

To: Anthony Serafini, FCC
From: Chris Voorhees, Planetary Resources Development Corporation (PRDC)
Re: NASA/ISS Amendment to PRDC FCC STA Application #0313-EX-ST-2014
Date: 8/26/2014

This memorandum outlines modifications to PRDC's application for FCC STA experimental license #0313-EX-ST-2014, related to operational conditions placed on its Arkyd 3 spacecraft flight experiment due to NASA concerns regarding potential interference with International Space Station (ISS) operations. To prevent interference to the ISS, NASA has requested that PRDC adhere to a 16-km keep-out zone (KOZ) between Arkyd 3 and the ISS for Arkyd 3 during its on-orbit mission life, including the initial spacecraft separation from the ISS (deployment), and to inhibit PRDC ground station uplink when both the Arkyd 3 and ISS are visible to the PRDC ground station. In response to these requests, PRDC has taken the following specific actions:

1. PRDC has extended Arkyd 3's on-board RF inhibit timer from its original 30-minute length to **6 hours** (360 minutes) in duration.
 - a. See the following Section A1 for supporting information on the establishment of the revised RF inhibit timer duration
2. PRDC will implement mission operations constraints to prevent uplink transmission from PRDC's ground station in Redmond, Washington whenever the Arkyd 3 spacecraft and the ISS are simultaneously within the station's field of view. Specifically, PRDC will do the following:
 - a. PRDC's mission operations system will acquire and continually update two-line orbital element (TLE) data from NORAD for both the ISS and Arkyd 3 spacecraft throughout mission operations.
 - b. PRDC's ground station planning software will compare ISS and Arkyd 3 TLE information to verify distance and angular relationships between the two vehicles.
 - c. In the event that Arkyd 3 and the ISS / ISS KOZ are simultaneously within the ground station's field of view, PRDC's ground station planning software will prohibit uplink transmissions from occurring during the communications session.
 - d. PRDC ground operator will also provide an on-console assessment of each upcoming Arkyd 3 communication session as an independent verification of PRDC's ground station planning software.

With the exception of the above modifications, all other information contained in the application and its other attachments / amendments remains unchanged.

Section A1: RF Inhibit Timer Duration Supporting Information

As mentioned in the memorandum above, PRDC received a request to comply with a 16-km Keep Out Zone (KOZ) for initial Arkyd 3 RF operations and subsequent ground station uplink operations. Arkyd 3 employs an on-board inhibit timer to prevent RF operations until a certain time period after ISS deployment. To determine the required duration for this timer, PRDC performed an analysis using AGI's Satellite Tool Kit (STK) orbital analysis software. The analysis used the expected deployment speed and direction as provided by NanoRacks, PRDC's launch services provider: 1 m/s deployment speed oriented 45 degrees down and aft of the ISS orbital track. As can be seen in Figure A1-1, the analysis indicates that Arkyd 3 will clear the 16-km ISS KOZ around 123 minutes, or just over 2 hours, after deployment.

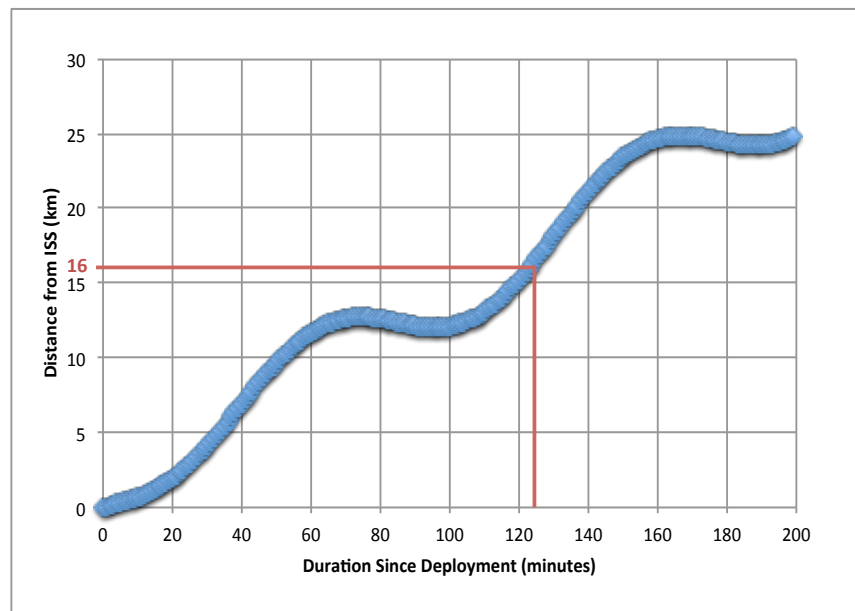


Figure A1-1: Arkyd 3 Distance from ISS, Post-Deployment

To account for changes in orbital conditions, ISS deployment conditions, and Arkyd 3 behavior, PRDC assigned a margin of 200% to its analytical estimate of required flight duration. Therefore, Arkyd 3's on-board RF inhibit timer has been implemented with a **6-hour** duration to prevent ISS RF interference issues upon deployment.