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High Altitude Balloon

Power Bus Development Team

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Faculty Advisors

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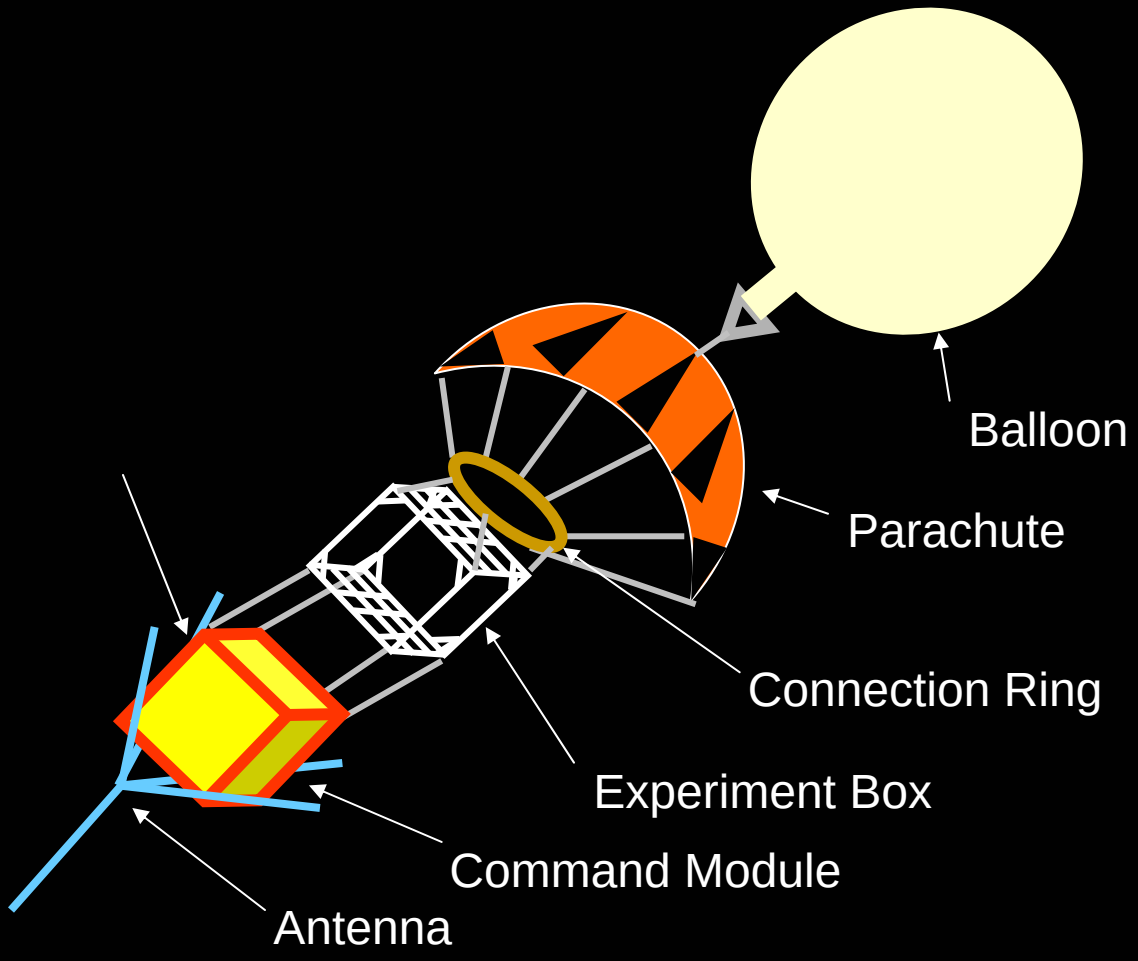
- John Gallagher
- Joseph Slater
- Bruce Rahn (Mentor)

Introduction to HIBAL Design

- What is HIBAL?
  - Dedicated to the exploration of near space for scientific and educational purposes

Balloon Setup



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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

Parts of Power Bus

- Battery Pack (power supply)
- Micro-converters
- Casing and boards

Specifications for Battery Design

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- 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

Li-Ion 18650 11.1V 6600 mAh

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PCB protection board

Rechargeable

Light weight (10 ounces)

Small size (7.0" L x 2.2" W x 1.2" H)

Temperature range (-40° C to +80° C)?

No memory effect (charge at any time)

Problem ?

- The rate of chemical reaction decreases with decreasing temperature, therefore voltage and current capacity decrease.
- By how much?
- If battery completely discharges, it’s ruined

Battery Testing

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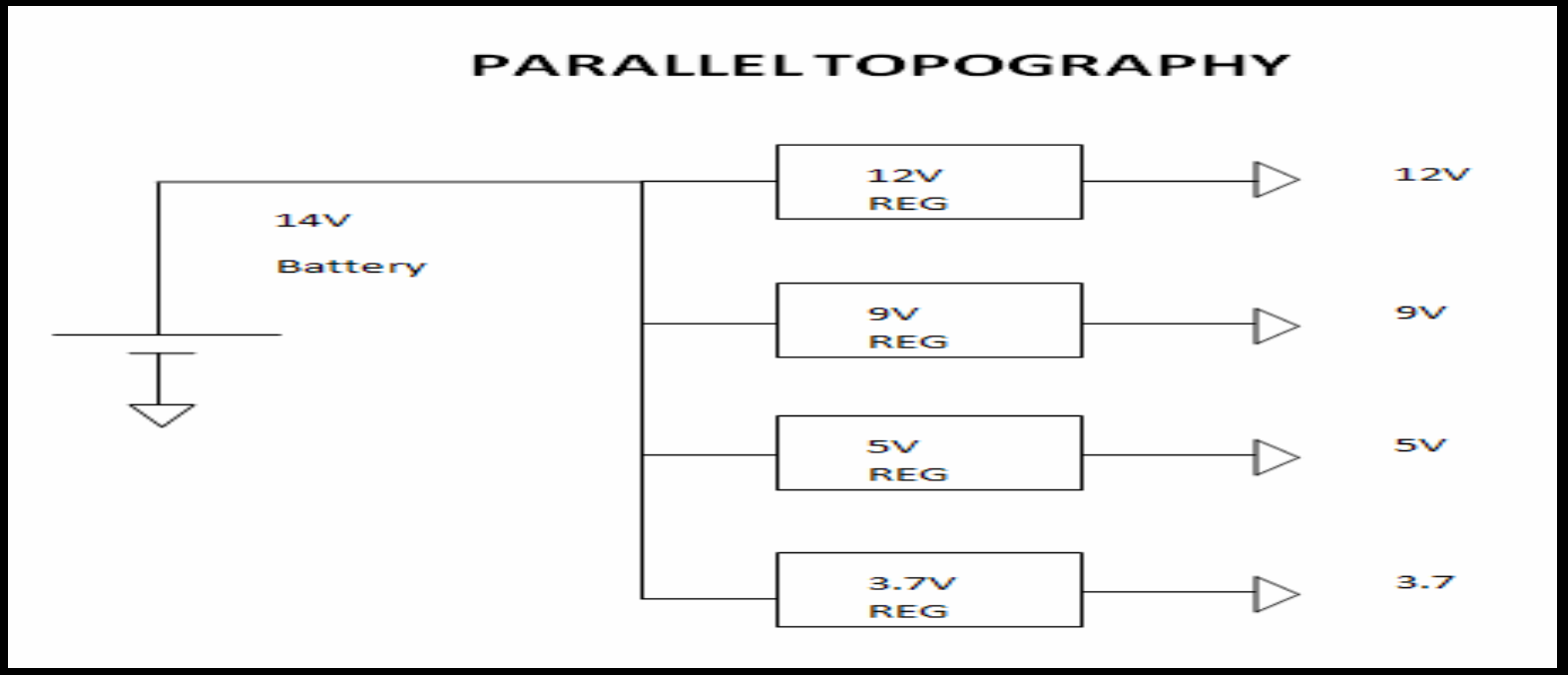
- Room temperature
- Refrigerator testing
- Freezer
- Dry ice ?
- Design a spreadsheet to analyze how temperature is proportional to battery performance

Basic model



Not Including the 3.7V

Final List of Regulators

- SR7805-05W : Outputs 5V
  - Input Range : 6-32V
- SR7805-09W : Outputs 9V
  - Input Range : 6-32V
- Boost-Buck Converter : Outputs regulated 12V

Boost Buck Converter

- Boost-Buck topology will allow the DC input voltage to be higher or lower than the output voltage.
- With temperature changes, during flight, the converter will ensure a constant 12V supply to units requiring Vin of 12V
- We are using Model # ASD10

Boost Buck Converter

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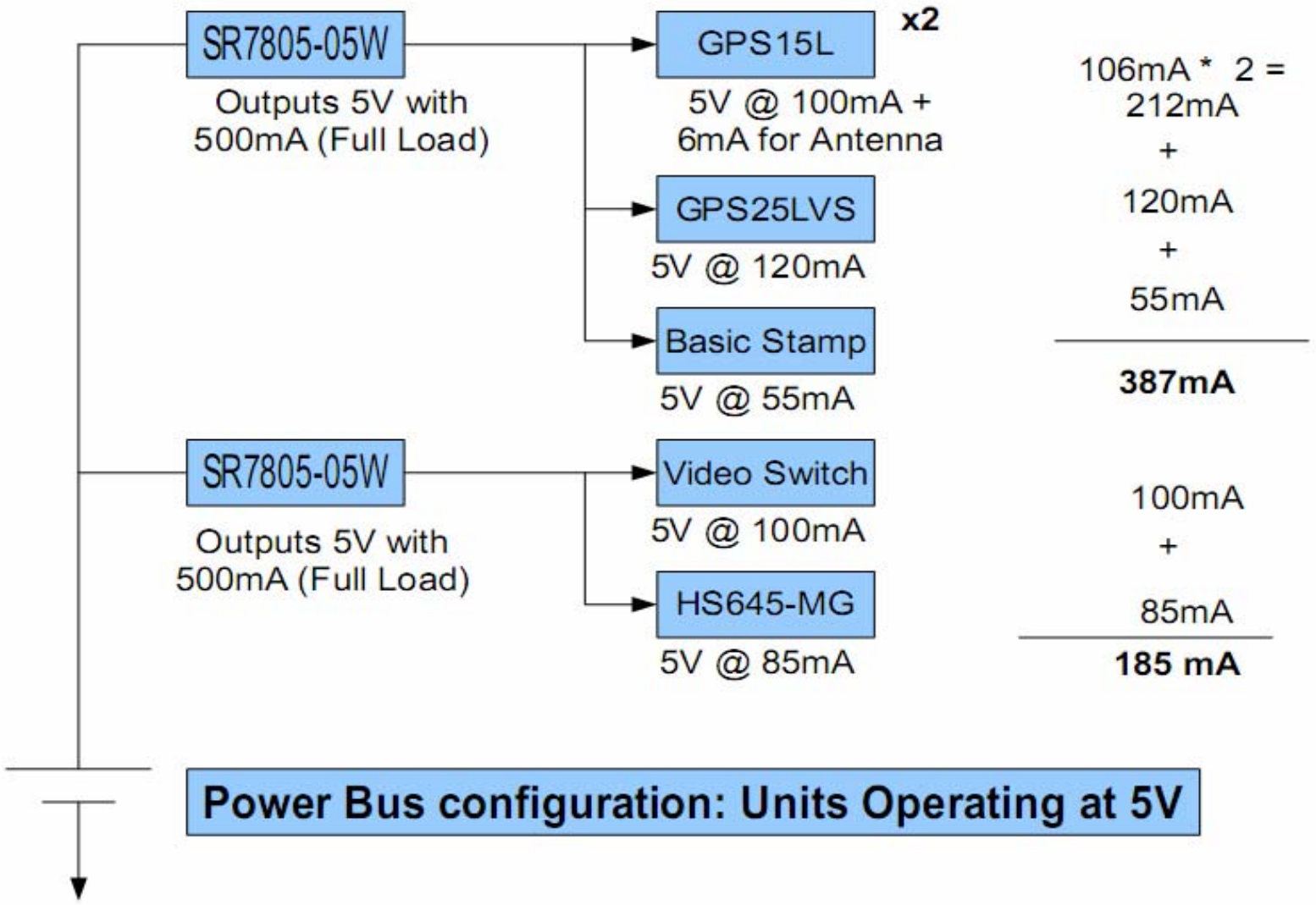
- Astrodyne Model # ASD10
- Wide 4 : 1 input range
- High Efficiency
- Regulated Output of 12V.

5V Equipment



3.3V for GPS Units

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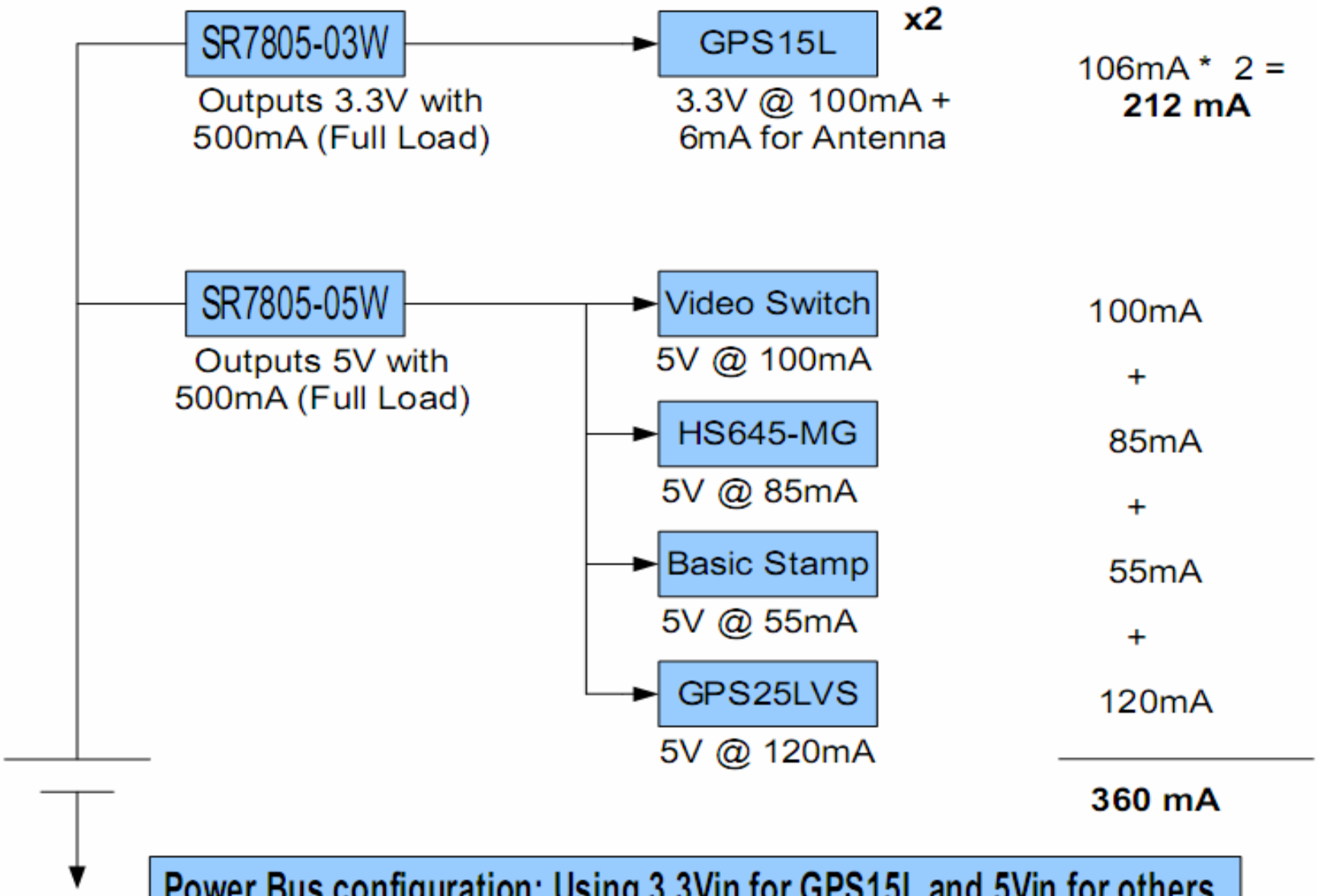
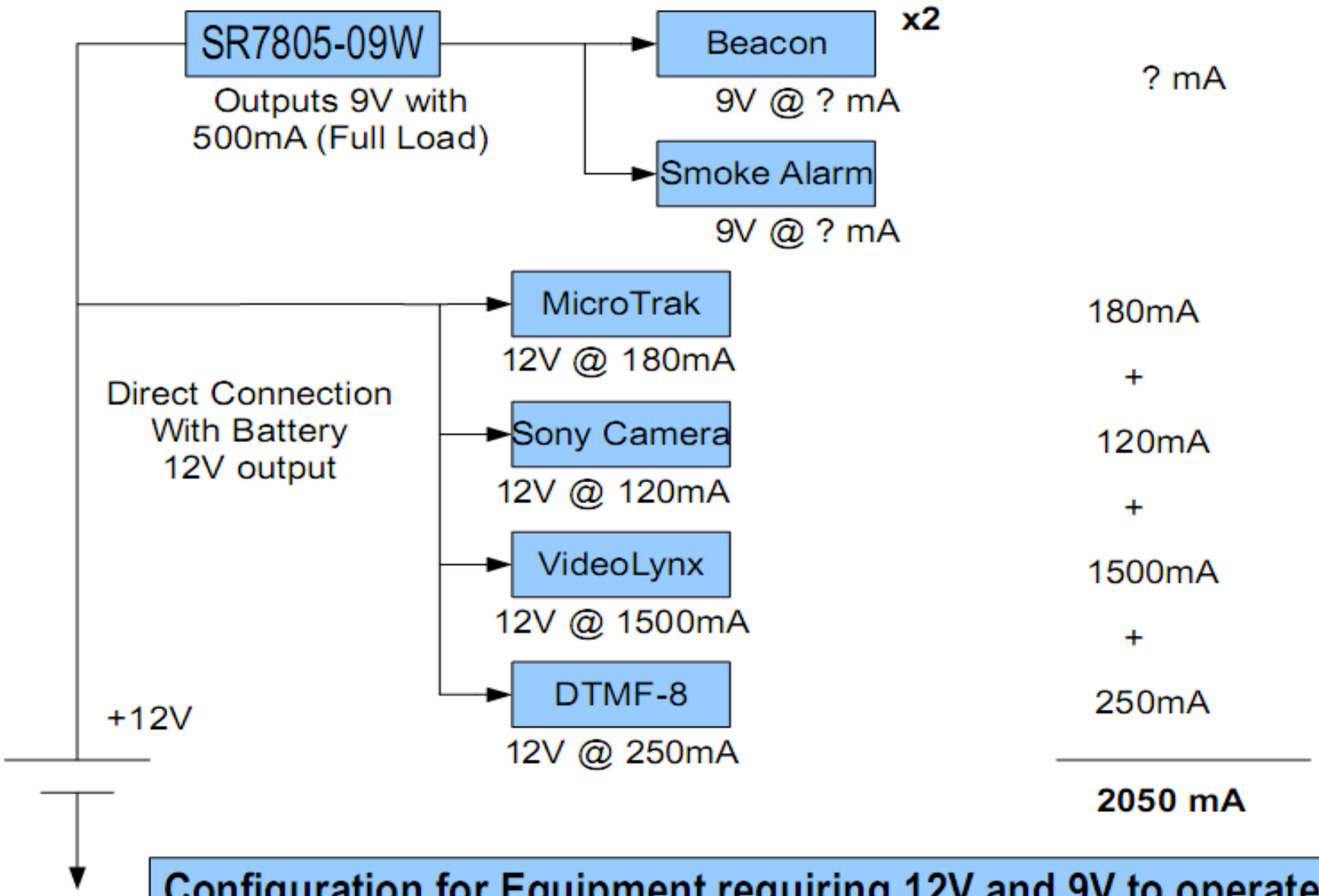


Power Bus configuration: Using 3.3Vin for GPS15L and 5Vin for others

12V & 9V Equipment



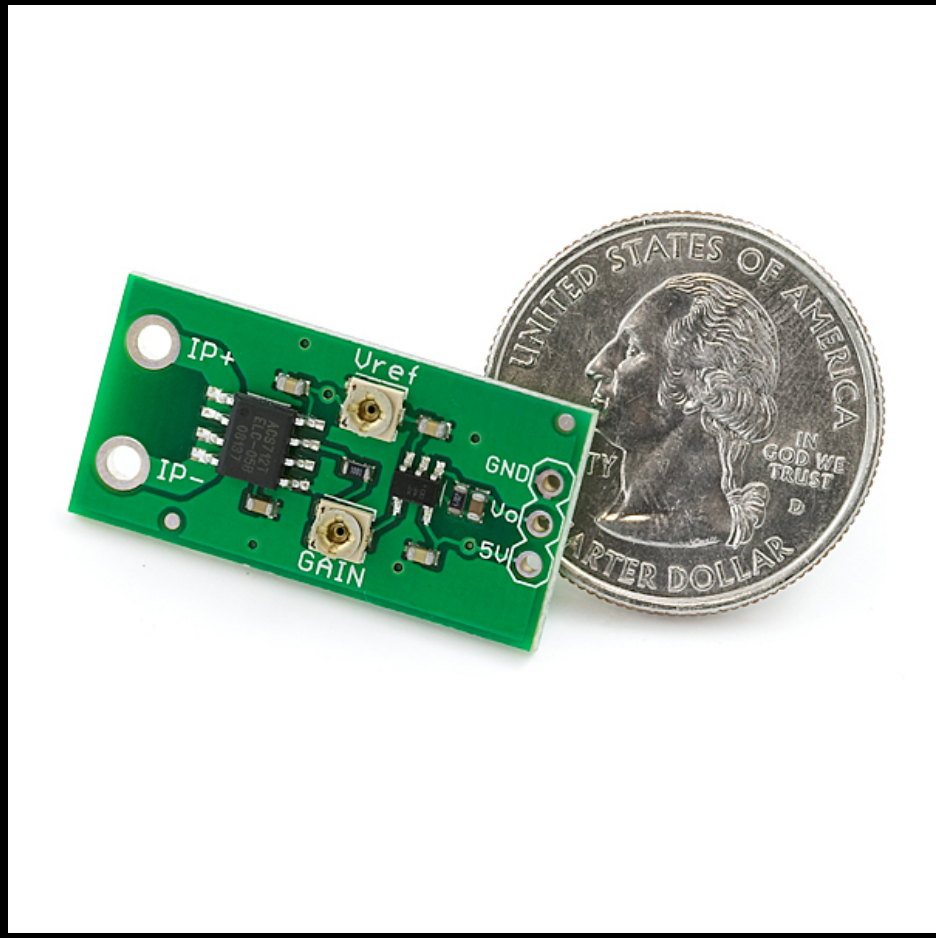
Configuration for Equipment requiring 12V and 9V to operate

Upcoming Schedule For Regulators

- Calculate Efficiency
- Build boards to be mounted on the power bus casing.
- Build connecters for the equipment
- Cold Test regulators with the Bus
- Send a “test board” up with the old package to calculate efficiency in real-time

ACS712 Low Current Sensor

- Sensor gives precise current measurement for both AC and DC signals
- Measures up to 5A of DC or AC current.
- Small & Inexpensive

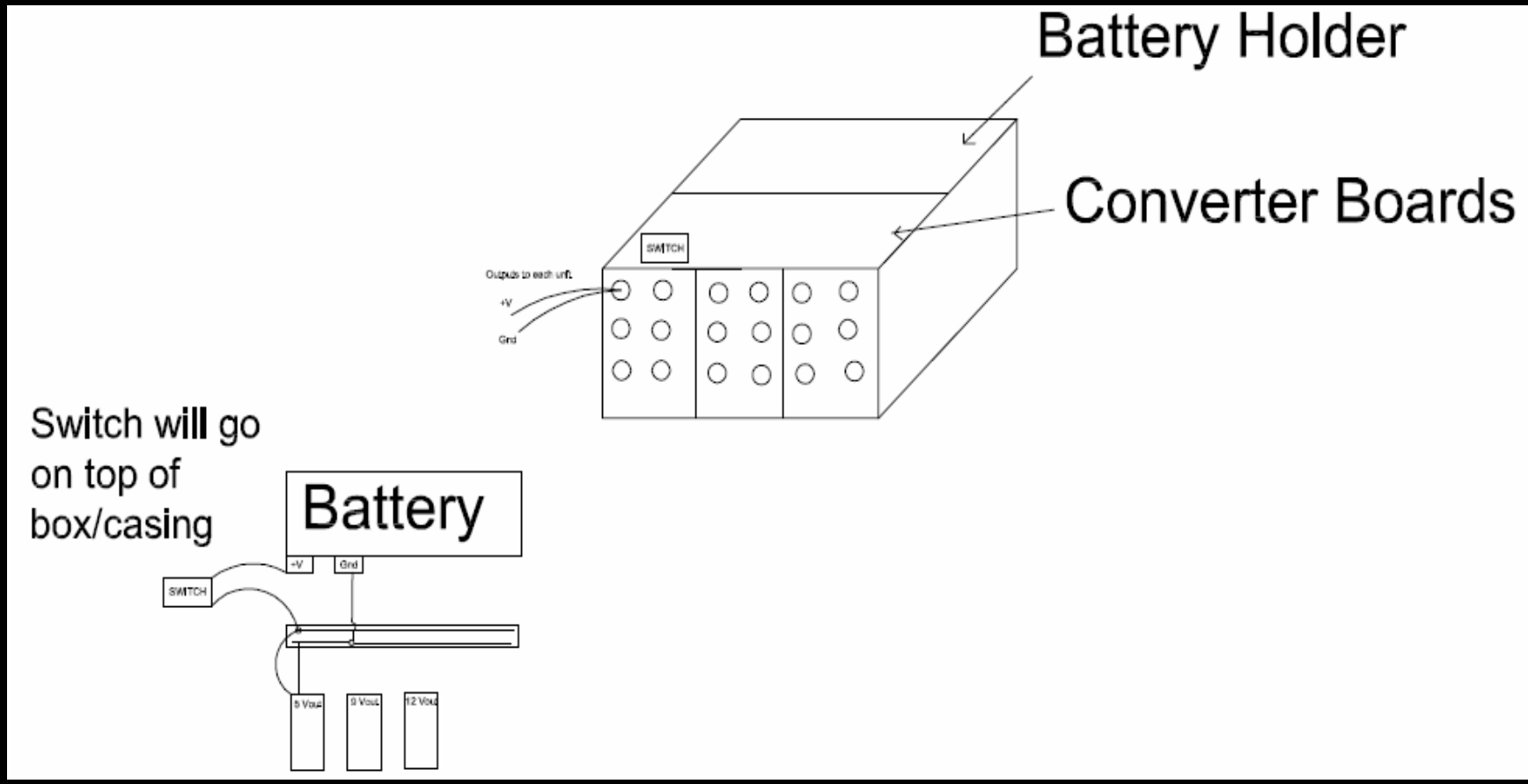


Converters Tested With Loads

Efficiencies Not Included:

	Voltage Tested	Theoretical Current	Resister Used (Ohms)	Output current
SR7805-05W	5	500mA Full	10	500 mA
SR7805-05W	5	250mA half	20	250 mA
SR7805-05W	5	no load		2 mA
D112ER	9	111mA Full	82	111 mA
D112ER	9	55.5mA half	162	56.5 mA
D112ER	9	No load 15mA		12 mA

Power Bus Casing



Top Box Switch

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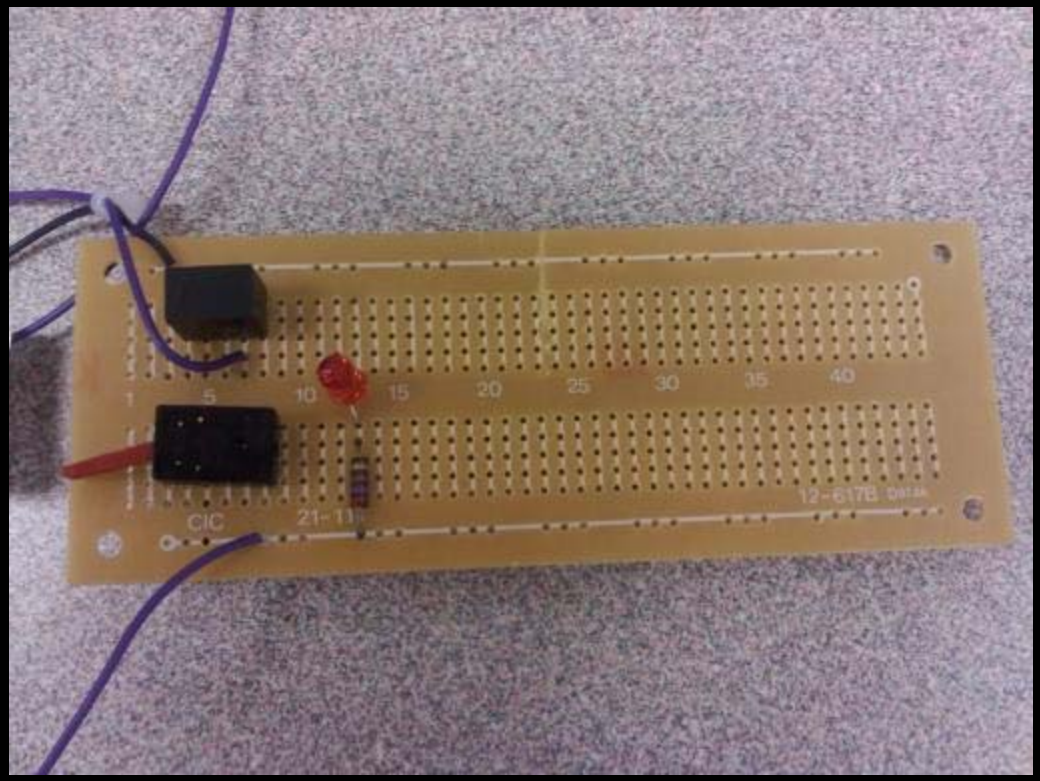
Circuit Board



Cost

Equipments	Cost
Converters	$100
Connecters	$10
Switch’s	$4.50
Circuit Boards	$3.50
	Total = $118

Conclusion

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

Contact Information

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ANY QUESTIONS ????