

From: Krystle Curnutte

To: Leann Nguyen

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Subject: Request for Info - File # 0987-EX-CN-2018

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Message:

The information provided below was rendered to Tyvak by the propulsion system provider:

The propulsion system is based on an ionic liquid. The propulsion system provider, has taken multiple precautions through design, testing, and procedures to mitigate unplanned leaks from the system before, during, and after operations. During launch, the propellant is stored in a system that has been specifically tested to withstand vibrations at or above NASA GEVS qualification levels while simultaneously being subjected to a launch fairing depressurization profile from ambient to rough vacuum. All components are designed to equilibrate internal fluid environments to the local external pressure, so no stored energy occurs in the form of compressed gases.

There is no mechanical pressure stored in the system (i.e. no actuators, compressed gas). As such, an MMOD strike directly to the propulsion system may generate solid debris, but even if it were able to cause a potential leak path, there is no subsequent internal mechanical force to drive liquid out of the system let alone away from the vehicle. Prior to firing the thrusters, a barrier is in place that prevents liquid from reaching the emission sites of the device. This barrier is removed during an on-orbit commissioning phase. Once the thrusters are firing, as with any EP system, the particles emitted by the electrospray process are purely ionic.

The propulsion system provider has completed significant testing and characterization of our system for shipping, launch, in space, and storage conditions. In addition to the aforementioned testing to NASA GEVS standards, we currently have a unit identical to that delivered for the Tyvak-0129 flight in similar storage conditions that has shown no leaks or degradation after >6 months of storage.

The solar array analysis was conducted using the NASA Debris Assessment Software. The solar array was modeled as two separate line items: Solar Array Wing, quantity 2; and Solar Cells, quantity 60. The DAS input and output logs for this analysis have been uploaded as an attachment to this application.