Cool Microcontroller Projects

2008 Rocket Altimeter

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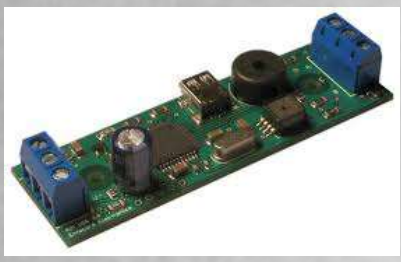
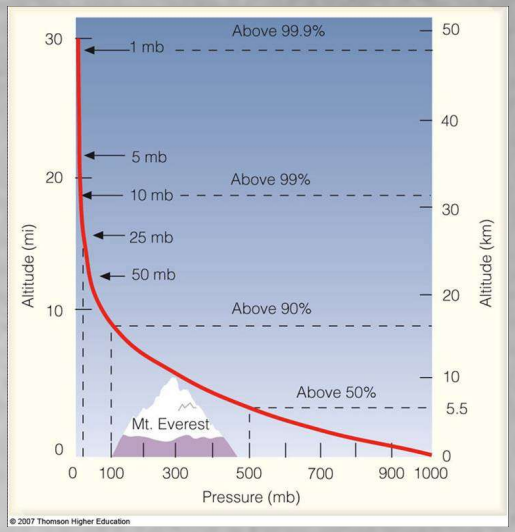
BACKGROUND

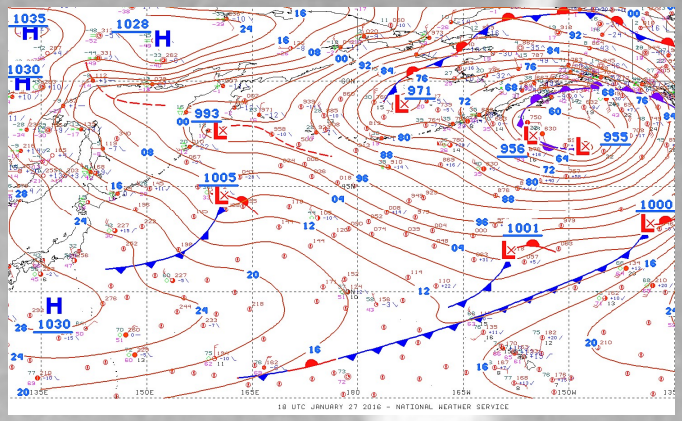
- Needed a low-cost solution to
  1. Measure altitude of rocket
  2. Deploy a parachute
- Had to be light weight
- Had to be small
- Simple to build – use pressure sensor



THEORY



Almost linear relationship between pressure and altitude



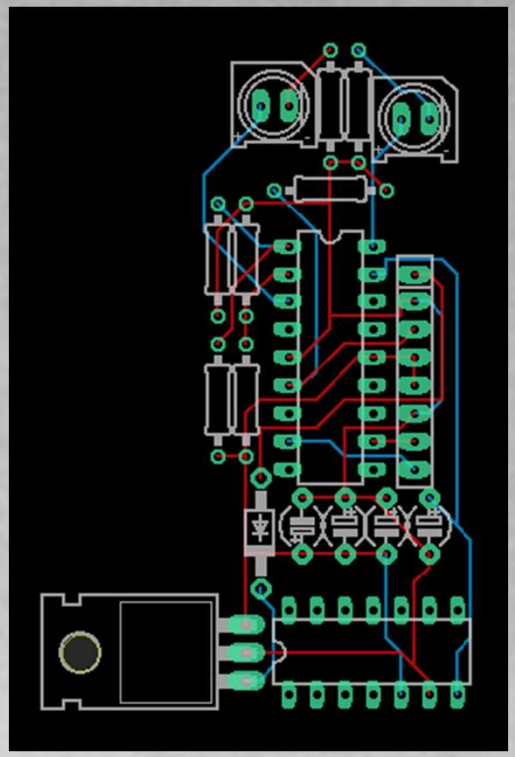
Pressure not absolute changed dynamically

Altitude (AGL) is relative to pressure at ground

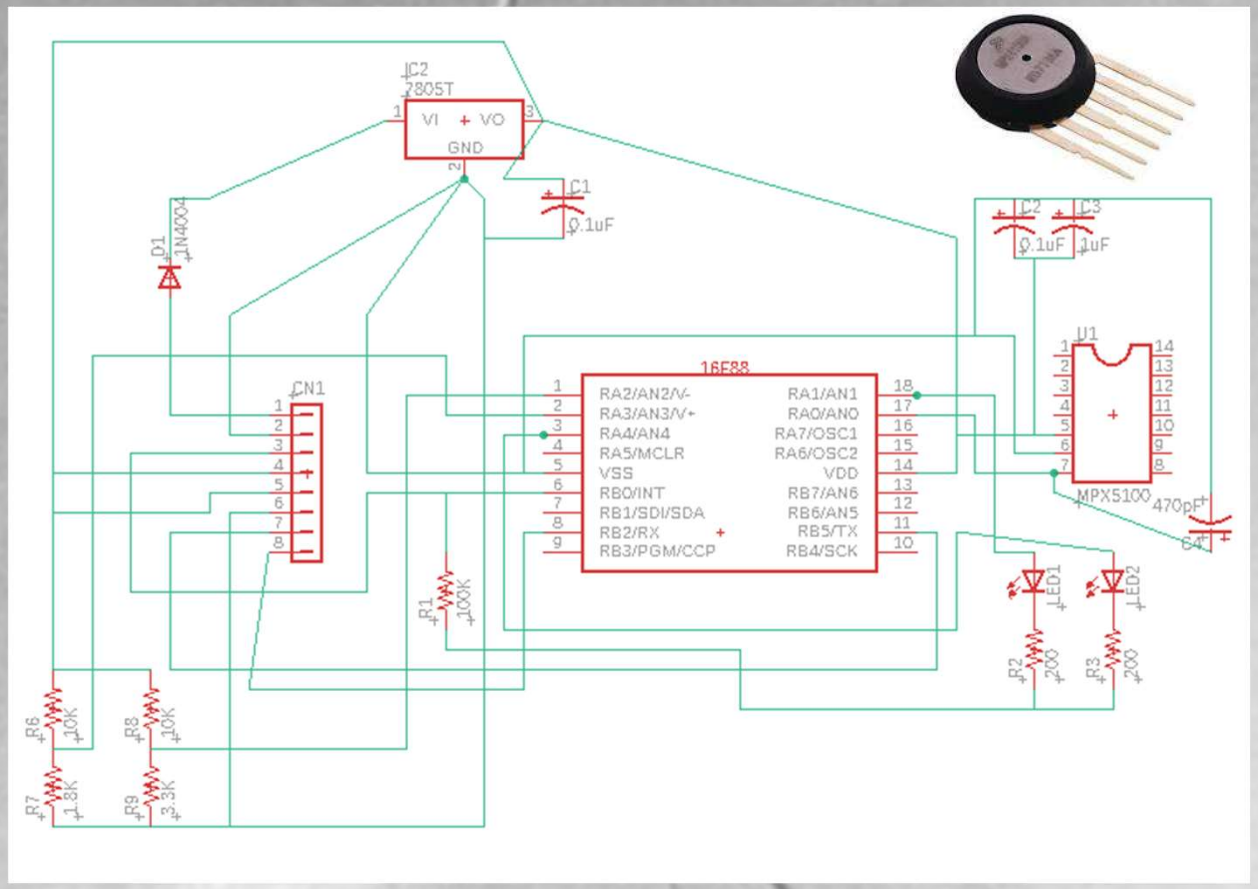
Airplane altimeter has a pressure setting

Set to 30.28 based on ATIS

THE CIRCUIT



No copper pour for gnd plane



Little power decoupling. Just wait till you see the data

SOFTWARE

```
while (1) {

    if ( pir1.RCIF ) {
        processChar ();
    }

    if ( ! (flags & COMPLETE) ) {

        getVoltage ( RUN );

        if ( flags & DISPLAY_ADC_VALUES ) {
            tel.savedelta = tel.maxdelta;
            displayData( 1 );
        } else {
            altitude = deltavoltage * tel.mALTITUDE_CONVERSION;
            if (deltavoltage > tel.lthresh) {
                flags = flags | LAUNCHED;
                if (tel.launch_signal) LAUNCH_SIGNAL = 0;
            }

            if ( (flags & LAUNCHED) && (flags & SAVE_SAMPLE) ) {
                updateEEPROM ();
            }
        }
    }
}
```

Calculates and average voltage from transducer and subtracts from a baseline generated when uC reset

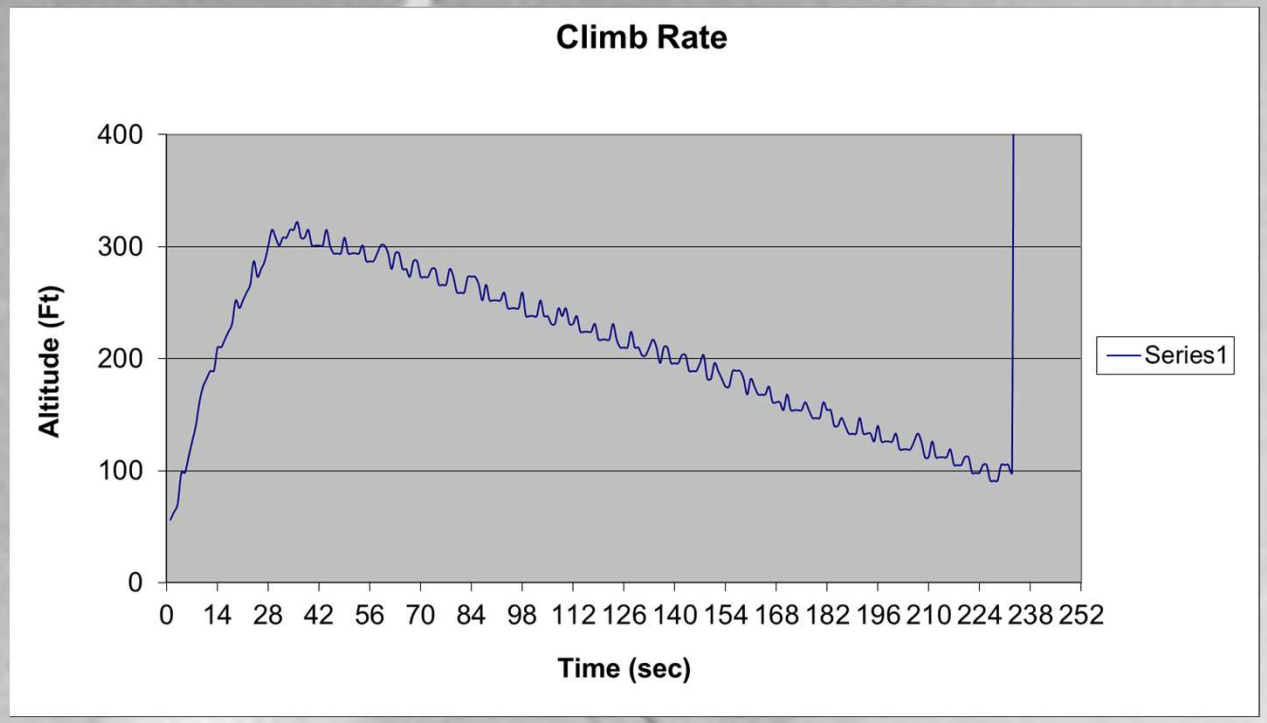
Math done prior to identify altitude per ADC count (e.g., 1 count = 30 feet)

Detect Launch. Voltage is greater than voltage above noise floor.
(e.g. prelaunch reading is currently 5 to 10, then set threshold to say 20)

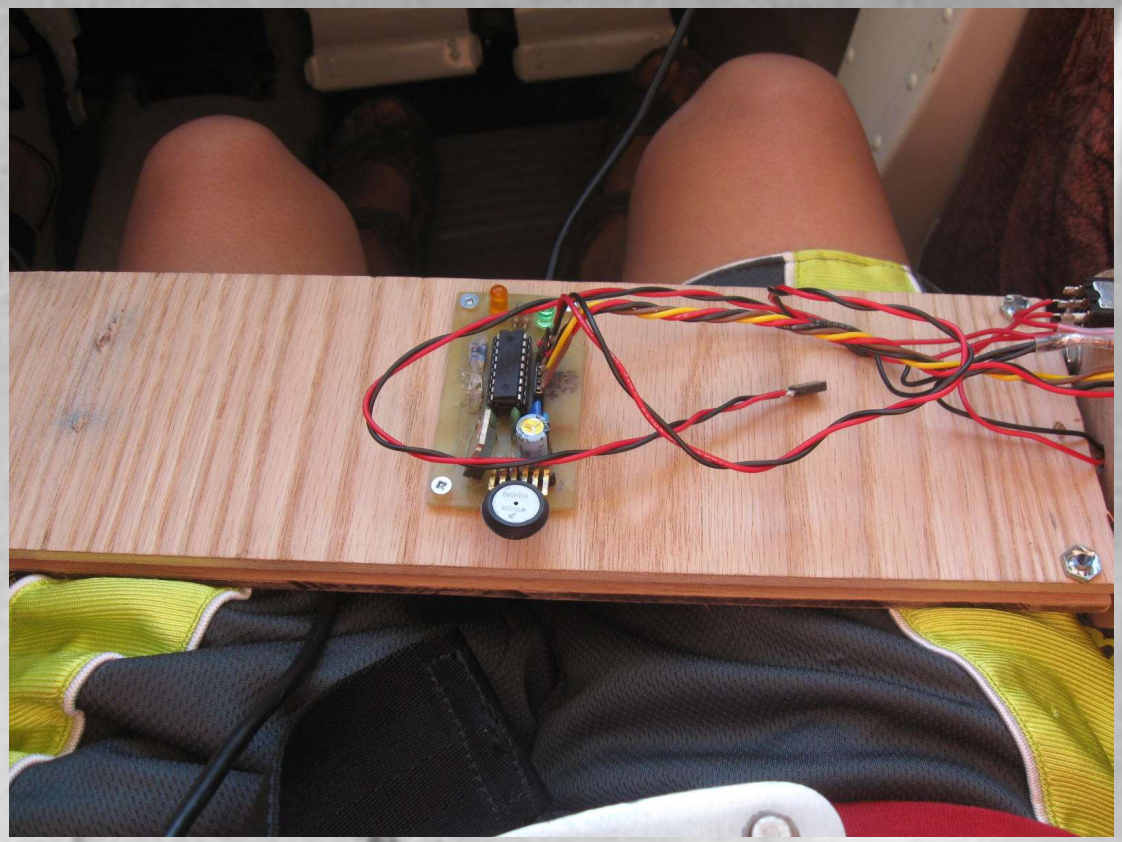
Interrupt started on launch that indicated when to save a reading

SAMPLE DATA

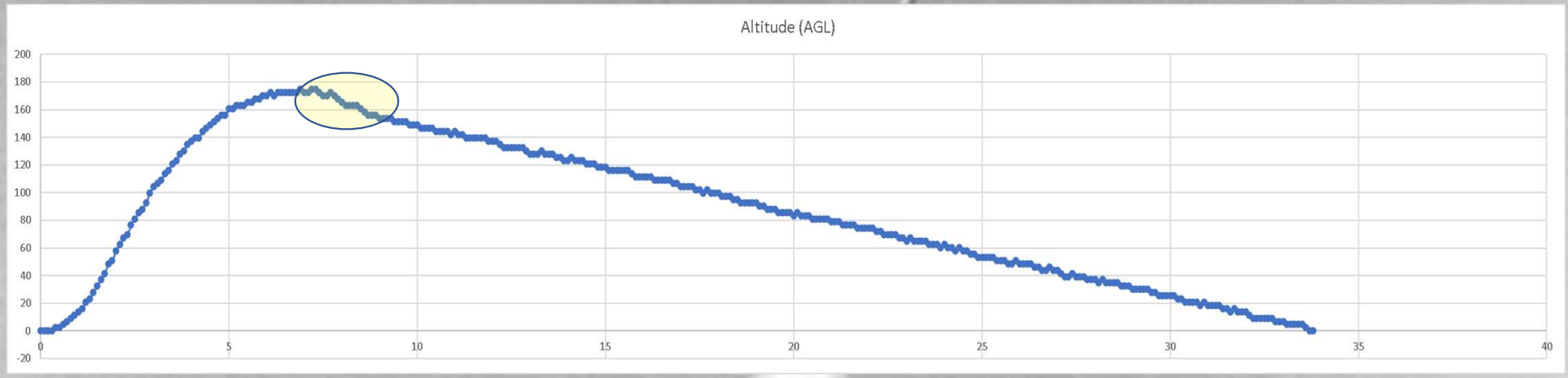
```
Alt v2.0

RDY> D

08      8
09      9
0A      10
0E      14
0E      14
10      16
12      18
.
.
.

0D      13
0D      13
0F      15
0F      15
0F      15
0E      14

RDY> S

793     747     812     813     19
46      46      1380
241     40      0       30      49      171
0       7
```

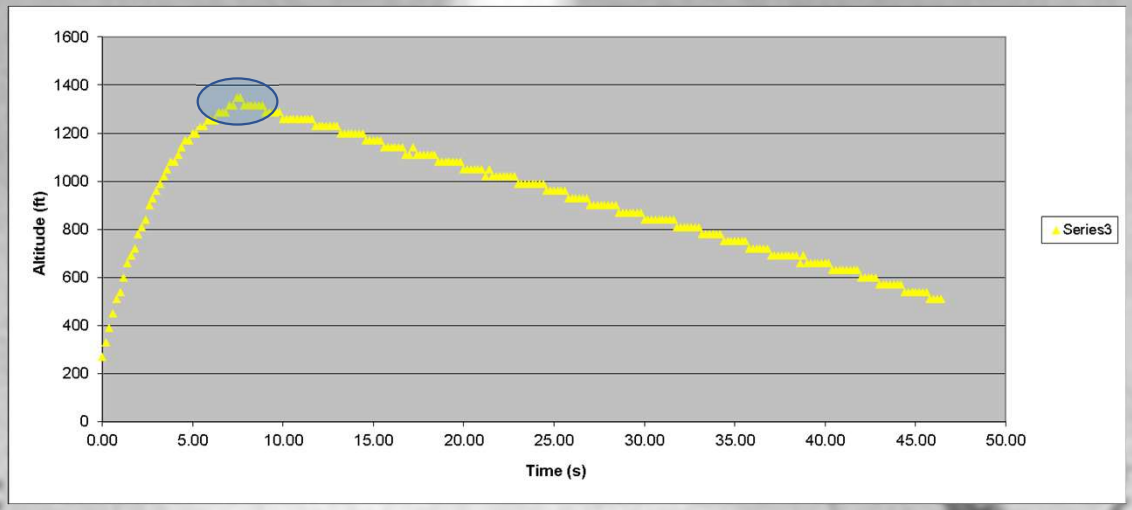


BETTER TESTING



EVOLUTION


Altitude (AGL)
200
180
160
140
120
100
80
60
40
20
0
-20
0
5
10
15
20
25
30
35
40


1600
1400
1200
1000
800
600
400
200
0
Altitude (ft)
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
45.00
50.00
Time (s)
Series3

FIN

The **Churchill Rocket Research Range** is a former rocket launch site located 23 kilometres (14 mi)[1] outside Churchill, Manitoba.[2] The facility was used by Canada and the United States beginning in 1954 for sub-orbital launches of sounding rockets to study the upper atmosphere. The site was scientifically beneficial due to lying in the center of a zone containing high aurora activity.[3] Over 3,500 sub-orbital flights were launched from the site.[4]