# SSTV, APRS & Telemetry

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Raspberry Pi SIG

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# Andrew Koenig, KE5GDB

- From Houston TX
- Grew up near JSC
- Licensed in 2005 (6th Grade)
- Junior, Telecommunications Engineering

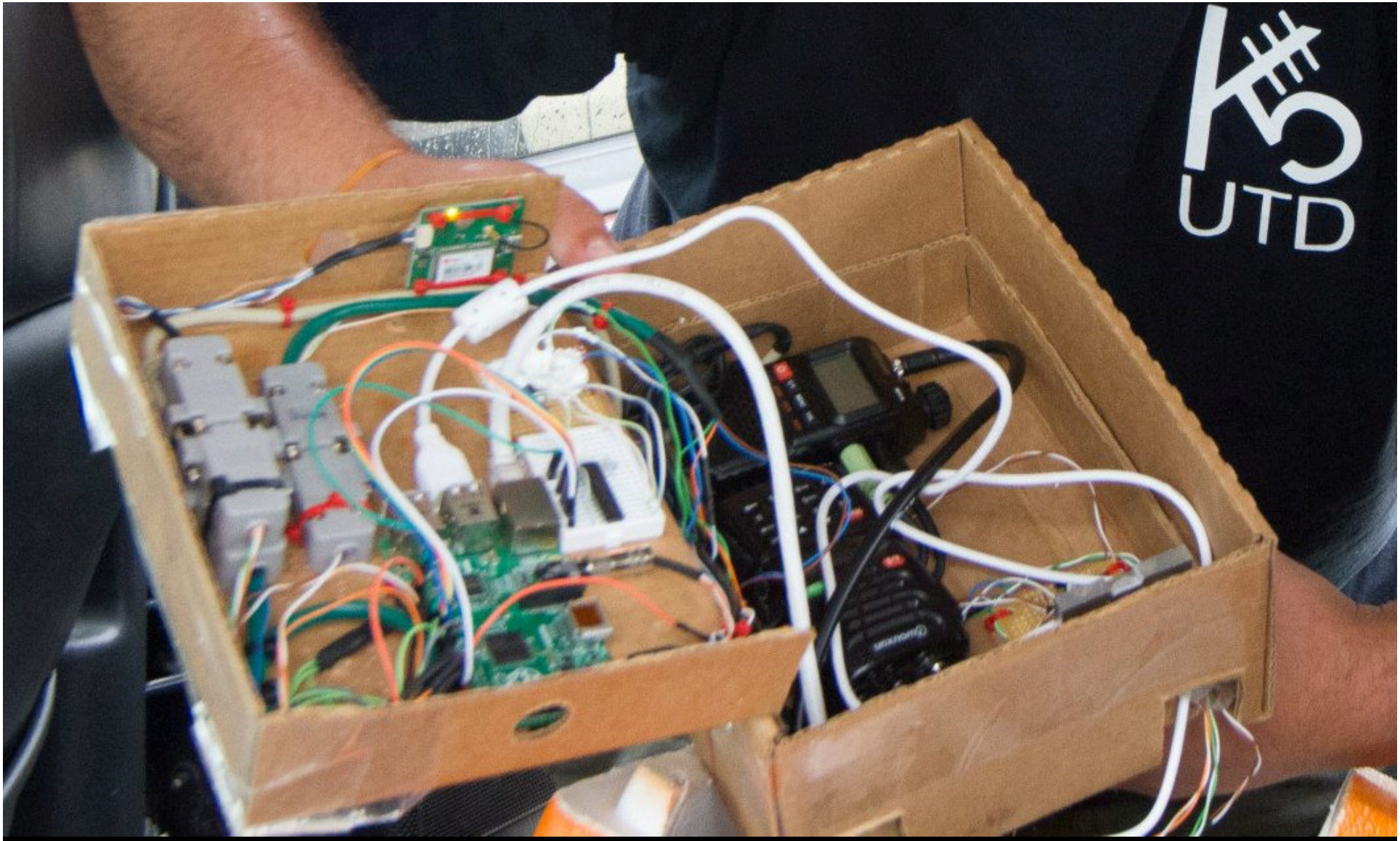
# High Altitude Weather Balloons

- South TX Balloon Launch Team (STX BLT)
- Intro to Space Camp, UT Dallas
- K5UTD ARC Balloon Launch
  - "Flight of the Leftovers"
  - Uses leftover elements from Space Camp launch

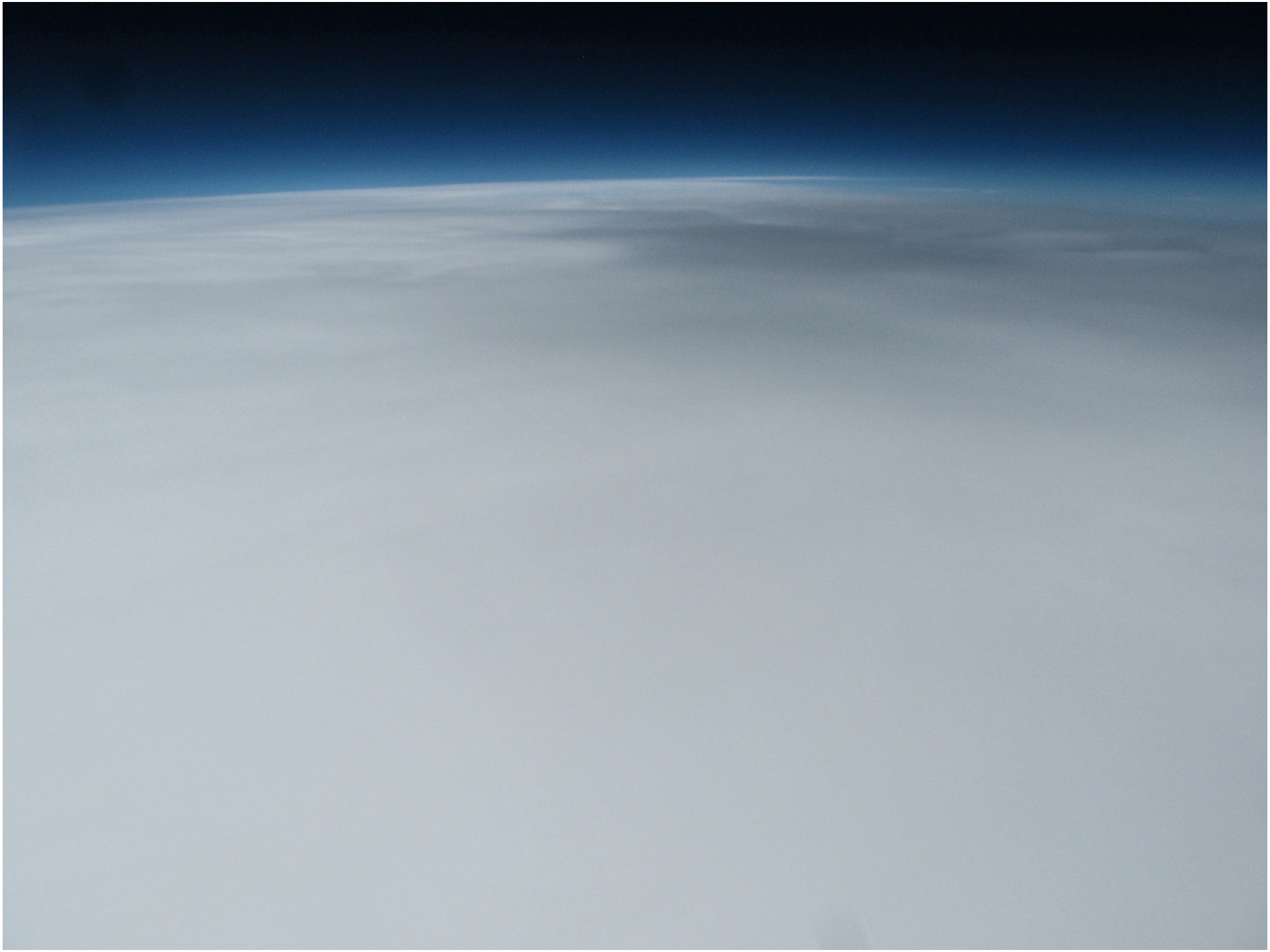
# Purpose

- Obtain Data and Pictures from Weather Balloon
  - Pictures – SSTV & Hi-Res
  - Tracking – APRS
  - Telemetry – APRS


RRL HANDBOOK


UTD


UTD
UT DALLAS
COMETS
REWARD
THOUGHT
FULL



# SSTV

- Take picture from Webcam
- Add headers (“K5UTD High Alt. Balloon”; APRS Packet; Timestamp)
- Encode .png as .wav file – Martin 1
- Transmit

# High Resolution Photos

- Canon SX110IS
  - Gift, almost a decade old
- Running Modified Firmware
  - Canon Hacked Development Kit – CHDK
- 15 second intervalometer
  - 1000 photo capacity, 4 hours of flight = ~15 sec

# APRS - Tracking

- Collect data from GPS
- Format (valid) APRS Packet
- Encode APRS packet as AX.25, 1200 baud AFSK
- Transmit

# APRS - Telemetry

- Collect data from sensors
  - 8-bit TI ADC (Battery Voltages)
  - 1-Wire Temperature Sensors
    - Internal
    - External
    - Voltage Regulator Heatsink
- Format (valid) APRS Packet
- Encode APRS packet as AX.25, 1200 baud AFSK
- Transmit

# Taking a Picture – Using fswebcam

- Command Will:
  - Wait for 30 frames
  - Take Picture
  - Add headers (Text & APRS Packet)
  - Save to image.png

Shell Script:

```
fswebcam -r 320x240 -S 30 --top-banner --title "K5UTD High Alt. Launch" --sub-title "$(cat /tmp/packet)" image.png
```

# Transmitting – Physical Radio

- Use L or R of stereo out
- Toggle GPIO Pin
- Play audio file

Shell Script:

```
echo 1 > /sys/class/gpio/gpio22/value
mplayer transmission.wav –af pan=2:1:0
echo 0 > /sys/class/gpio/gpio22/value
```

# Transmitting – GPIO Pin

- Pros:
  - All in One
  - Simple command to transmit
  - No soldering/circuitry needed for transmissions
- Cons:
  - Modulated from 500MHz square wave (harmonics)
  - Low Power Output (<20mW)

# Transmitting – GPIO Pin

- Connect ¼λ Antenna
- Run command

Shell Script:

pifm transmission.wav 144.39 22050

Breakdown:

pifm [wav file] [frequency] [sample rate]

# Thermal Sensors

- 1-Wire Protocol
- 3 Pins
  - Ground
  - Data
  - Power
- Obtain data at:

/sys/bus/w1/devices/*/w1_slave