York Space Systems LLC Response to FCC Demisability Questions
Re: Application File No. 1500-EX-CN-2023
May 6, 2024

1. **Please provide details on the previously considered and rejected designs for the spacecraft that were more likely to demise. In particular, what level of analyses were performed prior to moving on to a new/modified design?**

   Response: York Space Systems LLC ("York") performs repeated demisability analyses throughout the spacecraft design lifecycle, from preliminary design iterations up to and including final spacecraft system design. York's analysis and design process is iterative and responsive to customer requirements.

   York conducts demisability analysis using NASA's General Mission Analysis (GMAT) tool or Systems Tool Kit (STK) software to model high-precision orbit trajectories, accounting for the latest space weather influences on atmospheric density. Once the corresponding mission environment is modeled to the spacecraft's mechanical configuration, York uses the latest version of NASA Debris Assessment Software (DAS v3.2.5) to conduct reentry survivability analysis.

   Some of York's government customers have sent similar spacecraft designs to the Aerospace Corporation for re-entry analysis using the company's Atmospheric Heating and Breakup (AHaB) tool, which provides high-fidelity re-entry survivability analysis. These design lessons inform York's design process for its non-government customers. York uses lessons learned from its previous missions, including with respect to demisability, to help guide decisions on updated designs.

   For this mission, York used the NASA DAS v3.2.5 software described above, along with its own lessons learned from the higher fidelity AHaB analyses performed on previous programs, to iterate the spacecraft design.

2. **How many of these designs were considered to a modelable degree before being rejected?**

   Response: York considered at least three spacecraft designs to a modelable degree, inherited from previous missions.

   York evaluated different designs and materials with the aim of meeting both demisability criteria as well as separate requirements for spacecraft load, momentum management, and thermal management. Changes in material selection were limited to selecting parts of the spacecraft, such as the TCD frame. The majority of the spacecraft is made of aluminum and did not require multiple designs to satisfy demisability criteria.

3. **Additionally, the surviving debris with kinetic energy above 15 J, TCD frames and torque rods, please describe how these particular components and material types are essential to the success of your mission. Why would changing them out for more demisable materials cause your mission to fail?**

   Response: York determined these particular components and material types were necessary to meet mission-critical stabilization and thermal performance requirements. The Aerospace Corporation previously analyzed York's TCD frames and torque rods using its AHaB tool, which showed a demise altitude greater than 69 km; therefore, the actual kinetic energy from these components is likely no greater than 0 J. Due to various rights limitations governing access to, and use of, the AHaB data, however, York does not have access to the detailed AHaB results and had to rely on the more conservative DAS analysis to arrive at the 15 J figure for the kinetic energy of surviving debris. Even so, the high-level AHaB results suggest that, in real-world conditions, no surviving debris with kinetic energy greater than 0 J will exist.

As for the components' mission relevance, the TCD frames are critical to handling spacecraft mechanical loads and maintaining stable operating temperatures for the spacecraft electronics. York selected stainless steel for certain elements of the TCD frame (as opposed to aluminum) to best manage the spacecraft mechanical load and temperature requirements. Regarding the torque rods, these components are likewise integral to maintaining spacecraft stability, and material selection is critical in order to interact with Earth's magnetic field and generate torque for attitude control. York selected stainless steel here as well, to best address these potential magnetic influences and ensure stable spacecraft operations.