

From: Jennifer Manner

To: Nimesh Sangani

Date: December 16, 2020

Subject: Additional Information Request

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Message:

Response to December 7 Additional Information Request

1. Please confirm, or provide corrections, on the below information as an accurate description of the solar arrays to be used on the satellites and the method in which they were modeled for survivability in the Debris Analysis Program (DAS): The solar arrays being employed on the spacecraft are primarily a combination of Aluminum, PCB (fiberglass) and a small amount of carbon fiber. In order to provide a worst-case survivability number, the solar arrays were modeled as 100% pieces of carbon fiber, which resulted in larger surviving kinetic energy than will actually occur. In reality, the solar arrays are mostly Aluminum and fiberglass, both of which are not expected to survive reentry. The smaller amounts of carbon fiber may or may not survive reentry, but in the event they do survive, are not expected to pose a substantive casualty risk.

If available, please provide a material makeup (by percentage) of the primary materials of the solar arrays, as well as the amount of carbon fiber utilized. Additionally, please provide the thickness of the layer of carbon fiber being utilized on the solar arrays to provide extra stiffness to the components.

1A. As an additional explanation with respect to, and to confirm, information provided in No. 9A of the November 16th response, the derived debris casualty area is based on modeling of the entire solar array, assuming that it is composed entirely of carbon fiber. In fact, the carbon fiber is a thin layer within the solar array, and the solar array is composed of other materials with sufficiently low melting points that they can be expected to demise upon re-entry.

The actual mass of the carbon fiber is approximately 12.7 percent less than the modeled object. Again taking a somewhat unrealistic assumption that the carbon fiber layer would survive entirely intact, the area to mass of that object would be considerably greater than for the solar arrays as assumed for modeling purpose, and consequently considerably less energetic, with an anticipated energy well below the 15 J threshold for consideration as a casualty risk. The actual effect of re-entry upon the carbon fiber material is a subject of ongoing scientific study, but it is expected that actual results would involve an even greater increase in area and reduction in mass for surviving carbon materials, as compared to either of the two assumed objects described immediately above.

The thickness of the layer of carbon fiber is 0.2 mm, with a total mass of 257 grams.