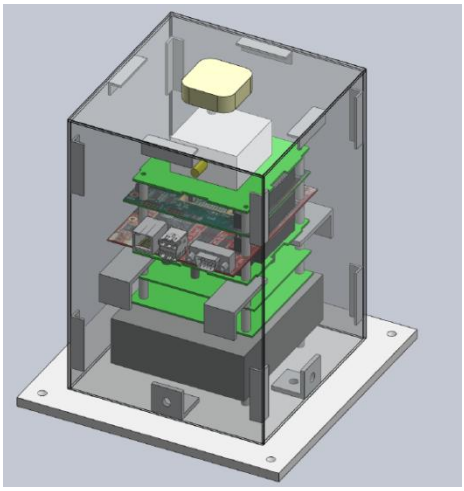
# ARIES GPS Payload



# Preliminary Payload Specification and Integration Plan


## By ARIES GPS Payload Team

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**Alexander Santiago**
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**Faculty Advisor: Dr. Hien Vo**

# Preliminary Payload Specification and Integration Plan

**Payload Title:** ARIES SAT GPS Payload

**Payload Class:** Small

**Payload ID:** 8

**Institution:** Inter American University of Puerto Rico

**Contact Name:** Oscar Valle

**Contact Phone:** (787)-546-7130

**Contact E-mail:** ovc_ovc@yahoo.com

**Submit Date:** April 20 2012

## I. Mechanical Specifications:

A. Measured weight of the payload

In order to know the ARIES GPS payload weight some steps were done. First we weighted all the electronic components (board and devices) that will be part of the ARIES GPS payload. Then doing the design of ARIES GPS payload in SOLIDWORK software we estimated the walls, top-cap and mounting plate weight with the information that it software provide. The material selected for the SOLIDWORK design were Aluminum 6061T6 (for the walls and top-cap) and PVC ¼(for the mounting plate). Table 1 show the result for the measured and estimated weight.

**Table 1: Weight for the ARIES GPS payload components.**

| ITEM | WEIGHT |
|---|---|
| MBS-GPS-OEMV -1DF PC/104 | 89.015g |
| Flight Computer TS-7260 | 113.53g |
| Temperature Sensors DS18B20-TO-92 | 1g |
| 4-Walls **(estimated from SOLID WORK)** | 501.4g |
| Top-Cap (**estimated from SOLID WORK**) | 95.16g |
| Mounting Plate **(estimated from SOLID WORK)** | 329.15g |
| Antenna | 74g |
| RF splitter+ board | 333g |
| CASES GPS | 453.592g |
| Power Board | 239g |
| **Total Weight** | **2295.847g** |
| **Weight Limit** | **3kg** |
| **Weight Margin** | **23.47%** |

B. Provide a mechanical drawing detailing the major components of your payload and specifically how your payload is attached to the payload mounting plate.
Several Solid Work designs were developed to addressing this point. **Figure 1** show the ARIES GPS payload major components and **figure 2** show how the payload will be attached to the mounting plate. In addition the **figure 3 and 4** illustrates the ARIES GPS payload design and dimensions.

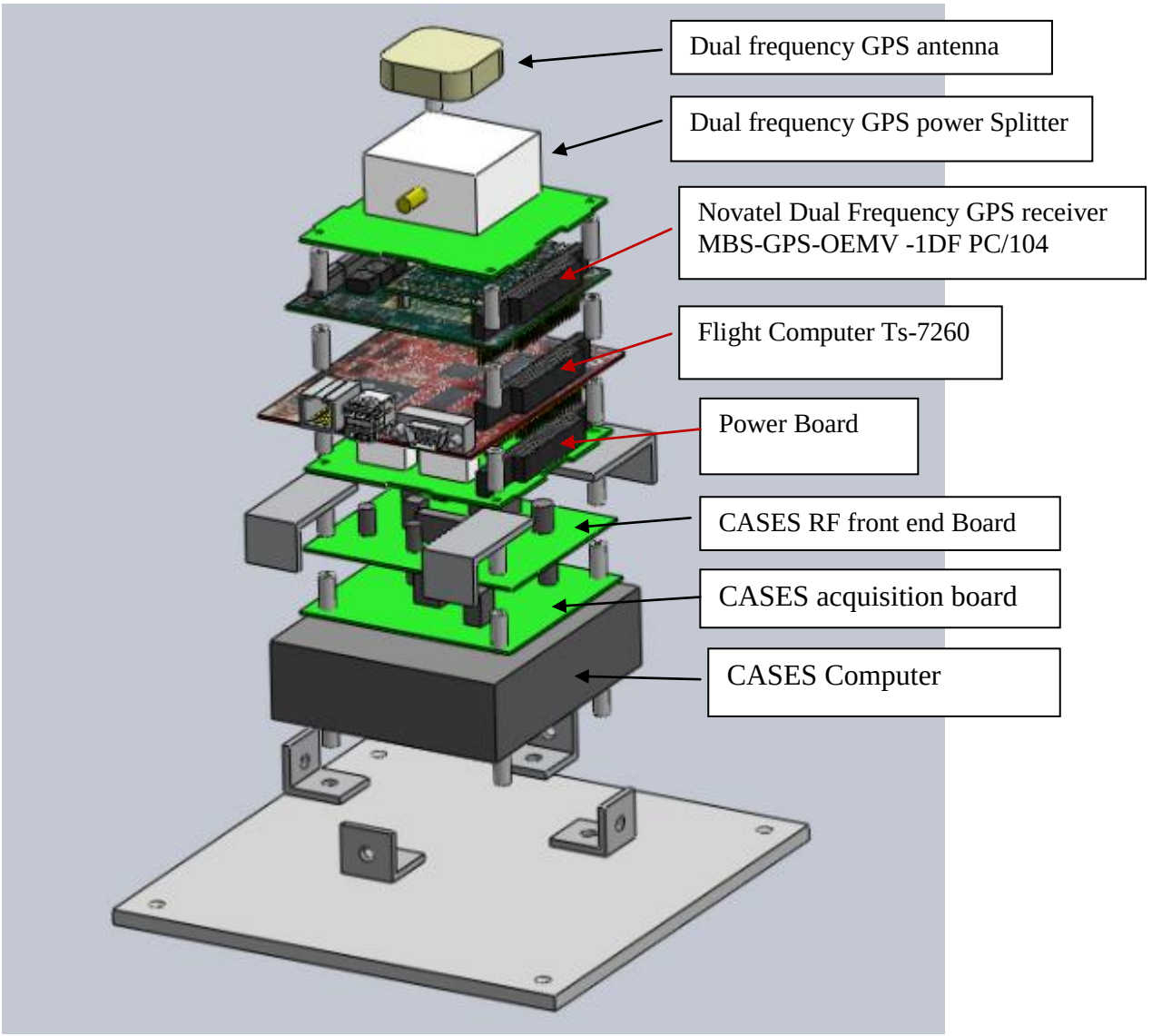



**Figure 1: ARIES GPS payload major components**

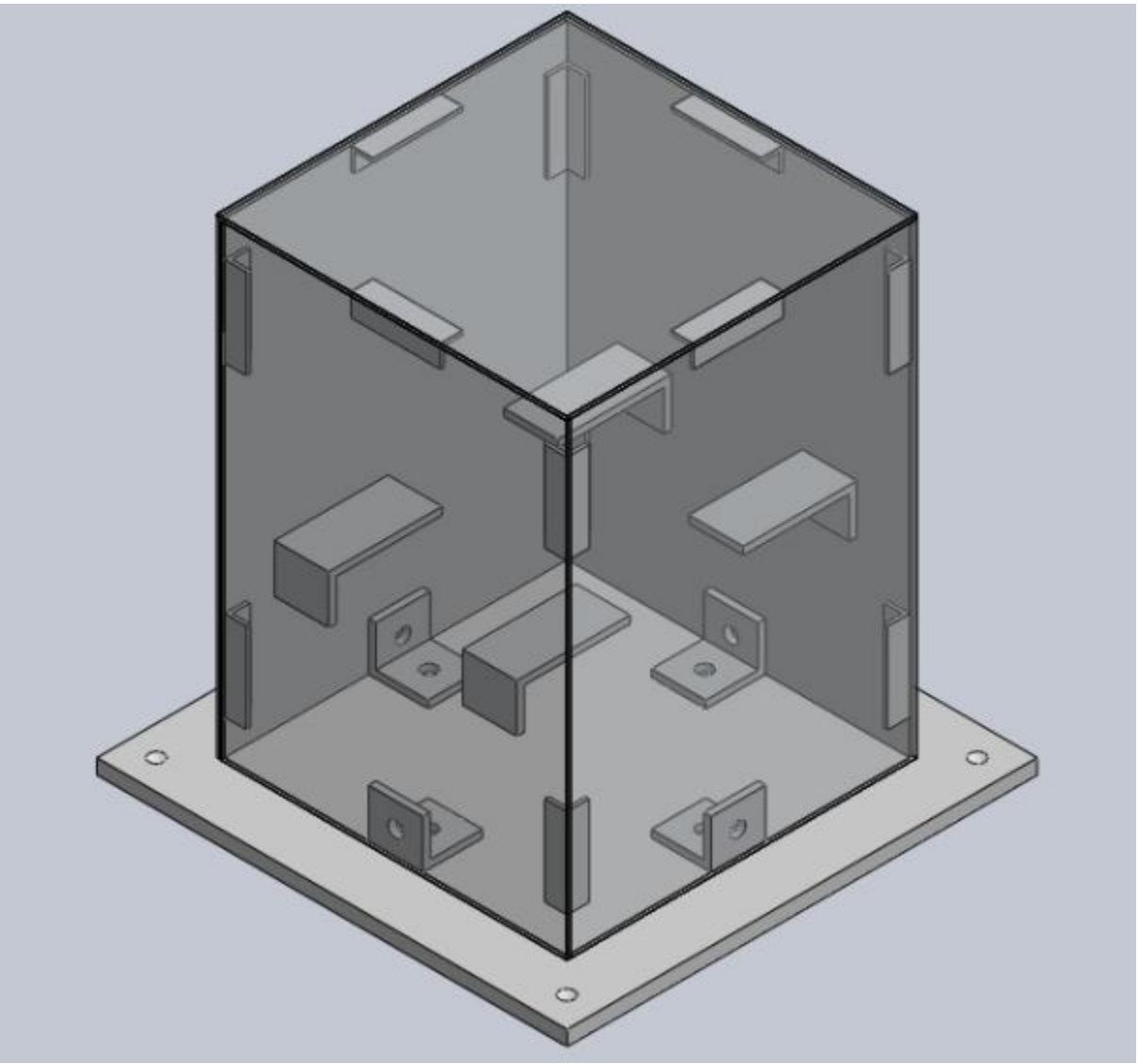


**Figure 2: how the payload will be attached to the mounting plate**

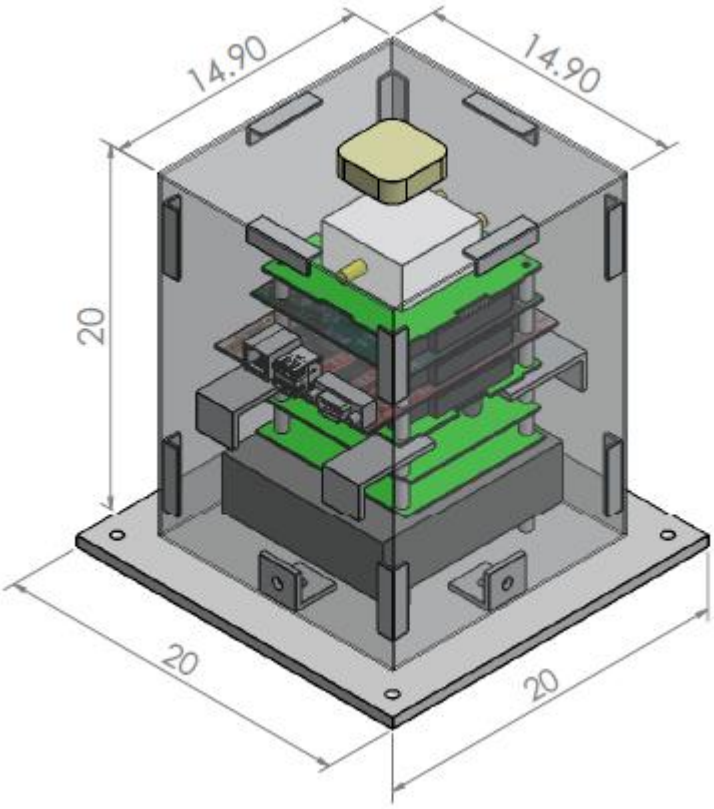



**Figure 3: ARIES GPS payload design and dimensions.**

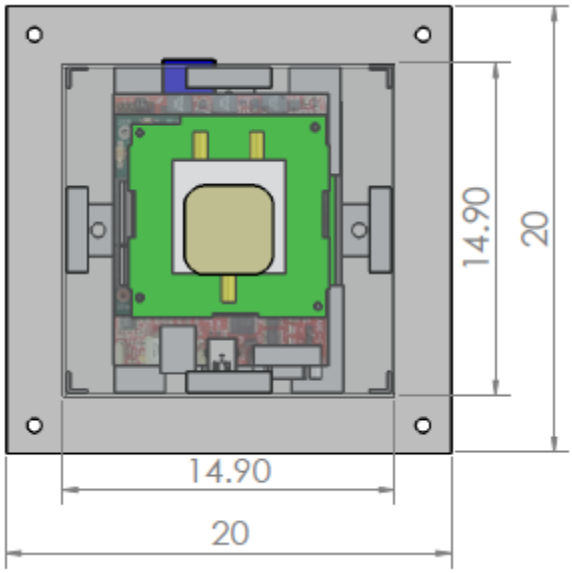



**Figure 4: ARIES GPS payload design and dimensions.**

C. Hazard Information:
ARIES GPS payload will not fly any material that will be hazardous.

D. Other relevant mechanical information:
N/A

**II. Power Specifications:**

A. Measured current draw at 30 VDC
In order to identify the total current consumption for the ARIES GPS payload at 30 VDC some test were realized on the payload. We connect a power supply with an output voltage of 30V to the DC to DC converter. Then we running the two GPS system independently and measured its current consumption by components. The result of this test is show in **table 2**.

**Table 2: Current draw for the components on the ARIES GPS payload.**

| ITEM | Voltage (V) | Current (mA) | Watts (mW) |
|---|---|---|---|
| MBS-GPS-OEMV -1DF PC/104PC | 5 | 320 | 1600 |
| Flight Computer TS-7260 | 5 | 200 | 1500 |
| Temperature Sensors DS18B20-TO-92 | 5 | 1.5 | 15 |
| Antenna | 5 | 50 | 250 |
| CASES GPS Computer board | 12 | 500 | 6000 |
| CASES GPS acquisition board | 5 | 200 | 1000 |
| ASTRA GPS RF front end board | 5 | 300 | 1500 |
| **Total Power Consumption** | **30** | **395.5** | **11865** |
| **Power Limit** | **30** | **500** | **15000** |
| **Power Margin** | **30** | **107.83** | **20.9%** |

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.
This payload will employ power from the HASP Platform. A source of 30 V at 0.5 A will be supply by the HASP platform to the payload through an EDAC 516 connector. This EDAC 516 will be connected to two different power converters within the payload. The connection between the EDAC 516 connector and the DC/DC converter of 5V will be through all power and ground pins on the EDAC 15 connector. This converter will supply the power to all the components that use 5V to operate (green blocks on the **figure 5**). The connection between the EDAC 516 and the DC/DC of 12V will be also through all power and ground pins on the EDAC 15 connector. It converter will provide power to the CASES GPS computer board (Blue blocks on **figure 5**). The configuration for the DC/DC converter is show in **figures 6 and 7.**

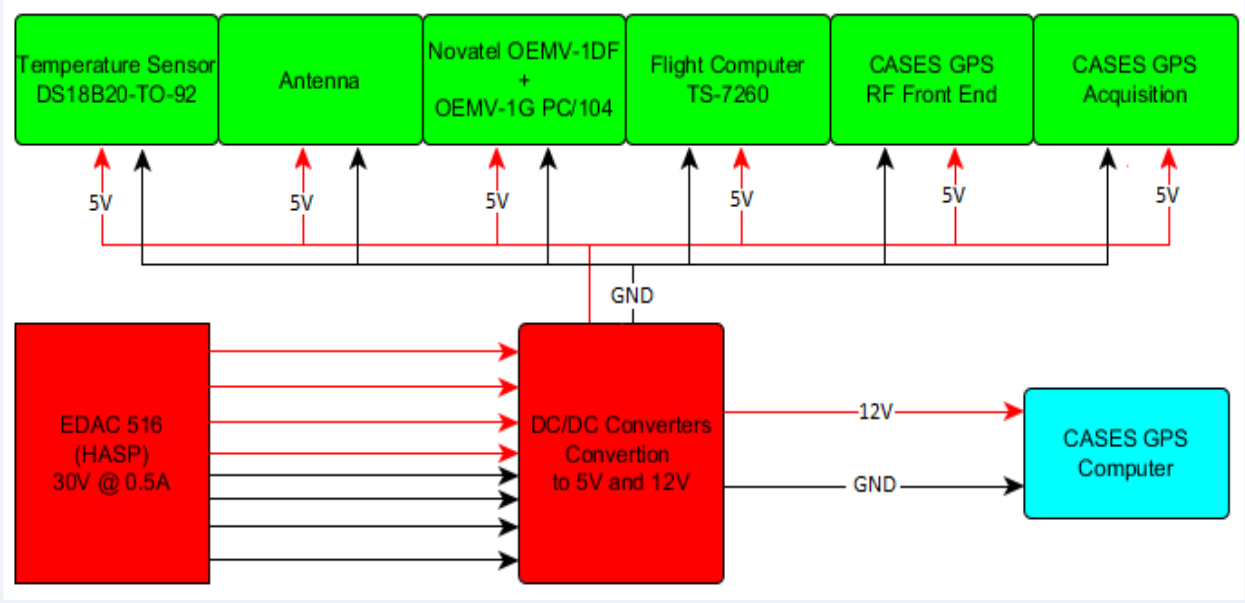
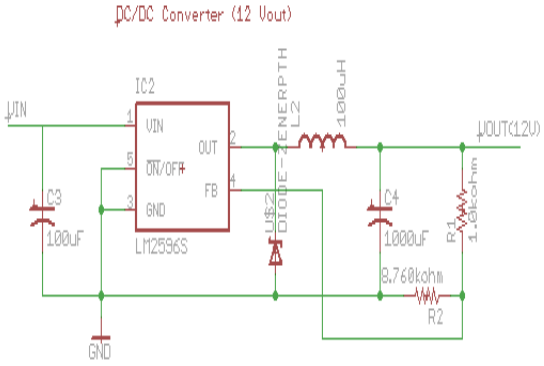
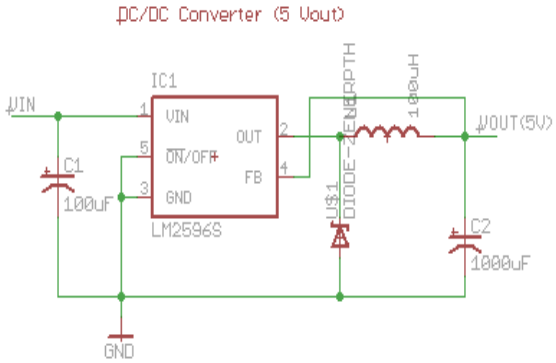



**Figure 5: ARIES GPS payload wiring diagram**




**Figures 6: Configuration to convert from 30 VDC to 5DC**




**Figures 7: Configuration to convert from 30 VDC to 5DC**

**C.** Other relevant power information
None

**III. Downlink Telemetry Specifications:**

A. Serial data down link format: Stream **Packetized** (circle one)

B. Approximate serial downlink rate (in bits per second)
It will be 1200 bps.

C. Specify your serial data record including record length and information contained in each record byte.
The ARIES-GPS team will send scheduled health and status packages through the downlink at regular intervals. These packets are used for monitoring the payload performance, at almost real time. In addition these packets will follow a custom made format developed by our team members, and will be composed of the bytes show in **table 3**:

**Table 3: Packets bytes format**

| BYTE | NAME OF BYTE |
|---|---|
| 0 | Start of header ('#'-ASCII character) |
| 1-4 | GPS Latitude |
| 5-8 | GPS Longitude |
| 9-12 | GPS Height |
| 13-16 | SBC temperature |
| 17-18 | Packet number(0-65536) |
| 20-21 | 16 its CRC |

D. Number of analog channels being used:
Not analog port will be used by ARIES Sat GPS payload.

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

F. Number of discrete lines being used:
Two discrete lines will be used.

G. If discrete lines are being used what are they being used for?
Discrete command will be used to change the state of the payload during the flight.
OFF- to turn of the payload in case of a problem
ON- to turn the payload ON in case it was turned off

H. Are there any on-board transmitters? If so, list the frequencies being used and the transmitted power.
No transmitter board on the ARIES Sat GPS payload.

I. Other relevant downlink telemetry information.

None

## 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 rate, i.e. n commands per hour)
We will use less than 4 commands and at least 2 commands per hour if needed; the amount of commands for uplink will depend on the payload's performance.

E. Provide a table of all of the commands that you will be up-linking to your payload

**Table 4: ARIES GPS payload Up-link commands**

| Hex Commands | Uplink Commands | Description |
|---|---|---|
| 4F | CGON | CASES GPS On |
| 46 | CGOFF | CASES GPS Off |
| 54 | GON | GPS Board On |
| 4E | GOFF | GPS Board Off |

F. Are there any on-board receivers? If so, list the frequencies being used.
Our payload will have two on-board GPS receivers, which we listed below:
1- Novatel OEMV-1DF GPS receiver, working at the L1(1575.42 Mhz) and L2(1227.60 Mhz) GPS frequencies.
2- ASTRA CASES GPS receiver, working working at the L1(1575.42 Mhz) and L2(1227.60 Mhz) GPS frequencies.

G. Other relevant uplink commanding information.
None

## V. Integration and Logistics

A. Date and Time of your arrival for integration:
ARIES Sat team will arrive on July 29 to Palestine, Texas. Time of arrival will be dependent on the flight schedule.

B. Approximate amount of time required for integration:
The integration for ARIES Sat GPS payload will take between two and three days.

C. Name of the integration team leader: Damian Millares

D. Email address of the integration team leader: dmiralles2009@gmail.com

# Preliminary Payload Specification and Integration Plan

E. List **ALL** integration participants (first and last names) who will be present for integration with their email addresses:
Damian Miralles: dmiralles2009@gmail.com
Jean Ojeda: jojeda6340@gmail.com

F. Define a successful integration of your payload:
To get a successful integration the ARIES Sat GPS payload has to meet all HASP requirements. Its total current draw at 30V has to be least than 500 mA and its weight less than 3kg. In addition the payload has to be able of send data to the HASP platform to a data rate of 1200 bps or lower. Moreover the ARIES GPS payload need be capable of receive uplink command from the HASP platform. Finally the payload dimension has to be equal or smaller to 15x15x30 (cm).

G. List all expected integration steps:
1. Weight the payload to prove that it is within the HASP parameter.
2. Provide to the HASP personnel a detailed drawing with the payload description.
3. Ensure that the payload is appropriate attach to the platform and is correctly insulated
4. Turn on the payload to prove that it power consumption doesn't exceed the HASP requirement.
5. Give to the HASP personnel a detailed wiring diagram.
6. Perform the thermal and vacuum test to demonstrate that payload is able to work appropriate on the HASP environment.
7. Send some downlink packages to evidence that payload data rate is within the HASP requirement and to confirm a successful communication between the ARIES GPS payload and the HASP platform.
8. Test the appropriate function of the discrete command.
9. Provide a list of the Up-link command for the payload to the HASP personnel.
10. Review that not frequency interference between the GPS receiver on the payload and the HASP platform.
11. Offer a list with the payload team members and their contact information to the HASP personnel.
12. Present the mission plant to the HASP personnel.

H. List all checks that will determine a successful integration.
The **table 5** shows all checks that will determine a successful integration for the ARIES GPS payload.

**Table 5: The checks that will determine a successful integration for the ARIES GPS payload.**

| Integration Step | Requirement | Expected |
|---|---|---|
| Weight the Payload | 3kg or less | 2.1 Kg |
| Payload Drawing | Mechanical drawing detailing the major components and how your payload is attached to the payload mounting plate. | A detailed Solid Work diagram addressing those points will be submitted. |
| Measure the current consumption at 30V | 500 mA | 376 mA |
| Wiring Diagram | Power system wiring diagram starting from pins on the student payload interface plate EDAC 516 connector through your power conversion | A complete power wiring diagram, developed in Eagle will be submitted. |
| Thermal and Vacuum Test | Thermal Range -80C to 40C and ambient pressure up to 10 mbar. | Several tests will be performed to the payload at the Inter American University vacuum chamber to ensure it appropriate operation under these conditions. |
| Down Link | 1200 bps | The flight computer baud rate will be setup to send serial data to 1200 bps. |
| Team Members information | A list of all payload team members including contact information | A document providing the team information will be submitted for the team during the integration process. |
| Mission Plant | A mission plant has to be developed. | A document specifying the mission plant will be developed for the team and summated for the corresponding deadline. |

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:
Until this moment the ARIES GPS team only required a power supply.