Mesa State College, Grand Junction

Project:
Weather Video Sat
4/2/04
Purpose of the Weather Video Sat

• Produce a full length, high quality video.

• Record humidity, pressure, and temperature during entire flight.
Achieving the Goal.

Project Management

Satellite Project

Structural Design: Box and mounts

Electronics

Power Board

Weather

Video

Heaters

Pressure

Humidity

Temperature
Power Board

- www.national.com
- Design tab
- WebBench
- Power, Amplifiers, or wireless designs.
- Includes parts and printed board in a kit.
- Solder and you’re done.
Box Design Considerations

- Tough & light
- Protection of components
- Modular design
Strong and light

- Fiberglass reinforced, 3/16” foam core board
  - From local hobby shop
  - Insulation, inexpensive, rigid and strength/weight
- ¼” PVC tubing
  - Strong, easily accessible, inexpensive
  - Easy to work with
Protection of Components

• Weather sensors nestled inside structural PVC tubing
  – Prevents damage during flight while still outside box
• Camera entirely inside box
  – Viewing window
Modular Design

• If 1 sub-system fails, others will continue
• Provide easy access to components
  – Last minute modifications/adjustments
• Provide adaptability for add-ons
• Standardize connections
  – Allow for removal of component boards
Heater Design Considerations

- Modifiable and adaptable
  - Thermistor/resistor is detached from board but attached to formed aluminum diffuser

- Easily manufactured

- Efficiently heat components
  - Using microcontroller to pulse heat on/off to achieve desired temperature

- Minimize parts
  - Lessen chance for hardware failure
    - Uses only well-tested components
Weather Sensing

- Temperature
- Relative Humidity
- Barometric Pressure (Absolute)
Design Considerations

• Using external A/D converters and digital port expanders.
  – Adds redundancy for acquiring data as well as a more robust system overall.

• Using Dallas 1-wire products.
  – Simple yet powerful protocol to use and implement.
  – Digital lines are less susceptible to interference

• Mounting sensors internally
  – Temperatures will reach far below specifications for R.H and Absolute Pressure
Basic System Overview

- Data Storage iButton
  - Microcontroller
    - Atmel Atiny 12
  - External A/D Converter
    - Dallas DS2408
      - Thermocouple Circuit Liner LTK001
      - Relative Humidity Sensor Humeral HS1101
      - Absolute Pressure Honneywell ASDX015A
Video Systems

• Project Description
  • Be able to record 3 hours of high quality video.
Camera and Features

• Panasonic SV-AV30
  – Main Features:
    • Remote Control
    • Static Focus
    • Light Weight < 2 oz.
    • Mpeg 4 Format

Full list of features list at Panasonic

3D View of SV-AV30
MPEG Format Recording Times

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*All Capacities are approximate. An MPEG2 motion image recorded on an SD Memory Card under 128 MB, or on a brand other than Panasonic, may produce lesser results.

Data provided at: http://www.panasonic.com/consumer_electronics/d_snap/images/capacitychart.gif
Control System

- Microchip PIC12F675
  - 8 pin chip
  - Very small
  - Low current draw
  - 6 I/O pins available
  - Full specs available on Microchip’s website
  - Summarize circuit diagram
Optics

- Static mirroring system
  - Fewer moving parts.
  - Kill Murphy, less to go wrong.
  - Lighter.
  - Less current wasted.
  - Capable of viewing in more than one direction at a time.
Thermal Management

- Insulated box
  - Will contain the 2 watts of heat generated by the camera.
  - Possible PWM heating.
  - Heating element needed to avoid condensation on lens.
  - Camera is enclosed to heat minimum amount of space.
Mass Budget

• Camera under 0.3kg.

• Circuit boards together 0.3kg. est.

• Box 0.5kg. est.

• We are expecting to come in well under 1.5 kg. limit.
Price Budget

- Total budget is $1500 for the project.
- Camera was approximately $350.
- Estimated $400 in other circuit boards, parts, and the box itself.
Project Schedule

• Expect to be testing by June 1st.

• Finished product by August 1st.
**NASA Benefits**

- High quality digital film.
- Repeated weather records.
- More innovative ideas.
Questions or Comments?