

Motor Test Stand

Static fire test of a rocket motor

Graduate



Andrea Schelbert

Initial Situation: “Projeto Jupiter” is an undergraduate, student-run rocket design group at the University of São Paulo, founded in 2015. The group provides all members with opportunities to develop, build, and work on aerospace projects.

Projeto Jupiter is participating in a rocket competition category where they must develop the rocket motor themselves. Before a launch can take place, a static test of the motor must be conducted. Several parameters are measured during the test. These measurements help characterize the engine's performance and identify any design issues.

Currently, Projeto Jupiter's test stand positions the oxidizer tank vertically above the engine. The engine thrust and the tank's weight are both measured by a load cell scale. This vertical arrangement makes it very difficult to measure the thrust separately from the oxidizer tank's fill level. Additionally, this vertical setup previously caused serious damage to the ground beneath the rocket engine.

Problem: To solve the aforementioned problems, a new test stand will be designed. The new test stand must fulfill the following criteria:

- The motor and the oxidizer tank should be placed side by side
- The motor must be oriented horizontally
- The ground beneath the motor must not be damaged
- The test stand must withstand a maximum force of 4000 N
- The test stand must be easy to assemble and fit inside a car for transport
- The motor must have as much freedom of movement as possible to ensure accurate thrust measurements
- The final assembly must be straightforward to set up outdoors using a minimal number of tools

Result: A new test stand was created and bolted to an existing steel beam. The test stand primarily consists of two aluminum profiles with linear guides attached. A steel plate is fixed onto the linear guides, and the motor is then mounted on this plate. The stand is designed to withstand the expected forces, as verified through various calculations. It was assembled on the Pirassununga campus and is now ready for its first test run.

The entire test stand was implemented as desired. All the requirements — such as budget and strength — could be fulfilled in the desired timeframe. The members of Projeto Jupiter were satisfied with the final result, and the collaboration was always very pleasant.

Advisor

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Co-Examiner

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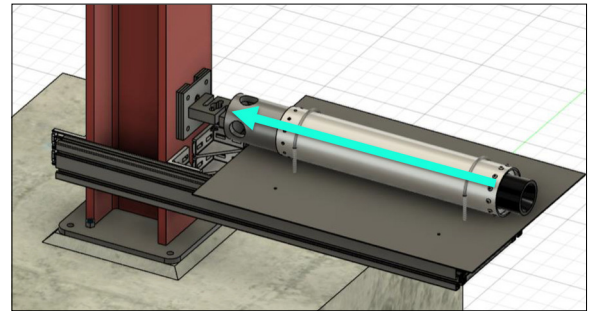
Subject Area

Product Development,
Construction and
System Technology

Project Partner

Projeto Jupiter, São Paulo, Universidade de São Paulo

test stand with motor direction
Own presentation



assembling the test stand
Own presentation



launch of a Projeto Jupiter rocket
Projeto Jupiter

