

MULTI-STAGE ROCKET RULES

TRIPOLI MID-OHIO #31

There is an old adage that refers to staging of rockets that goes something like this: "The mathematics of staged rocket flight is $1+1=5!$ "

When everything works as designed, a multi-stage high power flight is spectacular. However, when something goes wrong, things can get ugly really quickly. There is no doubt that a multi-staged rocket flight anomaly presents a higher risk of injury or property damage than a conventional single stage rocket.

There are several failure modes present in multi-stage rockets not present in single stage flights including sustainer motors firing when they are not supposed to (on the ground or in flight) as well as sustainers firing after the booster has failed for one reason or another. These failure modes directly impact safety of both the flyers and spectators as the result can be the flight of a rocket under thrust in a non-vertical trajectory.

In an effort to minimize risk, effective November 1, 2017, Tripoli Mid-Ohio #31 has implemented new safety rules regarding high power multi-stage flights at our field:

- An altimeter capable of inhibiting the ignition of the sustainer unless a specific time/altitude threshold is met, or an altimeter that checks for vertical trajectory of flight prior to sustainer ignition.
- Use of timers for second stage ignition is not permitted.
- All staged flights must be approved prior to showing up at the launch. We would prefer at least a week's advance notice.
- There will not be any drag races of multi-stage rockets regardless of impulse installed. When you consider the complexity of each flight with the number of events that must occur for a successful and safe flight, Tripoli Mid-Ohio #31 is not willing to subject our spectators and guests to that level of risk.
- The flier must provide a simulation for the RSO, in order to verify velocity/altitude threshold for allowing sustainer ignition. The rule of thumb is at least 80% of the expected altitude when the sustainer ignition sequence is activated, and at least 200 feet per second velocity when the sustainer comes up to pressure.
- A thrust to weight ratio of 5:1 on the booster + sustainer stack and 3:1 on the sustainer alone is a reasonable minimum.

New: November 1, 2017

Updated: February 22, 2018