Narrative Exhibit
Dove 3 is a technology demonstration mission to test the latest satellite subsystems, including the custom built, experimental radios. The satellite will be launched No Earlier Than (NET) February 2013 to Low Earth Orbit on the DNEPR launch vehicle. Dove 3 will be ejected from an ISIPOD 3U cubesat deployer into a planned elliptical orbit of 800 x 597 km at 97.8 degrees inclination.The experiment will operate for a maximum duration of 24 months and will deorbit in compliance within the 25 year rule due to the "high drag" configuration the satellite will assume at the end of mission. A detailed orbital lifetime analysis can be found as a separate attachment titled "Dove 3 Orbital Debris Assessment Report."

Dove 3 frequency characteristics:
Primary TT&C Uplink: 2.056 GHz
Secondary TT&C Uplink: 402.4 MHz
Primary Payload Downlink: 8.2 GHz
Secondary TT&C Downlink: 401.3 MHz

Dove 3 radio characteristics:
All radios on Dove 3 are custom built by Cosmogia
X-band transmitter: D3-8200-T
S-band receiver: D3-2100-R
UHF transceiver: D3-400-RT

Dove 3 antenna characteristics:
X-band: 5 dBi peak-gain patch antenna, 90 degree Half Power Beamwidth, Nadir facing
S-band: 5 dBi peak-gain patch antenna, 90 degree Half Power Beamwidth, Nadir facing
UHF: 2 dBi non-directional monopole

Earth Station Description
Stanford Research Institute (SRI) Observation Site: Palo Alto, CA
Latitude/Longitude: 37.403084, -122.174096
Primary Antenna Combination: 3 meter parabolic dish with X-band and S-band circularly polarized feed and boom-mounted UHF yagi (10 element, cross polarized)
Secondary Antenna Combination: 18 meter parabolic dish with UHF and S-band feed

Further Reentry Analysis
The Dove 1, 2, 3 and 4 Orbital Debris Assessment Reports include an analysis using NASA's DAS 2.0 software of the risk of casualties on the ground due to atmospheric reentry. While the risk of casualties was always found to be compliant with NASA-STD-8719.14, DAS did suggest a small probability that our optical tube assembly (OTA) would reach the ground. We therefore chose to perform higher fidelity analysis to better quantify this risk. Very few analysis tools exist to model the physics of reentry, so we chose to work with the NASA Debris Program Office who maintains The Object Reentry Survival Analysis Tool (ORSAT). From the ORSAT website:

"The ORSAT code uses integrated trajectory, atmospheric, aerodynamic, aerothermodynamic, and thermal/ablation models to perform a complete satellite or launch vehicle upper stage component analysis in determining the impact risk" More details on ORSAT's methodology and capabilities can be found online (http://www.orbitaldebris.jsc.nasa.gov/reentry/orsat.html).

Typically this tool is only used after DAS has deemed re-entry risks as non-compliant, however we requested that ORSAT be used for our Invar OTA. The dimensions and a drawing of the tube assembly were provided to Nicholas Johnson of the debris office and he confirmed, via email:

From: Johnson, Nicholas L. (JSC-KX111) <nicholas.l.johnson@nasa.gov> Date: Tue, Jul 10, 2012 at 8:32 AM
Subject: RE: ORSAT/SCARAB
To: James Mason <james@cosmogia.com>

Mr. Mason,

We have assessed the survivability of both the Invar tube and its end plate. We determine with high confidence that both elements will in fact demise, i.e., not reach the surface of the Earth following reentry.

Let me know if we can be of any further assistance. Best regards,

Nicholas L. Johnson NASA

Upon asking for further details of the analysis results, Mr. Johnson instructed us to refer any questions to him and the NASA Debris Program Office.

Contact

Nicholas L. Johnson
Chief Scientist, Orbital Debris
Email: Email: nicholas.l.johnson@nasa.gov Fax: 281-483-5276