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Why Is the Space Sustainability Rating Not Enough?

Introduction

Space debris is one of the main issues in outer space. The Space Sustainable Rating (SSR) is an initiative that aims to address this problem by encouraging companies to design sustainable space missions. It seems however not enough considering the structure of the contemporary space industry. Other relevant issues have also to be taken into account, making SSR incomplete.

A little bit of context: Today's space environment

According to ESA, more than 130 million debris bigger than 1 mm, including 1 million bigger than 1 cm,[2] are orbiting planet Earth. A space debris is moving between 7[3] and 20 km/s.[4] Each in-space collision, even with a 1 mm debris (e.g. a paint flake), can have catastrophic consequences.

Space is becoming accessible, launches are less expensive, constraints seem to reduce little by little, but the number of debris only increases, making each mission more dangerous. The task of cleaning up space also becomes more difficult.

The ESA 2022 Space Environment report gives a worrying assessment: even if no more launches took place, the number of collisions would continue to increase.

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[2] ESA 2022a.
[3] NASA 2011.
[4] CNES 2020.

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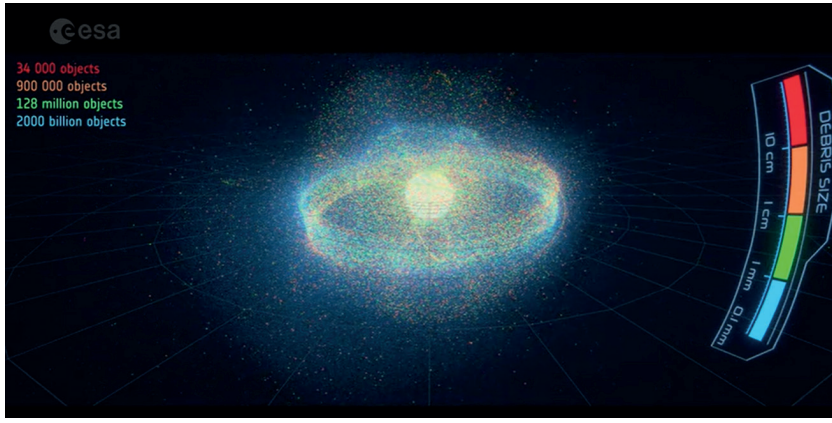


Figure 1: Time to Act
Source: ESA 2021

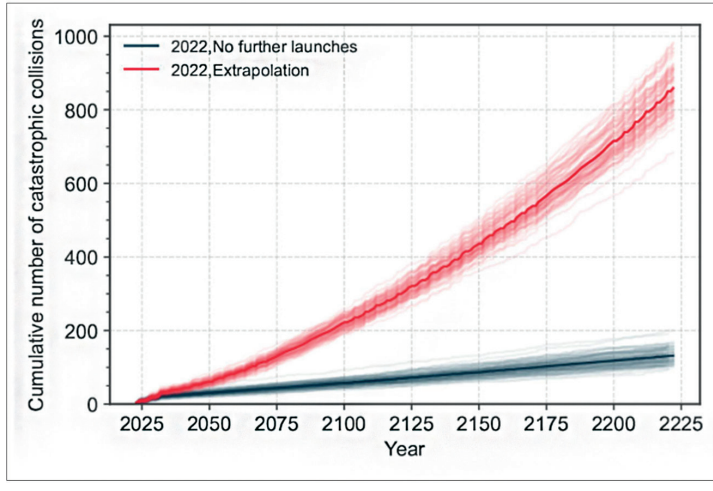
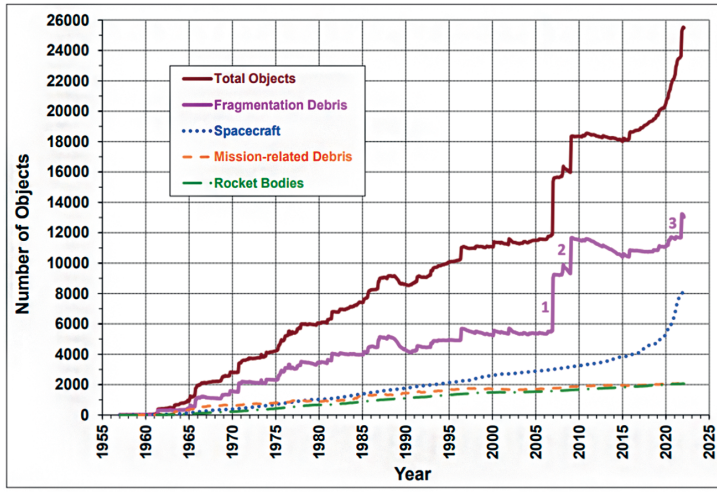


Figure 2: The future of catastrophic in-space collisions
Source: ESA 2022b

This is becoming unmanageable for space agencies and companies. After Russia's November 2021 ASAT test, Planet[5] had to handle an incredible number of CMEs.[6] The ISS was also put at risk.[7] ESA had to manoeuvre a first time a few years ago.[8] The problem becomes critical, and a solution has to be found.



The three upward jumps in fragmentation debris correspont to (1) the ASAT test conducted by China in 2007, (2) the accidental collision between Iridium 33 and Cosmos 2251 in 2009, and (3) the ASAT test conducted by the Russian Federation in November. More Cosmos 1408 fragments are expected to the added catalog in the coming weeks and months.

Figure 3: Historical increase of the catalogued objects based on data available on 1 March 2022
Source: NASA 2022: 2.

What legal protection of outer space against space debris?

Creating space debris is not forbidden. There is no rule today that prevents generating space pollution. Anti-satellite missile tests, i.e. the destruction of satellites in outer space for the sole purpose of testing a missile, are not forbidden, even though they generate thousands of pieces of debris (see Figure 3).

5 Private company owning hundreds of Earth Observation satellites in LEO.
6 Foust 2022.
7 Nelson 2021.
8 ESA 2019.

Article IX of the Space Treaty, which requires States to conduct their activities "with due regard to the corresponding interests of all other States Parties to the Treaty",[9] does not seem to include space debris. Some international law instruments try to mitigate space debris, for instance the Space Debris Mitigation Guidelines of the COPUOS,[10] or the IADC Space Debris Mitigation Guidelines,[11] but these are only soft law tools.

Some national laws require actors to de-orbit their out-of-service satellites located in LEO within 25 years. This measure is useful but insufficient, especially in view of the rapidly developing satellite constellations. Moreover, these are not international standards.

The FCC[12] has gone a step further by imposing a maximum of five years to deorbit out-of-service satellites in LEO.[13] This measure has sparked a lively debate on its feasibility, but would have a double beneficial impact on the space environment: it applies to the many American operators and could encourage other States to do the same. Until they follow the movement, initiatives such as the SSR exist.

What is the Space Sustainability Rating?

Space Sustainability Rating has two goals. The first one is to provide a rating system informed by transparent, data-based assessments of the level of sustainability of space missions. The second objective is to offer practical guidance to space operators on how to improve their sustainability performance, with the goal of helping to address the challenges raised by the proliferation of space debris.

So basically, a grade is given to a space mission. This grade depends on five criteria plus a bonus one. The "Mission Index" quantifies the level of harmful physical interference caused by the mission; the object has to be reliably included in space surveillance and tracking products ("Detectability, Identification and Trackability"); measures have to be taken to reduce the risk of accidental collision

[9] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, 1967, Article IX.

[10] Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space, 2007.

[11] IADC Space Debris Mitigation Guidelines, IADC-02-01, 2020.

[12] The U.S. agency responsible for licensing satellite operators.

[13] FCC 2022.

("Collision Avoidance Capabilities"), the operator has to share space situational awareness data ("Data Sharing"); the adoption of standardisation concepts is also taken into account ("Design and Operations Standards"); and finally, as a bonus, is the mission designed to receive external services? ("External Services").

These modules give a score, ranging from Bronze to Platinum.[14] In addition, there is also a bonus "Step" indicator.

Can the Space Sustainability Rating be effective?

The SSR is a very recent rating so we cannot really tell if it is efficient or not. But I have two main issues regarding the SSR: it is a non-mandatory evaluation, based on the will of space actors to be graded; and this evaluation is not free, companies have to pay to be graded. A question arises: how a costly non-mandatory rating could be widely adopted by space actors?

We have to keep in mind that one of today's goals is to make access to space activities cheaper. That is why there are so many new space companies and new launchers, promising space activities for a fraction of the current price.

Of course, in terms of the image sent back to the space industry, it will be better for a company to have a good SSR grade. But it is not enough to ensure a wide adoption of SSR, because the space sector is largely B2B (business to business) and not B2C (business to customer). In B2B relationships, the image is far less important than in B2C relationships. An economic incentive may be necessary.

Different actors at different levels of space mission preparation can help implement SSR on a large scale.

Insurance is mandatory in a lot of space faring nations, e.g. France.[15] Insurance pricing is calculated according to various factors (risks, orbit, duration, etc.). A good SSR grade could reduce the pricing.

States can also decide to refuse giving public money to companies with low grades. In France for instance there is the France 2030 program, companies have to respect some conditions to compete and get funding. The French Government could choose to only give money to companies with higher grades. National and regional space agencies could also decide to only work with companies with good grades.

[14] Bronze: 40–55%; Silver: 55–70%; Gold: 70–80%; Platinum: 80–100%.

[15] Loi n° 2008-518 du 3 juin 2008 relative aux opérations spatiales (1), Article 6.

The best solution would be that the governments, authorising national space activities,[16] refuse to give the authorisation for missions with low SSR grades.

States "bear international responsibility for national activities in outer space".[17] This responsibility is divided in two: responsibility for fault in space,[18] responsibility without fault on Earth and in the air.[19] A question arises: is it a fault to authorise a space mission that generates unnecessary debris and is not able to avoid collision (thus having a bad SSR score)?

Today it seems that no matter how the space mission was designed, the responsibility of the State is not yet internationally engaged because of space debris.

Is the SSR worse than not enough?

Could SSR have a negative effect on the sustainability of space activities? There are several trends that come to mind.

First of all, we must remember that the majority of States are not space faring nations yet. More and more countries are financing space activities, which are fundamental to face contemporary challenges (climate change, famine, war, migration, etc.). If the SSR becomes a mandatory standard, necessary to cooperate with space faring nations, developing countries will be disadvantaged.

The same competitive disadvantage may be found at national level with on the one hand well-established players (e.g. Ariane Group) that will have the means to both design sustainable missions and pay for the rating of each of their missions, and on the other hand startups that enter the market with (very) limited financial means. If it is clear that startups also have to make an effort to design their missions in a sustainable way, it can strongly impact innovation and the development of new technologies, while reducing the momentum of accessibility to space.

[16] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, 1967, Article VI.

[17] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, 1967, Article VI.

[18] Convention on International Liability for Damage Caused by Space Objects, 1972, Article III.

[19] Convention on International Liability for Damage Caused by Space Objects, 1972, Article II.

Second, the SSR is a private initiative, managed by a private organisation that space operators pay to get a score. Thus, it is almost certain that other initiatives of the same type will appear, with different criteria. Some ratings will probably be easier to obtain, with variable prices. In the end, understanding all these standards will be complex and will not serve the objective of transparency.

Finally, a last phenomenon could occur: the appearance of States of convenience. I have argued that the States themselves should force actors to obtain a good SSR score, or at least impose strict rules on the sustainability of space activities. If space faring nations impose these rules, private actors, especially startups, could decide to move in countries that do not impose these rules.[20] These States would become States of convenience, allowing cheap access to space, because they are provided by companies with no additional costs linked to the control of the sustainability of space missions. The phenomenon is well known in the law of the sea, the majority of ships being registered in States of convenience.[21] The States which regulate should then try to find a way to "punish" these unscrupulous companies and States, but the task is difficult.

The missing part of the SSR

Even if the SSR is not perfect, it has the merit to exist. But it is unfortunate that this rating only focuses on space debris, addressing only one problem at a time. The space sector is constantly growing and the challenges are numerous and interconnected. Having a global vision of these different challenges is necessary to find coherent solutions. Dealing with one problem at a time can be counterproductive.

A 2021 scientific study has criticised the practice of burning space debris in the atmosphere to avoid clogging low earth orbit.[22] Space tourism is also widely criticised, the negative impact on the environment far outweighing the limited usefulness of such missions.[23]

[20] One example is Rwanda's request for 300,000 satellites. De Selding 2022.
[21] CIA 2022.
[22] Boley–Byers 2021.
[23] Ross et al. 2010; Shukla 2021.

Light pollution is not taken into account by the SSR either, a worsening issue.[24] The SSR thus takes into account only the pollution in the traditional, historical sense of the term: space debris.

Despite these shortcomings, the SSR remains interesting because it allows a first awareness and sensitisation to the problem. Moreover, it allows companies that want to be virtuous and take into account the problem of space debris to act despite the inaction of their national State.

However, I must plead for a wider rating, including all types of pollution, free of charge, publicly accessible to ensure absolute transparency.

Conclusion

The real effectiveness of the SSR is questionable. While this type of rating may be beneficial because it puts all private actors on an equal footing, regardless of the State of nationality and/or launch, the optional nature of the rating could make it anecdotal or elitist. The SSR must be widely adopted by a majority of actors, at all levels: States, space agencies, private companies.

I must conclude this article on a positive note: the creation of the Space Sustainability Rating, regardless of its effectiveness, is a further step towards a generalised awareness of the entire space sector.

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