

# An Approach for Economic Efficiency Ratio on Suborbital and Orbital Activities vs Space Debris

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## Abstract

The space sector has become an exponentially growing industry in recent years. Its outcomes exert great impact on economic decisions. After the Space Race between the US and the Soviet Union, the space sector has started to shift its center from government to private components slowly and successfully. The private part of the space sector has been growing as well in years especially for the launch capabilities, such as the ones that can be reusable. Since we have easy and more ways to send a satellite to earth orbit or beyond, the number of space debris has also been increasing. As the final economic frontier has reached the Earth's orbit, the space economy needs new measurements for the space activities and an approach for the economic efficiency ratio for the relation between the suborbital activities and tests and orbital activities versus space debris.

## Safety and Sustainability of the Suborbital and Orbital Missions

It is obvious that the capability has been growing because of the number of the tests and launches that have been conducted every year. Especially with the suborbital flights for space tourism and high-altitude balloons (for scientific reasons for now and for commercial reasons in the near future). However, it is not easy to say that is safe doing these projects while there is ongoing space debris problem that sometimes even effect our daily lives because it is hard to predict the place the debris will fall down and how that is going to affect the suborbital space activities.

## State of the Space Debris

Kessler Syndrome is maybe happening today. If not today, it will definitely be the case in our future since the number of satellites has been increasing alongside the demand for allocations. Countries are more willing to be in orbit and it can be said that they go to the extent of acting irresponsibly against the active satellites and the security of space missions. While these numbers have been increasing, suborbital projects have been demanded more as well.

## An Approach for Economic Efficiency Ratio

To be able to act responsible and with economic efficiency for both suborbital and orbital activities, we developed an approach for a ratio created by the number of the rocket launches and approximate space debris and the impact on the suborbital missions (including the use of sounding rockets, aircrafts, high-altitude balloons, and suborbital reusable launch vehicles). If we do not approach this issue with a measurement, the future missions for all kind of activities would be at high risk for instance, high-altitude balloons, commercial balloon-space stations, suborbital reusable launch vehicles, satellites and human missions for the ISS or for the Moon and the beyond.

The space industry needs to find a plausible solution for the debris problem. While there is a high demand for suborbital and orbital missions and allocations on orbit, we are focusing on the space debris problem through an economic aspect which is efficiency especially during the ongoing recession statements with high inflation all across the world and unsolved supply chain problems.

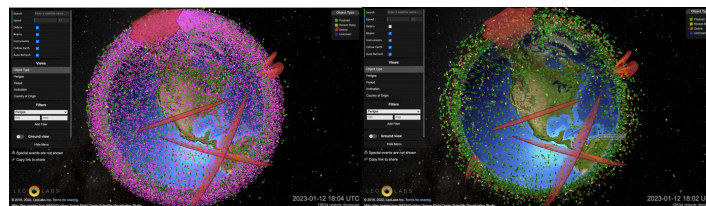


Figure 1: Leolabs Visualization of Earth Satellites with and without debris (Leolabs, 2023).