AA103 Air and Space Propulsion – Project 1

Dynamics of a Balloon Rocket
Due April 11, 2019
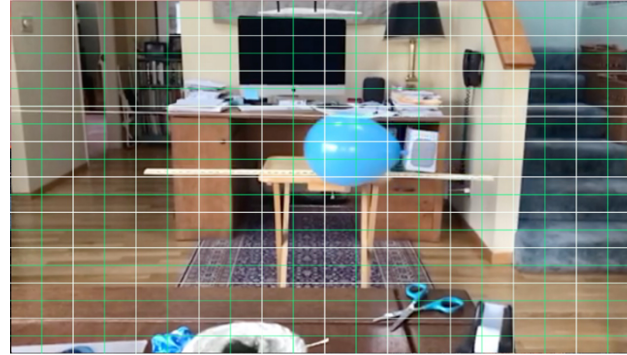
You have all been given a packet containing ten 12 inch and one 17 inch (cardinal or white) balloons, two straws, a bag cinch and 60 feet of polyester thread. The balloons are made of <u>natural latex rubber</u> (also simply called <u>latex)</u> . I would like you to:

1)   Use your iPhone or equivalent to measure the position versus time of a balloon released from rest. Try to capture as much of the trajectory as possible including the final motion as the balloon comes to rest. Feel free to add weight to the balloon if you wish.
2)   Use your data to estimate the velocity and acceleration of the balloon.
3)   Measure the pressurized and unpressurized mass of the balloon. Use this along with geometrical information about the balloon to estimate balloon thrust.
4)   Carry out a measurement of the static thrust of the balloon versus time. How does it compare with your data?
5)   Estimate the Reynolds number and drag of the balloon. Estimate the drag due to the apparent mass effect as the balloon accelerates.
6)   Estimate the friction due to the straw. You don't necessarily need to fly the balloon horizontally.
7)   Estimate the thickness of the balloon and hoop stress in the balloon material when it is inflated.

You should each do your own experiments, measurements and report but feel free to get help from a friend or Matt to hold the camera, release the balloon, etc.

Matt Subramaniam will help you with access to my lab to use the scale.

Turn in your results in the form of a report in a format that would be appropriate to a conference paper for the Joint Propulsion Conference (https://www.aiaa.org/Tech-Presenter-Resources/). Try to stick to a length limit of 10 pages although you can add appendices with data, videos, etc, if you wish.