

Soaring the Radio Skies on a Bed of Helium

Joanne Michael, KM6BWB
Culver City, CA

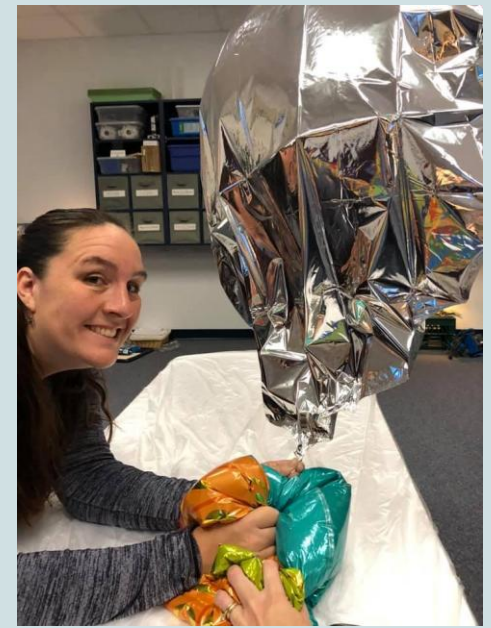
August 9, 2023

Who am I, and why am I talking with you?

- Joanne Michael, science educator in Culver City, CA (4 miles from LAX)
- Balloonatic- first HAB in 2016 next to the Goodyear blimp, 4 in total
- ARISS contact with ESA Paolo Nespoli in September 2017 (4 hours before Hurricane Irma in Florida)
- Pico/ MAB balloon launch- over 50 since 2018 with my team (I personally have launched 15 with my callsign)

Outline of tonight...

- What IS a picoMAB?
- Differences and decisions
- How do we explain this to the students?



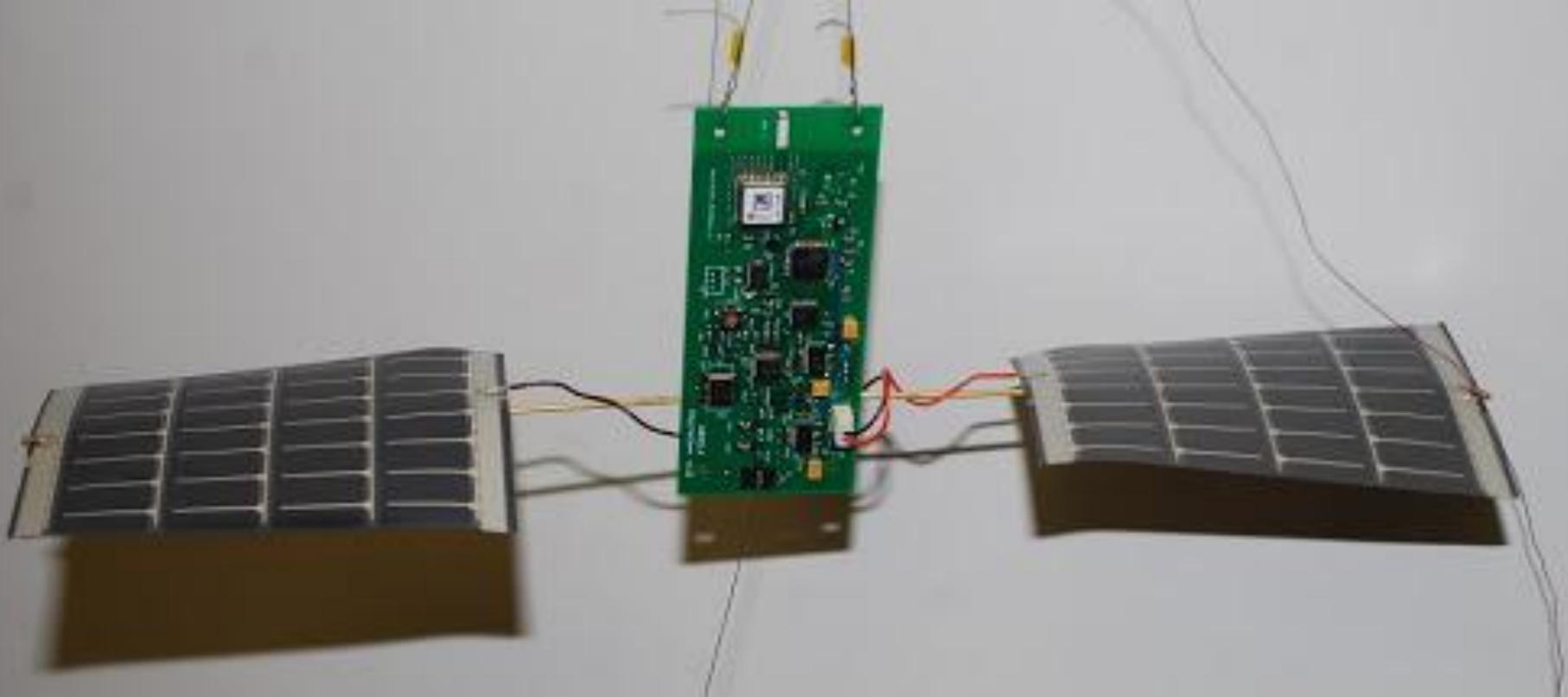
PLEASE interrupt me if you have questions! If I'm going to be addressing it later, I'll tell you! 😊

When it all comes down to it...

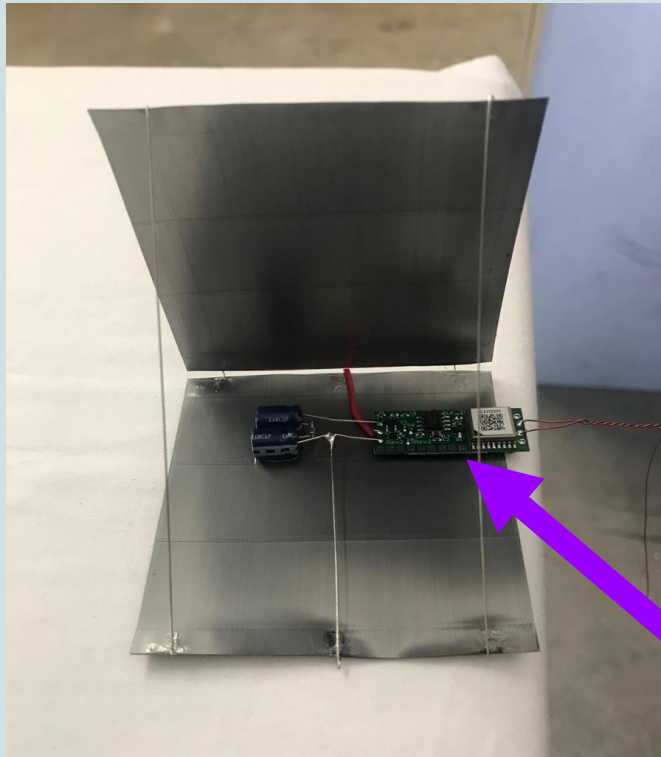
The absolute basic idea is that we fill a balloon with a gas that is lighter than air at ground level. We then attach a radio transmitter with GPS on it, and if we do the calculations right, the balloon reaches neutral buoyancy within the jet stream, and will sail around the world, transmitting its location back to the Earth.

HOWEVER...

- What kind of transmitter? APRS or WSPR?
- What kind of gas? Hydrogen or Helium?
 - Type of balloon? Yokohama or SBS?
 - When?
 - Where?



Bill Brown is a retired NASA engineer and the inventor of the device we often fly for pico balloons when flying APRS- called Skytracker. Everything is ready to go- he even pre-programs your callsign before he sends it to you!



This is an example of a WSPR tracker (sitting within the solar panels). Substantially smaller and lighter than APRS. Different people/companies are selling components of these- as far as I have found/heard, no one is selling a “plug and play” variety.

APRS

vs

WSPR

Pros for APRS

- Plug-and-play (can literally take out of envelope, attach to balloon and fly 20 minutes later)
- Location is VERY accurate- 20 meters in any direction
- Uses a variant of Google Maps to track- easy for all ages
- Antennas are 14 inches long up and down- 28 inches in all (2.3 feet)
- “Some assembly required”- you have to solder the antennas, the solar panels, the radio itself, the lift line (as well as purchase them individually)
- Location is VERY broad- 40 mile by 70 mile square/grid
- Need to do some calculations and check a specific site to find the map to see where the transmitter is
- Antennas are 17 ft, 1 in up and down- a total of 34 feet, 2 inches to keep track of and not get tangled

APRS

vs

WSPR

Pros for WSPR

- Transmits every 2 minutes in sunshine
- Furthest it can transmit is 600 miles- not over some countries, not over Atlantic or Pacific
- “heavy” - half an ounce or so
- Transmits every 10 minutes (kind of- 2 minutes with general location, and then a second signal 2 minutes later with more accurate data)
- Due to being on HF band, can transmit half-way around the world- ocean is no problem
- EXTREMELY light- a few grams

Next question- gas

This decision is much more straight- forward.



Helium is **SUBSTANTIALLY** safer when around students.

Hydrogen is cheaper, has better lift, and is a great option for launching if no minors are around for launch (if live-streaming the launch from an alternate location). It does have more of a tendency to leak than Helium.



Which type of balloon?
There are a few different options- the
main 2 are SBS and Yokohama



Yokohama= think Disneyland balloons, but
without the balloon in the middle. Incredibly
durable (literally made of plastic), but need
to be stretched out.

Cost- roughly \$26



SBS= body bag balloons, or the “clear
jellyfish”. Roughly 6 feet long, tube-
like. They will not look very inflated,
but are designed for this type of
experiment.

Cost- \$160



When and where should we launch it?

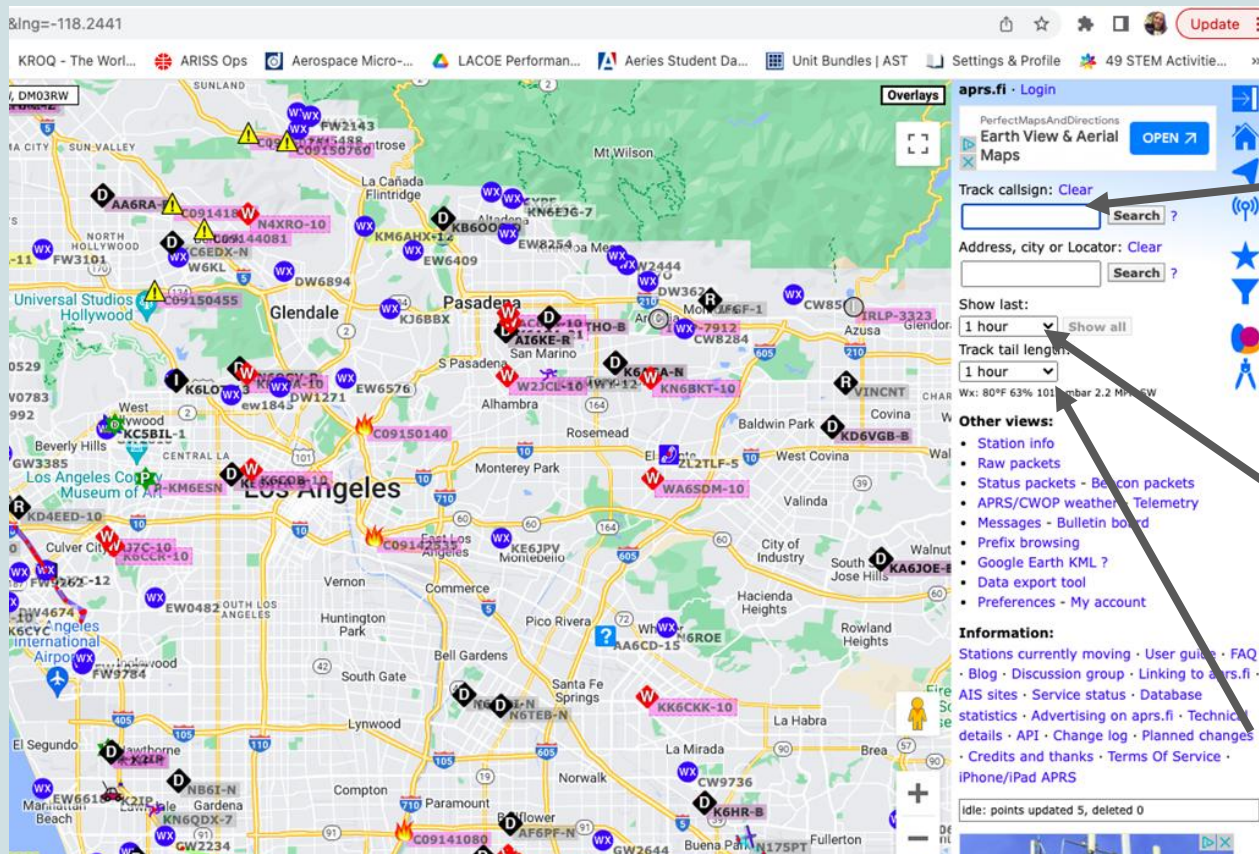
- Ideally on a clear day with no wind, and no trees close by (ESPECIALLY with a WSPR, due to the length of the antennas).
- Can have some clouds, but similar to HAB, you don't want more than 25% clouds- even the smallest cloud can and will affect the mass
- Do not need to get FAA clearance- FAA rule 101 defines what weights are allowed, and we are well below that amount

You made the decisions, you have the students with you... now what?

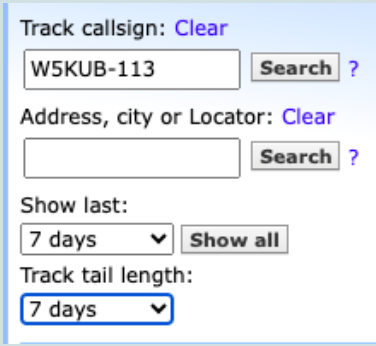
We can track balloons already in the air!

<http://aprs.fi>

It's going to look like a hot mess- but this is all you need!
We're going to look at a balloon that is up right now.



Under "track callsign"- put in W5KUB-113 DO NOT "search" yet!
Change to 7 days
Change to 7 days



Hey! It's the balloon!

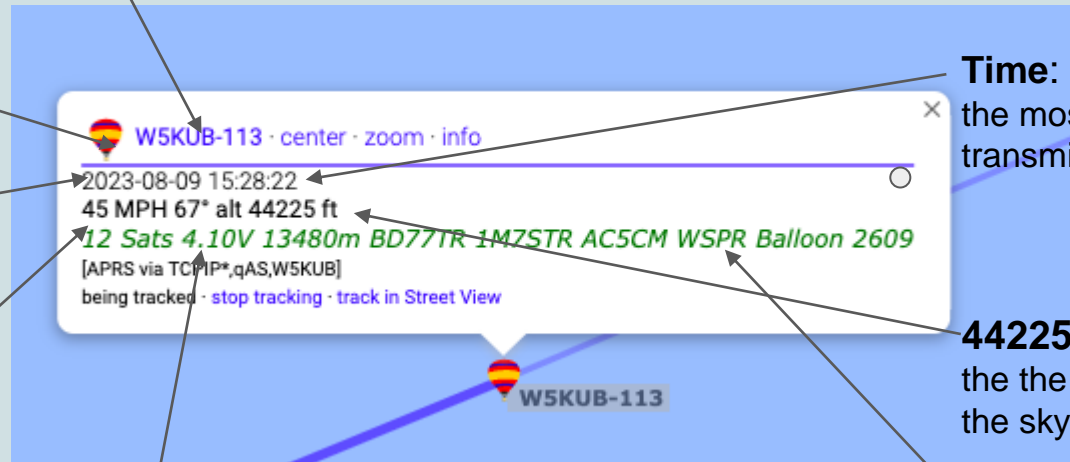
Callsign: **W5KUB-113** (this is the group's 113th flight)

The icon shows you it's a balloon, not a car, a dog, an ambulance, or something else.

Date: 2023-08-09- the date of the most recent transmission

45 MPH = the speed the balloon is traveling

How many volts the panels have to send out the packet. Good to keep an eye on to see if the Sun is setting.

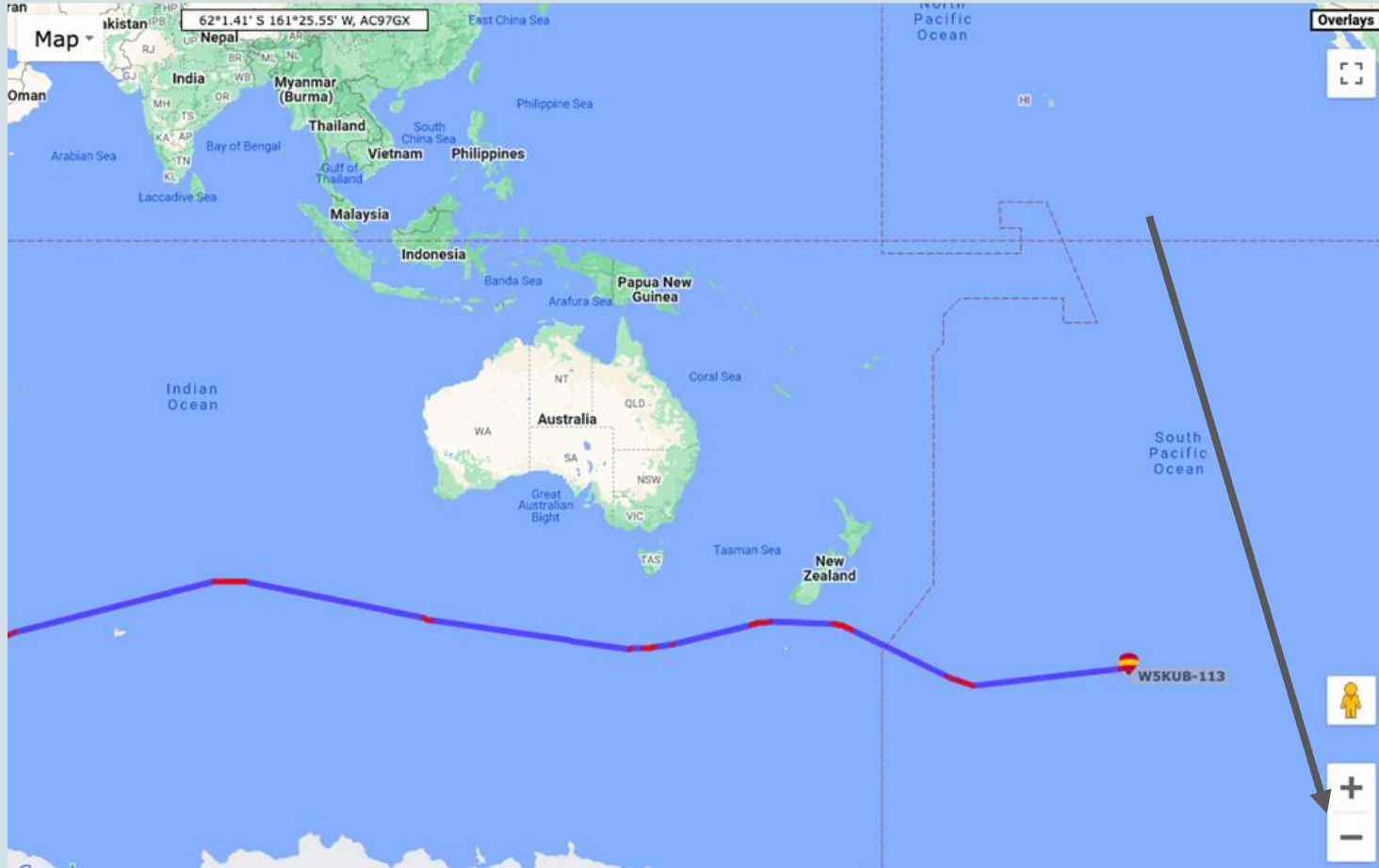


Time: 15:28:22 of the most recent transmission

44225 ft = how high the the balloon is in the sky













Shows what kind of radio- this shows WSPR, but we're on APRS. Some super tech guys are figuring out how to get the two to play nicely together.

Zoom out! Zoom out! Where are we?



I've already made graphs and such for your students!

These were created back in 2020, when I organized the “mid-altitude balloon race” across the country- you can find them here in my google drive- <https://shorturl.at/bhvzG> (yes, I will send this out as well). Designed to be able to be placed directly on top of each other, so if you print out and hold up to a light, you can have the juxtaposition.

Name	↑	Owner
	Altitude graph-Mylar-JM 	 me
	Altitude graph-SBS-13-JM 	 me
	Speed graph- Mylar or SBS-13-JM 	 me
	Temperature graph-JM 	 me

Questions?



Joanne Michael

KM6BWB

j_cozens@yahoo.com