FOSSASAT-1 Re-Entry Analysis

FOSSA SYSTEMS, NOVEMBER 2019

The following report calculates the best- and worst-case scenario orbital lives of the FOSSASAT-1 1P PocketQube satellite in a solar panel deployed and non-deployed state.

Considering the following characteristics and initial values for **deployed solar panels and antenna**:

Satellite Data:

Mass of 0.232kg, rounded to 0.24kg.

Averaged cross sectional area of 0.0073735 m^2 in a randomly tumbling state as calculated by the ESA DRAMA CROC tool, rounded to 0.0074 m^2. Note the UHF Dipole antenna has a length of 32cm and is calibrated to 436.7MHz.

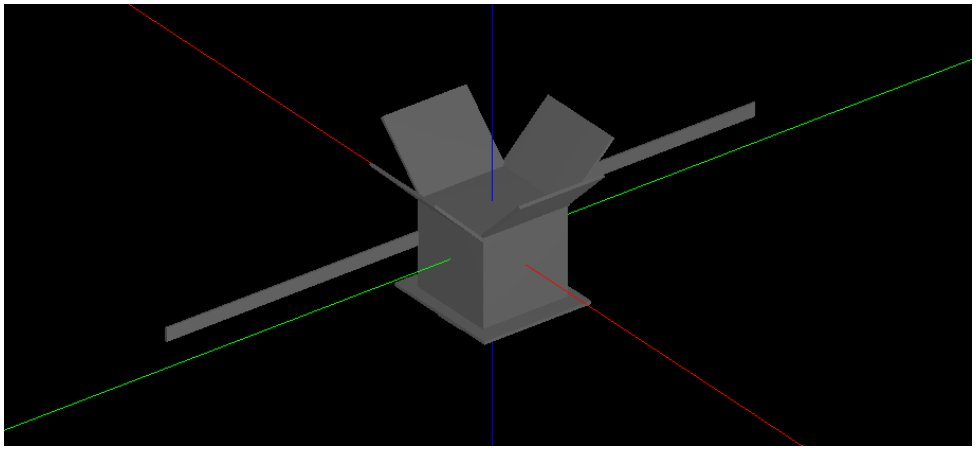


Figure 1– CROC Model of FossaSat-1 in deployed state

Orbital Data:

Nominal insertion at 392.5km, 97.1 deg inclination, LTDN 21:00 HMS, 0 Eccentricity, 0 argument of perigee. Start date of the simulation is the 28th of November 2019.

Result:

As calculated by the OSCAR ESA DRAMA orbital prediction tool using the latest Solar and Geomagnetic models as of the 23/11/2019.

0.69 - Remaining lifetime of target orbit (yrs)

0.55 - Best-case lifetime (yrs) (with 50% confidence Interval)

0.71 - Worst-case lifetime (yrs) (with 50% confidence Interval)

(incl. margin of 5.00 % according to ISO 27852:2011.)

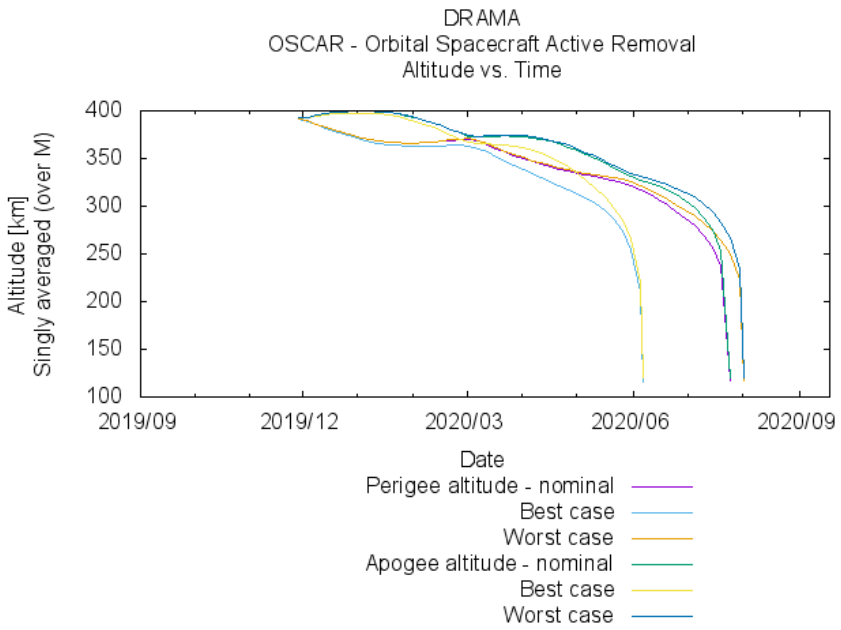


Figure 2 - Orbital life of FossaSat-1 in a deployed state

Considering the following characteristics and initial values for **non-deployed solar panels and antenna**:

Satellite Data:

Mass of 0.232kg, rounded to 0.24kg.

Averaged cross sectional area of 0.004899 m^2 in a randomly tumbling state as calculated by the ESA DRAMA CROC tool, rounded to 0.0049 m^2.

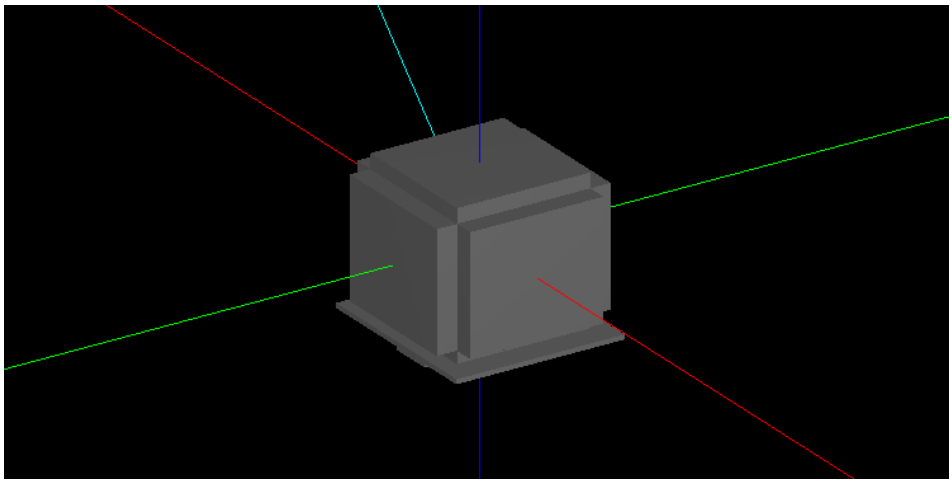


Figure 3 - CROC Model of FossaSat-1 in a non-deployed state

Orbital Data:

Nominal insertion at 392.5km, 97.1 deg inclination, LTDN 21:00 HMS, 0 Eccentricity, 0 argument of perigee. Start date of the simulation is the 28th of November 2019.

Result:

As calculated by the OSCAR ESA DRAMA orbital prediction tool using the latest Solar and Geomagnetic models as of the 23/11/2019.

1.00 - Remaining lifetime of target orbit (yrs)

0.86 - Best-case lifetime (yrs) (with 50% confidence Interval)

1.03 - Worst-case lifetime (yrs) (with 50% confidence Interval)

(incl. margin of 5.00 % according to ISO 27852:2011.)

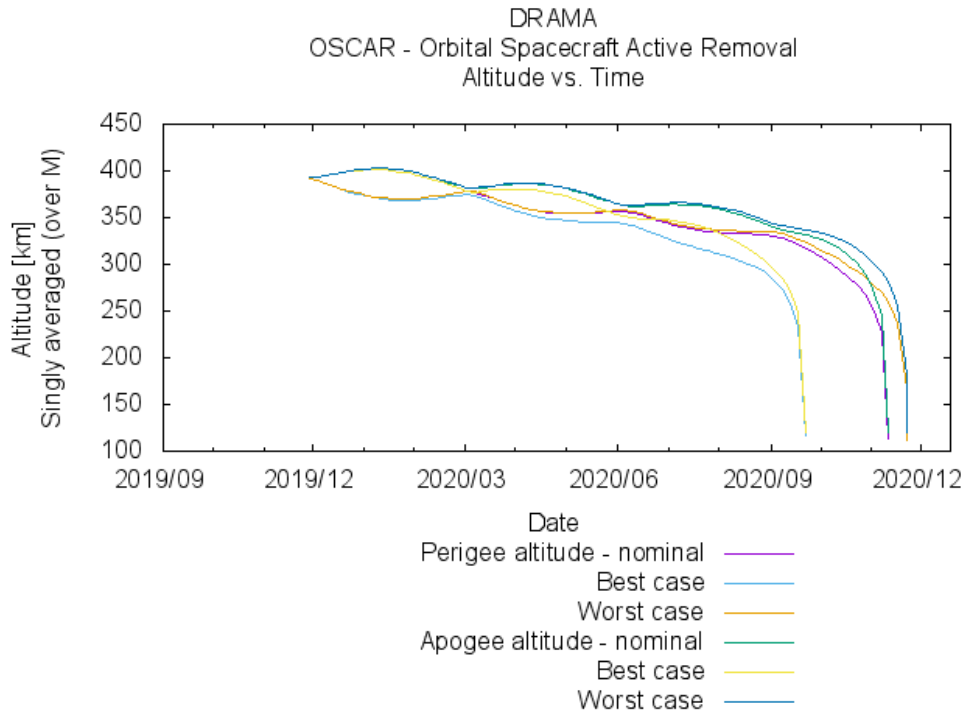
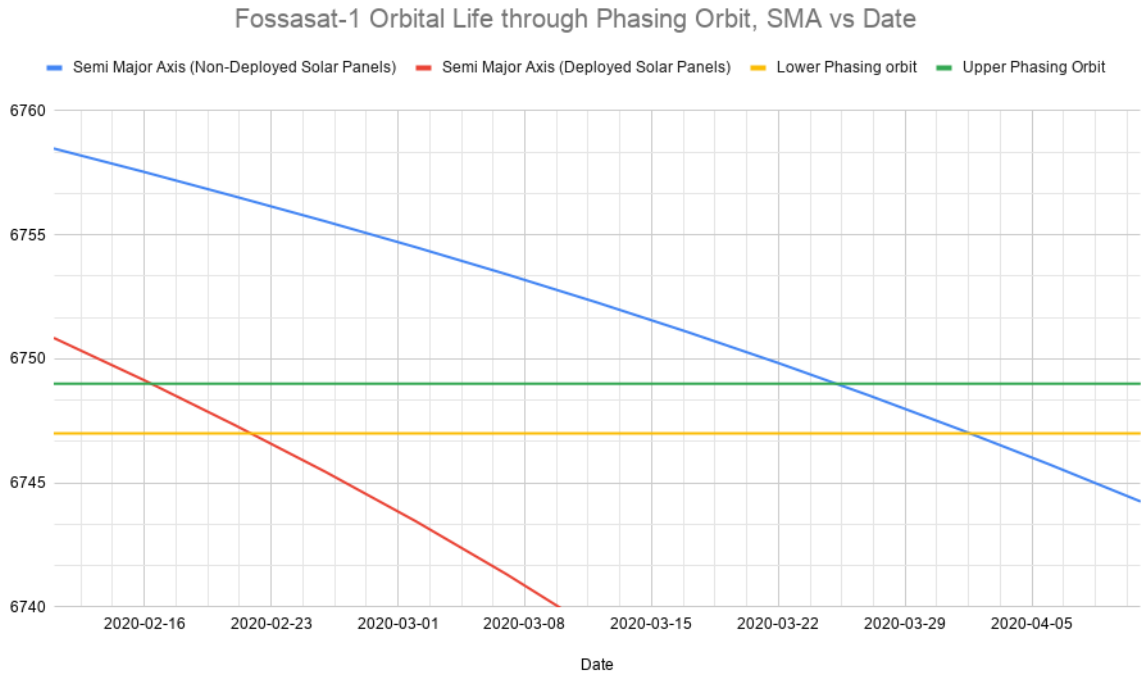
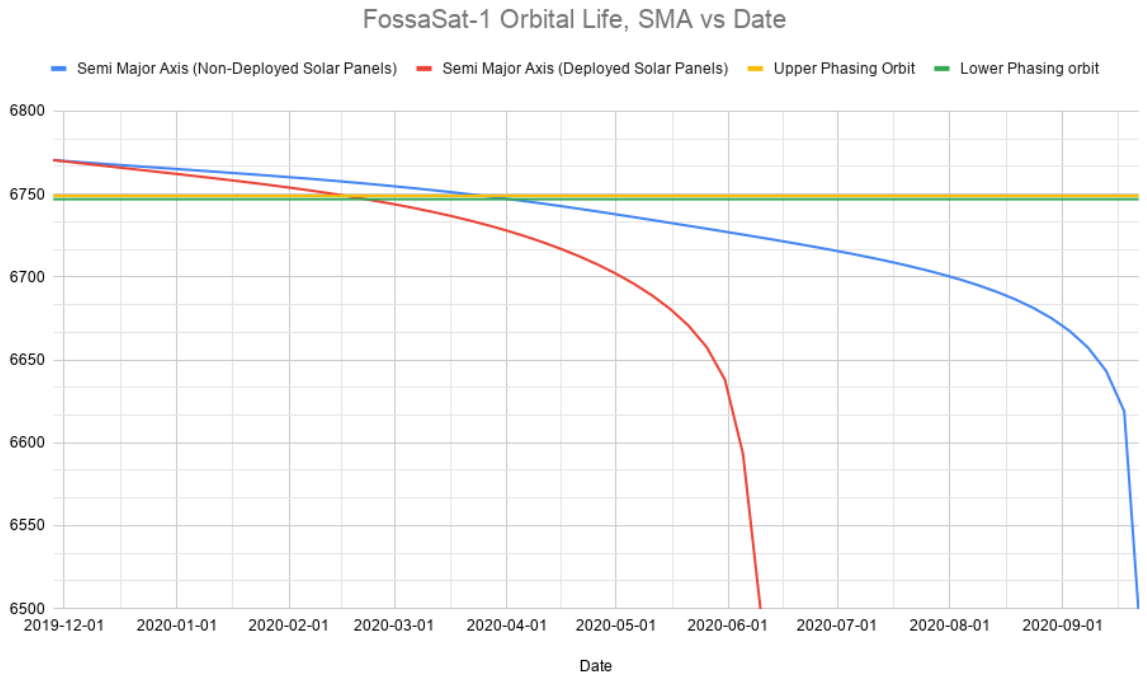


Figure 4 – Orbital life of FossaSat-1 in a non-deployed state

Considering a phasing orbit of 370km +/- 1km for the Soyuz Capsule, it is determined that this 1P PocketQube will only transit through this zone for a duration of under 7 days.

Cross sectional area of this satellite in a deployed state is equivalent to that of a 0.5U CubeSat, of which dozens of that size and smaller have been launches and tracked successfully.


Fossasat-1 Orbital Life through Phasing Orbit, SMA vs Date
Semi Major Axis (Non-Deployed Solar Panels)
Semi Major Axis (Deployed Solar Panels)
Lower Phasing orbit
Upper Phasing Orbit
6760
6755
6750
6745
6740
2020-02-16
2020-02-23
2020-03-01
2020-03-08
2020-03-15
2020-03-22
2020-03-29
2020-04-05
Date


FossaSat-1 Orbital Life, SMA vs Date
Semi Major Axis (Non-Deployed Solar Panels)
Semi Major Axis (Deployed Solar Panels)
Upper Phasing Orbit
Lower Phasing orbit
6800
6750
6700
6650
6600
6550
6500
2019-12-01
2020-01-01
2020-02-01
2020-03-01
2020-04-01
2020-05-01
2020-06-01
2020-07-01
2020-08-01
2020-09-01
Date