Project Apex II – Technical Design Document *(Jon Sowman – April 2011)*

Custom Data Format

We have the following data available to the flight computer via various sensors etc, that we will transmit via telemetry:

- Number of GPS satellites in view
- Internal & external temperature
- Barometric Pressure
- Battery Voltage
- IRD 1&2
- Light Sensor
- RSSI (1)

We are using the standard UKHAS format for the main telemetry packets:

```
$$<CALL SIGN>,<COUNTER D>,<TIME HH:MM:SS>,<LATITUDE DD.DDDDDD>,<LONGITUDE
DD.DDDDDD>,<ALTITUDE METRES MMMMM>,
<O SPEED KM/H DDDD.DD>,<O BEARING DDD.DD>,
<O TEMPERATURE INTERNAL C D.DD>,<O TEMPERATURE EXTERNAL C D.DD>,
<O TEMPERATURE CAMERA C D.DD>,
<O BAROMETRIC PRESSURE hPa(millibars)>,<O CUSTOM DATA>*<CHECKSUM><NEWLINE>
```

Given this, we will use the following format for the Apex II telemetry:

```
$$APEX,<TICKS>,<TIME>,<LAT DDMM.MM>,<LON DDMM.MM>,
<ALT MMMMM>,<SPEED DDD>,<BEARING DDD>,<SATS DD>,
<INT_TEMP>,<EXT_TEMP>,<PRESSURE HHH>,<BATT_VOLTS HHH>,
<IRD_1 HHHH>,<IRD_2 HHHH>,<LIGHT HHHHHHHHH>,
<RSSI HH>*<CHECKSUM HHHH>
```

Formatting

- **Temperature**: dd.dd variable length, two decimal points, degrees Celcius
  - Always two decimal places, but can be positive or negative variable length
- **Pressure**: hhhh fixed length hexadecimal
  - 12 bit ADC referenced to 5 Volts
  - `data = 10 * (((data / 4096) * 5) + 5 * 0.095) / (5 * 0.009)`
- **Battery** voltage: hhhh fixed length hexadecimal
  - 12 bit ADC referenced to 5 Volts
- **IRDs**: hhhh fixed length hexadecimal
  - Counts in the last 30 seconds
- **Light**: hhhhhhhh fixed length hexadecimal
  - Concatenated red, green, blue and white values, followed by a multiplier
  - rrggbbwwm
- **RSSI**: hh fixed length hexadecimal
  - 8 bit ADC referenced to 3V3