From: Douglas Yarbrough

To: Leann Nguyen
Date: May 11, 2012

Subject: FCC File# 0573-EX-PL-2011

Message:

Boeing has filed an updated narrative requesting amendment of its application to launch and operate the non-geostationary low earth orbit satellite referred to as Horton, File No. 0573-EX-PL-2011.

Boeing is requesting this amendment because the original Horton design for two tethered CubeSats forming a single satellite no longer meets the needs of its U.S. Government client. Boeing therefore seeks to amend its application from two tethered CubeSats to two free-flying CubeSats without physical or RF links between them. The updated narrative provides an overview of Boeing?s original application and identifies any changes in wording as a result of the proposed untethering.

The updated narrative also responds to the April 11, 2012 letter of Leann Nguyen on behalf of the International Bureau (Correspondence reference No. 16645). The questions and answers are duplicated below.

During its review of the Horton Application, the International Bureau raised the following four questions:

Question 1: Tethered or free flying, and collision risks

The Bureau notes that the spacecraft is described as consisting of two Cubesat units and indicates that it is not clear whether they are connected, or whether the Commission is being asked to authorize two spacecraft. The Bureau also asks whether the quoted collision risks are for a single satellite or aggregate.

The Horton satellite is composed of two free-flying space vehicles. The two CubeSats were originally proposed to be tethered together. This original configuration was eventually determined not to serve the operational needs of Boeing?s U.S. Government customer. In response, Boeing now intends to operate the two identical CubeSats as separate free-flying satellites with no physical or RF contact between them. Both CubeSats are identical with only a different vehicle designation in the operating software to distinguish vehicle identities. Each has its own independent UHF radio system and software coding so that communications with one of the satellites will be ignored by the other satellite. The collision risk provided in Boeing?s application, and in this amendment, is for each separate CubeSat individually. See reply to Question 4, Section I.D, infra.

Question 2: Working Fluid

The Bureau notes that the CubeSats will include ?a stainless steel actuator with an unspecified working fluid.? The Bureau requests information regarding the identity of the working fluid and its characteristics if it leaks, i.e., does it evaporate or does it turn into small debris balls?

The working fluid is polyethylene glycol, a non-flammable, low-toxicity fluid. In a vacuum, if a leak were to occur, the fluid would evaporate and present no risk of forming debris.

Question 3: Surviving Fragments and Human Casualty Probability

The Bureau requests ?a list of all surviving fragment(s), if any, including the mass and size of each surviving fragment(s), and an analysis of the probability of human casualty.? The Bureau further indicates that, if there is surviving debris, information would be needed regarding the insurance and indemnification arrangements.

The materials used on the CubeSat spacecraft are primarily composed of aluminum and PCB material, which have a relatively low melting temperature. Boeing modeled the Horton satellites using the Debris Assessment Software (?DAS?) from the NASA Orbital Debris Program Office. Information (i.e., mass, material, size) for all the major components was entered into the model to analyze the probability of human casualty, demise altitude, total debris casualty area, and kinetic energy. The analysis predicted that no Horton components are expected to survive re-entry; therefore, no insurance and indemnification arrangements are warranted.

Question 4: Collision Risk Analysis

The Bureau requests Boeing to ?submit an [expanded] analysis of collision risk during the orbital lifetime of the satellite(s).?

The Collision Risk has been evaluated for both large (greater than 10 centimeters) and small (less than 10 centimeters) object debris. The Horton mission meets the requirements for probability of accidental collection with small and large space objects as defined by NASA orbital debris standards. DAS was used to compute the probability of collision based on a conservative maximum area of 1.2 m2 at both the orbit perigee and apogee altitudes for the one year mission. The probability of collision per year was significantly lower than the thresholds of 0.01 for small debris and 0.001 for large debris because of Horton?s relatively short mission life (i.e., one year) and small cross-sectional area (less than 1.2 m2) as shown in Figure 1 of the Amendment Narrative included as in exhibit to the Horton application File No. 0573-EX-PL-2011.