



Send an
Amateur Radio
Balloon around
the World

Bill Brown WB8ELK

August 8th and 9th, 2020

Bill Brown WB8ELK

- Ham since 1969
- Pioneer in Amateur Radio High Altitude Ballooning (ARHAB)

Bill launched his first balloon into the Stratosphere carrying an Amateur TV transmitter and 2m beacon 33 years ago and has been instrumental in using ARHAB flights to encourage STEM education. He has flown over 600 flights since 1987.



Around the World in 14 days

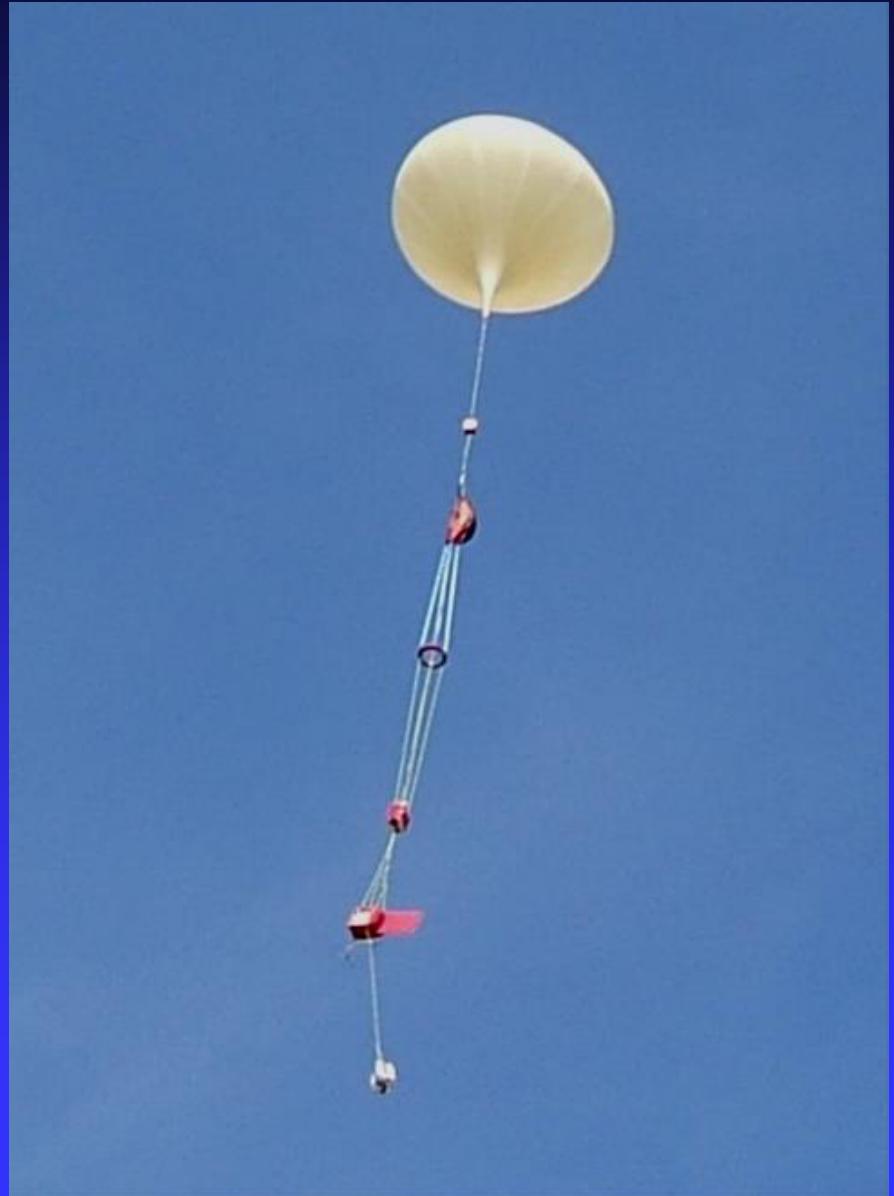


Send an amateur radio balloon around the World

Typical Amateur Radio latex balloon

Flight Train:

- Balloon
- Nichrome cutdown
- Parachute
- Primary APRS
- ATV payload
- Secondary APRS



UAH Student Flights



Most creative payload design

Simplex Repeater



Entering the Stratosphere



WB8ELK, KD4STH and KD0QCA balloon
photographed by Jeff Ducklow N0NQN at
53,000 feet.

The view from 85,000 feet



GoPro image over northern Alabama

Student Science Experiments

>> Very Angry Bird<<



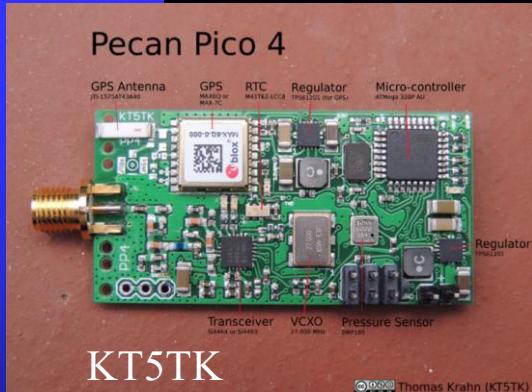
This very rarely happens



These are the usual
landing sites for
balloon payloads



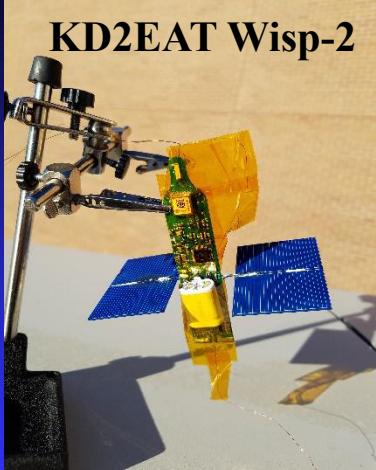
Pecan Pico 4



W7QO



KD2EAT Wisp-2



Pico Balloons



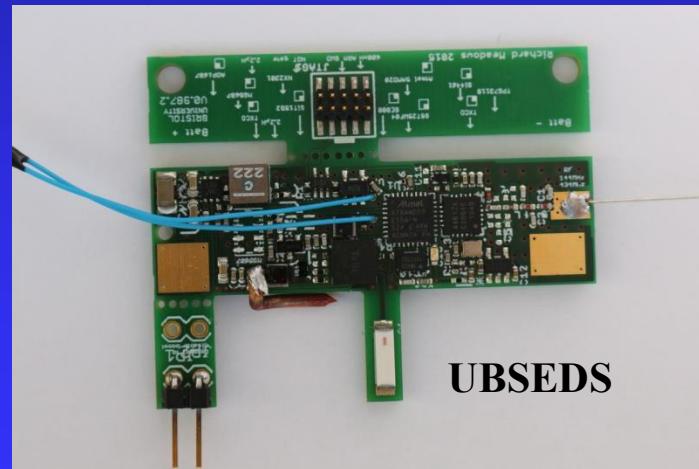
Leo M0XER
61.0 x 10.5mm



Andy VK3YT
61.0 x 12.7mm



QRP Labs U3B
33.8 x 12.7mm



UBSEDS



SP9UOB

A handful of hams around the World are developing trackers that weigh less than an ounce.

Pico Balloons

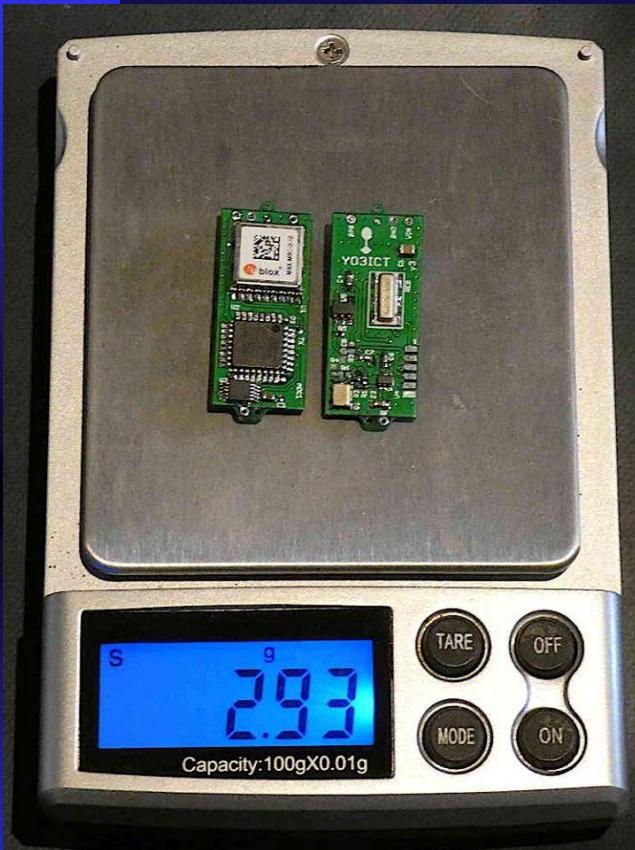


KD2KDD
KN4IUD



A handful of hams around the World are developing trackers that weigh less than an ounce.

Pico Balloons



YO3ICT



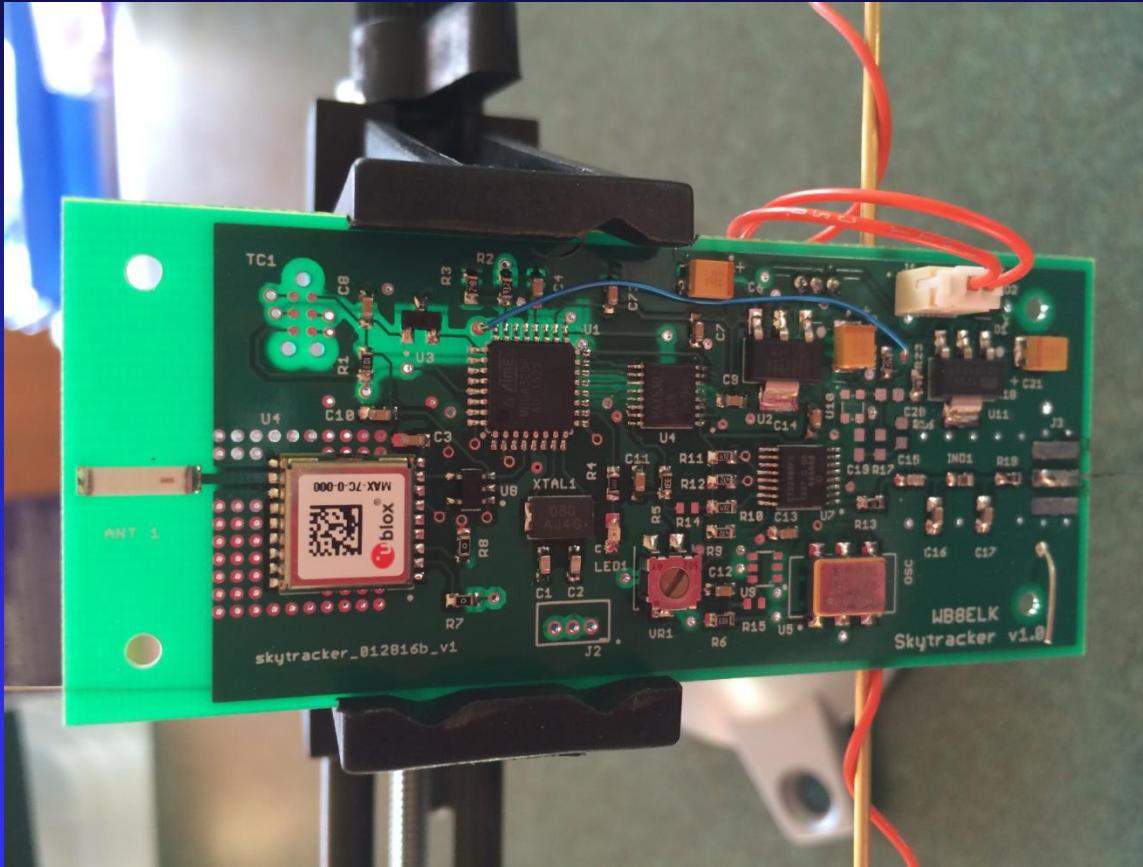
Light
APRS



Pico
APRS Lite
DB1NTO

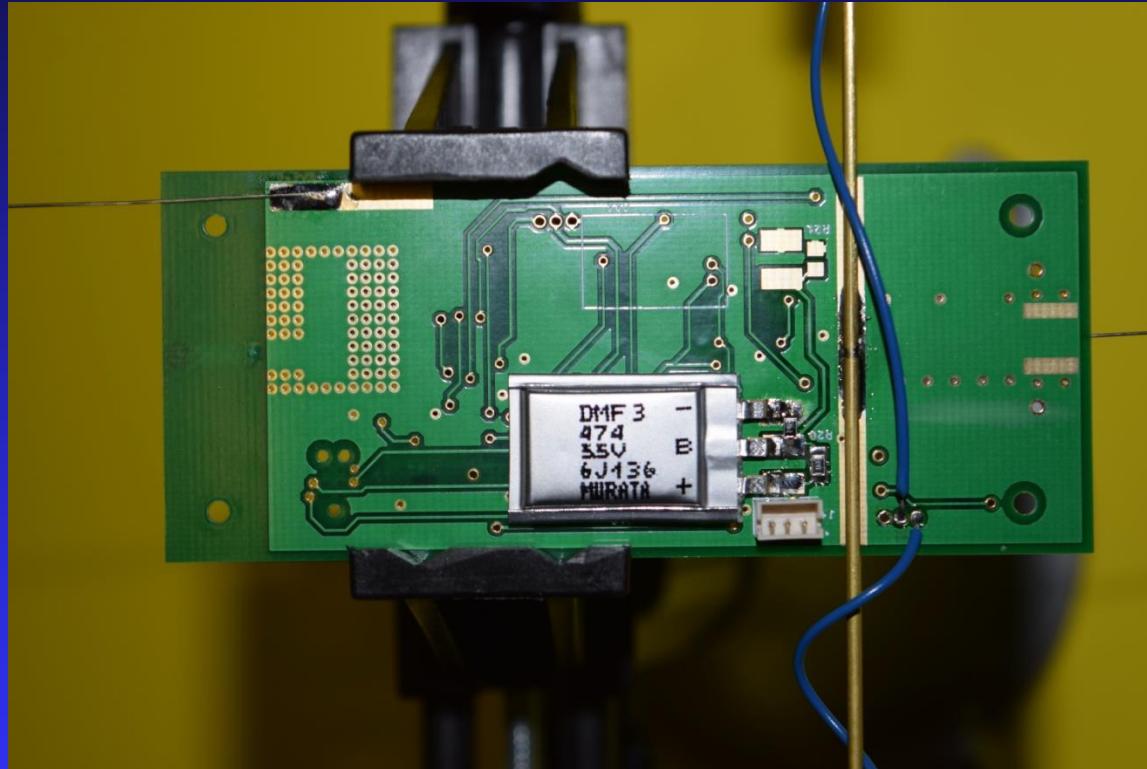
A handful of hams around the World are developing
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Pico Balloons



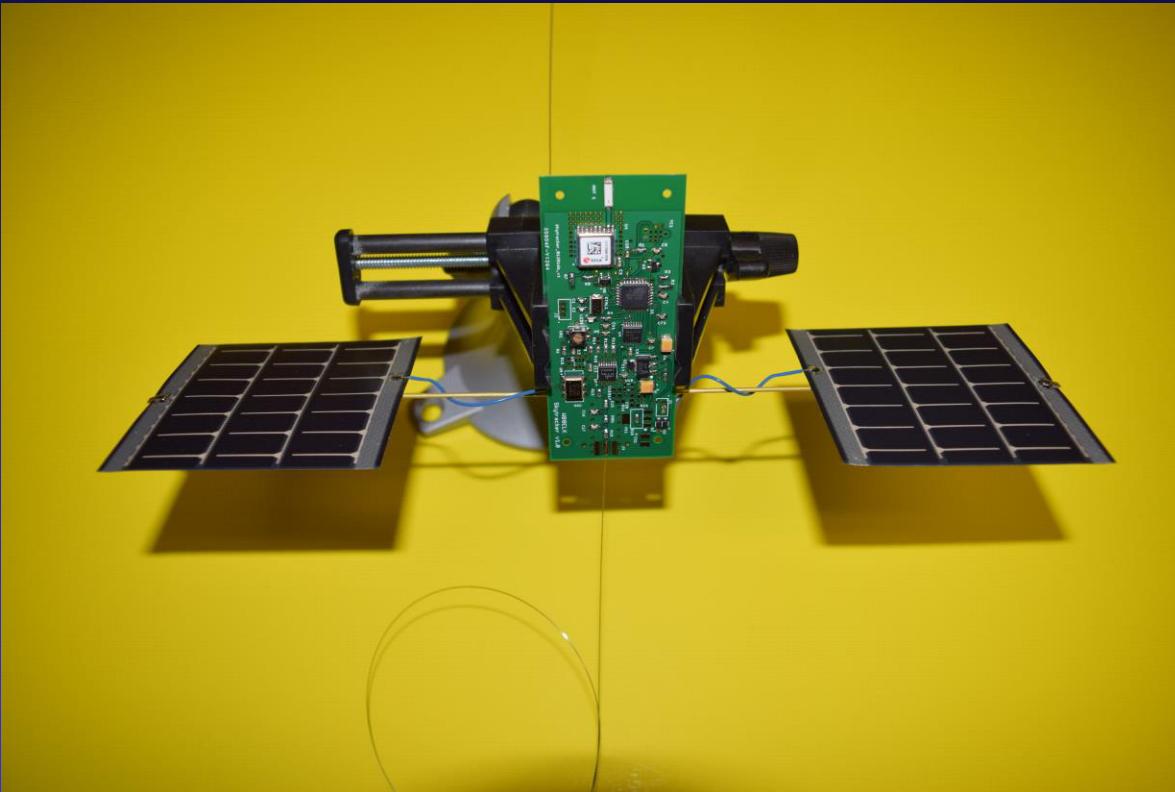
Designed a board called the Skytracker. Complete tracker with onboard GPS that can transmit on VHF or HF frequencies. APRS or WSPR modes.

Pico Balloons



The 0.47 Farad Supercap on the back is very lightweight.

Skytracker



Totally solar-powered using very lightweight thin-film flexible solar cells by PowerFilmSolar.

Pico Balloons



Small size makes this an ideal STEM student experiment.

Pico Balloons



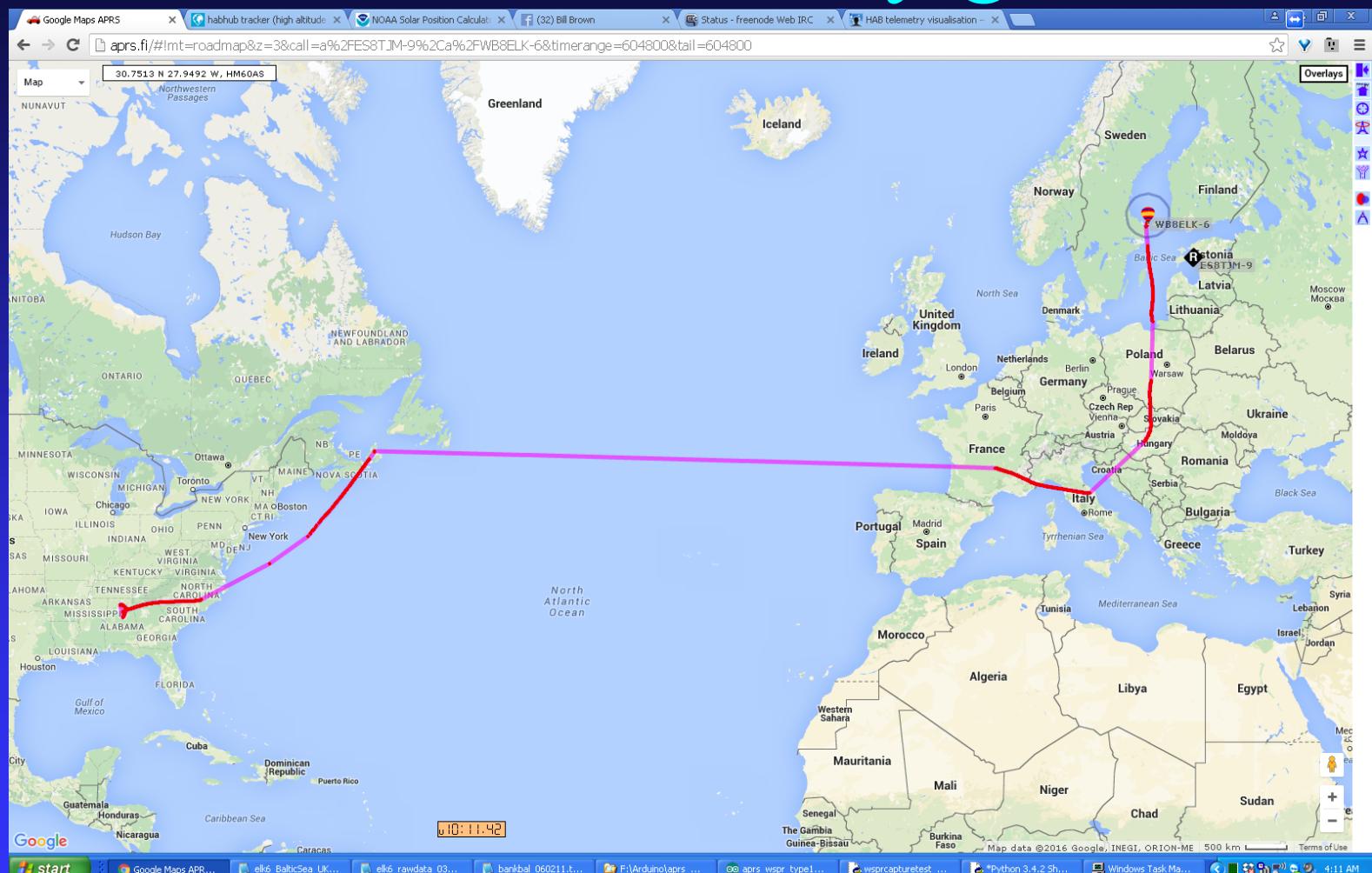
Easily launched by one person in a moderate wind.

Small 40 cubic foot tank of helium can be obtained at low cost



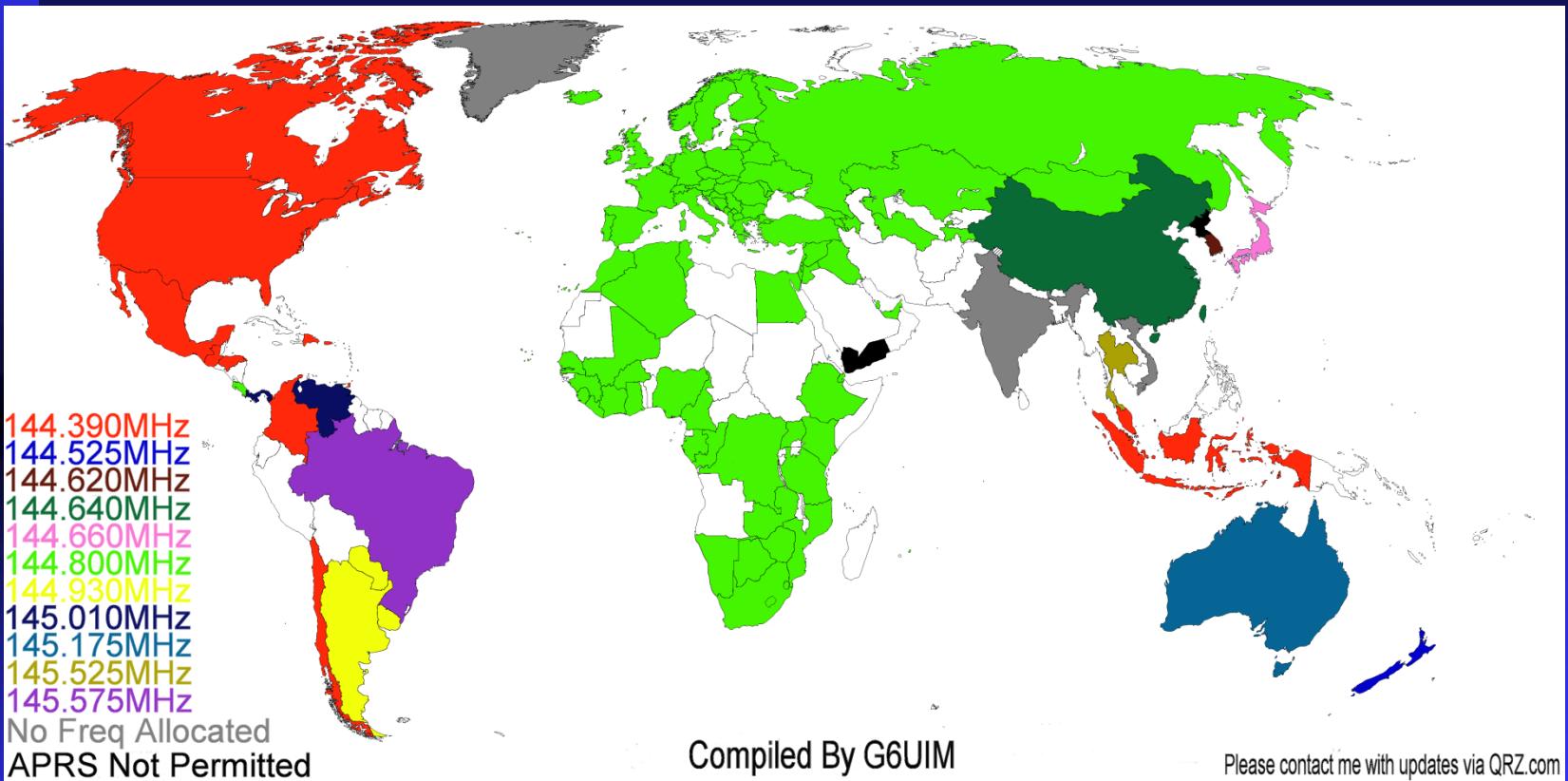
Easy to transport – can inflate 20 flights or more

How far can they go?



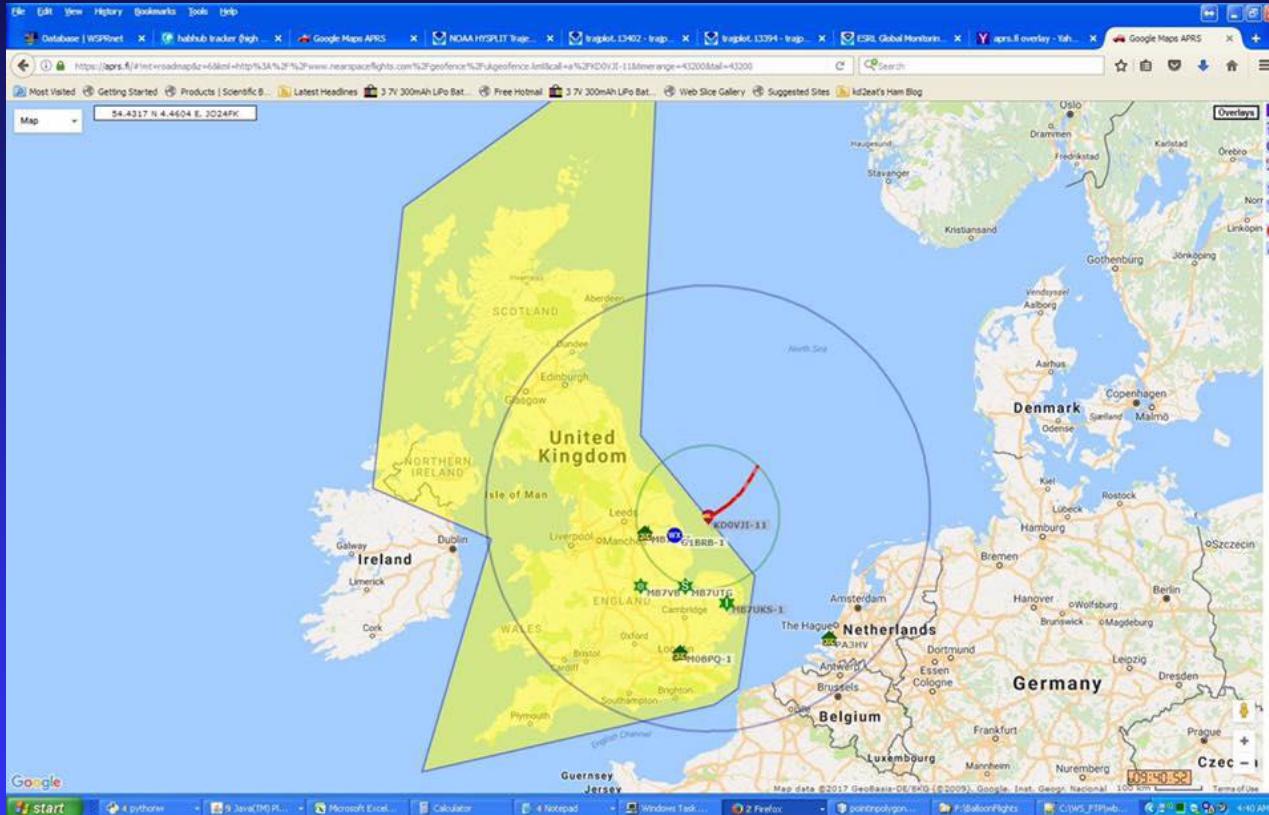
After six days floating at 27,000 feet my little party balloon ended up off the coast of Sweden having crossed the Atlantic Ocean in 32 hours.

Pico Balloons



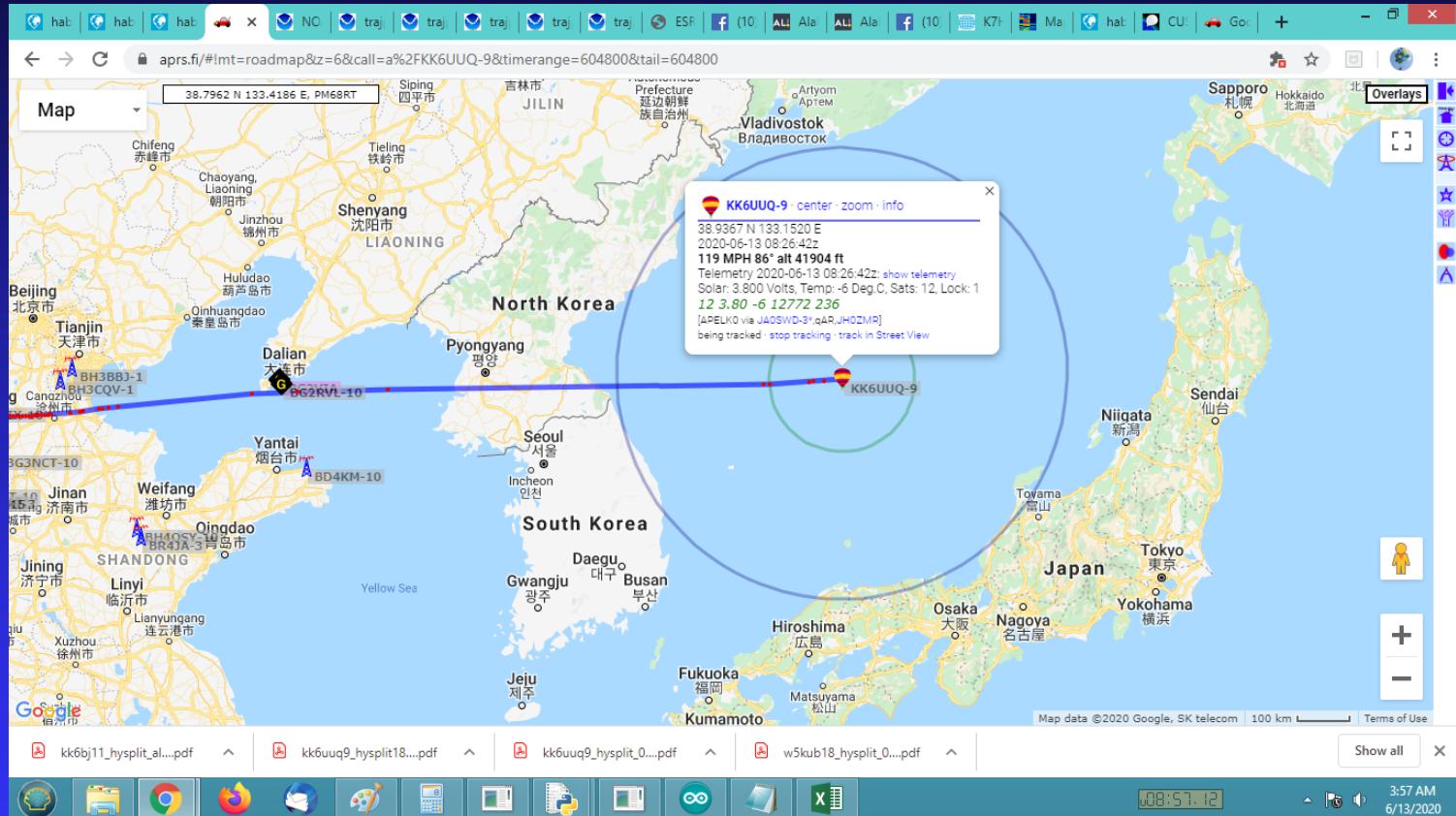
For an APRS tracker you have to automatically switch frequencies based on your location in the World.

Pico Balloons



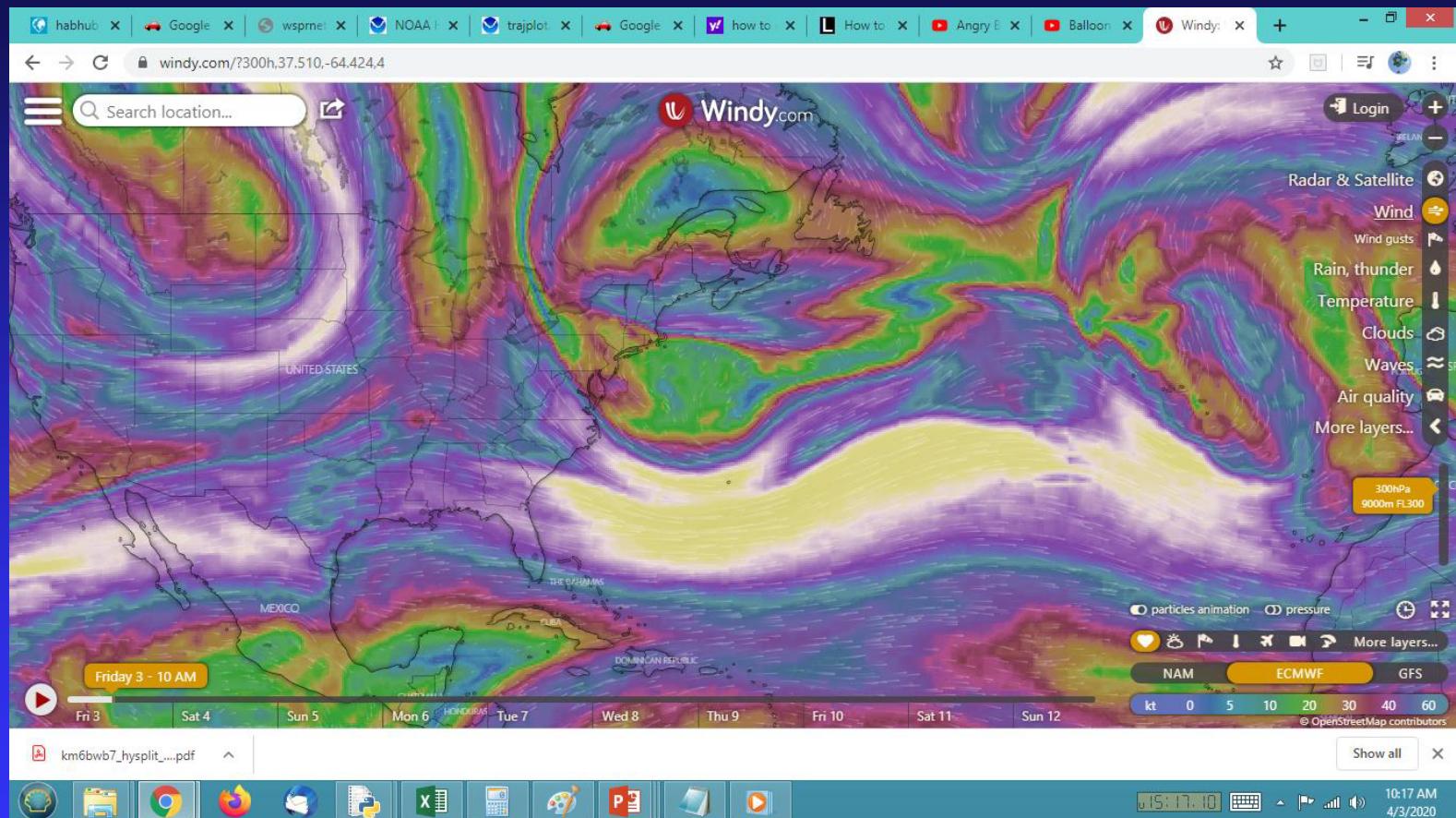
There are several Do Not Transmit zones in the World: The UK, Yemen and North Korea are three of the most critical ones. An integer-based point-in-poly routine was written by KD2EAT and W7QO.

Pico Balloons



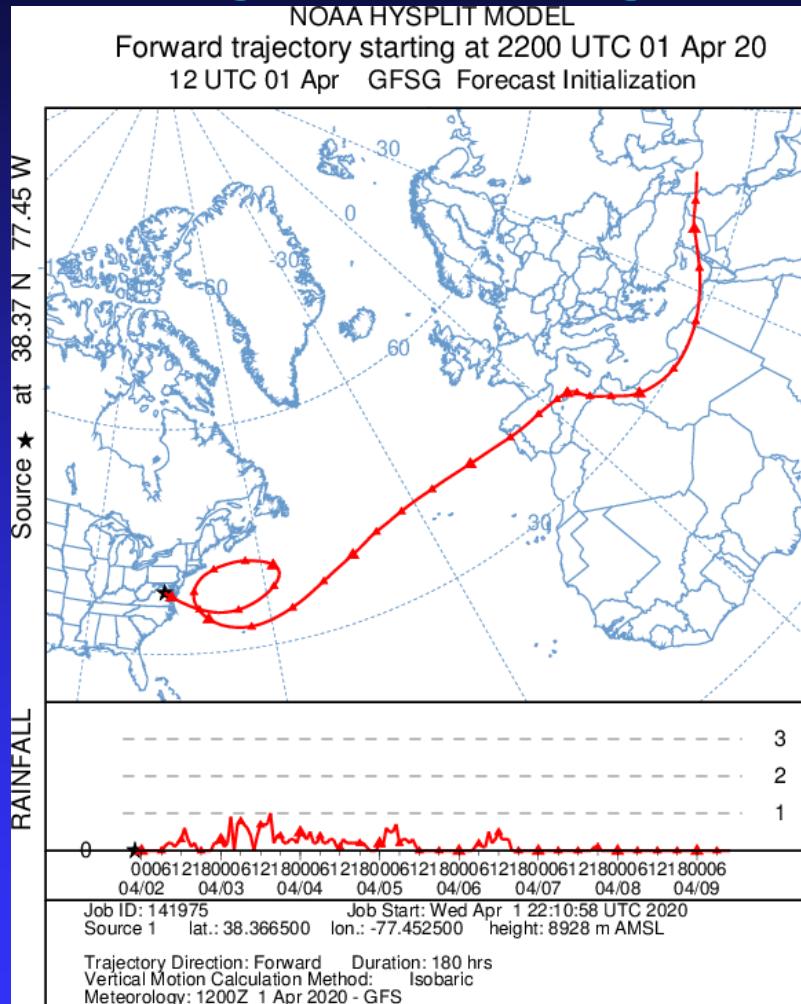
The recent KK6UUQ-9 balloon flew directly over N. Korea but stopped transmitting over the country to prevent WWIII.

FLOATS IN THE JET STREAM



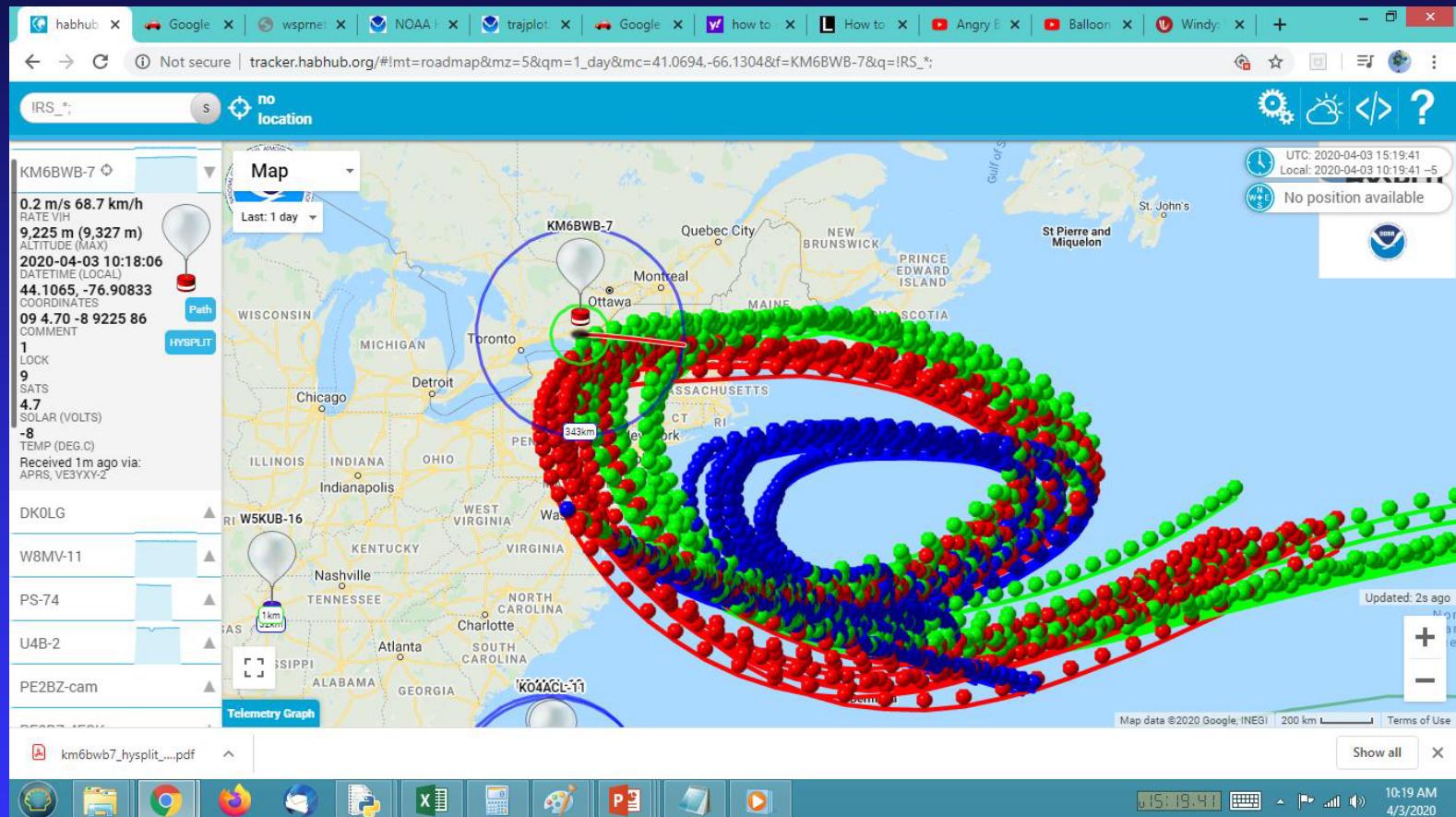
Pico balloons float between 27000 to 45000 feet in the highest winds of the Jet stream. (Windytv.com)

Predicting the Flight Path



<https://ready.arl.noaa.gov/HYSPLIT.php>

Actual Flight path



Tracker.habhub.org shows all balloons currently flying

SBS-13 balloon



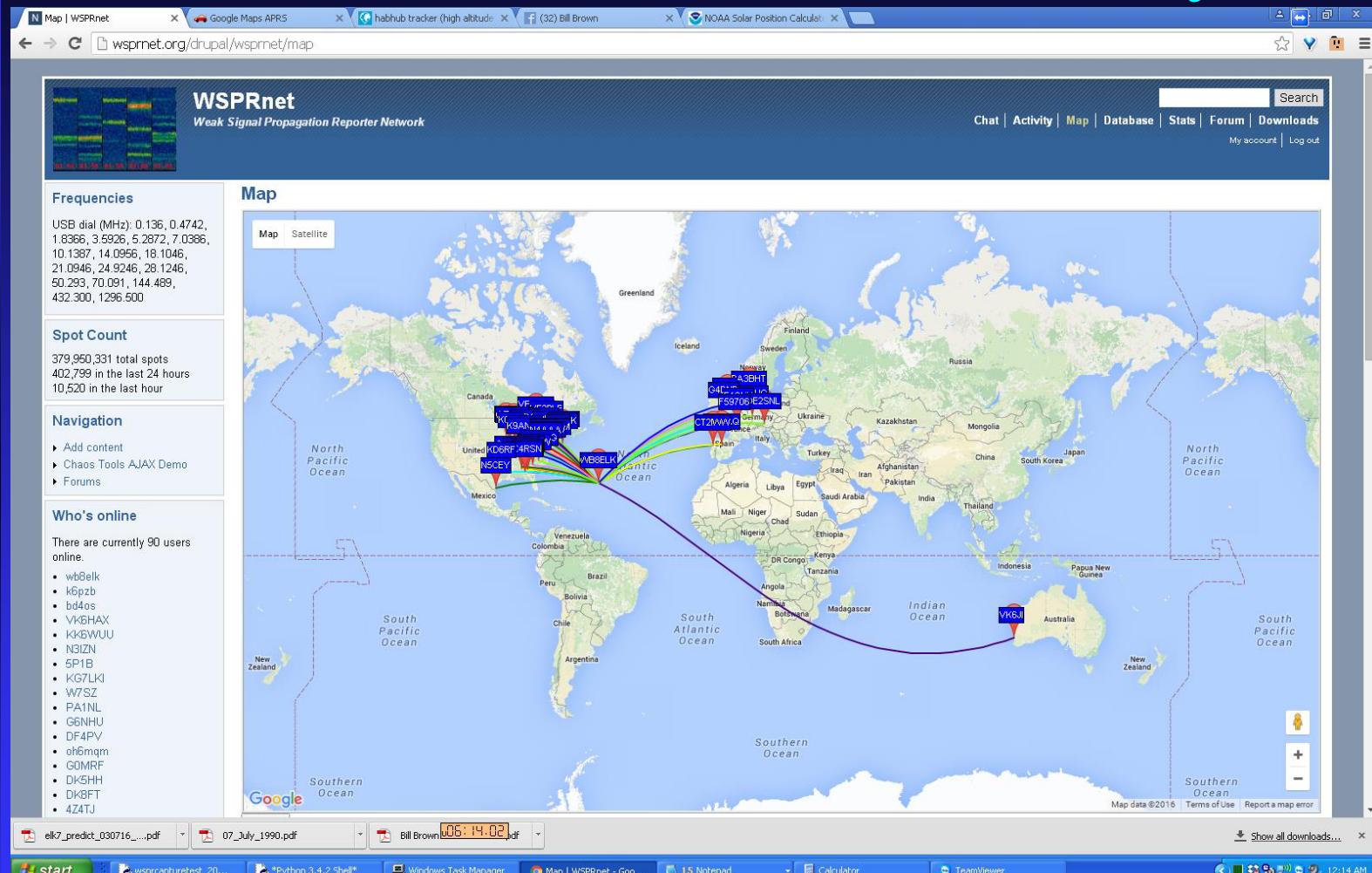
A new balloon by Scientific Balloon Solutions flies above 12 km to avoid most storm systems and can stay aloft long enough to circle the World.

SBS-13 balloon



On its way to attempt a circumnavigation of the World.

Over the Horizon telemetry



Wrote a Python script to skim WSPR data from WSPRnet.org which reformats it to post to the vehicle tracker websites. Data received as far as Australia from the tiny HF wireless transmitter.

Reception Report Database

The screenshot shows a web browser window displaying the WSPRnet database. The title bar reads "Database | WSPRnet". The main content area features a large blue header with the WSPRnet logo and navigation links for Activity, Map, Database, Stats, Forum, and Downloads. Below the header is a search bar and a menu bar with links to NOAA Solar Position, NOAA HYSPLIT Traje..., traplet.1716 - trapl..., AWK Tutorial, Facebook, Madison, AL (35758) ..., Database | WSPRnet, and AOL Mail (25623). The main content area contains a user login form, a frequencies table, a spot count table, and a navigation section. The central part of the page displays a table of 65 reception reports with columns for Timestamp, Call, MHz, SNR, Drift, Grid, Pwr, Reporter, RGrid, km, and az. The table lists various stations and their parameters over several days. A timestamp "08:48:41" is visible in the bottom right corner of the page.

Timestamp	Call	MHz	SNR	Drift	Grid	Pwr	Reporter	RGrid	km	az
2017-02-01 12:04	WB8ELK	14.097058	-26	0	IJ64	10	N4XWC	EM63nu	8792	304
2017-02-01 11:44	WB8ELK	14.097058	-28	0	IJ64	10	N4XWC	EM63nu	8792	904
2017-02-01 09:14	WB8ELK	14.097073	-28	0	IJ53	10	IK1RGM	JN35uc	4908	17
2017-02-01 09:14	WB8ELK	14.097065	-26	0	IJ53	10	P18ESA	J022fd	5554	11
2017-02-01 09:04	WB8ELK	14.097069	-25	0	IJ53	10	DK6UG	JN49cm	5373	15
2017-02-01 08:44	WB8ELK	14.097072	-24	0	IJ53	10	IK1RGM	JN35uc	4908	17
2017-02-01 08:44	WB8ELK	14.097069	-26	0	IJ53	10	DK6UG	JN49cm	5373	15
2017-01-31 17:34	WB8ELK	14.097069	-25	0	IJ48	1000	LA9UO	JP99gb	8161	11
2017-01-31 17:34	WB8ELK	14.097084	-18	0	IJ48	1000	OY6FRA	IP62oa	7075	2
2017-01-31 17:34	WB8ELK	14.097066	-25	0	IJ48	1000	DLOLU	JN49cm	5968	15
2017-01-31 17:34	WB8ELK	14.097067	-26	0	IJ48	10	DLOLU	JN49cm	5968	15
2017-01-31 17:24	WB8ELK	14.097084	-22	-1	IJ48	10	OY6FRA	IP62oa	7075	2
2017-01-31 17:14	WB8ELK	14.097084	-20	-2	IJ48	10	OY6FRA	IP62oa	7075	2
2017-01-31 16:14	WB8ELK	14.097070	-26	0	IJ48	10	DF6MK	JN68ik	6009	19
2017-01-31 13:34	WB8ELK	14.097052	-27	0	IJ88	10	N4XWC	EM63nu	8618	305
2017-01-31 13:24	WB8ELK	14.097052	-23	0	IJ88	10	N4XWC	EM63nu	8618	305
2017-01-31 13:14	WB8ELK	14.097070	-28	0	IJ88	10	N2NC	FN20ye	7722	314
2017-01-31 13:14	WB8ELK	14.097053	-25	0	IJ88	10	N4XWC	EM63nu	8618	305
2017-01-31 13:04	WB8ELK	14.097053	-23	0	IJ88	10	N4XWC	EM63nu	8618	305
2017-01-31 12:44	WB8ELK	14.097052	-22	0	IJ88	10	N4XWC	EM63nu	8618	305
2017-01-31 12:34	WB8ELK	14.097053	-22	0	IJ88	10	N4XWC	EM63nu	8618	305
2017-01-31 12:14	WB8ELK	14.097052	-26	0	IJ88	10	N4XWC	EM63nu	8618	305
2017-01-31 12:04	WB8ELK	14.097053	-21	0	IJ88	10	N4XWC	EM63nu	8618	305
2017-01-31 08:54	WB8ELK	14.097067	-26	0	IJ7	10	DLOLU	JN49cm	6136	17
2017-01-30 18:14	WB8ELK	14.097084	-24	0	IJ7	10	OY6FRA	IP62oa	7229	5
2017-01-30 18:14	WB8ELK	14.097067	-19	0	IJ7	10	F5KL	JN24ko	5674	20
2017-01-30 18:14	WB8ELK	14.097083	-27	0	IJ7	10	P18ESA	J022fd	6406	15
2017-01-30 18:14	WB8ELK	14.097058	-23	0	IJ7	10	P14HT	J032kf	6489	17
2017-01-30 18:04	WB8ELK	14.097084	-20	0	IJ7	10	OY6FRA	IP62oa	7229	5
2017-01-30 16:44	WB8ELK	14.097072	-25	0	IJ7	10	ON7KO	J021ce	6302	16
2017-01-30 16:44	WB8ELK	14.097068	-24	0	IJ7	10	F5KL	JN24ko	5674	20
2017-01-30 16:24	WB8ELK	14.097068	-26	0	IJ7	10	DLOLU	IM90ym	6272	19

Decoding software used by hundreds of ground stations Worldwide uploads reception reports to a central database.

Skimming data with Python

The screenshot shows a dual-monitor setup. The left monitor displays a Python 3.4 Shell window titled "Python 3.4 Shell". It contains a log of APRS data from various stations, including WB8ELK, QK7IUF, and QN7LVG. The right monitor displays a code editor window titled "wsprcapturetest_wb8elk_011517a.py". The code uses BeautifulSoup and urllib.request to parse APRS data, calculate temperature fields, and calculate battery fields.

```
#from bs4 import BeautifulSoup
import bs4
from urllib.request import urlopen

import sys
import string
import time
import csv
import socket # for socket

# Calculate Temperature Field
def temp_calc(call2):
    #temp_ref = ord(call2[3]) - 65
    #temp_ref = int((ord(call2[1])-48-7-satsfield)/3)
    if(ord(call2[1])-48 > 9):
        temp_ref = int((ord(call2[1])-48-7)/3)
    else:
        temp_ref = int((ord(call2[1])-48)/3)

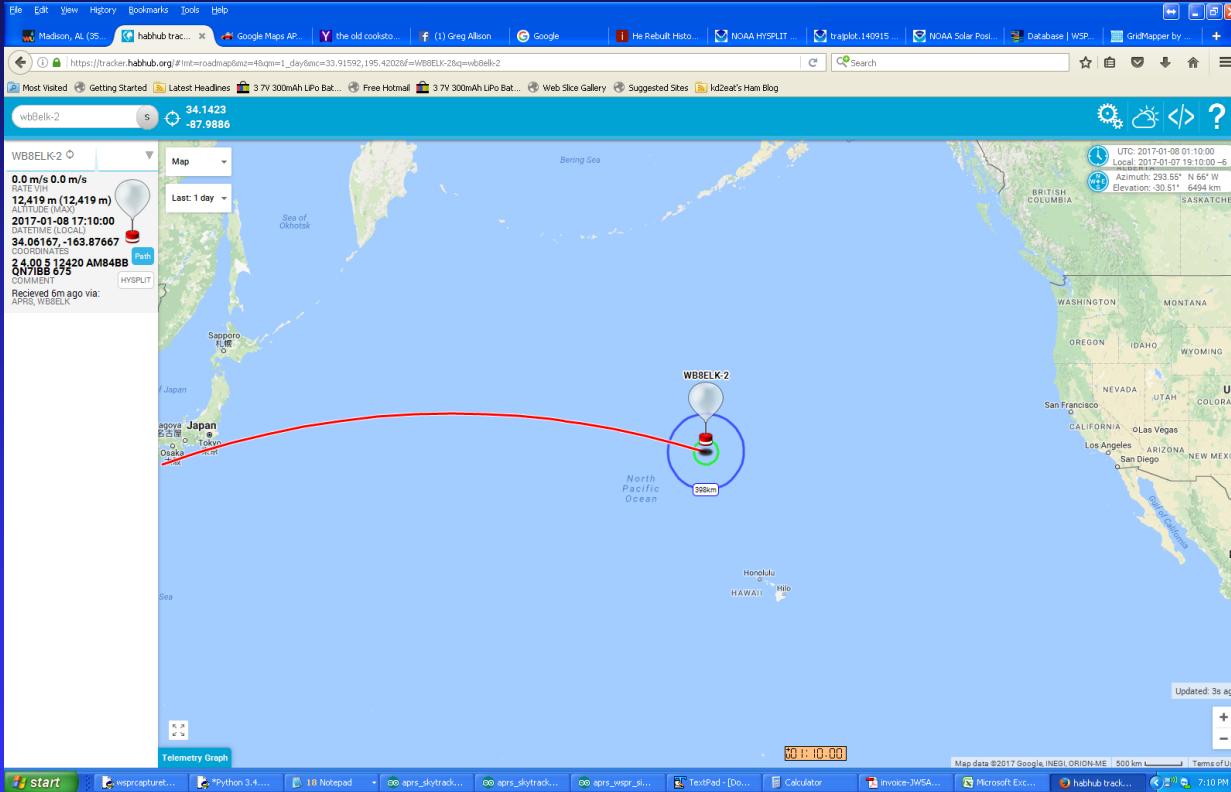
    print(temp_ref) # 102716 for testing
    if temp_ref < 0:
        temp_ref = 0
    elif temp_ref > 1:
        temp_ref = 11

    #tempfieldcalc = (temp_ref * 5) - 60
    tempfieldcalc = (temp_ref * 5) - 30
    tempfield = str(tempfieldcalc)
    #print(temp_ref)
    print(tempfieldcalc)
    print(tempfield)
    return tempfield

# Calculate Battery Field
def batt_calc(call2):
    #batt_ref = ord(call2[1]) - 65
    batt_ref = int((ord(call2[3])-65))
    if batt_ref < 0:
        batt_ref = 0
    elif batt_ref > 25:
```

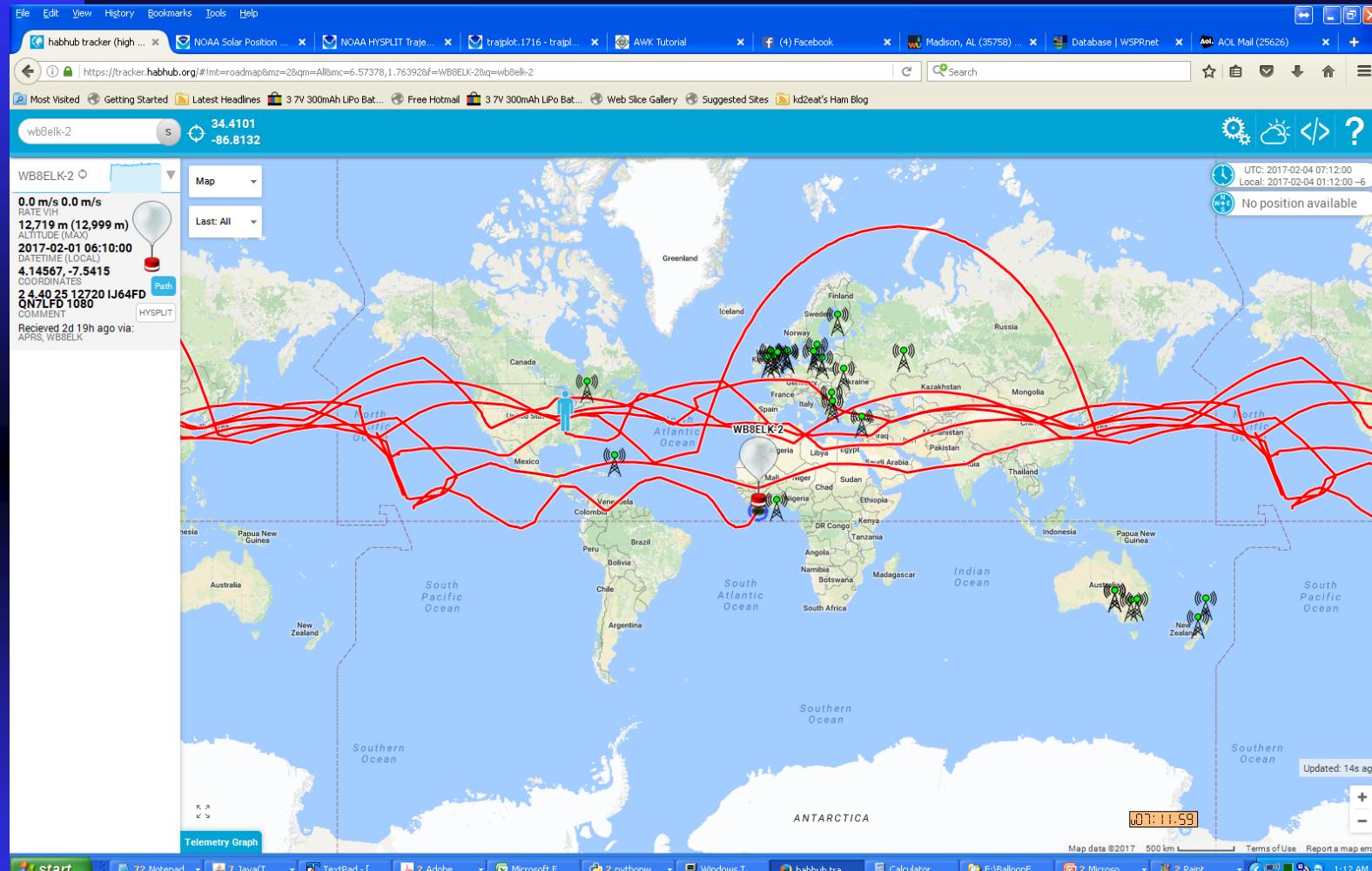
Python script skims the database of the raw position reports coming in from remote ground stations and sends it to a vehicle-tracking website for a position map display.

Balloon Tracking web map



Final result of reformatted raw WSPR data as displayed on the TRACKER. HABHUB.ORG map. Also shows up on APRS.FI

Around the World



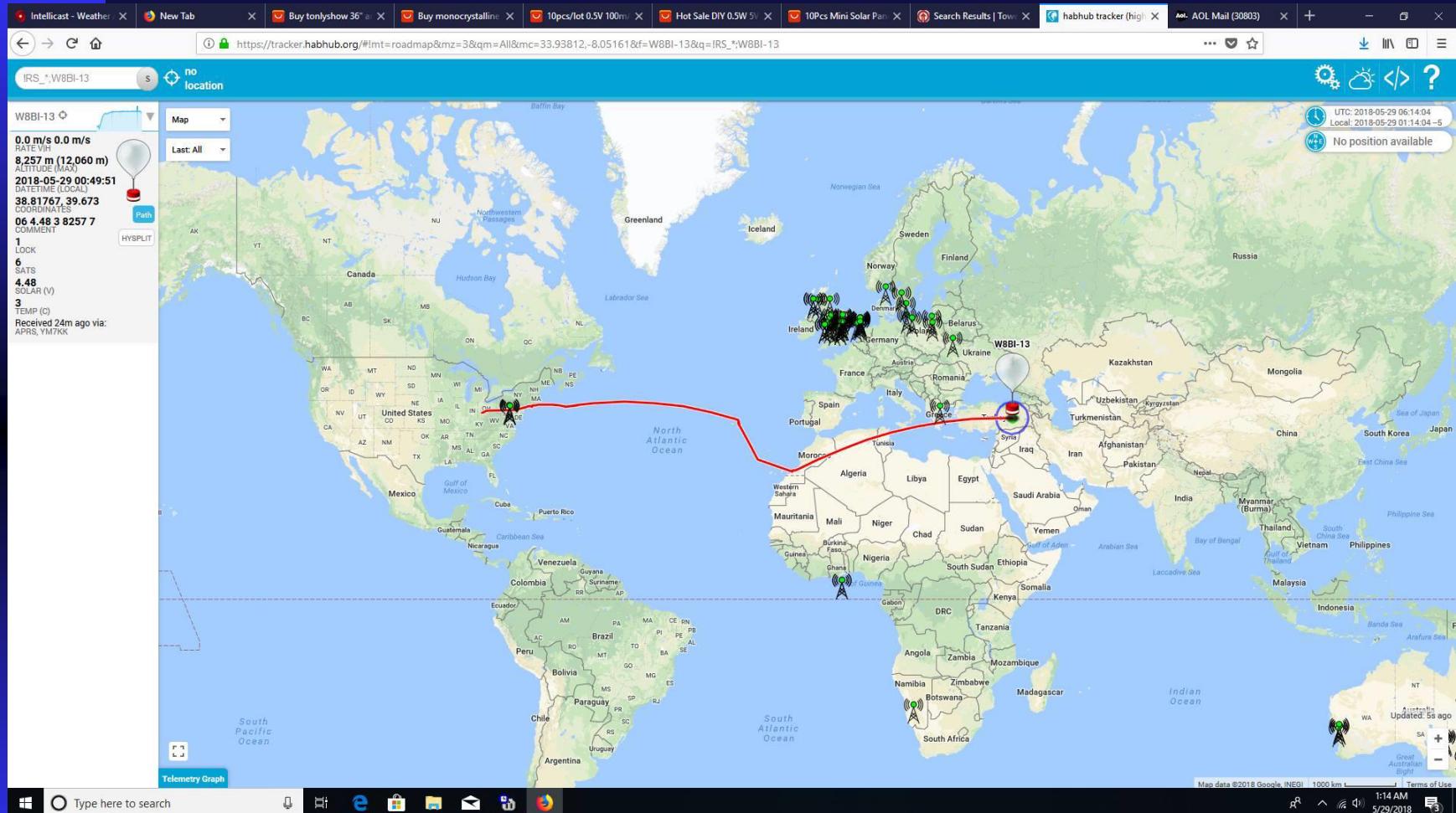
My Skytracker 20m WSPR flight went around the World over 6 times after flying at 40,000 feet for 75 days.

Dayton Hamvention 2018 Pico balloon flight



The Hamvention Hexbeam snags the W8BI-13 pico balloon

Dayton Hamvention 2018 Pico balloon flight



11 day flight from Dayton Hamvention to Turkey

Youth On The Air



Audrey KM4BUN and Jack KM4ZIA are quite active in High Altitude Ballooning, both regular latex flights and long duration Pico Flights, they plan to launch two WSPR balloons for GPSL2020.

YOTA Activities



Audrey KM4BUN produced a video she presented to the YOTA (Youth On The Air) group about Pico Balloons.

Bev WB4ELK prepares a pico balloon for liftoff



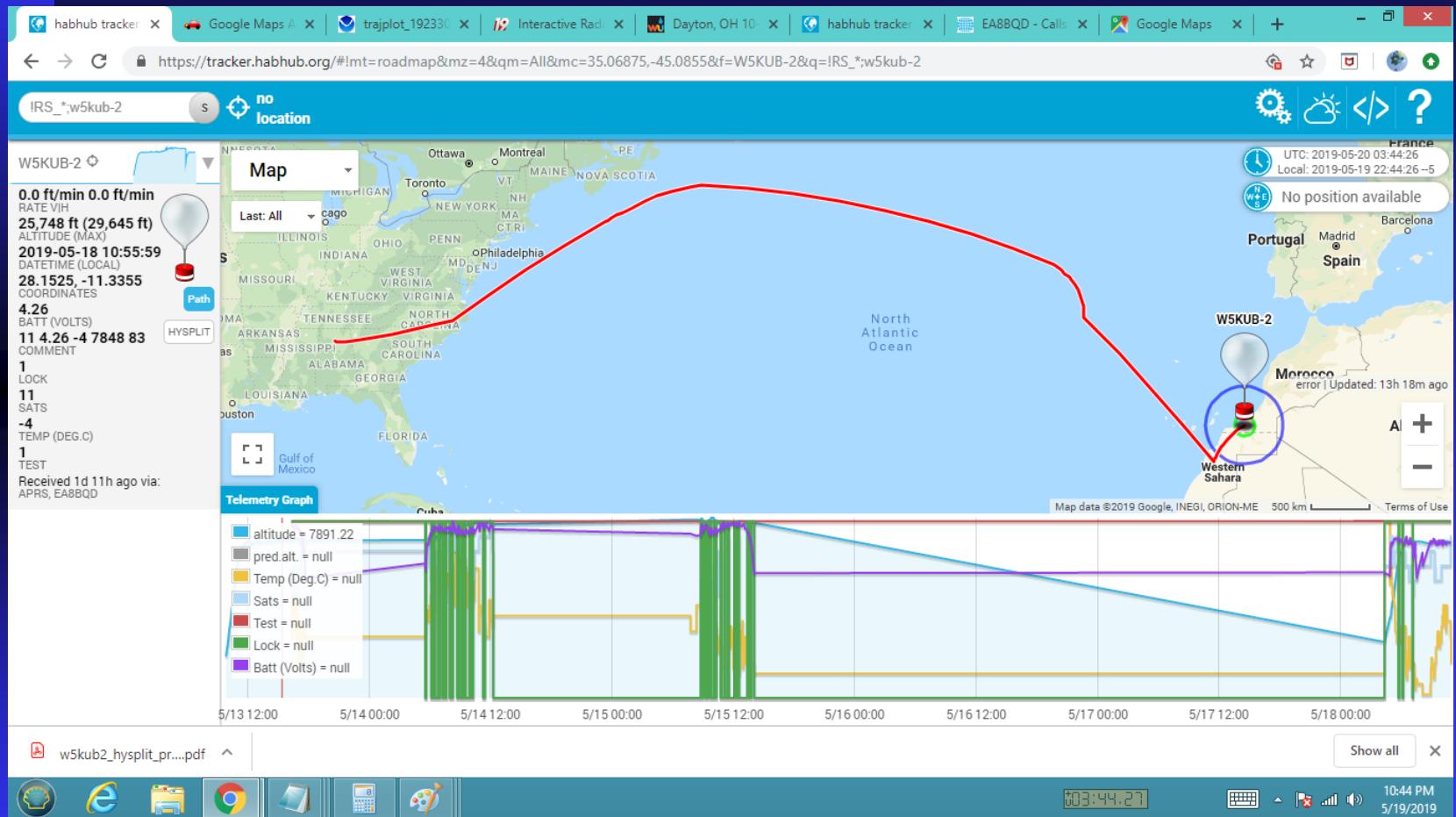
West Point Middle school pico launch – Cullman AL

West Point Middle school pico balloon launch



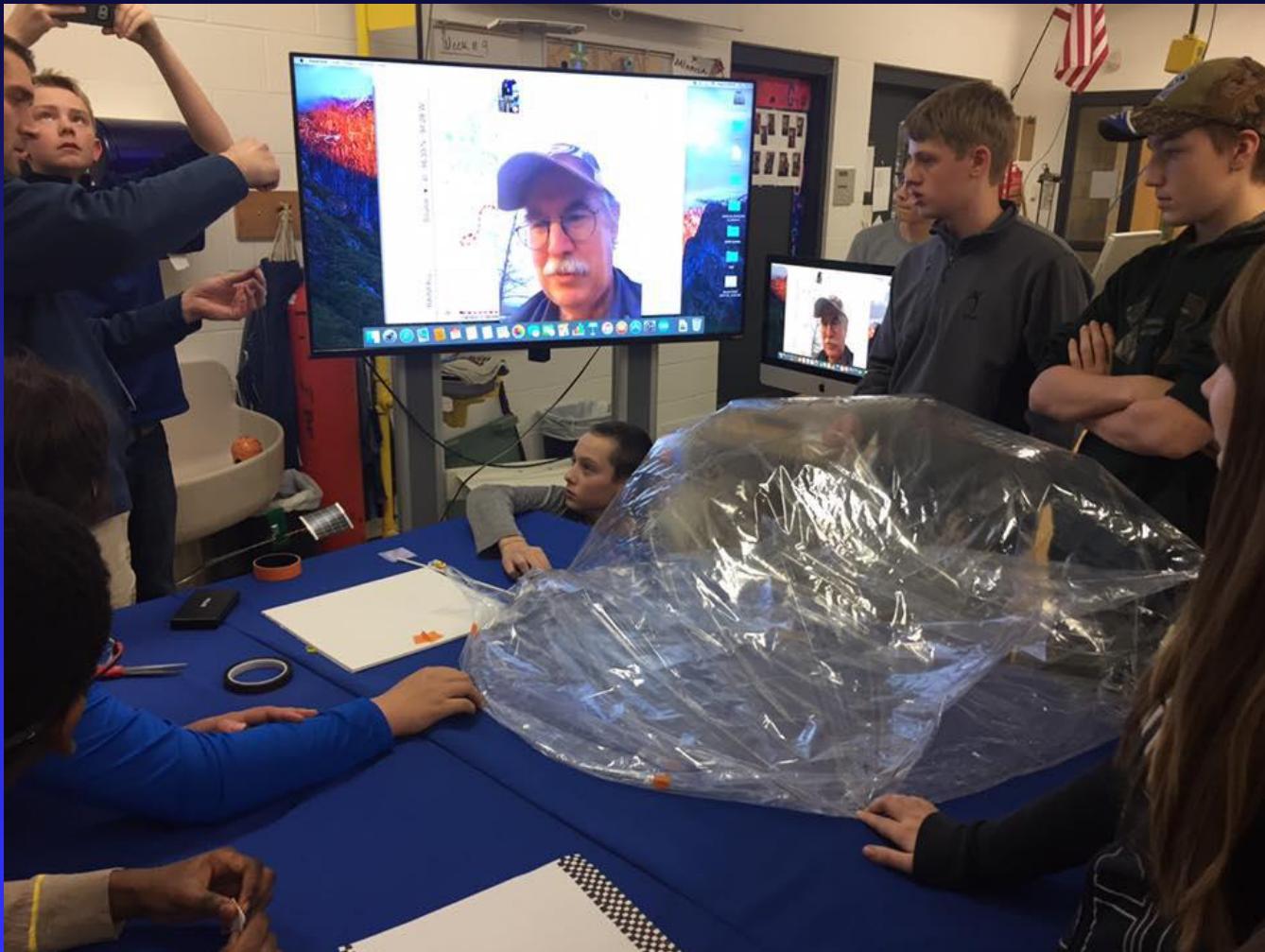
West Point Middle school pico launch – Cullman AL

West Point Middle School – Mylar party balloon to Morocco



W5KUB-2 showing predicted flight path

Around the World



Students at Forestview Middle School in Baxter MN flew the very first middle school balloon to circumnavigate the World.
KD0VJI-11

Around the World



UC San Diego students have flown their KK6PNN-5 balloon around the World 6 times and has been flying for 3 months.

Great Plains Superlaunch 2016



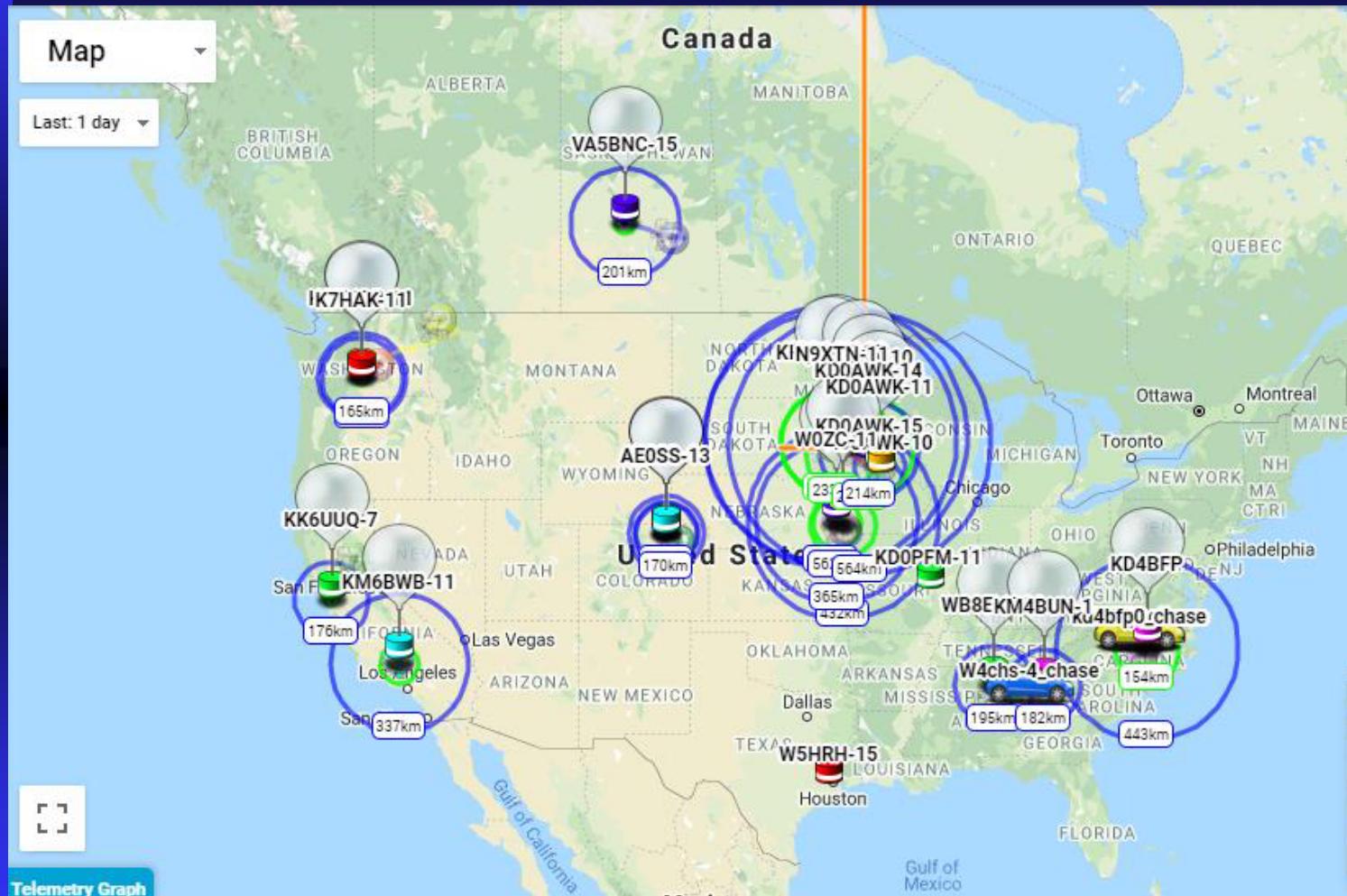
9 Latex weather balloons launched. 3 Mylar Pico balloons.

Great Plains Superlaunch



7 balloons in the air at once during group launch.

Great Plains Superlaunch 2020



10 Pico balloons and 5 Latex balloons launched live via Zoom streaming video. SUPERLAUNCH.ORG

For more info contact:

WB8ELK@gmail.com



The Future of Amateur Radio Ballooning?.



Q&A