

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Interactive Presentations (IP)

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A FULLY CONFIGURABLE MASS DUMMY DESIGN FOR CHANGING SPACECRAFT
STRUCTURES

Abstract

When a launch is acquired by an organization, the launch provider requires typically that the customer present a mass dummy of the spacecraft to the launch provider months ahead of the launch. This mass dummy is used during fit-check activities and other tests prior to launch, and can be eventually launched into space if the customer's spacecraft is not ready in time for the launch. The requirements for any mass dummy are to have the same volume and the same mass characteristics as the spacecraft it represents. The mass characteristics include the spacecraft mass, moments of inertia, and center of mass. In the fast-paced development cycles of this era, a highly configurable mass dummy can be useful in making quick adjustments to match the most recent spacecraft mass characteristics. University of Toronto's Space Flight Laboratory has developed a fully configurable mass dummy design that is capable of not only matching the mass characteristics of the spacecraft, but also its basic dynamic characteristics. It is possible to match the natural frequencies of the dummy to the satellite. This in turn allows the dummy to have identical mode shapes of vibration as the spacecraft through selective placement of mass points on a grid within its volume, without adding extra stiffness. In this configurable design, the stiffness can also be increased if desired while keeping the same mass. This leaves the satellite developer with freedom to choose from various options the means to change both the mass and dynamic characteristics of the mass dummy to match the characteristics of the spacecraft. This technique and mass dummy design may be of interest to spacecraft developers around the world. Having a configurable mass dummy design gives the developer quick solutions to handle unexpected spacecraft design changes. Furthermore, this general mass dummy design can be adapted for different satellite bus designs since it is highly configurable.