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Author: Mr. Jean Muylaert
von Karman Institute for Fluid Dynamics, Belgium, jean.muylaert@vki.ac.be

Mr. Ruedeger Reinhard
European Space Agency (ESA), The Netherlands, Ruedeger.Reinhard@esa.int
Dr. Cem Asma
von Karman Institute for Fluid Dynamics, Switzerland, cem.asma@s-3.ch
Mr. Abe Bonnema
ISIS - Innovative Solutions In Space B.V., The Netherlands, a.r.bonnema@isispace.nl
Mr. Jeroen Rotteveel
ISIS - Innovative Solutions In Space B.V., The Netherlands, J.Rotteveel@isispace.nl

CUBESATS FOR KEY TECHNOLOGY DEMONSTRATION TO BE LAUNCHED TOGETHER WITH THE QB50 NETWORK

Abstract

The QB50 network of 50 double CubeSats will be launched in June 2014 by a Russian Shtil-2.1 from Murmansk in Northern Russia into a circular orbit at 320 km altitude. This launch also provides an opportunity for several CubeSats to demonstrate key technologies in addition to exploration of the lower thermosphere: - Two triple CubeSats (Delta and Phi) equipped with micropropulsion for formation flying, - A double CubeSat (Re-EntSat) equipped with a hemispherical heat shield of ablative material to survive re-entry down to 70 km, - A double CubeSat (GT-Sat) for testing the link quality between the satellite and the GENSO network of ground stations, - GAMA-Sat, three double CubeSats forming for the first few weeks a mini network for inter-satellite telecommunication, - A triple CubeSat (PICASSO), PICosatellite for Atmospheric and Space Science Observations, - A triple CubeSat for GPS radio occultations, - A triple CubeSat carrying a biological microgravity payload, - A triple CubeSat (Inflate-Sail) for testing a solar sail with inflatable booms, - A triple CubeSat to demonstrate de-orbiting technologies for debris mitigation.

The Re-EntSat proposal will be submitted by the Von Karman Institute for Fluid Dynamics (VKI) in Brussels. One half of the double CubeSat (the 'functional' unit) will provide the usual satellite functions, while the other half (the 'science' unit) will accommodate the standard QB50 set of sensors for in-situ measurements in the lower thermosphere. The standard CubeSats of the QB50 mission are expected to lose their functions at around 100 km of altitude. Somewhat later the CubeSats will disintegrate during the atmospheric re-entry.

Re-EntSat has the objective to survive beyond this point and to continue carrying out measurements. To achieve this, Re-EntSat will be equipped with an ablative Thermal Protection System (TPS) and relevant instrumentation to monitor the status of the TPS. The typical instruments will be thermocouples and pressure transducers, aiming at collecting scientific data during the atmospheric re-entry. Other than these, an inertial measurement unit is to be utilized (3-axis gyroscopes and accelerometers) to perform measurements on the flight trajectory of the CubeSat. An important part of the work will be dedicated to controlling the point of re-entry. Micropropulsion systems suitable for CubeSat platforms and aerodynamic de-orbiting techniques will be studied for that purpose. According to initial orbital dynamics and re-entry trajectory calculations, Re-EntSat is expected to have a peak stagnation point heat flux at around 70 km of altitude.