UMD/ABC Payload Specification and Integration Plan

Payload Title: UMD/ABC (University of Maryland / Advanced Balloon Communications)

Payload Class: Small Large (circle one)

Payload ID: 05

Institution: University of Maryland, College Park

Contact Name: Dru Ellsberry

Contact Phone: 610-730-0944

Contact E-mail: Dru@UMD.edu

Submit Date: Monday, June 9th 2008

I. Mechanical Specifications:

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

Mass of UMD/ABC Payload (based on weight of prototype) = 0.90 kg

The structure for our flight unit has not yet been assembled in its final form; it will be more compact and efficient than for the prototype, so this weight is most likely a bit high.

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

The UMD/ABC Payload consists essentially of a rectangular aluminum box (15 cm x 15 cm x 15cm), inside which is housed a circuit board with a couple of protruding antennas (see figure 1). The rectangular box will be attached to the payload mounting plate using eight (8) bolts and nuts, secured with loctite. The hole pattern (2 fasteners, 8 cm apart, on each side of the square footprint of the payload, as shown in figure 2) will be match drilled from the payload base frame into the mounting plate, and washers will be used on both sides of the assembly.

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…)

No hazardous materials will be flown. Please see the downlink section for information on the radio transmitters.

D. Other relevant mechanical information

The two antennas on top of the payload will be roughly 20 cm tall but they will be removable for ease of handling.

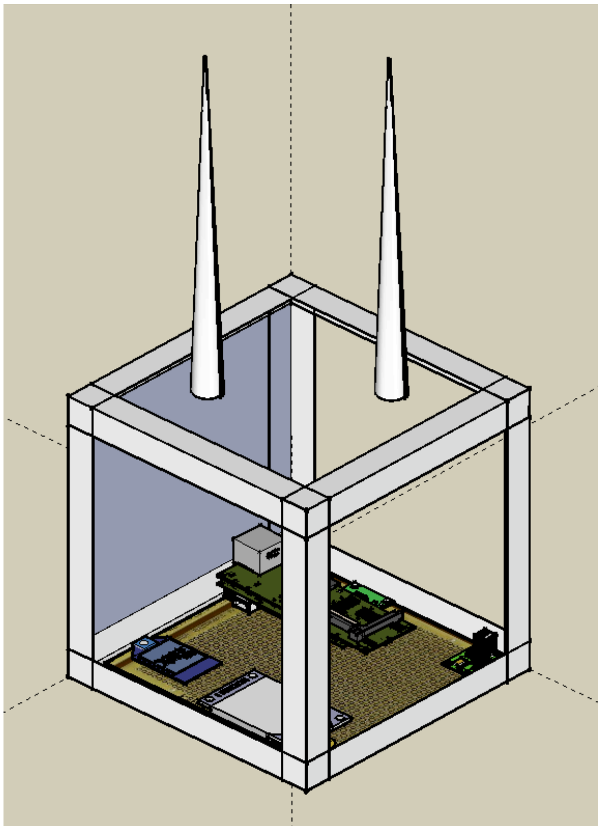

Figure 1: UMD/ABC Payload Sketch: circuit board is at the bottom; two antennas are shown on top; closure plates will be used on all 5 sides.

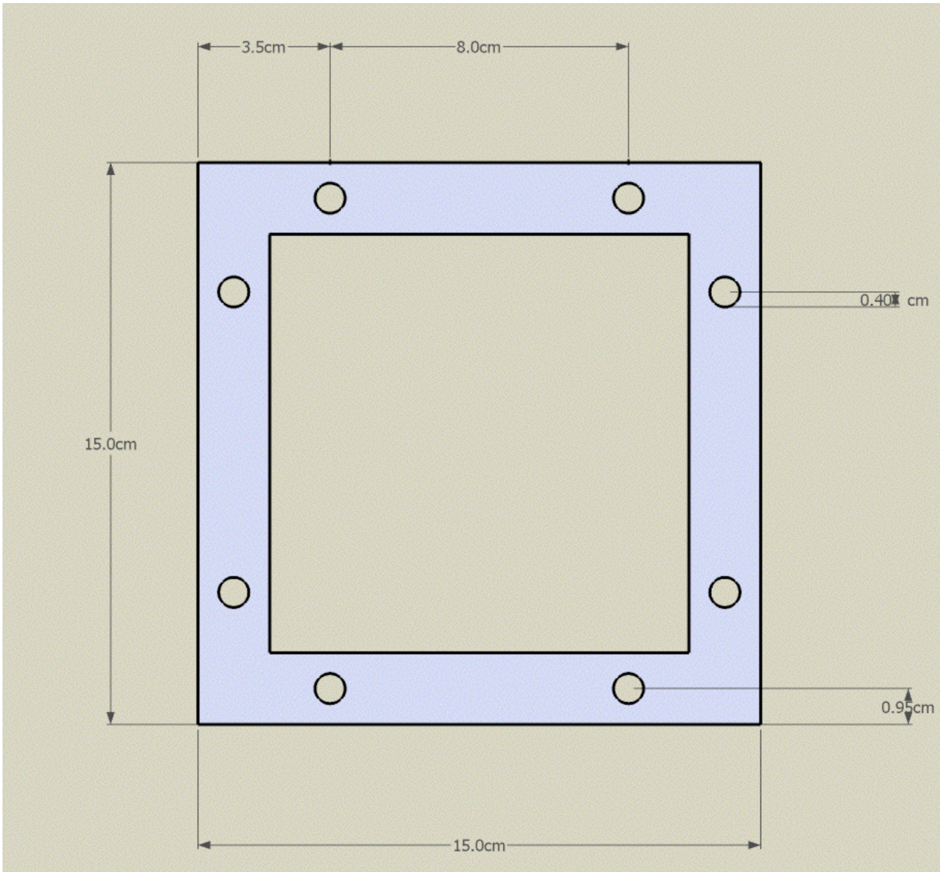

Figure 2: Diagram of hole pattern on mounting plate

II. Power Specifications:

A. Measured current draw at 30 VDC

- 0.25 Amps (max)

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 Figures 3 and 4.

C. Other relevant power information

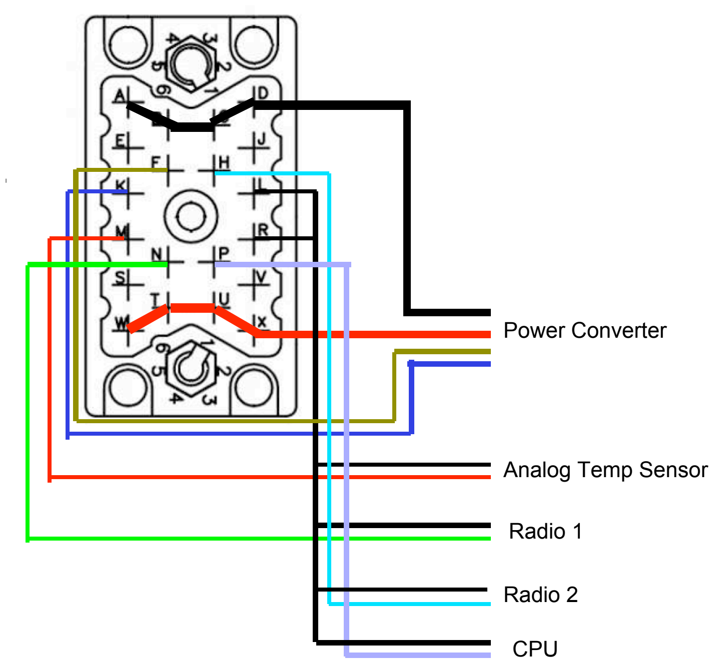

Figure 3: EDAC Connections

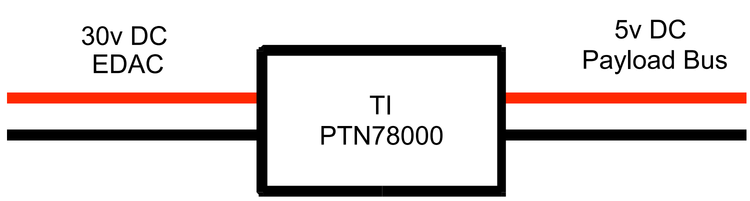

Figure 4: Power Conversion Diagram

III. Downlink Telemetry Specifications:

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

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

   i. 4000 bps

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

- Records (in bytes):
  - 1 - Packet type
  - 2-5 - Timestamp (s)
  - 6-9 - Timestamp (ns)
  - 10-11 - Size (bytes)
  - 12 - Checksum
  - 13-... – data
- There are 4 different types of packets, that contain different data:
  - GGA Packet - GPGGA string from GPS, with the GGA header removed ~ 63 bytes
  - RMC Packet - GPRMC string from the GPS, with the RMC header removed ~ 61 bytes
  - Radio signal statistics (ASCII):
    - Test ID - 5 + comma
    - Decibells 3 + comma
    - Packet # - 3 + comma
    - Mode - 2 + comma
    - Error code - 2
    - = Total of 19 bytes
  - Payload info (ASCII):
    - 6 temp sensors - 3x6 + 1x6 commas
    - Compass heading - 3
    - = Total of 27 bytes

GGA, RMC and payload info are transmitted at 1 Hz. Radio signal info is transmitted at up to 10 Hz. Each of the packets includes the 12-byte header.

The total rate comes out to 497 bytes/s = 3976 ~ 4000 bits/s

D. Number of analog channels being used: 2

E. If analog channels are being used, what are they being used for?
   - Internal (5v) bus voltage
   - Internal temperature

F. Number of discrete lines being used: 4

G. If discrete lines are being used what are they being used for?
   - Payload power (voltage regulator enable)
   - CPU enable
   - Radio 1 sleep
   - Radio 2 sleep

H. Are there any on-board transmitters? If so, list the frequencies being used and the transmitted power.
   - Yes
   - 902-928 (ISM) FHSS - 1 W
   - 902-928 (ISM) FHSS - 100 mW

I. Other relevant downlink telemetry information.
   - Only one radio will be operating at a time
   - Radios can be put into a "sleep" mode via the discrete IO where they will not transmit or receive

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*)
   - ~6/Hour

D. Provide a table of all of the commands that you will be uplinking to your payload
   - See Table 1 below.

E. Are there any on-board receivers? If so, list the frequencies being used.
   - Yes
   - 902-928 (ISM) FHSS (2 Radios)

F. Other relevant uplink commanding information.

Command (Binary)	Checksum	ID #	Description
0000	0	05	Run Startup Diagnostics
0001	D	05	Radio 1 9.6 Kbps
0010	7	05	Radio 1 115 Kbps
0011	E	05	Radio 2 9.6 Kbps
0100	6	05	All Radios Off
0101	0	05	Radio 1 Receive 9.6
0110	A	05	Radio 1 Receive 115
0111	1	05	Radio 2 Receive 9.6
1000	F	05	Run In-Flight Diagnostics
1001	0	05	Payload Mode 1
1010	1	05	Payload Mode 2
1011	2	05	Payload Mode 3
1100	3	05	Payload Mode 4
1101	4	05	Payload Mode 5
1110	5	05	Payload Mode 6

Table 1: Table of Uplink Commands for UMD/ABC payload

V. Integration and Logistics

A. Date and Time of your arrival for integration:

-The UMD team will be arriving in Palestine, TX, Sunday evening, August 3rd, 2008.

B. Approximate amount of time required for integration:

- 2 hours (nominal)

C. Name of the integration team leader:

- Dru Ellsberry

D. Email address of the integration team leader:

- Dru@UMD.edu

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

- Dru Ellsberry dru@umd.edu
- Mary Bowden bowden@umd.edu
- Connie Ciarlegio cciarleg@umd.edu
- Kasra Sanjari (foreign national) ksanjari@umd.edu

F. Define a successful integration of your payload:

i. Secures mechanically to the HASP boom

ii. Payload powers up and interfaces with mini-SIP
1. Discrete I/O (systems enabled)
2. Analog signals
3. Uplink
4. Telemetry

iii. CPU is operational
1. Runs program
2. Logs Data

iv. Radios working
1. Uplink/downlink working
2. Reasonable signal strength reading

v. Non-mission critical items functioning
1. Digital temperature sensors
2. Camera
3. Compass unit

G. List all expected integration steps:
1. Attach payload mechanically and electrically
2. Test discrete and analog I/O through the mini-SIP
3. Test serial uplink and downlink through mini-SIP
4. Test RF communications
5. Run payload on ground and ensure overall operation as time permits

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

i. Analog signals received

ii. Power converter produces 5V
iii. CPU powers on
iv. Mini-SIP uplink successful
v. Mini-SIP downlink received
vi. Test program loads
vii. Radio 1 TX/RX test
viii. Radio 2 TX/RX test
ix. GPS receives valid signal (must be exposed to sky)
x. Camera takes image
xi. Temperature sensors and compass working

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…):

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