UMESAIR: A NASA-UMES COLLABORATIVE

Experiential Learning Project

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Project team (Summer)

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UMESAIR Project

Undergraduate **M**ultidisciplinary **E**arth **S**cience
Air-Borne **I**maging **R**esearch Project

- Involves undergraduate students in mathematics, science, engineering and technology (MSET) curricula in an active learning and exploratory research experience in the field of remote sensing and its applications;
- Positive impact on recruitment and retention;
- Interaction among interested faculty in MSET programs at UMES;
- Participation of NASA Wallops Flight Facility engineers and safety officers in an advisory capacity;

UMESAIR Project

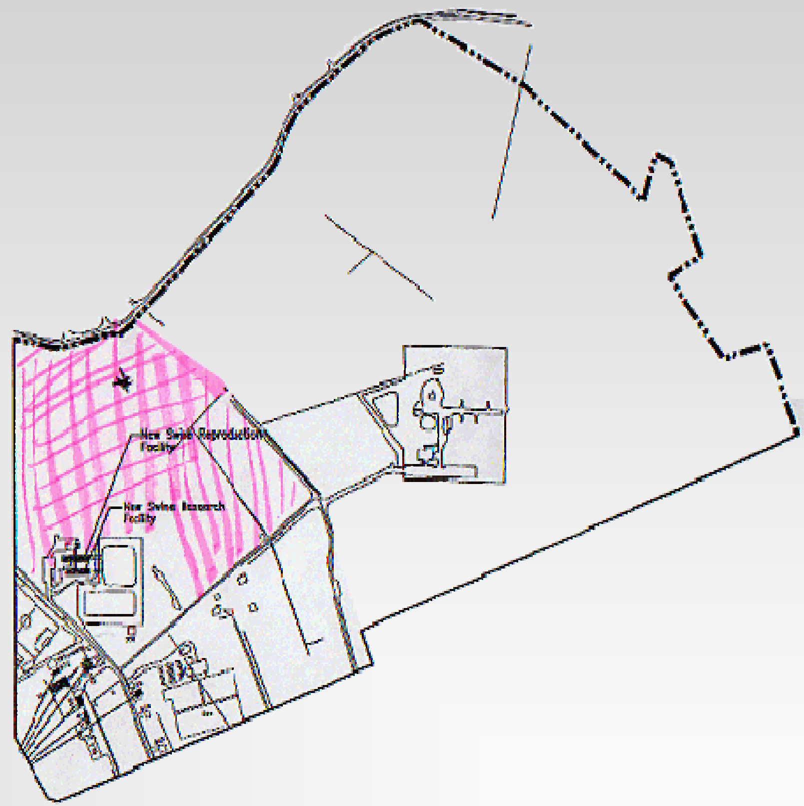
Undergraduate **M**ultidisciplinary **E**arth **S**cience
Air-Borne **I**maging **R**esearch Project

Vision: The vision of the UMESAIR project is to provide experimental learning primarily for undergraduate Mathematics, Science, Engineering and Technology (MSET) students. Students will interact in teams to investigate multi-disciplinary problems associated with applications of remote sensing.

Mission: The mission of the UMESAIR project is to design, build, and fly an instrumented payload to remotely determine coastal topographic and vegetation features.

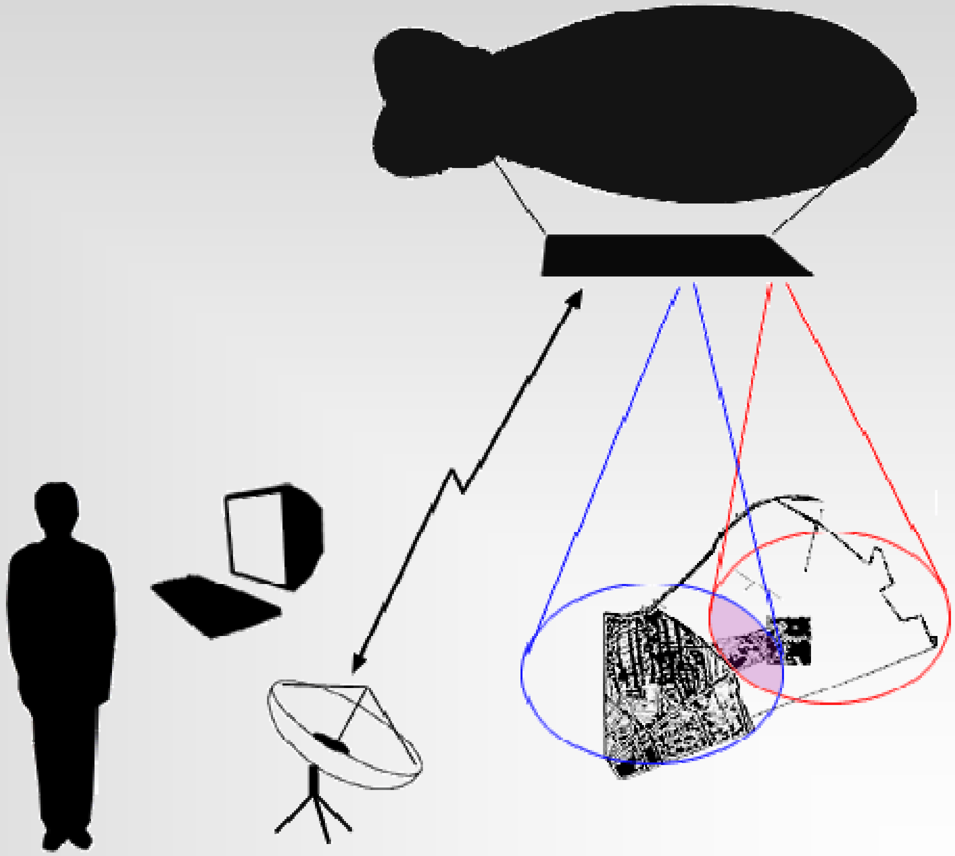
Objectives

- **C**oastal Marsh Studies
- **A**gricultural / Vegetation
- **L**and Use (Mapping)
    - Sidewalks
    - Field
    - Buildings
- **E**nvironmental
    - Chlorophyll analysis
    - Wildlife Studies
    - Fishery related applications



Project Teams

- Electrical Systems
  - Camera systems
  - Telemetry (RF)
  - Safety
- Blimp / Gondola
- Blimp Shed
- Winch / Tether
- Image Analysis
- Handy Board



Electrical Systems

Camera System

-Cameras ordered from Edmund Optics

- Monochrome Video Camera

- Color Video Camera

- Filters ordered from Edmund Optics

600 nm

620 nm

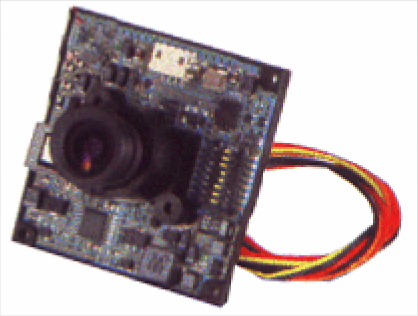
650 nm

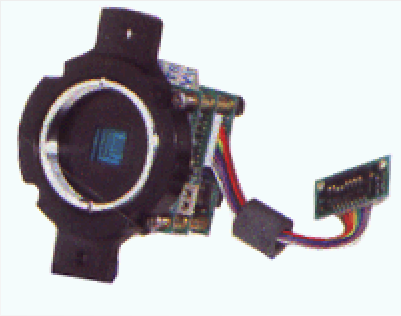
671 nm

550 nm

435 nm

589 nm

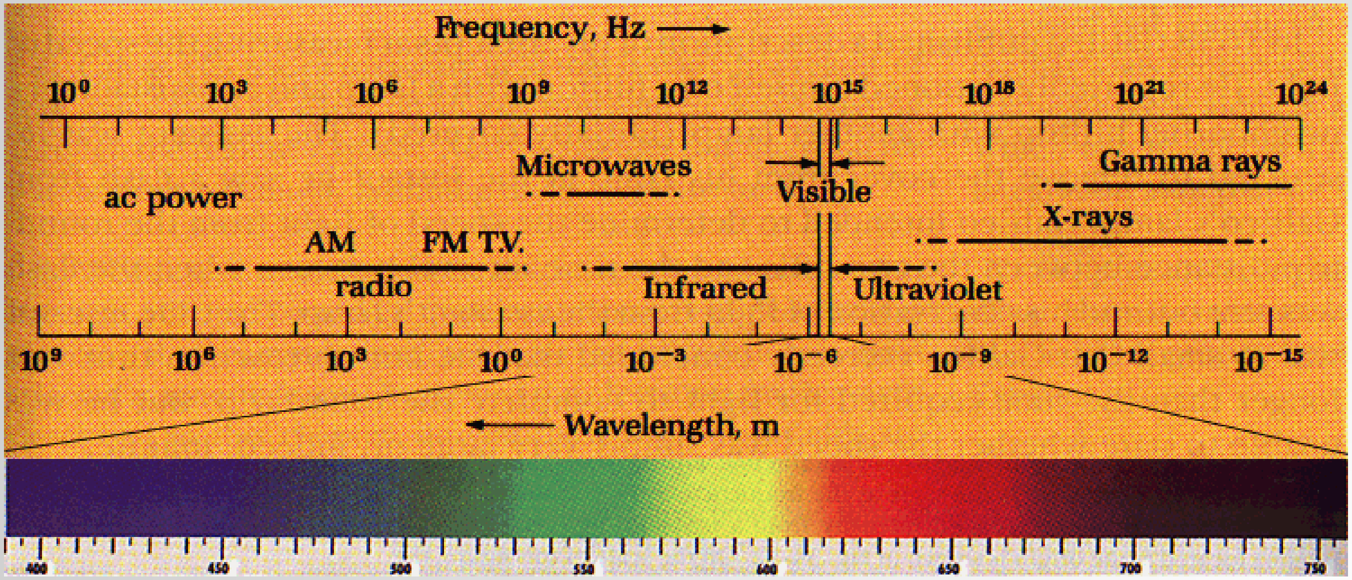




Camera Specification

- Imaging Bands

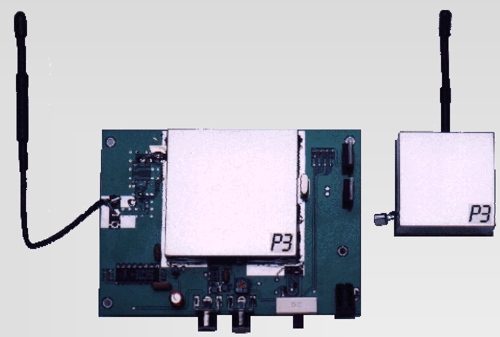
  - Visual spectrum segmented into 10 bands



Telemetry (RF)

P3 Watchguard Video Surveillance System

- 10 mW Power Output
- Ultra-lightweight, 48 g



TM-2 Transmit Module

- 2.05" high, 4.55" wide,
Lightweight, 372 g
- 7.25" deep

-

Electrical

- **P**ower System

  -The following components are powered by battery:

Transmitter #1	0.25 Amps
Transmitter #2	0.25 Amps
Camera #1	0.12 Amps
Camera #2	0.12 Amps
Total	*0.74 Amps*

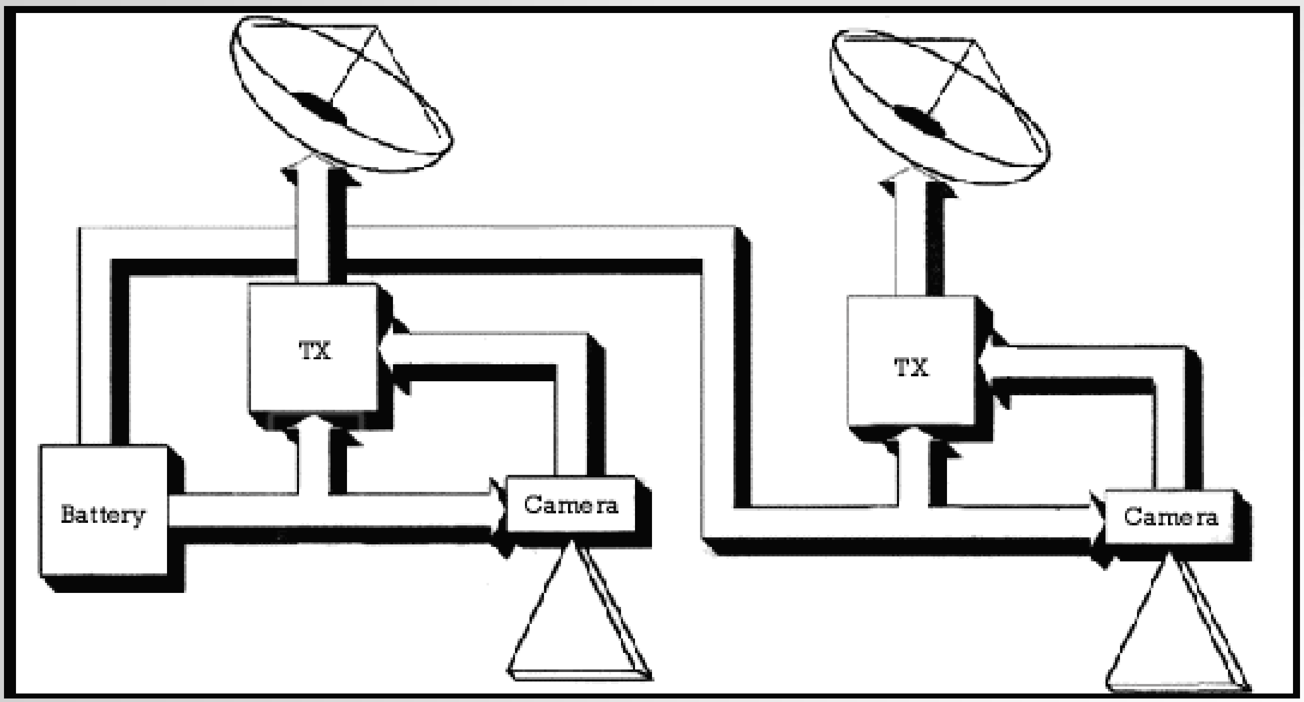
- Battery pack: 10 type 'A' Nickel-Metal Hydride cells in series.

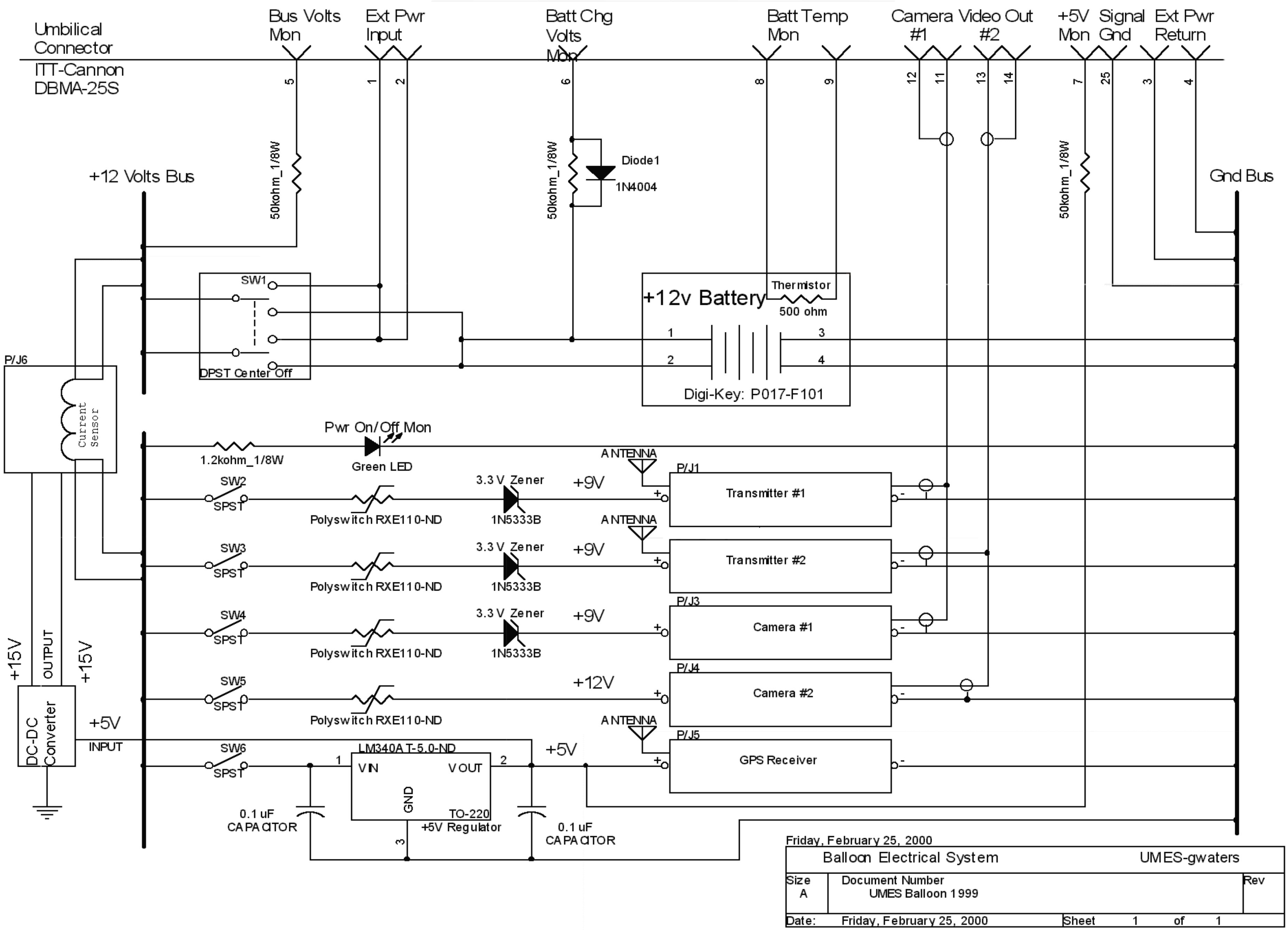
- **T**his battery is capable of supplying the 0.790 Amp load for more than 120 minutes while maintaining a bus voltage of 12.0 volts or greater.

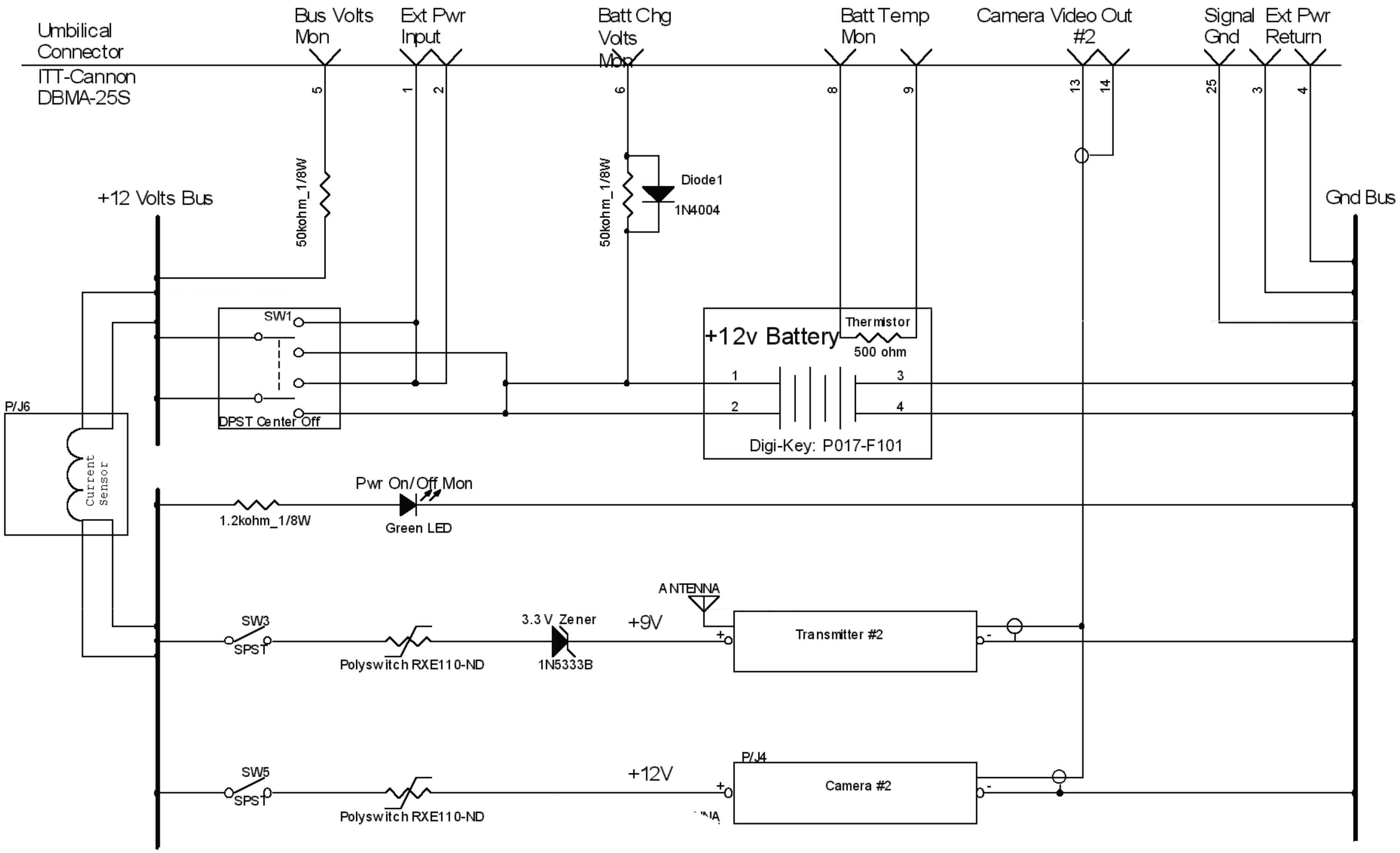
- **E**xternal power, bus/battery voltage, current monitoring, and battery charging will be available from the payload ground support equipment.

Telemetry (RF)

- **T**ransmitters
  - -P3 Watchguard
  - -TM-2 Transmit Module
- **S**pecifications
  - -2.4 GHz Transmitters
  - -4-Channel Usage Optional




Umbilical Connector
ITT-Cannon DBMA-25S
Bus Volts Mon
Ext Pwr Input
Batt Chg Volts Mon
Batt Temp Mon
Camera Video Out
#1
#2
+5V Mon
Signal Gnd
Ext Pwr Return
5
1
2
6
8
9
12
11
13
14
7
25
3
4
50kohm_1/8W
Diode1
1N4004
+12 Volts Bus
Gnd Bus
SW1
DPST Center Off
+12v Battery
Thermistor
500 ohm
1
2
3
4
Digi-Key: P017-F101
P/J6
Current Sensor
Pwr On/Off Mon
1.2kohm_1/8W
Green LED
ANTENNA
P/J1
SW2
SPST
Polyswitch RXE110-ND
3.3 V Zener
1N5333B
+9V
Transmitter #1
SW3
Transmitter #2
P/J3
SW4
Camera #1
P/J4
SW5
+12V
Camera #2
P/J5
SW6
GPS Receiver
+15V
OUTPUT
+15V
DC-DC Converter
+5V
INPUT
LM340AT-5.0-ND
VIN
VOUT
GND
TO-220
+5V Regulator
0.1 uF CAPACITOR
0.1 uF CAPACITOR
+5V
Friday, February 25, 2000
Balloon Electrical System
UMES-gwaters
Size A
Document Number
UMES Balloon 1999
Rev
Date: Friday, February 25, 2000
Sheet 1 of 1

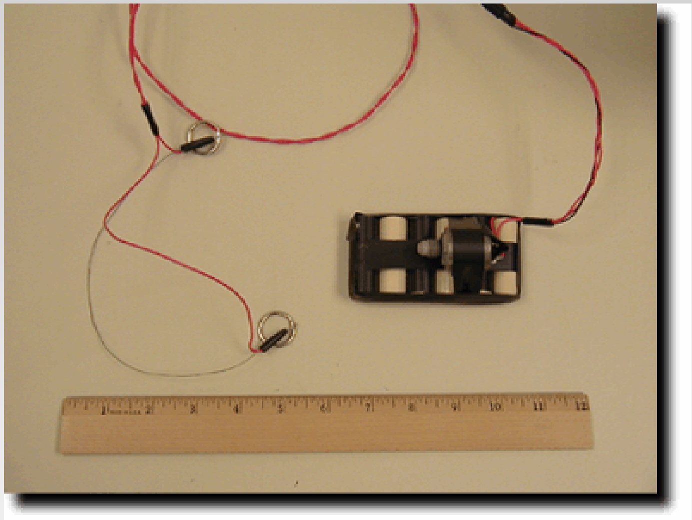


Friday, February 25, 2000

Balloon Electrical System			UMES-gwaters
Size A	Document Number UMES Balloon 1999		Rev
Date:	Friday, February 25, 2000	Sheet 1 of 1	

Safety

- **W**eather-based Launch Criteria
- **P**ersonnel Safety
- **S**eam Splitter
  - -Completely mechanical



- **N**i-Chrome Wire Splitter
  - -Independent Battery Supply
  - -Circuit incorporates a battery, 25 cm of Nichrome wire, and a set of barometric pressure activated switches.

Blimp / Gondola

- **B**limp
  - -7 foot dia.
  - -21 foot length
  - -16 lb. lift

- **G**ondola
  - -1 3/4 lb. (includes all components)
  - -Detachable from blimp

- **H**elium
  - -210 cubic ft. tanks

Gondola

-Requirements

-Able to contain all instruments and allow their full operation

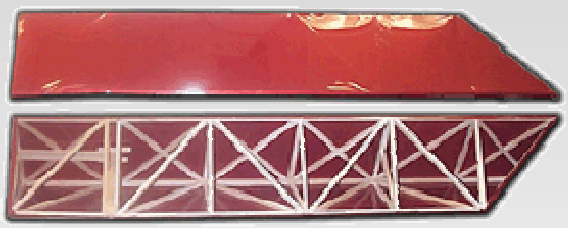
- Withstand loads

- Aerodynamically stable

-Dimensions and Materials

Old Gondola vs. New Gondola

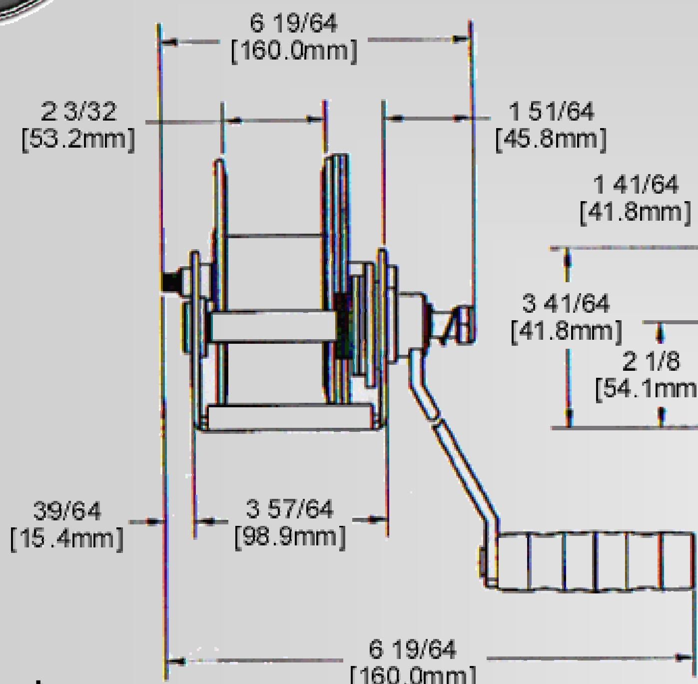
- Old Gondola
  - Aerodynamic problems
  - Loose joints
  - Imaging problems
- New Gondola
  - Aerodynamically efficient
  - Joints well constructed
  - Imaging problem fixed

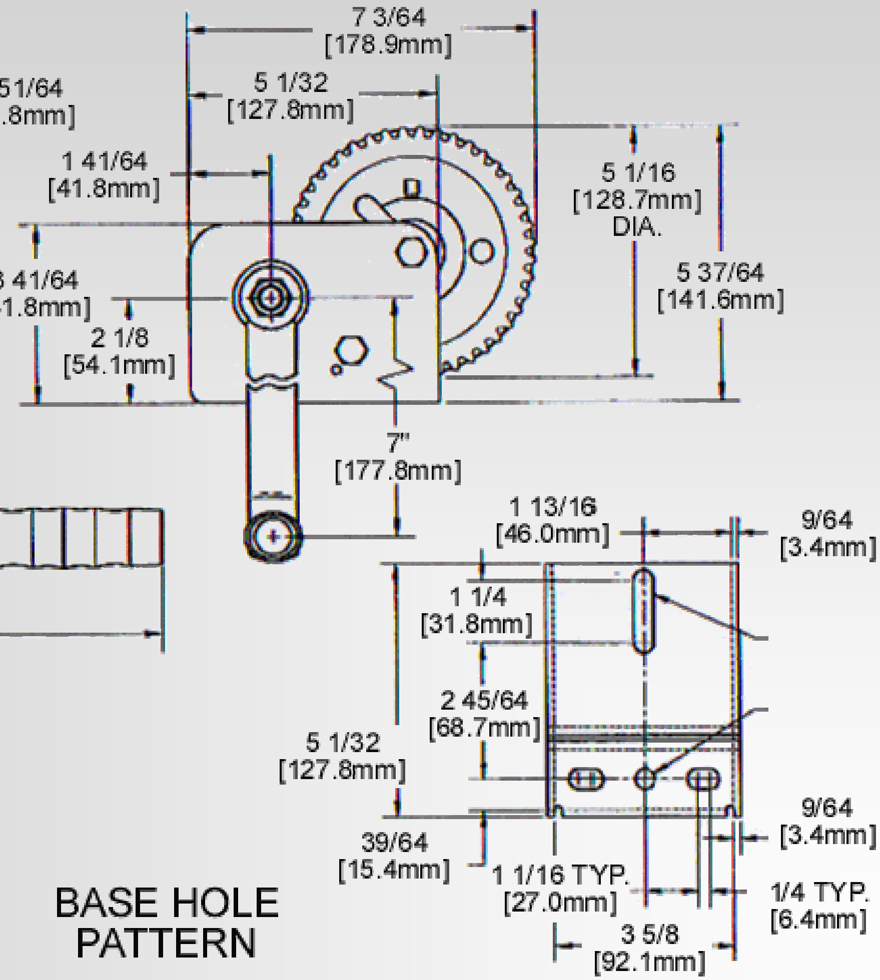


Phase II Gondola

- Design
    - Similar to previous design (second phase I gondola)
    - Size Increase
- New Design Considerations

Winch / Tether





- **T**ether

  Spectra 1000:

  .07 in. dia.

  750 lb. Test

  14 lbs. / 100 ft

Meteorology Station

Purpose

- Allows the participants to accurately chart and predict weather conditions affecting the flight of the blimp.

Materials

- Oregon Scientific Weather Monitoring Station
- 1 10’ Antennae Mast
- 2 5’ Antennae Masts
- Various tools

Set-up

- The anemometer is connected to a PC that collects data in a real time program. The information is then able to be charted and analyzed.

MultiSpec Data Analysis Software

-This software system implemented for Macintosh computers. A version is also available for PC-Windows systems, though it does not yet have all of the capabilities. It is intended for the analysis of multispectral image data, such as that from the Landsat series of Earth observational satellites or hyperspectral data such as from AVIRIS, MODIS, and other systems which contain many bands.

Additional documentation is available at:

http//:dynamo.ecn.purdue.edu\~biehl\multispec

Steps of Processing Image data

The following are the processing steps we are intending to take:

- **Data Review**
- **Class Definition**
- **Feature Determination**
- **Analysis**
- **Results Evaluation**

Image Analysis

-Multispec is able to read any data file in binary or some data in ASCII format Multispec will attempt to determine these parameters from the header portion of the selected data files.

Currently Multispec recognizes:

-ERDAS*.lan

-ERDAS*.gis

-ERDAS Imagine

-GAIA- Land Analysis System (LAS)

-HDF- Scientific Data Model (some)

Image Analysis

-TIFF uncompressed

-TARGA uncompressed

-VICAR formatted data files

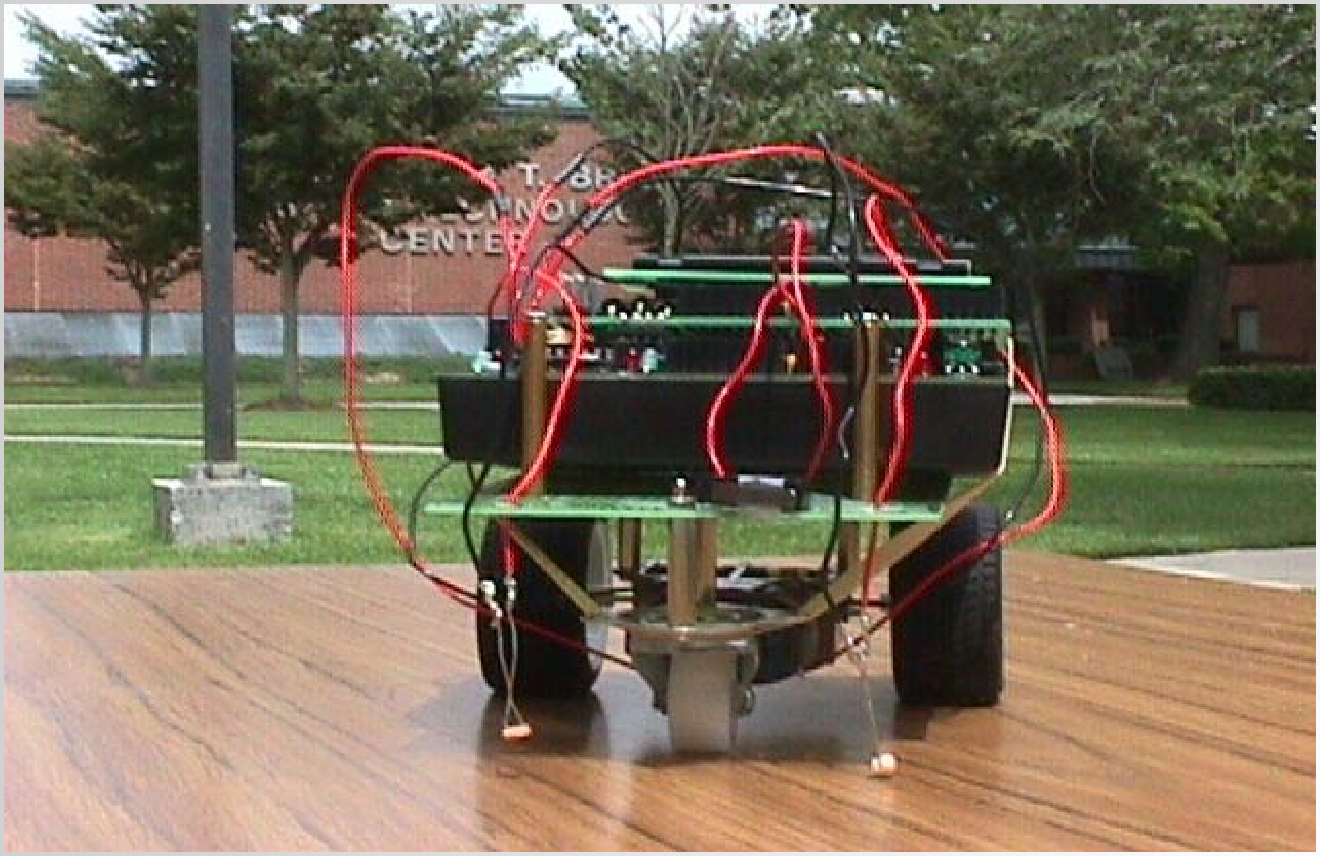
-PDS

-LARSYS Multispectral Image Storage Tape (MIST)

The data may have either one or two bytes per data value ,and may have 4 to 16 bits per data value.

Robotics

(Handy Board)

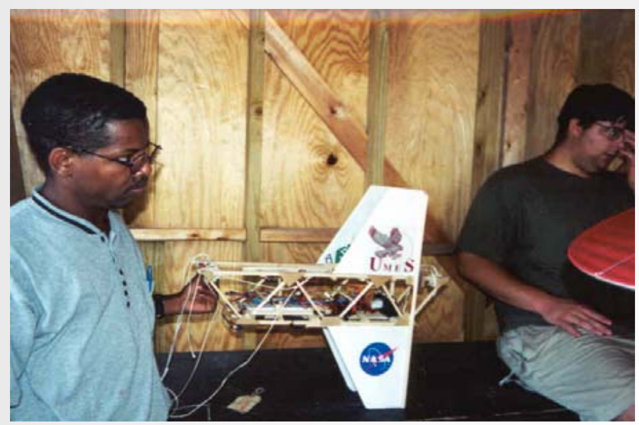


Overview

- The Objective of the Handy Board Project
- Introduction
- Work Done
  - Handy Board
  - Sensors and tests
  - IC Coding
- Future Objectives
- Conclusion
  - Achievements

Current Status

- First launch successful
- Preparing for 1500 ft launch
- Preparing for phase II



Possible Future Applications

- **V**isual surveillance for NASA Wallops Island Range
- **W**ildlife management efforts in Deal Island
- **R**emote Thermal Imaging (Night)
- **F**isheries (Monitoring algal blooms)

- **P**HASE II & Beyond
    - Unmanned Aerial Vehicle
    - Global Positioning System
    - Receiving Antenna
    - Scanner
    - Gimbaled Platform

Learning Outcomes

- Ability to apply knowledge;
- Ability to work in multi-disciplinary teams;
- Ability to integrate knowledge;
- Improved critical thinking skills;
- Experience with project planning and execution;
- Improved communication and presentation skills;
- Exposure to NASA's Earth Science and Aerospace research
- Interaction with NASA engineers and other personnel.