Launch Tower

Team 58 Technical Presentation to the 2017 IREC

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INTRODUCTION

The launch tower is a new system developed by the Texas A&M Sounding Rocketry Team during the 2016-2017 academic year. The goal of this new system is to facilitate safer launches by decreasing weight and increasing stability of the structure, compared to the launch infrastructure used by the team in the past. It is also the goal to facilitate the launch of heavier rockets beyond what can be achieved with rail buttons. The launch tower's adjustable rail design allows the launch of rockets of varying body tube diameters, with or without rail buttons. The launch tower is integrated with the launch trailer to facilitate hybrid launch operations.

RAIL DESIGN

It was the objective of the rail design to allow for the launch of various rocket sizes without the need for rail buttons. The launch tower utilizes multiple rails contacting the side of the rocket body in order to constrain lateral movement as the rocket exits the tower. One rail supports the rocket from directly underneath when lifting from a horizontal to vertical position. Three or four rails can be installed, corresponding to the number of fins on the rocket being launched. The rails are adjusted radially to conform to the body of the rocket.

The launch tower rails are composed of t-slotted extruded aluminum, which was chosen for its ease of assembly, modularity, light weight, and bending stiffness. In addition, the t-slots allow the use of rail buttons should they be required. The tower has a rail length of 30 ft.

TOWER STRUCTURE

The tower consists of six plywood platforms vertically spaced 5 feet apart, connected by vertical aluminum square tubing at the corners for a total of 25 ft of structure. The rails pass through the center of the platforms and are adjusted at their connection points at each plaform, and extend 5 ft above the structure. Plywood was the chosen material for the platforms due to ease of workability, light weight, and low cost. 6063 aluminum alloy was chosen for the vertical tubing due to its corrosion resistance, low cost, and favorable strength-to-weight ratio, which is comparable to low carbon steel. The total weight of the main tower structure is approximately 300 lbs, and each rail weighs 20 lbs. The cross-section of the tower structure is 42" x 46" square. This provides a large spacing between the feet of the tower, increasing its stability.

The rocket rests on a steel cap plate assembly at the base of the tower. Three load cells are sandwiched in between the cap plate and a steel protector to shield them during launch. The load cells record weight data in real time for oxidizer filling immediately before launch.

TRAILER INTEGRATION

The launch trailer serves multiple functions in addition to providing transport of the tower to the launch site. The trailer is used as a stable base on which the launch tower is attached and raised. A steel frame and hinge is located on the back edge of the trailer, on which the tower rotates from a horizontal to vertical position. Trailer jacks are used to level or otherwise orient the tower to the desired launch angle. This is assisted by adjustable leveling feet on the tower itself to maintain contact with the ground for all four legs of the tower.

RESULTS, CONCLUSIONS, AND FOLLOW-ON WORK

The launch tower has been successfully assembled and erected in less than an hour with an assembly crew of 6-8. It has proved to be safe and stable during the erecting process, as well as when vertical and subjected to transverse wind loads. Rocket integration into the tower has also been successful, and rail clearances are as expected. It is expected that the rocket will exit the tower successfully during launch.