P Rev – A Date- 04/16/04 page 1 of 2
Approved by ________________ date _______________

NOTICE: This document addresses Payload Pressure Vessel Certification efforts. This document cancels and replaces Operations Policy No. 04-09-01: **DOCUMENT FOLLOWS:**

Payload Pressure Vessels Certification

1. Introduction

NSBF mechanical engineers routinely evaluate the design and fabrication of payload gondolas for safety prior to' flight. This evaluation leads to an internal certification of the gondola that becomes a permanent part of the flight record. The evaluation and certification of payload pressure vessels previously was performed by the Balloon Program Office (BPO). BPO mechanical engineers would evaluate documentation supplied by individual science groups that provided data on pressure vessel design, material specifications, fabrication, flight history, and, testing history. The BPO evaluation would result in a memorandum certification retained in BPO flight history files. A recent catastrophic failure of a payload pressure vessel has served to emphasize the flight safety evaluation of pressure vessels, as well as highlighting the requirement to evaluate the payload as a total entity for flight safety purposes. As a part of the corrective action initiative, the pressure vessel certification responsibility has devolved to NSBF. The following paragraphs will discuss the implementation the certification procedures that will be employed by NSBF.

2. Payload Gondola Certification Procedures

Pressure vessel certification is a new responsibility. It will be performed in addition to the current gondola certification process. Existing gondola certification procedures are neither modified nor superseded.

3. Implementation

Payload pressure vessel certification will be performed by the Mechanical Engineering Section. Responsible personnel will be assigned to evaluate individual payloads as required. Individual science group Principal Investigators will continue to be responsible for the design, fabrication and testing of all pressure vessels associated with their payloads. Test programs must be performed to the extent necessary to demonstrate that the pressure vessel(s) will not present an unacceptable risk to personnel or property as a consequence of ground or flight operations. National Scientific Balloon Facility Payload Pressure Vessels Certification OF-600-22-P Rev – A Date- 04/16/04 page 2 of 2

As a part of the annual Candidate Flight Program formulation process, individual science group Principal Investigators will be request to supply the information listed below as a part of their flight application.

Design pressure analysis showing maximum design pressure(s).

N/A

Normal operating pressure for ground and flight operations.

3500 psi

Overview of material and construction specifications.

The compressed gas cylinder (Part # 6313) we intend to fly was manufactured by Carleton Technologies Inc. The DOT class label for the tank is: DOT-E11005-M4927. The maximum pressure rating is 4500 psi. More info on this part can be taken from the following websites:
http://resources.carltech.com/PTD/PTDproduct_list.pdf
http://resources.carltech.com/PTD/FRPretest.pdf

We are unsure of the manufacturer for the regulator. The regulator was recently purchased from the following site, but has not yet been received.
http://www.smartparts.com/Store/default.aspx?Prod=aba95ad9-78a7-43e7-9887-9718c04b1de2
The regulator is also rated to 4500 psi.

Pressure test dates, methodology, and results.

The cylinder and regulator were purchased new, and are certified by the manufacturer. We are operating the cylinder below the maximum pressure to provide a safety margin for any pressure changes that might occur due to radiative or convective heating. Calculations indicate that even if the temperature of the cylinder reached 100 degrees Celsius, that the pressure would increase no more than 25%.

Past flight history of the pressure vessels.

This apparatus has not been flown previously.

The certifying mechanical engineer will review the flight application for the presence and adequacy of the preceding documentation requirements. The Operations Department Head or applicable Campaign Manager will coordinate obtaining any missing or inadequate information from the applicable Principal Investigator. Based on the information supplied, the certifying mechanical engineer will determine whether or not the operation of the payload pressure vessel will present an unacceptable ground or flight safety risk. The emphasis of the process will be on determining the possibility of significant structural failures. Determining minor failure modes that could result only in possible science degradations are not within the purview of this process. If the certifying mechanical engineer determines that the payload pressure vessel(s) do not present unacceptable safety risks, the engineer will draft and forward to the Operations Department Head a memorandum certification, stating approval for flight operations. The memorandum will be made a permanent part of the flight record retained by NSBF.