

MEMO

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SUBJECT: Station keeping plans for Global 1-4 satellites

DATE: May 17, 2018

This memo has been updated to reflect Global-2's initial altitude of 575 km rather than 585 km.

Background

The initial operating orbits for the four Global satellites is given in Table 1. Assuming no propulsion is used, the expected altitude over time of each satellites is shown in Figure 1 - Figure 4. Note that the timescale on the plots goes until deorbit, but the satellites have a planned three-year operational life. These plots are identical to what was provided in the Orbital Debris Assessment. Accompanying assumptions were provided in the Orbital Debris Assessment Report. In practice, the altitude change over time will depend on the attitude profile of the satellite, and the plots use a conservative attitude profile from an orbital lifetime perspective. That is, the actual orbits should decay at least as fast as shown or faster.

The plans for station keeping vary by satellite. For Global-1 and Global-2, no orbit maintenance is planned. The natural decay of the orbits are sufficient for operations, and therefore Figure 1 and Figure 2 provide the expected profile. Since these are the first two Global satellites, the propulsion system will be exercised for test and characterization in preparation for station keeping of future satellites. This propulsion system testing will not be used to raise the orbit at all, but instead experiments would only lower or adjust the phasing of the orbit. Any lowering of the orbit through prop system testing would be limited to a maximum of 15 km beyond the natural decay of the orbits.

For Globals-3 and -4, since the initial altitude is much lower, the propulsion system will be used to maintain an altitude of at least 450 km. The station keeping plan for Globals-3 and -4 is to let the altitude decay naturally to 450 km, and then begin periodic orbit maintenance to hold the altitude near 450 km during the planned 3-year operational life of the satellites. For Global-3, and using Figure 3 as a reference, this means beginning orbit maintenance within the first year of operations to maintain an altitude of approximately 450 km for the first 3 years of operations. For Global-4, and using Figure 4 as a reference, this means beginning orbit maintenance between years one and two of operations.

On-Orbit Altitudes & Station Keeping

Given the plans described above, and adding some additional altitude variation to account for uncertainties in the modeling, expected operational altitudes of the four satellites are shown in Table 1. The specific schedule of orbital maintenance for Globals 3 and 4 has not yet been finalized. But in general, the propulsion system will be used for a large number of very short and low-thrust maneuvers, as opposed to more infrequent and larger orbit changes. Each use of the propulsion system will result in less than 1 m/s of deltaV. Many of these small and short "burns" will be carried out to counteract

aerodynamic drag. This method will be used to stabilize the altitude of Globals 3 and 4 once it is reaching 450 km.

Table 1. Initial operating altitudes for each satellite

Satellite Name	Initial Altitude	Inclination	Expected Operational Altitude
Global 1	505 km circular	SSO	470 – 505 km
Global 2	575 km circular	SSO	555-575 km
Global 3	460 km circular	45°	440 – 460 km
Global 4	475 km circular	45°	440 – 475 km

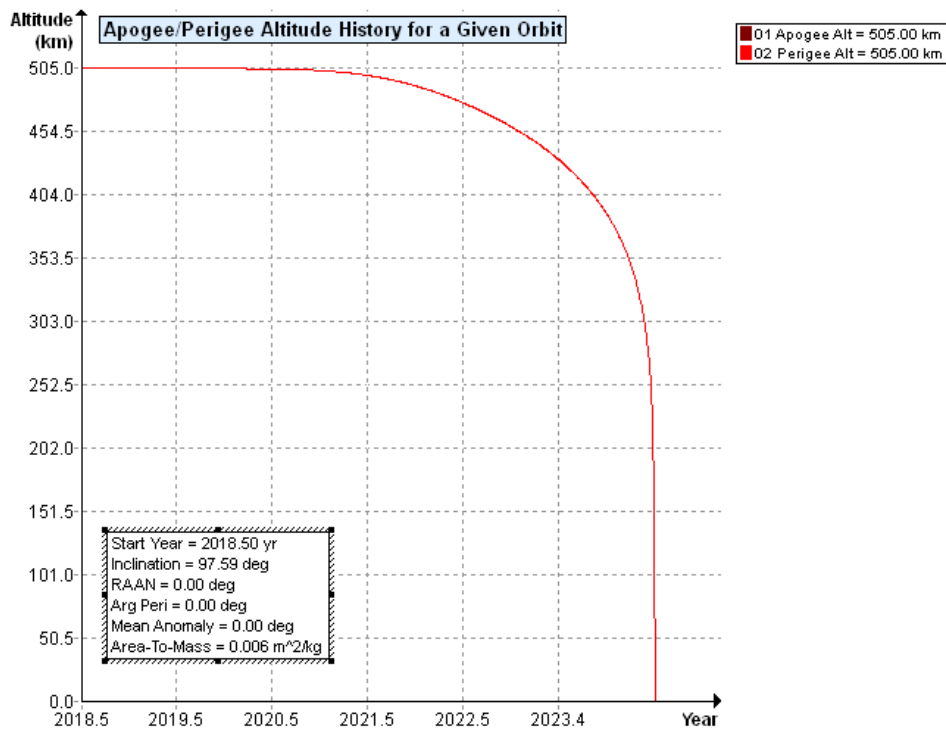


Figure 1. Expected altitude profile of Global-1 with no station keeping.

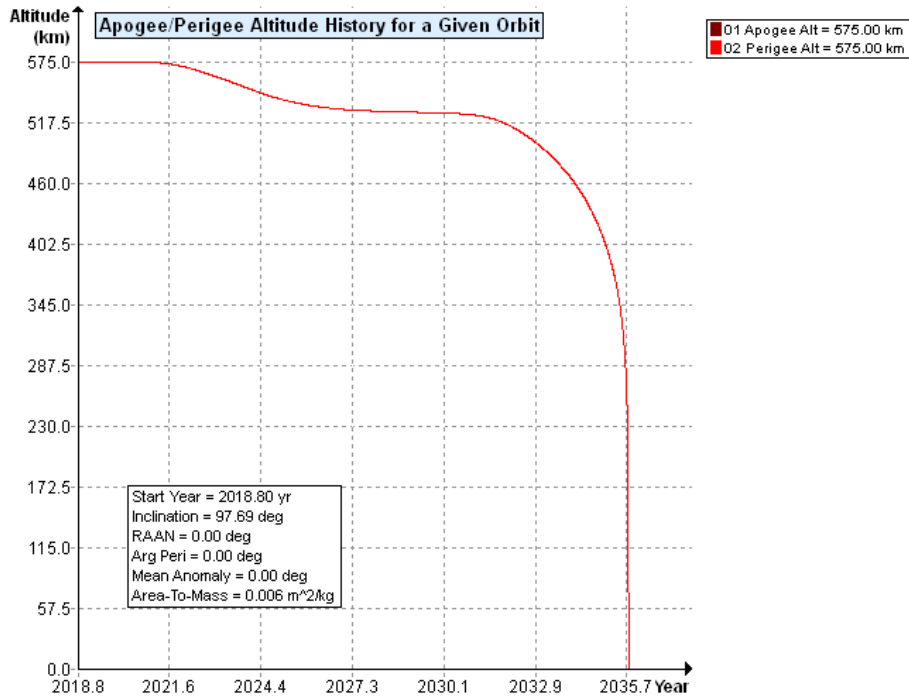


Figure 2. Expected altitude profile of Global-2 with no station keeping.

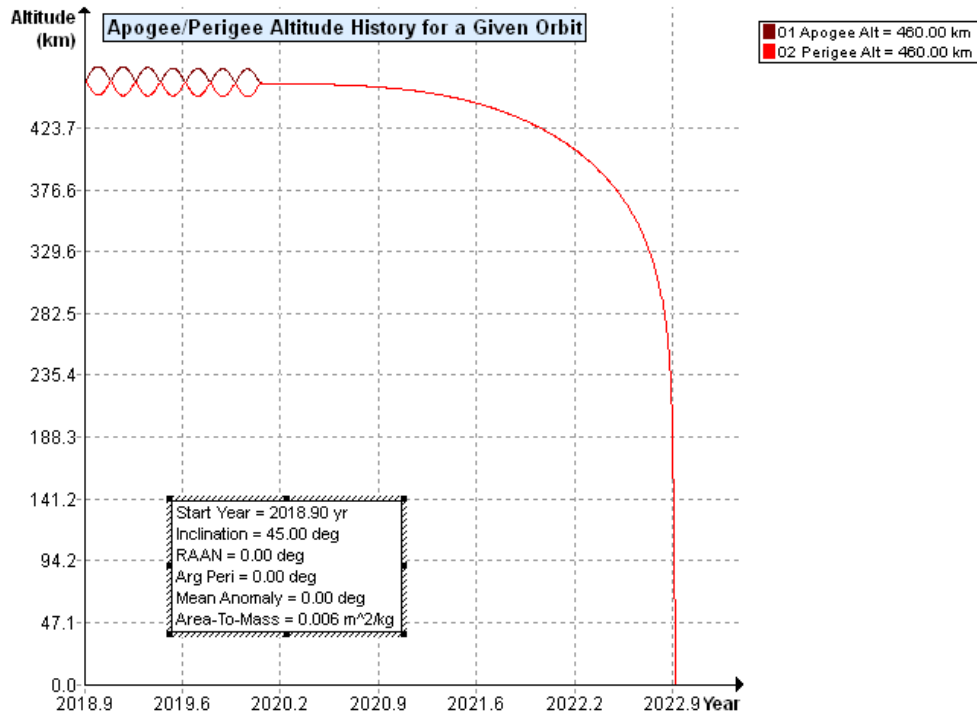


Figure 3. Expected altitude profile of Global-3 with no station keeping

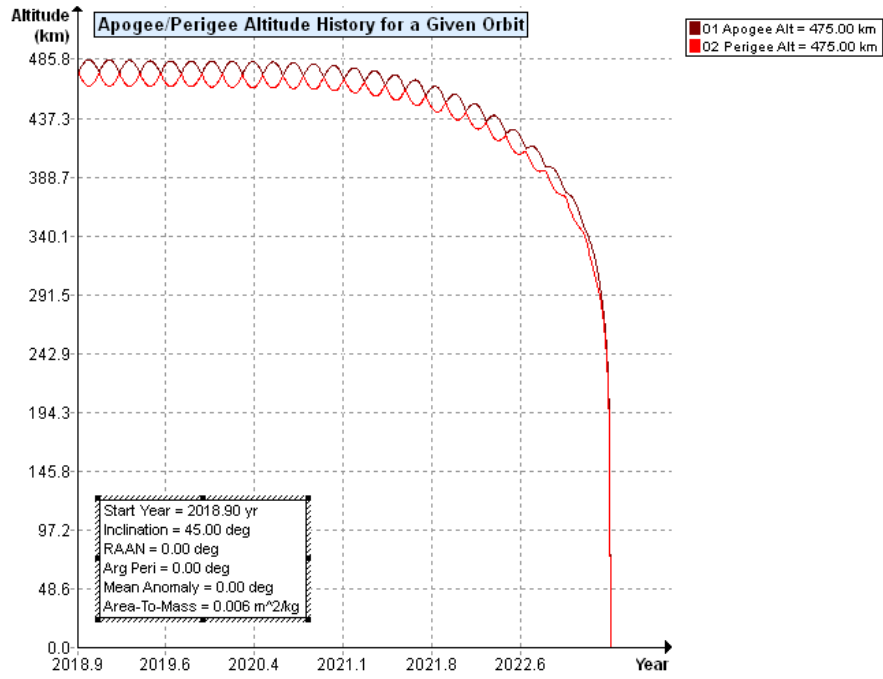


Figure 4. Expected altitude profile of Global-4 with no station keeping.