


APOGEE
PEAK OF FLIGHT
NEWSLETTER

What is an Over-Stable Rocket?

By Tim Van Milligan

The RockSim program has revolutionized the way modelers look at rocket designs. And this is a good thing. It makes the hobby safer, and it gives us yet another way to immerse ourselves into the fun of rocketry.

But now that we're learning all types of great things, we may discover something we don't fully understand. One of these is the term "over-stable." What does this mean?

When RockSim indicates that a rocket is overstable, it is simply telling us that the distance between the CG and the CP is greater than two body tube diameters. That is the criteria for an over-stable rocket.

Is this good or bad?

Being unstable in a rocket design is bad. Being over-stable is not bad. It basically means that the rocket will have a greater tendency to weathercock if there is any wind at launch. Instead of the rocket going straight up, it will gradually turn into the wind. It is possible that the rocket could travel horizontally -- which is bad. That is why we need to remind ourselves of an over-stable design. We need to make sure that when we launch the rocket, that it will travel in a straight-up direction.

You can play with this in RockSim by creating a long rocket with big fins. Then set the wind velocity at 20mph and run some simulations. By using the "Flight Profile" feature of RockSim, you can see how the rocket will behave in windy conditions.

If your rocket design is over-stable, you should use extra caution on breezy days. By running these simulations, you may decide to modify the configuration of the rocket so that it has less tendency to weathercock into the wind.

I would also recommend switching to a motor that has a higher average thrust level, and also use a longer launch rod. This will allow the rocket to reach a higher lift-off velocity, and it will be less effected by the wind. You can simulate this in RockSim, and I highly recommend that you perform as many

simulations as you think is necessary. You want to bracket the behavior of the rocket with different motors, and see how it flies in different wind conditions.

There is a free demo version of the RockSim software on the Apogee Components web site. After you download it, you can design rockets, and run them through simulations to see how it will behave under different motors and flight conditions.

About the Author:

Tim Van Milligan is the owner of Apogee Components (<http://www.apogeerockets.com>) and the curator of the rocketry education web site: <http://www.apogeerockets.com/education>. He is also the author of the books: "Model Rocket Design and Construction," "69 Simple Science Fair Projects with Model Rockets: Aeronautics" and publisher of the FREE e-zine newsletter about model rockets. You can subscribe to the e-zine at the Apogee Components web site, or sending an email to: ezine@apogeerockets.com with "SUBSCRIBE" as the subject line of the message.



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