

NASA Scientific Ballooning Support

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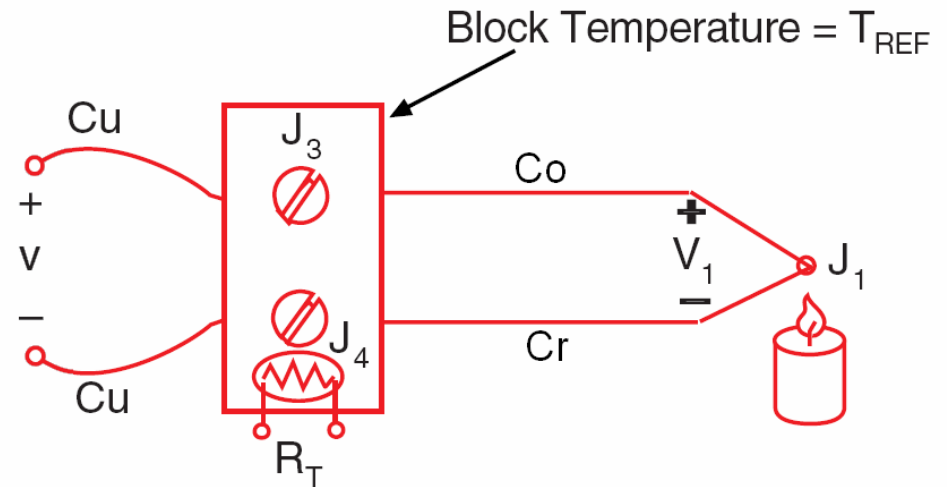


Research Overview

- ZEPHYR Mars Scout Proposal
- Analog Temperature Sensor
- Scientific Ballooning Introduction
- Atmospheric Profiling System
- LDB Science Stack Redesign

ZEPHYR Mission Proposal

- Research and design of temperature transducer.
- Type E thermocouple based sensor
- Space and Martian Atmosphere survivability
- 0.1° C Resolution
- $\pm 0.5^{\circ}$ C Accuracy
- $150\text{ K} < T_{J_1} < 280\text{ K}$

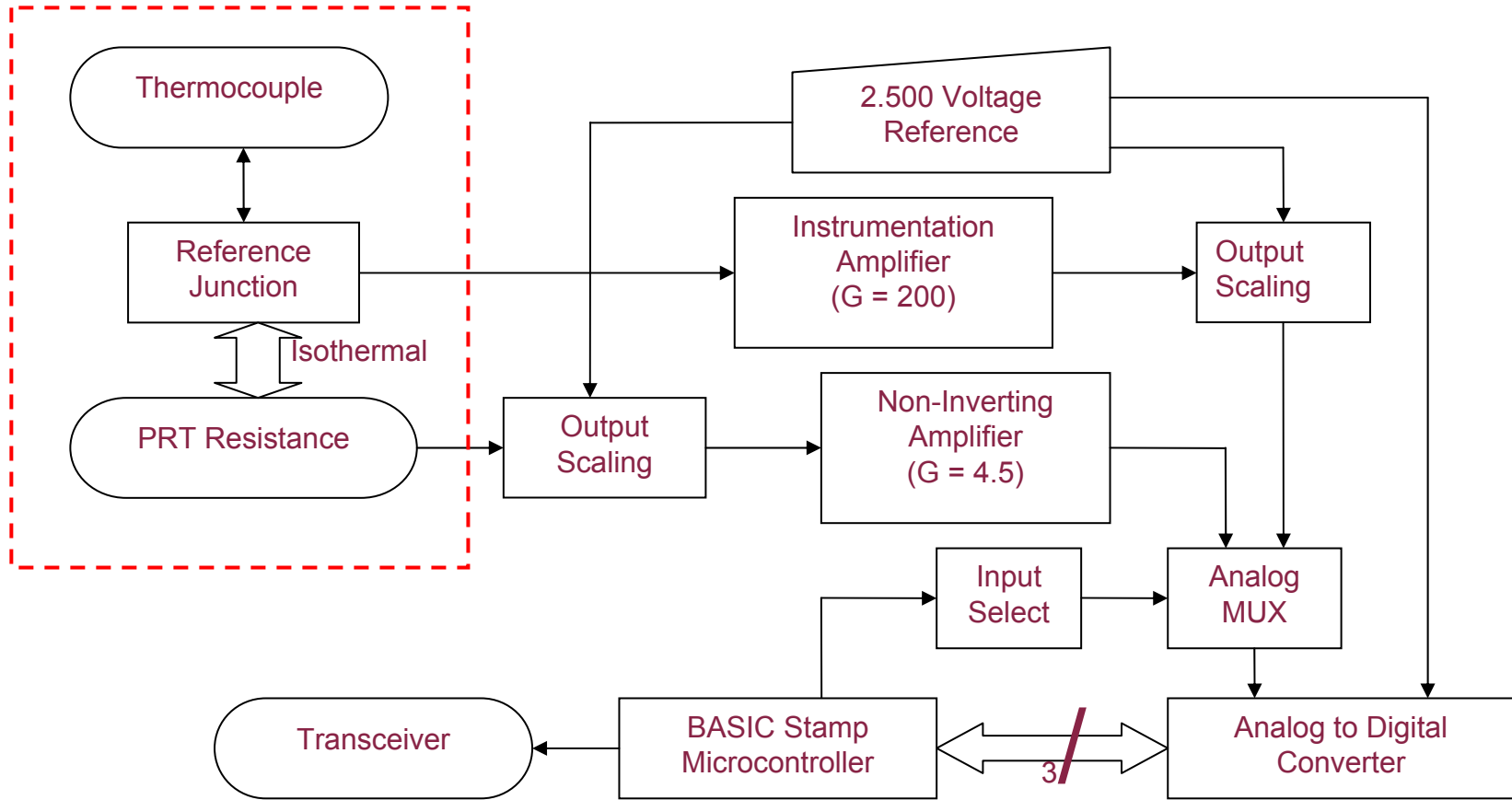


Design Equation:

$$V = \alpha (T_{J_1} - T_{REF})$$

$$\alpha_E \approx 11\text{mV} / ^{\circ}\text{C}$$

Analog Signal Conditioning



Extreme Climate Testing



Input Δ Temperature	Expected Output	Observed Output	% Error
129.2° C	1.550 V	1.578 V	1.81
59.9° C	0.719 V	0.748 V	4.03
3.6° C	0.151 V	0.164 V	8.61
0° C	0 V	0.001 V	~

Scientific Ballooning Introduction

- High altitude ~ 120,000 ft
(Airliners fly at about 30,000 ft)
- Conventional balloons fly for less than 24 hours, line of sight
- Long Duration Balloons (LDBs) can fly for up to 42 days and circumnavigate the pole 3 times
- Guided by atmospheric winds
- Payloads include University and NASA research experiments such as:
 - High energy particle detection
 - Background radiation
 - Solar and heliospheric observation



NASA Science Payloads

Atmospheric Profiling System

Problem:

- Atmospheric temperature profile becomes observably random above troposphere
- Old measurement systems are very sporadic and unreliable
- Very important for research about global warming, and Earth's climate.

Requirements:

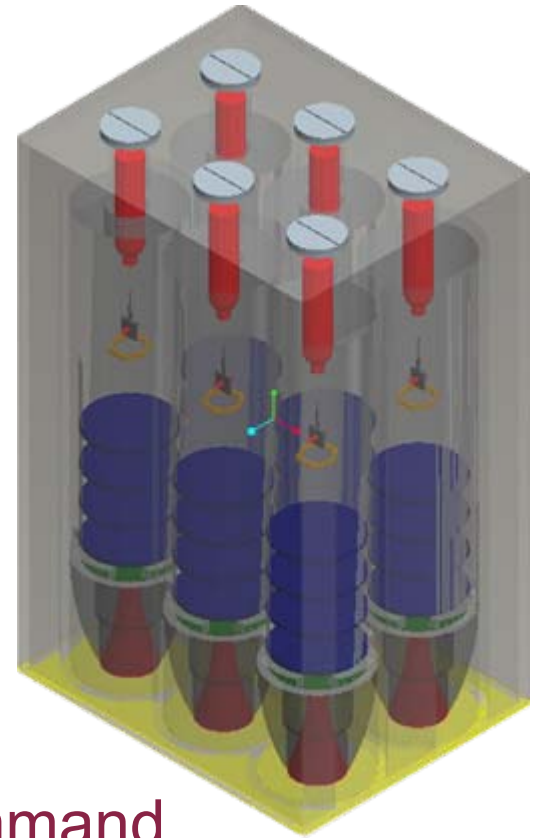
- Devise a low thermal mass temperature transducer
- Provide electronic interface to balloon payload
- Provide for electronic dropsonde launch
- Relay results wirelessly from the dropsonde

APS - Overview

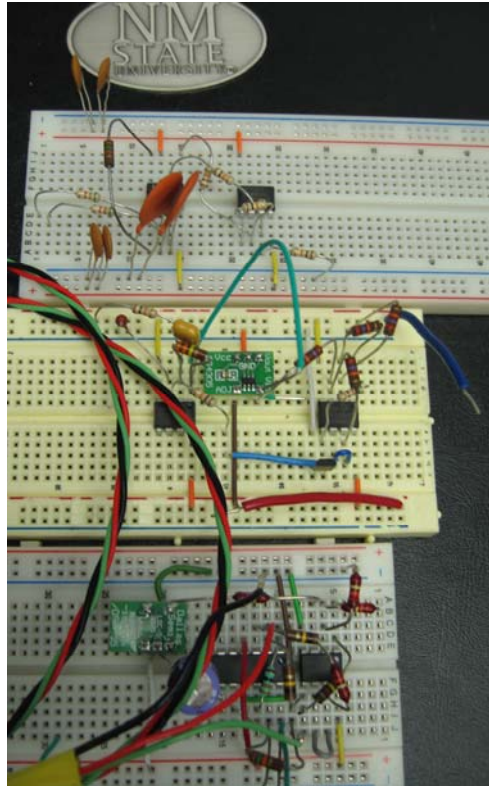
Approximately the size of 3 soda cans stacked from end to end.



Containment device will hold 6 dropsondes and will be able to fire any of them on command.



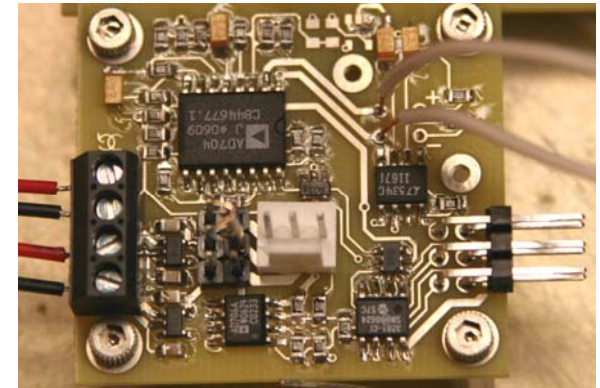
APS – Sensor Board



Prototyping Setup

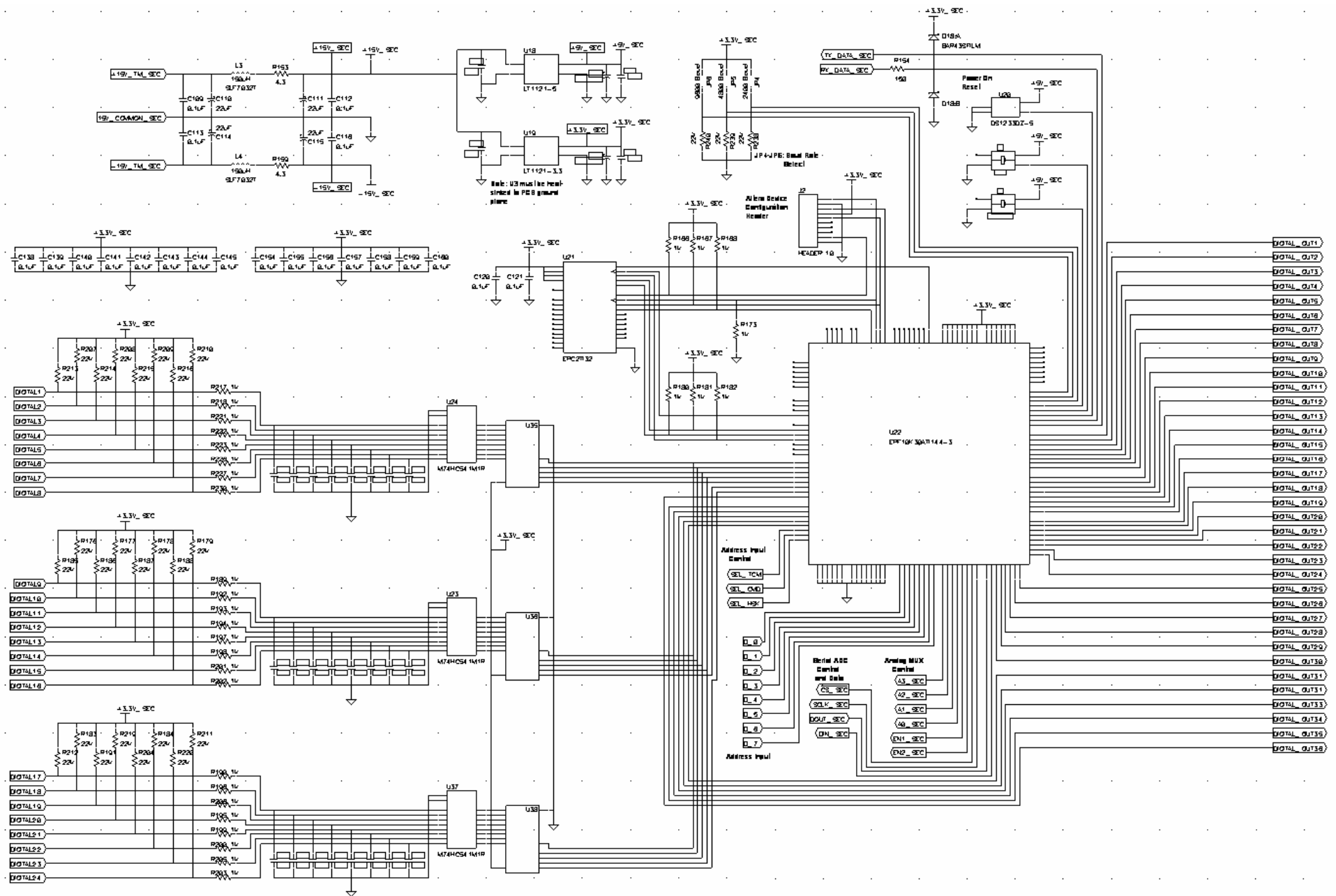
Features:

- Thermocouple and PRT Measurement
- Analog conditioning circuitry
- Analog-to-Digital Conversion (ADC)
- Digital Signal Transmission
- Power Supply
- Test points
- 4.1 cm x 3.8cm
- State-of-the-art SMD Technology employed



Fabricated PCB

Revised Telemetry Deck Schematic



QUESTIONS?

