Abstract

Planetary Systems Corporation (PSC) developed a Canisterized Satellite Dispenser (CSD) to provide a means and method for the deployment of small satellites and CubeSats. The CSD is designed to operate in a gravity drop tower environment, in which the payload is dropped from a specified height. To quantify the performance of the CSD, a number of independent test cases were conducted in the PSC small satellite lab. Each test case included the collection of high-fidelity data on the linear and angular motion of the CSD during deployment. The test cases were designed to characterize the CSD's performance in a variety of deployment scenarios.

Push Plate Force Test

Objectives

• Characterize the linear and angular motion of a 6U CubeSat as it is deployed from a push plate.

Method

• Use a 12U CSD w/ 6U Canisterized Satellite Dispenser (CSD) on a platform with a gravity drop tower.

• Collect high-fidelity data on the linear and angular motion of the CSD during deployment.

Deployment Tests

Objectives

• Measure CSD linear velocity via base plate w/ an accelerometer using a 12U CSD.

• Measure CSD linear & angular deploy rate via base plate w/ an inertial measurement unit (IMU) using a 6U CSD (to compare against multiple deployment cases w/ and w/o static force test rig).

• Determine the effects of payload mass on linear & angular deploy rate.

Method

• Use a 12U CSD w/ 6U Canisterized Satellite Dispenser (CSD) on a platform with a gravity drop tower.

• Collect high-fidelity data on the linear and angular motion of the CSD during deployment.

Door Interference

Objectives

• Physically confirm door interference/contact, characterize it, and find magnitude of impact.

• Determine the effects of payload mass on door interference/contact.

Method

• Use a 12U CSD w/ 6U Canisterized Satellite Dispenser (CSD) on a platform with a gravity drop tower.

• Collect high-fidelity data on the linear and angular motion of the CSD during deployment.

Equations of Motion

Angular Motion

1. The CSD's angular motion is described by a combination of rotation and translation.
2. The rotation of the CSD is described by Euler angles.
3. The translation of the CSD is described by linear velocity and acceleration.

Linear Motion

1. The CSD's linear motion is described by a combination of translation and rotation.
2. The translation of the CSD is described by linear velocity and acceleration.
3. The rotation of the CSD is described by angular velocity and acceleration.

Friction

1. The CSD's friction is described by the friction force.
2. The friction force is a function of the friction coefficient and the normal force.

Push Plate Contact

A 12U Payload must be in a push plate contact point to center of mass (CoM) prior to deployment.

1. The CSD's CoM is defined as the center of mass of the payload.
2. The CoM is located within the push plate contact point at all times.
3. The CSD's CoM must be centered within the push plate contact point at all times.

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Equations of Motion

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3. The translation of the CSD is described by linear velocity and acceleration.

Linear Motion

1. The CSD's linear motion is described by a combination of translation and rotation.
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