High Altitude Balloon Flight Telemetry and Remote Control Upgrade

Winter 2009

January 2009

Team Members

- Team :

  Andrew Crowdy
  - Team Leader
  - Experience as a radar, missile and communications technician

  Steve Overmyer
  - Has Ham radio license (N8BCM)
  - Experience in commercial and amateur communications and industrial controls
- Faculty Adviser

  Dr. John Wu
- Engineering Mentors

  Daniel Rahn
  - Graduate student
  - Member of previous High Altitude Balloon team

  Bruce Rahn
  - Engineer at base
  - Has vast knowledge on implementation
  - Experience in two way radio

Outline

- Previous Balloon Experiments
- Current System
- Concerns and Solutions
- Other Tasks
- Possible Problems

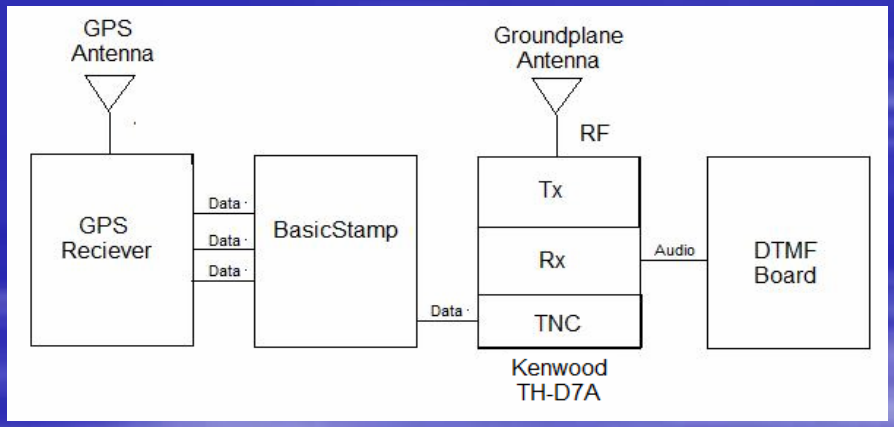
Previous Balloon Experiments

- 2005-2006
  - Team initiated the High Altitude Balloon project at WSU. They started from scratch and conducted two successful launches.
  - Pictures were taken and recovered later.
- 2006-2007
  - Conducted two successful launches
  - Completed development of GPS tracking systems.
  - Improved flight path prediction and visualization.
  - Used a three camera, altitude controlled, video system to record digital video
- 2007-2008
  - Conducted two successful launches
  - Attempted to design a three dimensional, unfolding truss using a shape memory polymer (SMP) composite material for the hinges
- 2008-2009
  - Currently there are two other Electrical Engineering projects
    - Video Transmission
    - Power-bus
  - Mechanical Engineering group
  - Computer Engineering group

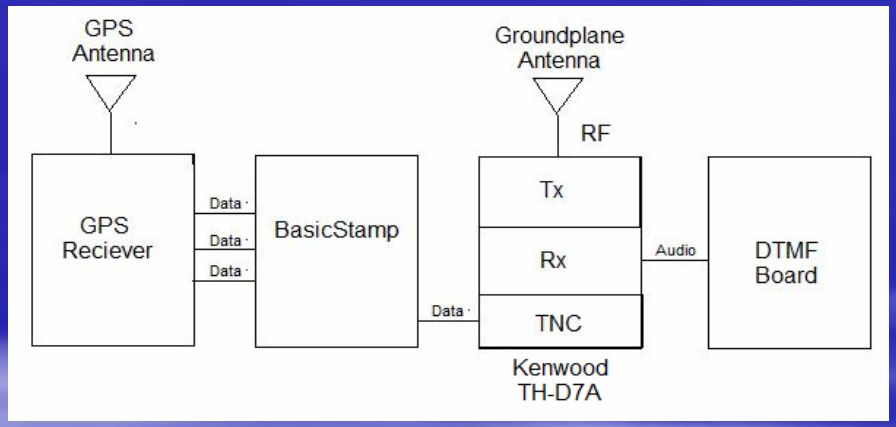
Current System

Current Telemetry System

- GPS
  - Antenna
    - Microwave
  - Receiver
    - Outputs a digital data signal
- SBC
  - The Basic Stamp board
    - Programmed by basic stamp protocol
    - Stores and converts data inputs (GPS and Temperature)
    - Outputs Digital Data
- Transceiver
  - Kenwood TH-D7A
    - Terminal Node Controller (TNC)
      - Converts digital data to analog for output to transmitter
    - Transmitter
    - Receiver
      - Outputs audio to the DTMF board for “cut down”
- Antenna
  - Shared VHF antenna with APRS system

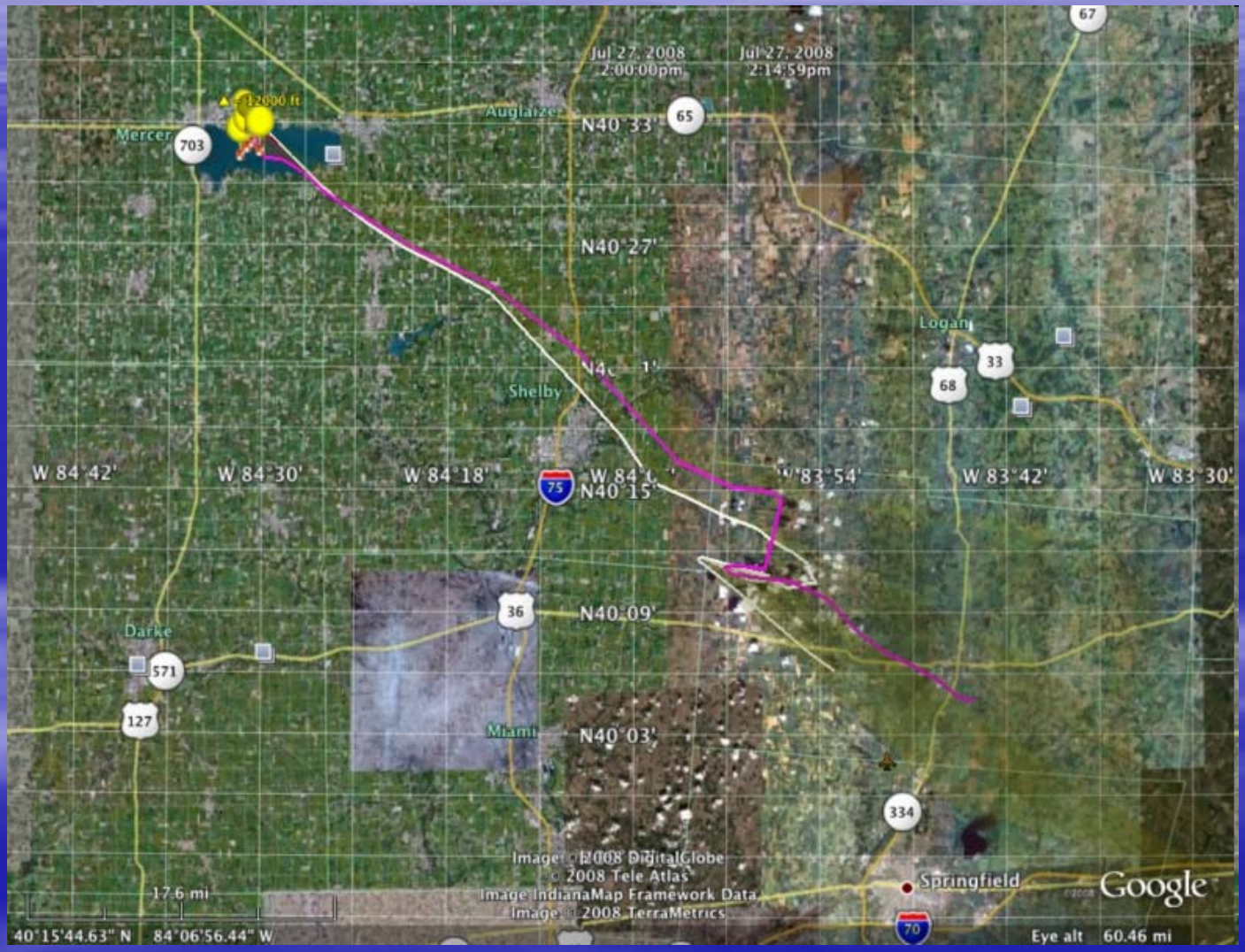


Remote Control



- VHF ¼ wave ground plane antenna
- Transceiver
  - Kenwood TH-D7A
    - TNC
      - Converts digital data to analog auto for output to transmitter
    - Transmitter
    - Receiver
- DTMF
  - Dual Tone multi-frequency decoder/controller
    - Converts an audio input to a cut signal for the cutting device

Concerns and Solutions

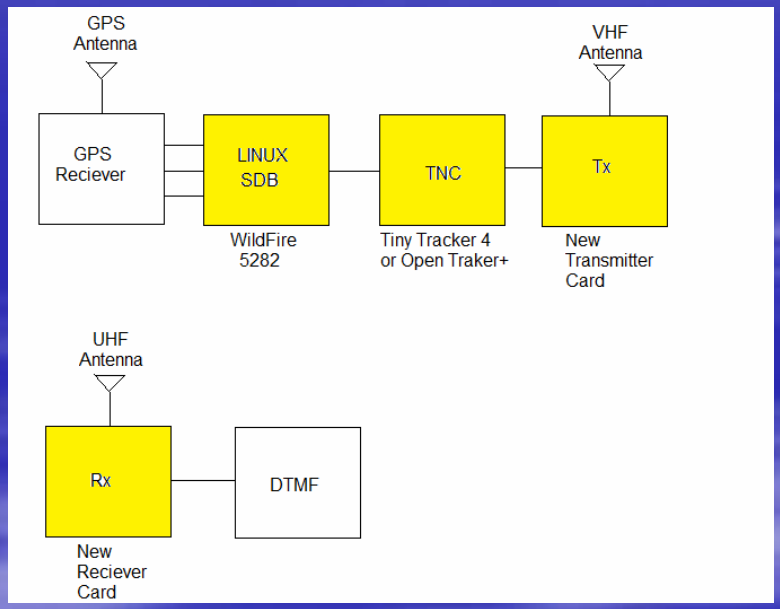


Single Board Computer

- Problems
- Currently using the Basic Stamp
  - Temperature Effects
    - Not rated for extreme cold
    - Not very rugged
  - Uses an uncommon operating system
    - PBASIC
- Solutions
  - Replace with more rugged unit that can operate within specifications
    - WildFire 5282 uClinux Development Kit

Radio System

- Problems
  - Radio receiver degradation
    - Front end overload
  - Excessive Weight
  - Discontinued Transceiver
  - Expense
- Solutions
  - Replace with separate transmitter, receiver and TNC boards
    - Isolation of transmitter and receiver frequencies
      - Use UHF receiver
    - Are lighter weight
    - Are grossly less expensive
    - TNC will be replaced with the Tiny Track 4 or Open Tracker+
    - Still looking for best receiver transmitter



Other Tasks

- Will upgrade the overall system to lower weight, ease of use, and efficiency

Possible Problems

- Lack of programming experience
  - Will work closely with the computer engineering team
- Antenna implementation (placement, aerodynamics)
  - Will work closely with mechanical engineering team to ensure best fit with maximum distance
- FAA and FCC rules and regulations
  - Weight
    - Must ensure slim and efficient manufacturing
  - Controlled Air-space
    - Must ensure balloon does not pass over controlled airspace by preplanning launch
  - Radio frequency allocation
  - Licensing
- Extreme climate conditions due to high altitude
  - Must order parts rated for cold and test continuously

Deliverables

- The goals
  - To ensure better and easier recovery and tracking of High Altitude Balloon
  - Better balloon control. Namely, the cutoff device
- Interested Parties
  - We believe that many different disciplines will be interested in our research
    - NASA and ILC Dover
    - Companies that deal with operating equipment in extreme cold such as the Arctic

Project Schedule

- Week 1: January 26, 2009
  - Help EE 432 team prepare for launch and research
- Week 2 to Week 4: February 2, 2009 to February 21, 2009
  - Research, Acquisition, and Testing of components
- Week 4 to End of Quarter
  - Implementation and Testing

Funding

- Sponsors
  - Ohio Space Grant Consortium
  - The National Science Foundation
- Donors
  - CRG Corp- Vacuum Pump, raw SMP materials
  - The Wright State University Physics Department- Vacuum Chamber
  - ILC Dover- SMP tube

Questions?