Operation STORC
Operation STORC

by

James Murdock (ECE)
Kyle Hutchings (ECE)
Joe Grantham (EE)
Neil Davis (EE)
John Wells (CS)
Objectives

- Functional Description
- Preliminary Overview
- Implementation
- Tasking
- Interface
- Bill of Materials (BOM)
- Risk Assessment
- Questions
Functional Description

- Weather Balloon
- Payload
- Ground Station
- Radio Communication
Objectives

- Functional Description
- Preliminary Overview
- Implementation
- Tasking
- Interface
- Bill of Materials (BOM)
- Risk Assessment
- Questions
Preliminary Overview

Hardware

✓ Software Defined Radio (SDR)
  - FPGA
    - SmartFusionSOC (A2FXXX)
  - MCU
    - CortexM3 (Included with A2FXXX)
  - Board Design
    - Michigan University (provided by Dr. Schmid)
Preliminary Overview (cont)

- **SDR**
  - Antenna
    - Wire of X length to be tuned to desired frequency

- **Balloon / Payload**

- **Sensors**
  - Position (GPS)
  - Temperature
  - Acceleration
Preliminary Overview (cont)

- **Software**
  - ✓ **FPGA**
    - Community code provided by gnuradio.org to be modified per our specifications
  - ✓ **MCU**
    - C or Assembly code to interface with
  - ✓ **Launch Predictions**
    - Using weather data from weather.gov
    - Real-Time position adjustments
Preliminary Overview (cont)

- **Software**
  - ✔ Launch Predictions
    - • Recovery Location (Landing Zone)
  - ✔ Radio Communication Protocol
    - • APRS with AX.25
    - • The method of transmitting packets between radios and radio to computer
Objectives

- Functional Description
- Preliminary Overview
- Implementation
- Tasking
- Interface
- Bill of Materials (BOM)
- Risk Assessment
- Questions
Implementation

- **Hardware**
  - ✓ Consulting from L3, Amateur Radio Enthusiasts, and University Staff
  - ✓ Weather Balloon Enthusiasts

- **Software**
  - ✓ ECE / CS Combined Efforts
  - ✓ University Staff

- **Sponsorship and Donations**
Objectives

- Functional Description
- Preliminary Overview
- Implementation
- Tasking
- Interface
- Bill of Materials (BOM)
- Risk Assessment
- Questions
Tasking

- May 1, 2012 – SDR Design (High Risk)
- June 1, 2012 – Debug/Implement/Test SDR
- June 8, 2012 – MCU/Sensor Design and Development
- June 24, 2012 – Debug/Implement/Test MCU
- August 1, 2012 – Software Design
- September 1, 2012 – Debug/Implement/Test GUI and Entire Project Integration
- October 1 thru November 30, 2012 – Finalize Project
Objectives

- Functional Description
- Preliminary Overview
- Implementation
- Tasking
- Interface
- Bill of Materials (BOM)
- Risk Assessment
- Questions
Interface

- I2C
- Serial
- APRS / AX.25 Protocol
Interface (cont)

- **SDR Block Diagram**

![SDR Block Diagram](image)
Interface (cont)

- SmartFusion Block Diagram
Interface (cont)

- Michigan University SDR
Objectives

- Functional Description
- Preliminary Overview
- Implementation
- Tasking
- Interface
- Bill of Materials (BOM)
- Risk Assessment
- Questions
BOM

- GPS $38 Argent Datat – Serial Interface
- FPGA $42 SmartFusion 500 LBGA 500k (w/ CortexM3 MCU)
- Accelerometer $8 Digikey 80XL346 I2C Interface
- Digital Thermometer $6 Digikey DS620 I2C Interface
- PCM $54/each 4 layer @ Qty 5 from PCB Universe
- Helium $0.69/cu ft
- Balloon 350g $40
- Parachute 36” $15, Rocketchutes.com
- Batteries 30137-0 Li-Polymer 3.7V 2400mAh $7, All-Battery
- Radar Reflector SD152 $50, landfallnavigation.com
- Digital Latch (build)
Objectives

- Functional Description
- Preliminary Overview
- Implementation
- Tasking
- Interface
- Bill of Materials (BOM)
- Risk Assessment
- Questions
Risks

- SDR Complexity
- Budget Constraints
- Falling Object
- Payload Loss / Destruction
  - Drift
  - Crash and Burn
- Malfunction
Objectives

- Functional Description
- Preliminary Overview
- Implementation
- Tasking
- Interface
- Bill of Materials (BOM)
- Risk Assessment
- Questions
Questions?