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MORE SUSTAINABILITY AND PROFITS WITH DEORBITING SYSTEMS

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Thousands of satellites have been launched in the space era: it is difficult not to think about their possible impacts with other future satellites, or with some place in the Earth when falling down.
Concerns are about loss of image, interruption of services, loss of money, damages to goods or even injury to persons.
From a different perspective, however, actions for debris prevention and removal could be seen not only as means for avoiding negative situations, but as means to implement positive actions as to implement "space sustainability" and profits.

INTRODUCTION TO THE PROBLEM

From the early stage of the space era (1957), man-made objects remaining from satellite launches and their injection into orbit have populated space.

While at the beginning few residual remained in space: dead satellites, missile last stages, upper stages, pieces from fragmentation or collision of parts and so on, nowadays the number of "space debris" is unbelievable high.

The majority of space debris in number have limited dimensions, however, even space debris with dimensions in the range of millimetres may provoke severe injury to satellites, space station personnel in extra vehicular activity starting from brazing and going to damage to the most exposed experiments or to vital damages to the spacecraft.

Today the number of that space debris fragments is higher than some hundred million, as depicted in Table 1, and is growing exponentially.

Space debris affect primarily the most interesting orbits for space based activities: GEO and LEO and spacecrafts are forced to be equipped with mechanisms (like shields) to protect themselves from this hazard.

But the increase of the number of launches, and therefore the number of objects put into orbit, can easily lead to the orbit "saturation" if the number of new spacecrafts (or objects) put into orbit is higher than the number of objects that decay.

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Consequently, space objects may start colliding into each other, generating fragments and thus increasing the already high number of debris, towards a sort of “collision reaction”, known also as Kessler Syndrome[1].

Some people thinks that we are very near to this point.

Table 1. Estimated Orbital Population[2]

Size	Number	% Mass
> 10 cm	> 30,000	99.93
1-10 cm	> 750,000	0.035
< 1 cm	>166,000,000	0.035
Total	> 166,000,000	6,000 tonnes

THE PERCEPTION OF THE PROBLEM

The emerging "potential" problem of space debris was forecasted in the 70's and since then the main institutional and governmental entities worldwide monitor the situation through collection of launches and their recording into database, to “flying objects” optical and radar surveillance. With time, data collection showed clearly the trend of increasing number of objects orbiting uncontrolled around the Earth.

Mayor events, as for example operative spacecraft’s collisions with dead satellites, generating clouds of debris, reinforced the perception of the threat.

Parts of spacecraft brazed by debris, pieces of spacecraft falling down to the Earth, more and more frequently, warnings of potential collisions (even with ISS) are proofs that the problem is going to be really severe.

THE THREATS

About the main perceived threats generated by space debris range from the impossibility to access, in future, to certain orbits, to the possible damages to spacecrafts or to people and assets in space or down to the Earth.

All of the cited risks are potential and/or probable future damages, both from a social and an economic point of view.

However, the economic and social effort spent in order to avoid such events is already an effect and a damage derived by space debris

The avoidance of collisions imply to have continuously under surveillance all the "flying objects" to predict their orbit or trajectory, to compute them in order to find out whether some collisions would be possible and, in case, to perform manoeuvres with the spacecraft to change orbits to decrease impact probability.

This means an investment of conspicuous amounts of public money for the surveillance infrastructures, and, from a commercial space operation point of view, a consumption of propellant, which affect the operative life of the spacecraft and, therefore, shortage of services and loss of revenues.

Therefore, the space debris represents severe threats: from future possible loss of image, loss of money, damage to goods, injury to the people to present loss of revenues due to debris monitoring and anti-collision manoeuvres. Without taking into account the liability risk of space operators – through launching states – in case of in orbit collision or damages produced to people and assets on the Earth: today a dead satellite is not insured.

These problems involve institutions, operators, spacecraft manufacturers, insurance companies and so on.

All these institutional and private bodies are moving: establishing regulations, reinforcing monitoring programmes, putting in place mitigation means, considering the real value of the risk.

THE THREAT MITIGATION

For the mitigation of those risks, debris prevention and debris active removal are coming to be important topics for the space community: the removal of satellites after their operative life nowadays is not an option, but a strong requirement.

From a different perspective, however, actions for debris prevention and removal could be seen not as means for avoiding negative situations, but as means to implement positive actions.

In fact, if we look to space as a resource-like environment, energy- and platform for further business development, its "consumption" should be limited and considered as we intend to achieve planet sustainability allowing operations and businesses in space also to future generations.

Therefore, debris prevention and removal are pillars and the very first steps to implement sustainability concepts also in space.

Applying strategic sustainability principles to space activities, such as the ones that many multinational corporations apply on Earth increasing their reputation and profitability, may drive the future design and development of the technology for the space sector.

Not only an intelligent strategy applied to the space sector could reduce costs, but could also generate more profits.

This is particularly true for satellites that offer services to the users, like, for example telecommunication satellites.

In fact, the use of dedicated and independent decommissioning devices, based on highly reliable solid propellant technology, is a primary response to debris mitigation solutions and enable commercial satellites to increase the revenues generated per mission and decrease satellite operators' liability.

THE DECOMMISSIONING APPROACH

Studies made by D-Orbit, that is developing smart solid motors for spacecraft decommissioning and therefore debris prevention, demonstrate that the cost of the device and the major launch cost for its weight on the satellite is more than compensated by the increase of the satellite operational life and therefore increase of revenues due to more service time.

D-Orbit represents the solution, allowing satellites to perform a safe, fast (few hours) and controlled deorbiting or re-orbiting into a graveyard orbit at the end of their operating life or when major malfunctions occur.

REFERENCES

[1]"Scientist: Space weapons pose debris threat – CNN". Articles.cnn.com. 2002-05-03. Retrieved 2011-03-17.

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