



Space Debris: A Tale of Two Satellites

by David Dickinson on July 23, 2013

It's sometimes tough being a satellite in Earth orbit these days.

An interesting commentary came our way recently via NASA's Orbital Debris Program Office's Orbital Debris Quarterly News. The article, entitled High-Speed Particle Impacts Suspected in Two Spacecraft Anomalies, highlights a growing trend in the local space environment.

The tale begins with GOES 13 located in geostationary orbit over longitude 75° West. Launched on May 24th, 2006 atop a Delta IV rocket, GOES 13 is an integral part of the U.S. National Oceanic and Atmospheric Administration (NOAA's) Geostationary Operational Environmental Satellite network.

The problems began when GOES-13 began to suffer an "attitude disturbance of unknown origin" on May 22nd of this year, causing it to drift about two degrees per hour off of its required nadir (the opposite of zenith) pointing.

The anomaly was similar to a problem encountered by the NOAA 17 spacecraft on November 20th, 2005. At the time, the anomaly was suspected to be due to a micrometeoroid impact. The Leonid meteors, which peak right around the middle of November, were a chief suspect. However, NOAA 17 suffered a second failure 18 days later, which was later traced down to a hydrazine leak from its errant thrusters.

GOES-13 has weathered hard times before. Back in December of 2006, GOES-13's Solar X-Ray Imager suffered damage after being struck by a solar flare shortly after initial deployment. GOES-13 also began returning degraded imagery in September 2012, forcing it into backup status for Hurricane Sandy.

GOES-13 was restored to functionality last month. Current thinking is that the satellite was struck by a micrometeorite. No major meteor showers were active at the time.

Loss of a GOES satellite would place a definite strain on our weather monitoring and Earth observing capability. Begun with the launch of GOES-1 in 1975, currently six GOES satellites are in operation, including one used to relay data for PeaceSat (GOES-7) and one used as a communications relay for the South Pole research station (GOES-3).

The GOES program cost NOAA billions in cost overruns to execute. The next GOES launch is GOES-R scheduled in 2015.

But the universe seems to love coincidences.

Less than 26 hours after the GOES 13 anomaly, Ecuador's first satellite, NEE-01 Pegaso began to have difficulties keeping a stable attitude. The event happened shortly after passage near an old Soviet rocket booster (NORAD designation 1986-058B) which launched Kosmos 1768 on August 2nd, 1986. The U.S. Joint Space Operations Center had warned the fledgling Ecuadorian Space Agency that conjunction was imminent, but of course, there's not much that could've been done to save the tiny CubeSat.

Although the main mass passed Pegaso at a safe distance, current thinking is that the discarded booster may have left a cloud of debris in its wake. Researchers have tracked small "debris clouds" around objects it orbit before- the collision of Iridium 33 and the defunct Kosmos 2251 on February 10th, 2009 left a ring of debris in its wake, and the Chinese anti-satellite test carried out on January 11th, 2007 showered low-Earth orbit with debris for years to come.

The loss represents a blow to Ecuador and their first bid to become a space-faring nation. Launched less than a month prior atop a Long March 2D rocket, Pegaso was a small 10 centimetre nanosatellite equipped with solar panels and dual infrared and visible Earth imaging systems.

A translation from the Ecuadorian Space Agencies site states that;

"The NEE-01 survived the crash and remains in orbit; however it has entered uncontrolled rotation due to the event.

Due to this rotation, (the satellite) cannot point its antenna correctly and stably to the Earth station and although still transmitting and running, the signal cannot be decoded. The Ecuadorian Civilian Space Agency is working tirelessly to stabilize the NEE-01 and recover the use of their signal.





The PEGASUS aired for 7 days your signal to the world via [EarthCam](#), millions could see the Earth seen from space in real time, many for the first time, the files in those 7 days have been published after transmission.”

Ecuador plans to launch another CubeSat, NEE 02 Krysaor later in 2013. A carrier has not yet been named.

While both events suffered by the GOES-13 and NEE-01 Pegaso satellites were unrelated, they underscore problems with space junk and space environmental hazards that are occurring with a higher frequency.

Such is the modern hazardous environment of low Earth orbit that new satellites must face. With a growing amount of debris, impact threats are becoming more common. The International Space Station must perform frequent debris avoidance maneuvers to avoid hazards, and more than once, the crew has waited out a pass in their Soyuz escape modules should immediate evacuation become necessary. Punctures from micro-meteoroids or space junk have even been seen recently on the ISS solar panel arrays.

Plans are on the drawing board to deal with space junk, involving everything from “space nets” to lasers and even more exotic ideas. Probably the most immediate solution that can be implemented is to assure new payloads have a way to “self-terminate” via de-orbit at the end of their life span. Solar sail technologies, such as NanoSailD2 launched in 2010 have already demonstrated this capability.

Expect reentries also pick up as we approach the peak of solar cycle #24 at the end of 2013 and the beginning of 2014. Increased solar activity energizes the upper atmosphere and creates increased drag on low Earth satellites.

It's a brave new world “up there,” and hazards, both natural and man-made, are something that space faring nations will have to come to terms with.

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