High Altitude Balloon

Power Bus Development Team

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Faculty Advisors

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Introduction to HIBAL Design

• What is HIBAL?
  – Dedicated to the exploration of near space for scientific and educational purposes
  – Undergraduate and Graduate Students
  – Multidisciplinary projects
Objective

• Design a universal power bus that replaces multiple power sources
  – Reduce weight
  – Space (physical access)
  – Providing power for 5 to 8 hours

• Research alternate power source
  – Solar panels
  – Secondary power supply
Specifications for Centralized Power Bus Battery Design

• Light weight (two boxes, 12 lb limit)
• Small size (area inside box is limited)
• Temperature sensitive (0° C at 85 K ft.)
• Rechargeable
• Power all components for 5 hours
• Adding future components
Centralized Power Bus Battery Design (5 hrs)

<table>
<thead>
<tr>
<th></th>
<th>Input Voltage - Max</th>
<th>Input Current (A) Nominal</th>
<th>Power Consumption (Watts)</th>
<th>Amp Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Garmin GPS model number</td>
<td>5.4</td>
<td>0.085</td>
<td>2.805 - 4.59</td>
<td>0.53</td>
</tr>
<tr>
<td>GPS15L</td>
<td>6</td>
<td>0.12</td>
<td>0.432 - .72</td>
<td>0.75</td>
</tr>
<tr>
<td>Garmin GPS 25-lvs</td>
<td>9</td>
<td>0.18</td>
<td>1.62</td>
<td>1.13</td>
</tr>
<tr>
<td>Microtrak 300</td>
<td>9</td>
<td>0.5</td>
<td>27</td>
<td>3.13</td>
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<tr>
<td>Basic Stamp Version 2.2</td>
<td>12</td>
<td>0.01859</td>
<td>0.26</td>
<td>0.12</td>
</tr>
<tr>
<td>Servo</td>
<td>14</td>
<td>0.085</td>
<td>0.459</td>
<td>0.53</td>
</tr>
<tr>
<td>Cutter</td>
<td>3.3</td>
<td>0.085</td>
<td>2.805-4.59</td>
<td>0.53</td>
</tr>
</tbody>
</table>

Total Power Required 35 Watts
Total Amp Hours 6.72 Ah
Lithium-Ion Battery
14.8V – 7 Ah -95 W

- Light weight (1.1 lbs )
- Rechargeable
- Small size (7.0" L x 2.2" W x 1.2" H)
- Low internal impedence
- Temperature range (-40° C to +80° C)
- If battery completely discharges, it’s ruined
- No memory effect (charge at any time)
- Higher cost than nickel-cadmium
HYBRID TOPOGRAPHY

14V
Battery

12V
12V REG

9V
9V REG

5V
5V REG

3.7V
3.7V REG
Topographies Cont’d

PARALLEL TOPOGRAPHY

14V Battery

12V REG

9V REG

5V REG

3.7V REG

12V

9V

5V

3.7

SERIES TOPOGRAPHY

14V Battery

12V REG

9V REG

5V REG

3.7V REG

12V

9V

5V

3.7
Updated List

• 3 GPS
  – Antenna’s with each
• Basic Stamp (Being replaced)
• Video System
  – 3 cameras
• Remote Cut down Servo (M.E Project)
• List is always changing with many groups
D100E Series

Features:
• 1 W Output Power
• Miniature Case
• Single and Dual outputs
• D111E
  • Step down
  • 12Vin -> 5.0Vout
  • Power systems like GPS, and DVR
Graph: Output power vs. Ambient Temperature

- Temperature range experienced in the module:
  - 0 degrees to 60 degrees
- This converter meets weight and temperature requirement
SR7805 Miniature Series

- SR7805-09W
- To power 9V Units (Cameras and Microtrak)
- Output Current 500mA
- Input V Range 11-32V
- Regulated Output.
- Greater Efficiency and wide input voltage range
SR7805-05W (Vo: 5V)

• Tested
• Our group favors this model
  – Wide Input voltage range
  – Easy set-up
  – Inexpensive
  – Cons: Single Output compared to other models
• Other models in this series currently investigating: SR7805-06, and SR7805-12W
D111ER DC/DC Converter

- Regulated output Voltage
- Input Voltage Range
  - 11.4-12.6 V
- Output Voltage/Current
  - 5V
  - 150mA
Allegro: ACS712

- Inexpensive method of measuring current.
- Easy implementation
- Total output error 1.5% at T: 25 degrees Celsius
Tasks

• Test all parts ordered
• Test the topographies
• Real-time test (Temperature)
• Debugging systems for maximum efficiency
Summary of Accomplishments

<table>
<thead>
<tr>
<th>Current Accomplishments</th>
<th>Future Accomplishments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Specification</td>
<td>Prototype</td>
</tr>
<tr>
<td>Obtain Parts</td>
<td>Test Before Launch</td>
</tr>
<tr>
<td>Tested Equipment</td>
<td>Launch</td>
</tr>
</tbody>
</table>
Problem Faced

• Time Factor
• Class conflict
• Waiting Time
• Many new groups
Conclusion

• HIBAL – What is HIBAL?
• Our main objective and solution
  – Centralized Power bus system
• Battery
• Micro-converters, voltage converters
• Team is on schedule
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– ANY QUESTIONS?