

Experiment: Parachute vs. Streamer

Purpose

The purpose of this experiment is to determine if the effectiveness of a streamer and parachute adequately line up with the theoretical model by testing each apparatus in real conditions. This is necessary to determine which of these will be chosen to limit the speed of the CanSat during phase 1 of its descent.

Theoretical Background

Air craft are a common mode of transporting goods and people across the world. Sometimes it is necessary to deliver these goods or people without landing the plane. During these instances the terminal velocity of the falling objects must be limited to prevent a heavy impact from damaging goods or injuring people. The terminal velocity of an object is reached when the objects drag force is equal to its weight. Multiple types of passive aero-braking systems have been implemented using this fact by decreasing the velocity that drag equals weight. For this experiment a parachute and a streamer will be tested to see how they fit the model.

The terminal velocity of an object is determined using the equation below:

Where m is the mass of the object, g is the gravitational constant, ρ is the density of the air, C_d is the coefficient of drag, and A is the area of the aero-brake. The coefficient of drag for a parachute with no hole or slits is 0.75. The coefficient of drag for a streamer can vary from 0.14 to 0.4 depending of the surface roughness and whether or not the material can be folded.

Experimental Apparatus

A Large Can of Oats

A large can of oats is around the size that the CanSat must be to fit inside the rocket. The can of oats should be full.

A Model Rocket Parachute

A Streamer (Ribbon)

Fishing Line

Stop Watch

Procedure

- Make two small holes in the bottom of the can of oats.
- Remove some of the oats until the mass of the can is about 740 grams and tape the lid

closed.

- Find a tall structure you can drop the test rig off of that the height can be measured and does not endanger any bystanders.
- One person will go to the top of the structure with the can of oats, the parachute, and the streamer. A second person should stand a safe distance away at the bottom of the structure.
- Attach the parachute to the bottom of the can of oats with fishing line.
- Hold the Cansat over the ledge in one hand (do not lean over the ledge) and raise the other hand.
- Drop your raised hand when you release the Cansat.
- When the person dropping the test apparatus drops their hand, the person on the ground will start their timer.
- When the test rig hits the ground stop the timer.
- Repeat once more.
- Repeat twice with the streamer attached.
- Compare the measured time with expected time from the MATLAB code.