[[1]](#footnote-1)

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# INTRODUCTION

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# the mass establishment of the satellite

Our satellite is based on a project called SMART-OLEV from the SSC (Sweden), Kayser-Threde (Germany) and Sener (Spain). It has a similar goal as this project. The SMART-OLEV project designed a satellite which is used as an orbital life extension vehicle for servicing commercial spacecraft in GEO. [1] The SMART-OLEV satellite is a low thrust satellite which shall be attached to working satellite without propellant to maneuver itself. In that way, the SMART-OLEV satellite shall be able to help the obsolete satellite to work several more years. The SMART-OLEV satellite uses a grabbing device which dock to the propulsion system of the client satellite and can operate for many years depends on the size of the client satellite. [1] The satellite in this project uses a similar docking device and a similar propulsion system. The SMART-OLEV satellite shall work for less than one year but working with bigger object. So, this means that the SMART-OLEV satellite shall have a similar design as the satellite in this project.

The mass of the SMART-OLEV satellite is limited to one ton and one third of it is the propellant. This means that the SMART-OLEV is using around propellant. [1] Which is around the same amount of propellant needed in this project.

The SMART-OLEV is using 6 hall-effect thrusters which is the same type as the SMART-1 satellite. [1] The SMART-1 satellite is using the PPS-1350-G thruster. [2] The PPS-1350-G thruster has the mass of and a nominal power of 1500 W. [3] So the total mass of these 6 thrusters should be around 32 kg and the total power of them should be around 9 kW. BHT-8000, the electrical thruster we are using, has a mass of 25 kg and a nominal power of 8 kW which are a little smaller than the SMART-OLEV’s. [4] So, the same amount of mass on thruster system as the SMART-OLEV one is assumed.

Our grabbing device is similar to the one SMART-OLEV is using so similar mass is assumed as well.

The SMART-OLEV project is about operating client satellite at the GEO. [1] At there the satellite is almost always receiving the solar energy. But at the LEO there is a possibility of that the Earth is blocking the Sun which means there can be a while when the satellite is not receiving energy. So, the satellite needs a battery to maintain the acceleration. The longest time the satellite will be out of inputting power shall be half the orbiting period. The orbiting period can be calculated by the following equation according to the Kepler’s third law.

This maximum value of the period time is calculated assuming the satellite is orbiting at the highest possible altitude. So, the longest unpowered time should be less than half an hour. Thus, we need a battery that can provide 8 kW power for the thruster for half an hour. This means the battery should have at around energy.

The mass of the battery is assumed to be then the ratio of specific energy and the specific power of the battery should be the following.

According to our source [5] the battery type that has the similar property is the lithium nickel manganese cobalt oxide. So, the mass of the battery shall be around 30 kg.

So, our satellite is assumed to be 30 kg heavier than the SMART-OLEV satellite which is just 3% compare with 1 ton so we can assume that our satellite is at the same mass and dimension as the SMART-OLEV satellite.

# References

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