

# Amateur Radio Ballooning

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# Two Types of Amateur Ballooning

## Pico-Balloons (“Picos”)



Small “party balloons” designed to float in the jet stream (10-14km ASL) for many weeks or months, often looping the Earth

## High-Altitude Balloons (“HABs”)



Much larger balloons designed to fly for 2-3 hours, flying up to 35km ASL, carrying radio repeaters, cameras, and other experiments



# A Multi-Disciplinary Hobby!

- ▶ Materials science
- ▶ Wind/Weather profiling
- ▶ Thermodynamics
- ▶ Weak signal propagation
- ▶ Power management
- ▶ Chemistry
- ▶ Precise measurement of weight and lift

---> And a LOT of critical thinking!



# “Do you need permission?”

- ▶ Surprisingly no! At least not in Canada.
- ▶ Only rules are you cannot use more than 115 cubic feet of gas and must avoid airports (like with drones).
- ▶ Use some common sense – avoid power lines and other hazards



# What Gas Do You Use?

- ▶ Pure Helium (hard to get right now) or Hydrogen
- ▶ Yes, it is safe - as long as you aren't doing something stupid like smoking.







# Part 1: Picos

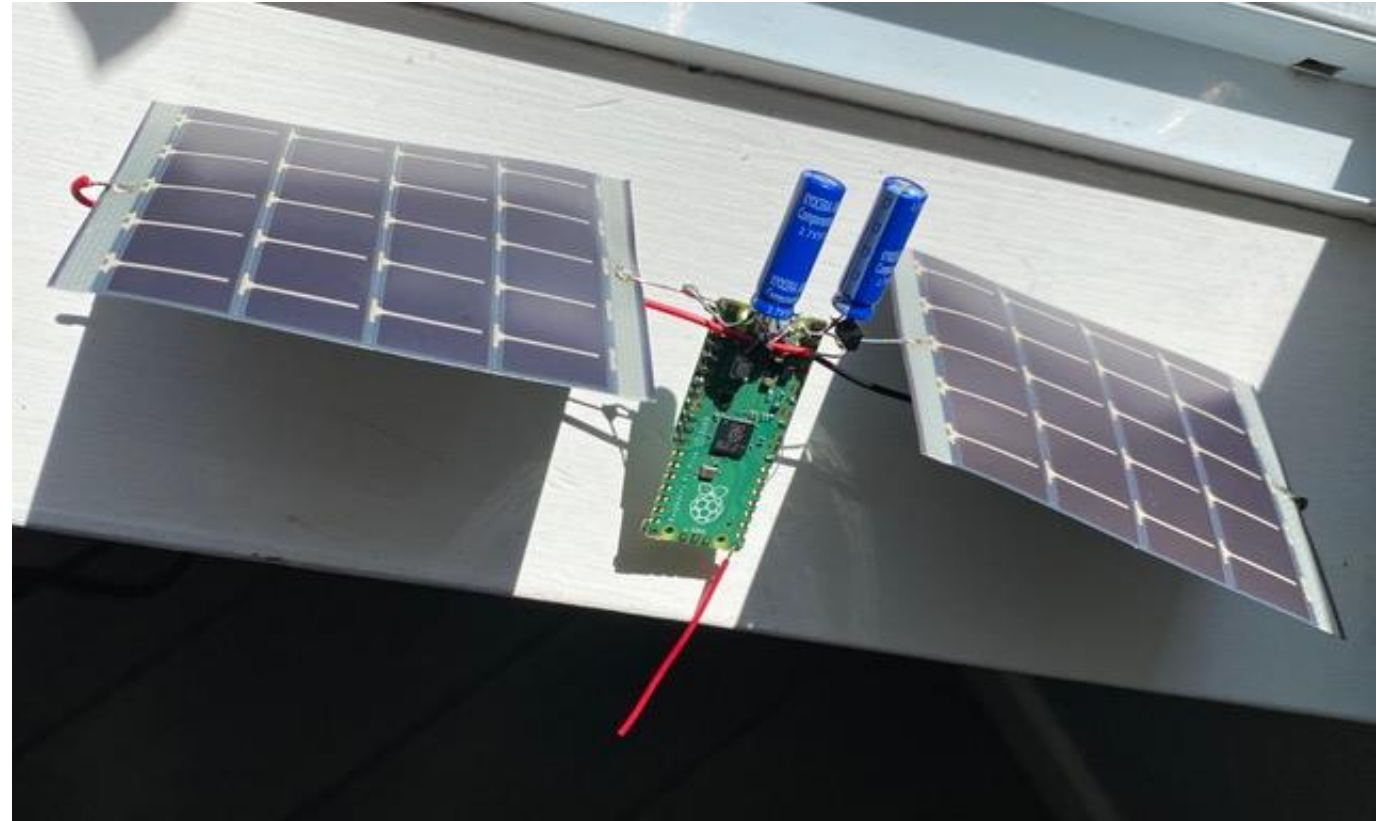
# The Balloon

- ▶ Mylar (polyethylene) party balloon
- ▶ Around 32" diameter / 100" circumference after "stretching"
- ▶ Inflated at launch with 5 grams of "free lift"



# The Payload

- ▶ Must be light! Less than 20 grams (less than three toonies or four US quarters)
- ▶ Solar powered with capacitors to store charge
- ▶ Raspberry Pi pico
- ▶ GPS receiver
- ▶ 27 mW WSPR transmitter
- ▶ Antenna: 38-gauge magnet wire (one tenth of a mm diameter!)
- ▶ Antenna is a 20m halfwave dipole, so 5 metres above and below the tracker.



(Solar panels are 9 x 7cm)

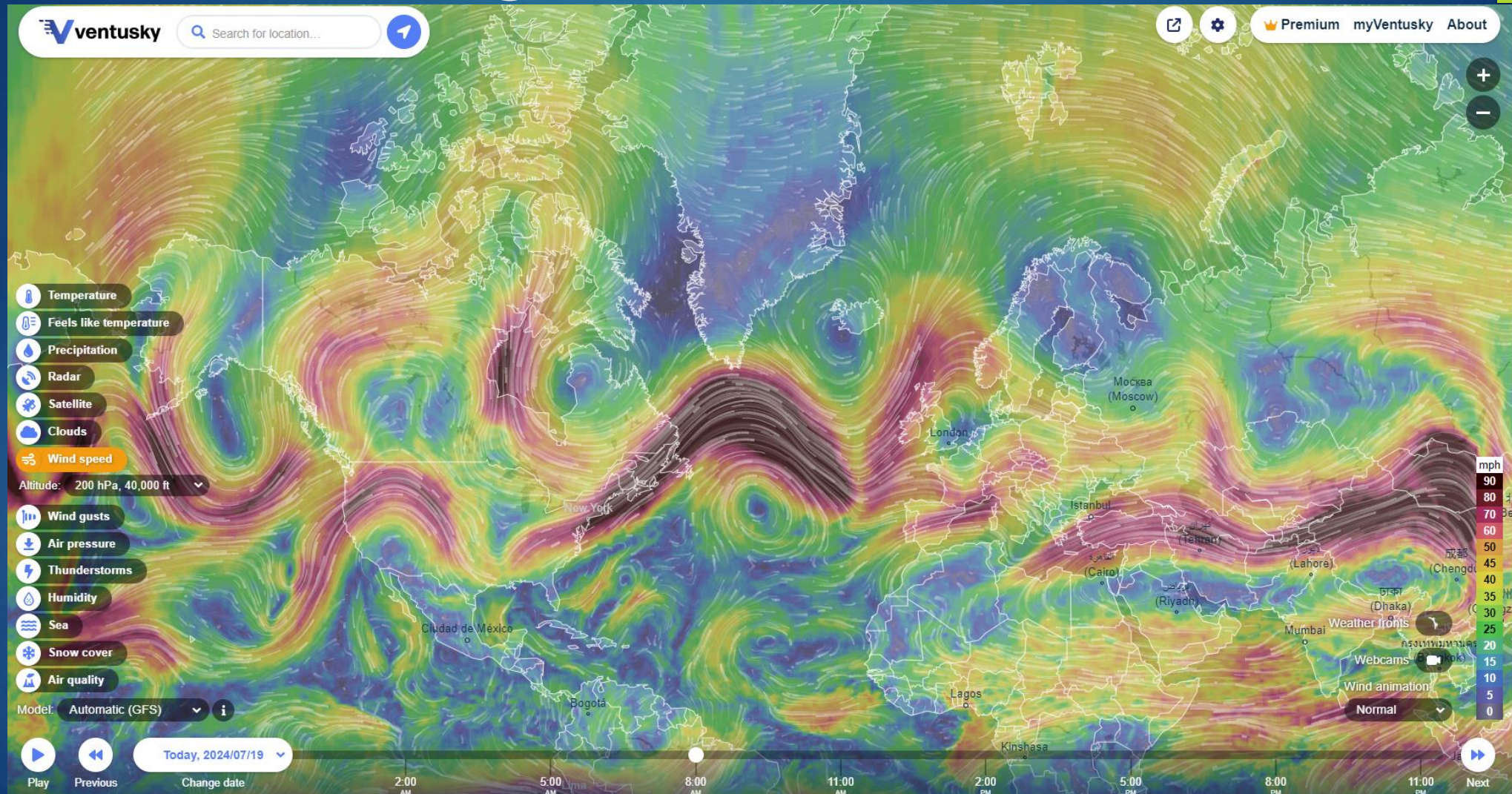


# Video of pico launch





# Where will it go?



► <https://www.ventusky.com/?p=57;-39;2&l=wind-200hpa>



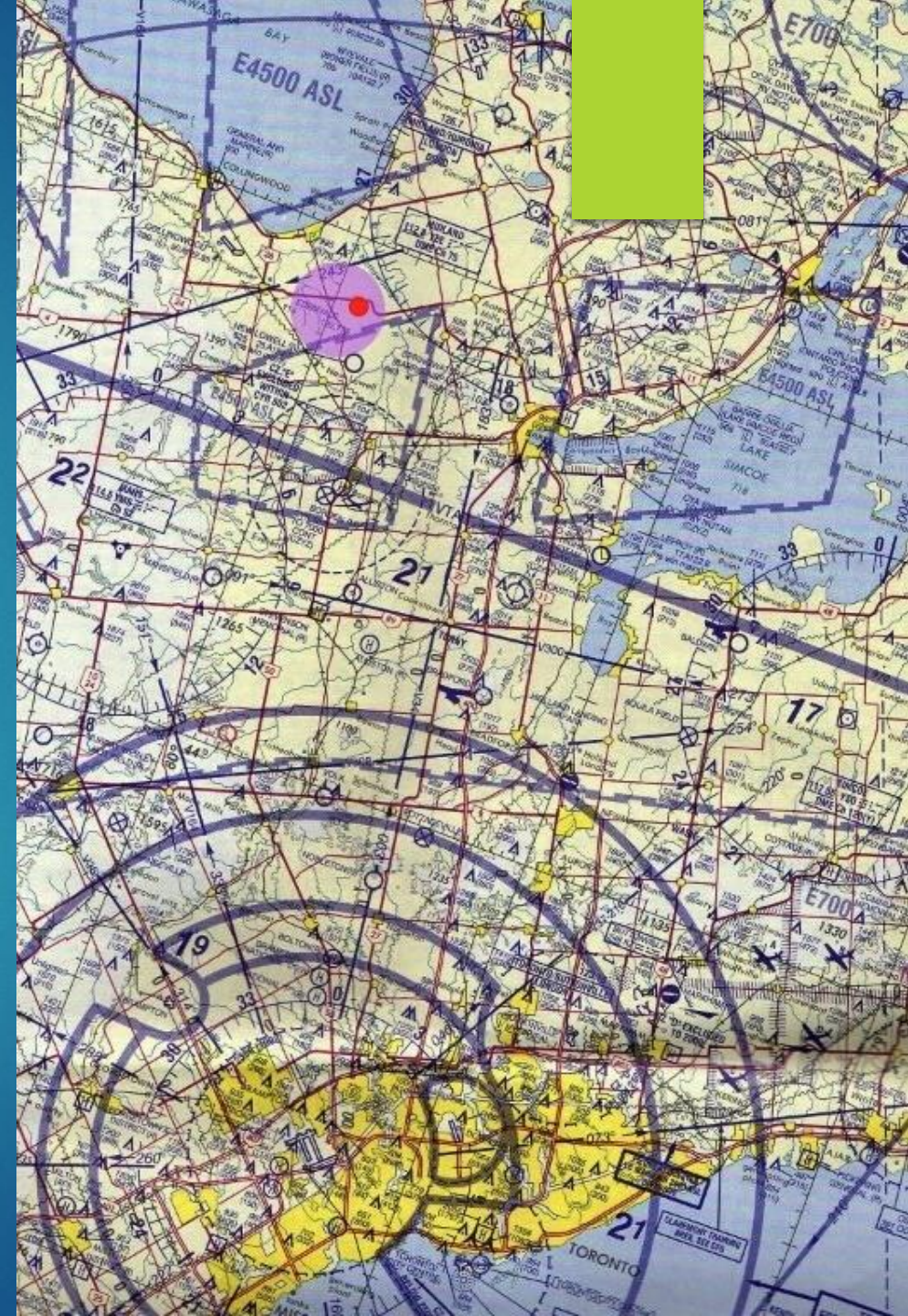
# Tracking Picos on SondeHub.org





# Challenges to Navigation

- ▶ Getting to float altitude - rain/ice/wind
  - ▶ Too high = burst, too low = risk of rain
- ▶ Getting too hot and bursting
- ▶ Getting too cold and becoming brittle
- ▶ Solar storms!
- ▶ GPS outages over war zones
- ▶ Exclusion zones: N. Korea, Yemen, Latvia, UK (!)
- ▶ Floating into arctic darkness
- ▶ Getting shot down? No. Not anymore.





## Part 2: HABs



# The Balloon

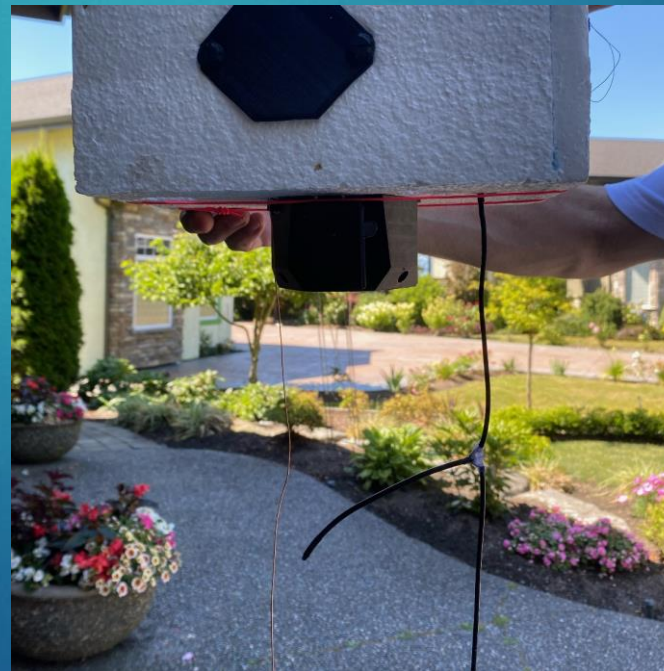
- ▶ Latex weather balloon capable of handling over 1 kg payload
- ▶ Must be handled carefully – with gloves!





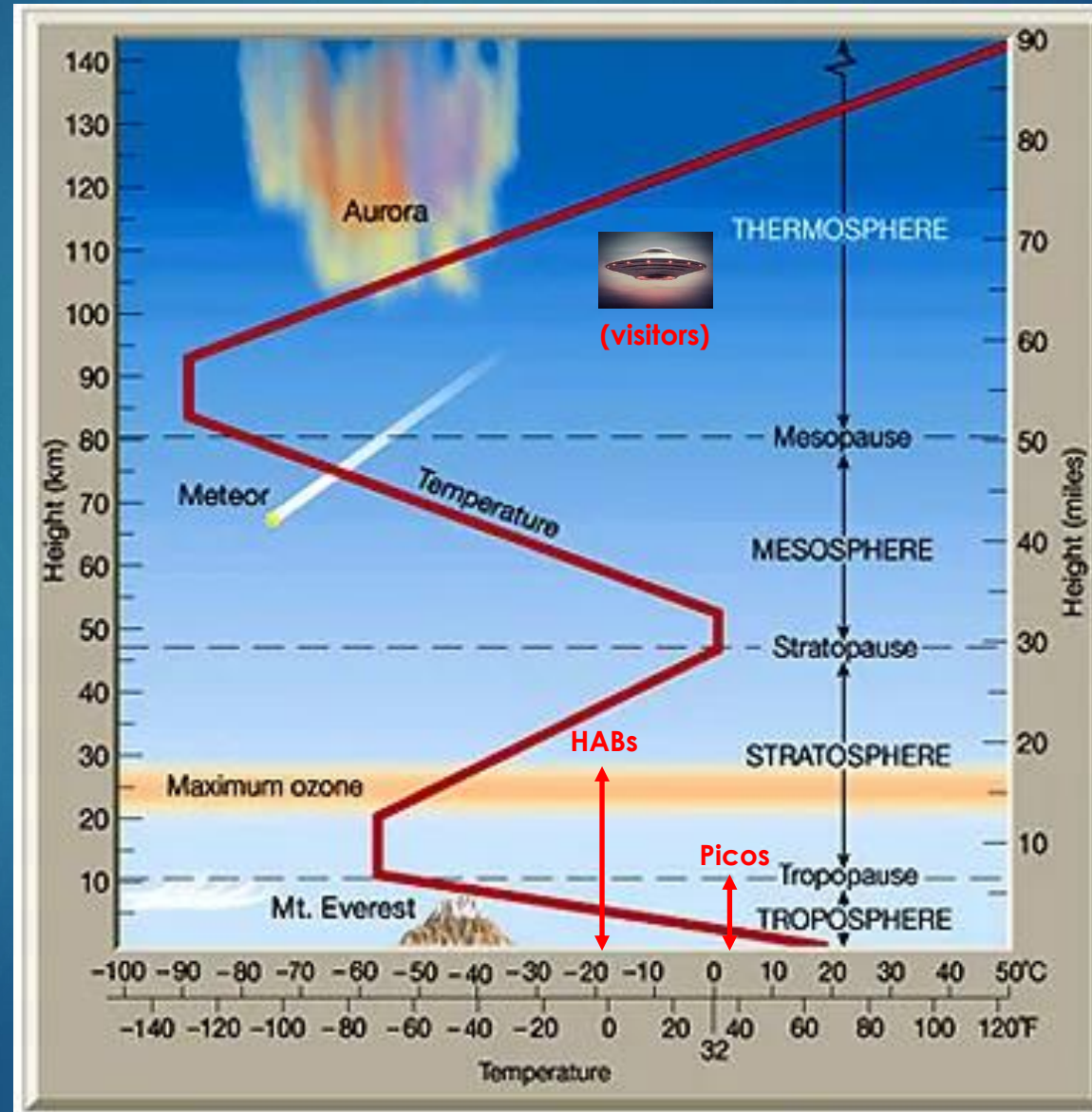
# HAB Payloads

- ▶ 1 Watt VHF/UHF radio repeater (acts like a low-orbit satellite).
- ▶ 0.5 Watt GPS / APRS transmitter
- ▶ Cameras
- ▶ Particle sensors
- ▶ Radiation detectors
- ▶ Flashing lights
- ▶ Star wars animation figures

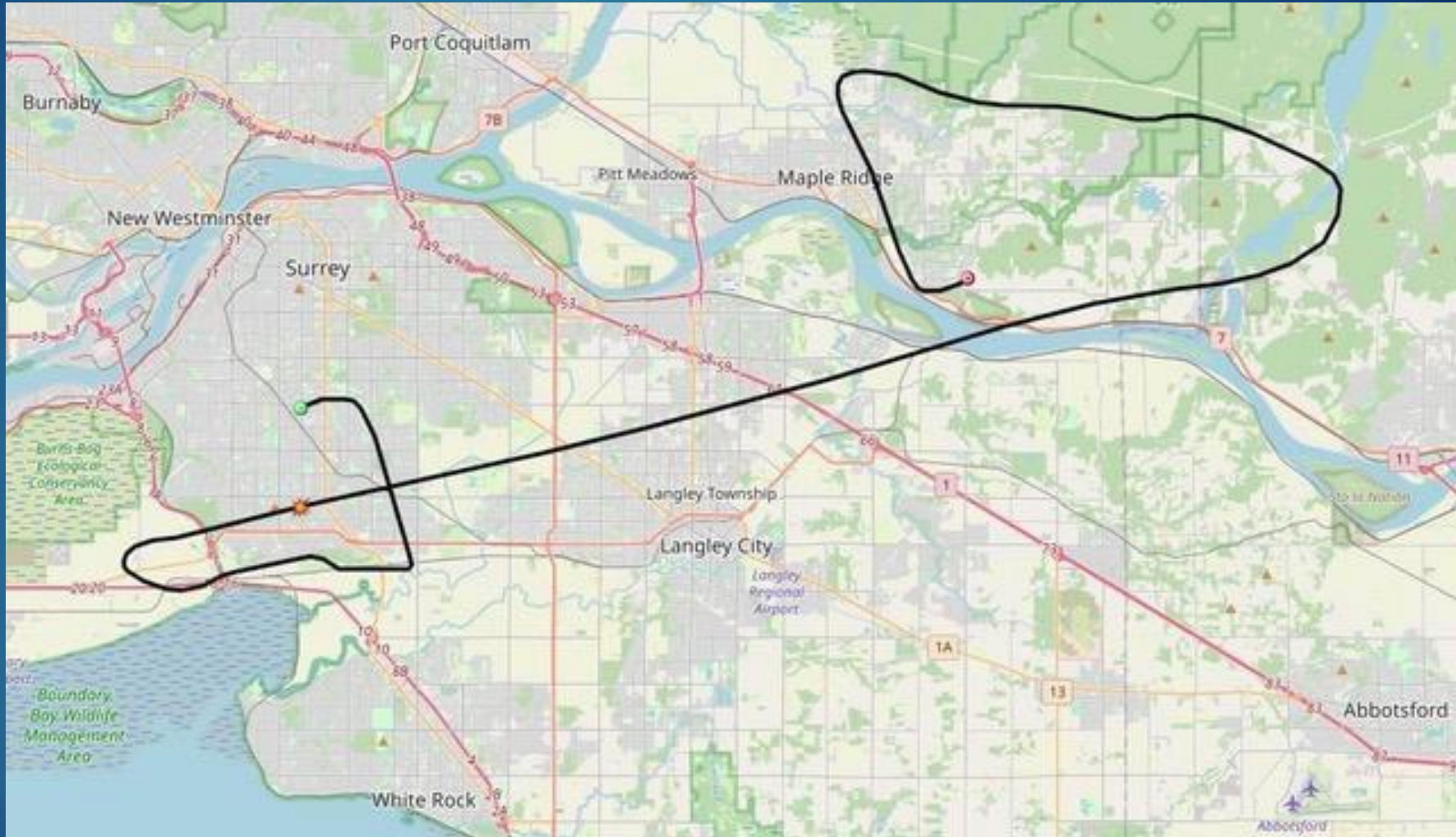




# Managing Temperature



# Where Will It Land?



Our nighttime February 2024 launch from Maple Ridge landed *when* and *where* we predicted: 2.5 hours later and within 300 metres of the prediction.



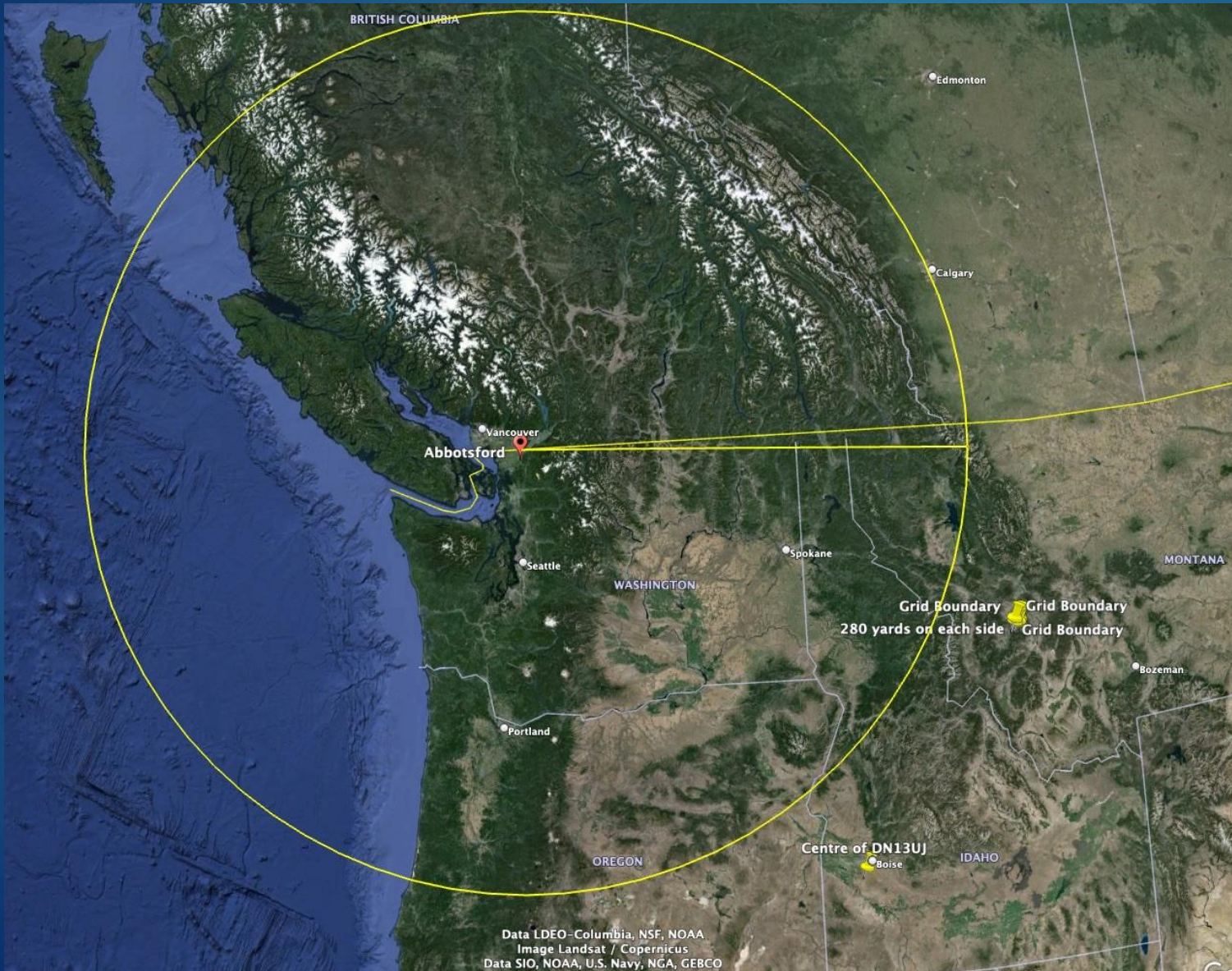


We also did a night launch





# Audio From HAB Repeater



At 31km ASL the horizon is 630km!

▶ [HAB Audio Excerpt - July 7 2024 \(youtube.com\)](https://www.youtube.com/watch?v=...)



# What does it cost?

- ▶ There's nothing more fun than watching your money fly away!
- ▶ Picos cost ~ \$100.
  - ❖ You don't expect to recover them, but we put our contact info on anyway.
- ▶ HABs cost ~ \$600.
  - ❖ \$400 of which can be reused if you recover the balloon
- ▶ We were funding this ourselves but then hams asked us to start a GoFundMe page so we could do more flights for everyone to follow and enjoy (found at [www.ve7nfr.com/pico-balloons.html](http://www.ve7nfr.com/pico-balloons.html))





# What's the Plan for 2025?

- ▶ Trying to get our first pico circumnavigation. Waiting on the weather to improve.
- ▶ Next HAB flight will likely include a live video broadcast from the balloon, improved GPS/APRS performance, and of course, recovery of the payload.

Follow our progress at [www.ve7nfr.com/pico-balloons.html](http://www.ve7nfr.com/pico-balloons.html)  
or follow BC Ham Radio group on facebook for updates.

Questions to Adrian c/o [ve7nz@myrac.ca](mailto:ve7nz@myrac.ca)



**Thank you.**

