Design Testing Highlights
Level II Team 18

Introduction

As part of the design validation phase of Team 18's Preliminary Design Review process, several live drop tests were conducted with a prototype lander. The purpose of these tests was to determine if the design's performance was up to standards in terms of the controlled descent, landing and payload deployment. For the best possible results, the tests were conducted at two different locations, each providing unique landing surfaces that ultimately confirmed that the design needed to be changed in order to work in different conditions found on Mars, and more specifically, Terby Crater.

Location: The tests were done primarily on the Chardón building of the University of Puerto Rico at Mayagüez Campus, with additional tests being done at the Physics building located very close to the first location. Coordinates are: **18.210170 N, 67.140364 W** & **18.211051 N, 67.139514 W.** In total, 13 tests were conducted in the Chardón building on grass-covered ground while 3 additional tests were done in the Physics building on a cement landing surface.

Analysis: The grass-covered ground proved to be a troublesome area to conduct tests in due to the grass acting as a buffer between the ground and our lander, which in turn caused our release mechanism to not be as effective as predicted. Therefore, after the scheduled tests were done, the team decided to try out a different location with a concrete landing area to see the effectiveness of the new material on the lander's parachute release. We concluded that changes had to be made to the release mechanism in order to ensure that it can properly operate on the soft surface of Mars' sand-covered landing location.

Time & Date: Tests were conducted on Sunday, March 31st 2019 between 11:00 am and 6:00 pm.

Design Review: The triangular pyramid design proved to be optimal for rough landing and protecting the science payload. In many failed attempts the main body managed to escape almost completely unscathed from the drop. The bubble wrap helped to absorb part of the impact; justifying the use of airbags for extra protection on the design. Having said that, the most troublesome part was the parachute deployment. Most of the failed attempts came from the parachute coming off from the lander before touchdown and leaving the payload free falling from two or three meters. To work around the problem the design was tweaked a bit. The team decided to add friction at the base of the pyramid using hot glue where the release button of the parachute is located. This way we avoid the early deployment of the parachute since a little bit of force is needed to move the mechanism, a force that could only be provided by the impact.

Design Images

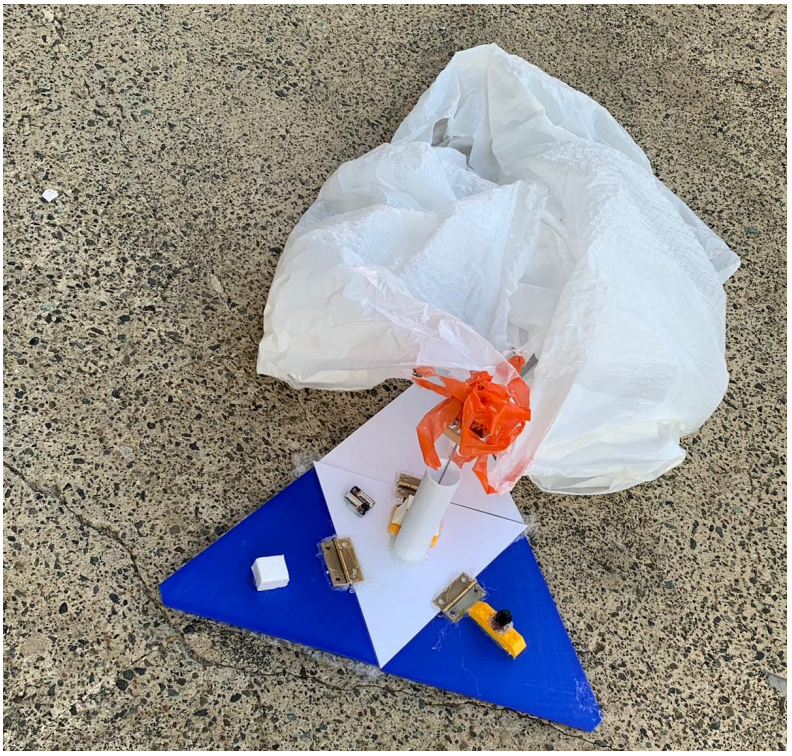

Figure 1: Lander with Deployed Payload

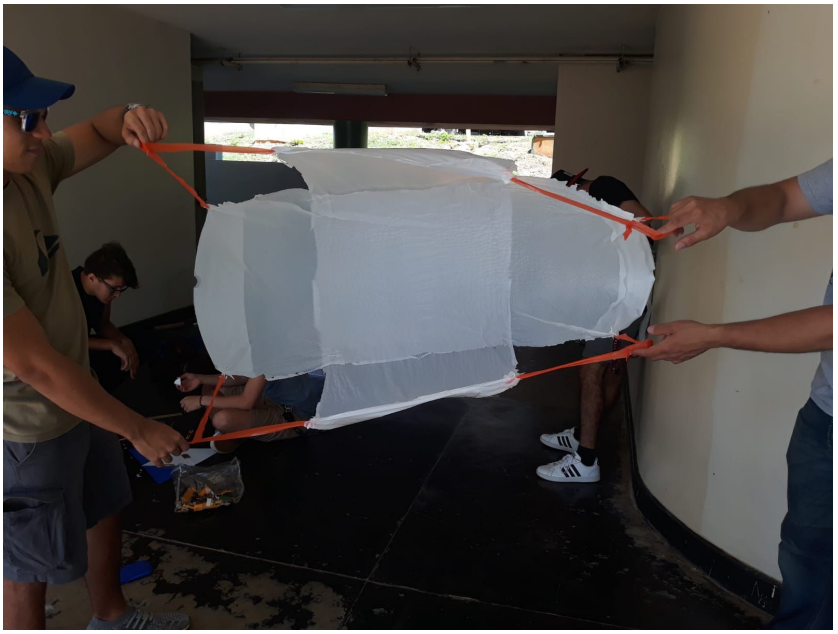

Figure 2: Parachute Manufacturing and Testing

Footage of the Tests: ***https://youtu.be/w8UbktQhp98***