Full of hot (lighter than) air

Developing a new helium fill calculator

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Why yet another fill calculator?

Existing helium prediction script had some shortcomings:

- Used hard-coded constants based on incorrect assumptions about tank volume.
- Requires Python to be installed - can't run anywhere.

Kentucky team also wanted outputs in terms of free lift, so we could use a ballast to measure fill.

CUSF Habhub calculator gives these values but was consistently resulting in low rise rates.

Algorithm

- Set up system of forces on balloon: buoyancy, drag, & gravity with mass of helium used as unknown.
- Solve for mass of helium used.
  - Use numerical rather than symbolic solution.
    - Removes dependency on symbolic math library.
    - Speeds up execution.
- Use Boyle's Law to get tank pressure delta.
- Find free lift needed from buoyant force and payload mass.

Helium Balloon Fill Calculator

Mass of balloon		Current air pressure		Desired rise rate	
600	grams	1013	millibars	5	meters per second

Mass of payload		Current air temperature		Tank volume	
100	grams	30	°C	2990	in^3

Edit Constants

Calculate Fill

Results

Mass: ❓
0.284 kg

Volume: ❓
1763.390 liters
1.763 m^3
62.274 ft^3
107608.824 in^3

Pressure: ❓
528.752 psi

Lift: ❓
Gross: 1.769 kg
Free: 1.069 kg

New Calculator

PROS:

Simple, well-labelled code

Highly configurable with user input

Input validation

Runs on anything with a web browser

Runs 6x faster

CONS:

PSI output values are not well-verified

Requires user to provide more input fields

Less inter-operability with other scripts

Pretty formatting requires an internet connection

Try it yourself!

https://ukyuav.github.io/hab_fill_calc/

See the code: https://github.com/ukyuav/hab_fill_calc