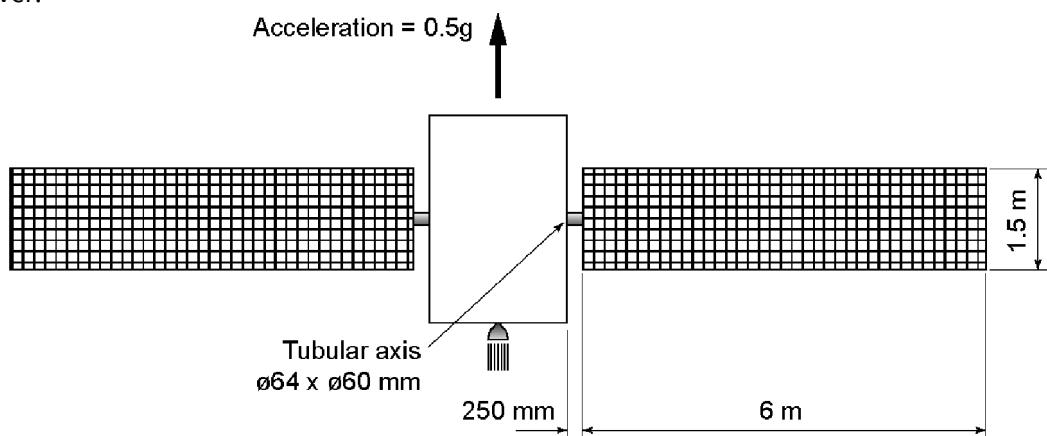


Exercise 4.1 - Solar Array

v.01

Problem Statement

The spacecraft from the picture below is submitted to a 0.5 g acceleration during a maneuver.



The solar arrays have a mass power of 45 W/kg

The energy efficiency of the solar cells is 25%

Evaluate

1. The mass of one single solar array wing (hint: take into account the average solar constant).
2. The torque that is applied to the axis during the acceleration.
3. The maximum stress on the axis.
4. Optional: the margin of safety for the fatigue strength of an aluminum tube (A7075-T6).

The maximum allowable stress for aluminum (A7075-T6) is [Pa]:

$$\text{In [Pa]: } \sigma_{al} = 150 \times 10^6;$$

A factor of safety (FOS) of 2 is considered.

Hint: ECSS-E-ST32C Rev.1 section 4.5.16

Solution