Ian Abstract:

Deploying a parachute within a Thrust Vector Control model rocket system is not trivial. Thrust Vector Control (TVC) model rocketry is a type of rocketry in which aerodynamic fins are not used and instead the thrust angle is manipulated with electrical actuation to stabilize the rocket. Model TVC technology mimics how space bound rockets are stabilized along their flight path to orbit, the only difference is the rocket does not reach orbit due to the size of the engine. Typically when you launch a model rocket, the engine has a built in ejection charge to deploy a parachute for a safe landing. However, since we are manipulating the engine in a gimbal, the parachute charge does not act as it normally would since there is an electromechanical system inside instead of empty space. Typically, TVC enthusiasts solve this issue by using a detached black powder charge to deploy their parachute, but this method is not safe and can be unreliable. In our project we wanted to answer what is the best method to deploy a parachute for TVC rocketry in terms of reliability and safety. To do this, we created a design study to compare 1) a Through Body Flange design, 2) a Helicopter Air Brake, and 3) a Spring Loaded Parachute Ejector. We compared these methods through a combination of research and prototype design testing to arrive at a conclusion that the Spring Loaded Parachute Ejector is the best parachute deployment method for TVC model rocketry.

Edited:

Thrust Vector Control (TVC) model rocketry is a type of rocketry in which aerodynamic fins are not used and instead the thrust angle is manipulated with electrical actuation to stabilize the rocket. Model TVC technology mimics how space bound rockets are stabilized along their flight path to orbit; the only difference is the rocket does not reach orbit due to the size of the engine. One challenge in TVC model rocketry is parachute deployment. Typically the engine in a conventional model rocket has a built-in ejection charge to deploy a parachute for a safe landing. However, since TVC model rocketry manipulates the engine in a gimbal, the parachute charge is not effective because there is an electromechanical system inside instead of empty space. Typically, TVC enthusiasts solve this issue by using a detached black powder charge to deploy their parachute, but this method is not as safe and can be unreliable. This project examines what is the best method to deploy a parachute for TVC rocketry in terms of reliability and safety. To do this, we created a design study to compare 1) a Through Body Flange design, 2) a Helicopter Air Brake, and 3) a Spring Loaded Parachute Ejector. We compared these methods through a combination of research, analysis, and prototype design testing to arrive at a conclusion that the Spring Loaded Parachute Ejector is the best parachute deployment method for TVC model rocketry.