High Altitude Video Transmission

Team Members

- Team Leader: Brent Guenther
- Team Members: Mark Falknor and Adam Kelly
- Faculty Advisor: Dr. John Wu

Outline

- Previous Balloon Experiments
- What we are doing
- Goals for Project
- Potential Technical Difficulties
- Possible Solutions
- Our First Design
- Possible future upgrades
- Summary

Previous Balloon Experiences

- 2005-2006:
  - Pictures were taken and recovered months later
- 2006-2007:
  - A 3 camera altitude controlled video system recorded to a digital video recorder
  - Completed development of GPS tracking device
- 2007-2008:
  - Attempted unfolding of a truss using a shape memory polymer (SMP) composite material for the hinges

What We Are Doing

- We plan to obtain a live video feed from the high altitude balloon
- We plan on having three separate cameras alternating views
- We also plan to constantly record all three cameras onto a DVR at the same time
- We will also take over current tracking system for HIBAL

What are we doing? cont.

- Joint project with mechanical engineering students: Caleb Barnes, Nathaniel Herrmann, and Michelle Wilson.
  - They have a separate experiment in which we will help them
- Other advisors involved: Joseph Slater, Mitch Wolff, Ruby Mawasha, and Stephen Mascarella.

Goals for Project

- Help future teams be able to better recover the balloon after launch
  - Video will allow to see what went wrong with device if something should fail
  - Allow better tracking of balloon through the use of live video
- Help future senior design project teams and adventurers better understand high altitude experiments

Potential Technical Difficulties

- Must meet multiple FAA regulations
  - Weight
  - Projected travel
  - Notice requirements
- Our product must withstand temperatures nearing -50 degrees Celsius
- Being able to stream the video
- Nobody has accomplished this

Possible Solutions

- In order to obtain a live video feed from a moving high altitude balloon we have several possibilities
  - Inmarsat satellite communication
  - USRP
  - RF signal
    - Basic camera, transmitter, and receiver

Inmarsat

- Inmarsat is a company which offers satellite communication
  - Ability to send wireless video
  - High speed wireless IP data
    - Better video quality
    - More than one video
  - Other data can also be streamed
    - Balloons current overall state (speed, direction, altitude)

Inmarsat cont.

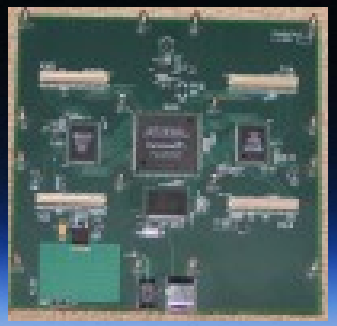
Pros

- All in one package
- Lightweight (3.3 lbs)
- High Speed with data rates up to 128 kbps
- Can be used with Bluetooth (camera)
- Battery included in weight. Lasts 1.5 hrs

Cons

- Expensive
- Cost money every time you use it
- Can’t survive below zero degrees Celsius on battery power

USRP



- The Universal Software Radio Peripheral (USRP) allows transmission of data for various frequencies
- The mother board can carry up to four daughter boards
- Daughter boards can be: transmitters, receivers, or transceivers

USRP cont.

Pros

- Affordable ($700)
- Programmable
- Lightweight
- Create whatever we want out of it
- Plug and play

Cons

- Requires external power source
- Never tested in sub zero climate
- Needs amp and high gain antenna to traverse long distances

RF Signals

- Using very high frequency (VHF) or ultra high frequency (UHF) like broadcast television.
- VHF range from 30 to 300 MHz
- UHF range from 300 to 3000 MHz

RF Signals cont.

Pros

- Proven technology
- Multiple models found
- Able to stand down to -40 degrees C
- Lightweight

Cons

- Greater range needs greater power source
- Limited to certain frequencies.

Our First Design

- The first design will include the use of a USRP and other components
- The USRP will allow us to transmit the video data through a low cost experimental design
- This design will also allow us to connect multiple video inputs and record them to a DVR

Our First Design cont

- What we will need to do:
  - Build a power amp for transmitter
  - Possibly build an antenna
  - Write a program for the camera system
  - Create a control system for the three cameras and the digital video recorders
  - Test our design in low temperatures
  - Test our design for interference with other parts of the design. This may lead to the development of a Faraday cage

Our First Design cont

- We do not have the necessary knowledge regarding USRP's and will require the help of Dr. Wu
- We will come up with an initial design by next week and continue to design through the seventh week.
- We will then begin to build our first design and hopefully be able to test our design before the end of the quarter

Possible Future Upgrades

- Once we have increased the recovery rate, we plan on sending more expensive products in the air to transmit a better quality video (such as Inmarsat)
- If we can't increase the recovery rate from the first video, we plan on creating ways to increase the recovery rate
  - Enhance the GPS system
  - Find other methods of tracking the package

Summary

- Attempt to get a live video feed from the high altitude balloon
- Use USRP for first design
- Increase recovery rate. Then build better, more expensive video transmitter
- Also, help M.E. teammates build actuators for their package design