Aerospace

Diminutive Assembly for Nanosatellite deploYables (DANY)

Decreasing the risk of equipment damage and deployment failure for SmallSat owners

SmallSats (i.e., mass below 500 kg) are increasingly becoming big business. More than 100 global organizations across academia, governments, and industry are involved in the development of SmallSats of the nanosat/microsat variety (i.e., mass of 1-50 kg). According to SpaceWorks, up to 2,750 such nanosats/microsats will be launched from 2014 to 2020.

To extract the most utility from these small packages, peripheral parts of the satellite (e.g., solar panels, antennae, sun shades, etc.) are deployed after a small sat is positioned in orbit. Meanwhile, these "deployables" are restrained close to the small sat body until extended using a release signal and mechanism.

BENEFITS

- Less Risk of SmallSat Damage: Where fishing line or similar solutions loosen equipment restraints through stretching, DANY greatly decreases the risk of restraint-facilitated damage during the vibration-laden launch process.
- Less Risk of Failed Deployment: Where the aforementioned stretching creates other points of system failure, DANY greatly enhances the probability of successful deployment.
- Space Savings: Through intelligent and elegant design, DANY provides superior performance while introducing very little mass to SmallSat systems.
- Low Cost: While decreasing the risk of equipment failure is of high value to any SmallSat owner, DANY can be manufactured at very low expense using commercial-off-the-shelf parts.
THE TECHNOLOGY

SmallSat designers seek to employ restraints and release mechanisms of minimal size and weight, often placing each on the outside of the SmallSat structure. Surprisingly, "fishing line" (released via burn through) is often used to secure and release deployables. Vibrations and forces generated during launch can stretch the fishing line, thus allowing these precious deployables to become damaged or otherwise not release properly later on. While these small sats are less expensive than their larger counterparts, satellite owners must minimize the chance that deployables are damaged or that deployment is unsuccessful.

Five years ago, engineers at NASA GSFC faced these SmallSat deployment challenges and knew a better way must exist to prevent equipment damage and ensure successful release. Investigating a host of designs to minimize size, weight, and cost while maximizing communication and mechanical reliability, NASA's engineers created DANY (the Diminutive Assembly for Nanosatellite deploYables). NASA's DANY technology uses spring-loaded metal pins, a reliable burn-through mechanism, efficient bracketing, and a circuit board - all within a 3.0” x 1.3” x 0.2” volume (smaller than a stack of 10 business cards) - to reliably stow and release deployables on command. Using DANY, stowed deployables are securely fastened using the spring-loaded locking pins. Upon receiving a deployment signal, a plastic restraining link is burned through which allows the spring-loaded pins to release the deployable and simultaneously trigger a switch to signal a successful deployment event.

DANY stows solar panels, antennas, or even sunshades on CubeSats. Two DANY devices are placed next to a quarter to show their relative size (3” x 1.3” x 2”)

APPLICATIONS

The technology has several potential applications:

DANY can be employed by any SmallSat designer in academia, government, and industry.

PUBLICATIONS

Patent No: 9546008