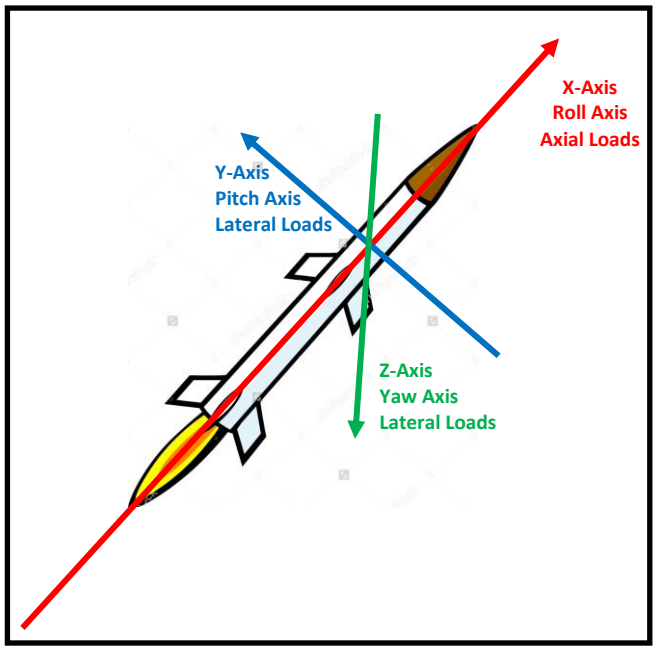
Launch Vehicle Environment

Satellites usually face a “rough” ride into orbit on their rockets. Forces acting on the satellite can literally shake it to pieces if it has not been designed correctly and tested to withstand those forces. These forces include “Axial Loads” cause by the acceleration of the rocket and occur along the long axis (X-Axis) of the rocket. The satellite must also deal with “Lateral Loads” caused by the sideways pitch and yaw motions of the rockets along the Y & Z Axis’s. Also, the satellite can receive a “Shock Load” from a sudden event on the vehicle such as the firing of explosive bolts to separate the first and second stages of the rocket or to release the satellite from the launch vehicle. All of these loads are measured in g’s. One g is one times the force of gravity. For example, a five-pound weight sitting on a table exerts 5 pounds of pressure on the table in 1 g. At 2 g’s, the weight exerts 10 pounds of pressure on the table. 3 g’s = 15 pounds, 4 g’s = 20 pounds, and so on. Finally, the satellite can experience “Acoustic Loads” from the rocket. These acoustic loads are caused by very large sound waves (think absurdly loud, make your ears bleed rock concert). These sound waves come from the noise of the rocket’s engines or the sound of the air rushing past the payload fairing. Acoustic levels are measured in Decimals (dB).



The satellites are built to withstand a certain level of Axial Loads, Lateral Loads and Shock Loads. They are also tested to a defined level of maximum Acoustic Loads inside a payload fairing. Some of these loads can be improved by modifying the launch vehicle, such as by adding acoustic blankets inside the fairing for the noise or adding shock reduction mechanisms for separating the satellite from the rocket. However, these alterations may result in reduced launch vehicle performance, lengthen the time to prepare for launch and increase the launch costs.

Satellites are usually designed to survive the launch environments of a specific launch vehicle and fit inside that rocket’s payload fairing. However, different launch vehicles have different capabilities and environments. Teams must not recommend a launch vehicle which exceeds the environments the satellite is designed to experience or the volume requirements of the satellite. There is neither the time nor the money to make major modifications to the basic satellite.