Space Debris Mitigation: Understanding the Business Case and Proposing Solutions

Authors: Sophia Gustely, Adriana Ordonez, Ryan Kirby Faculty Advisor: Dr. Tinoco

Abstract

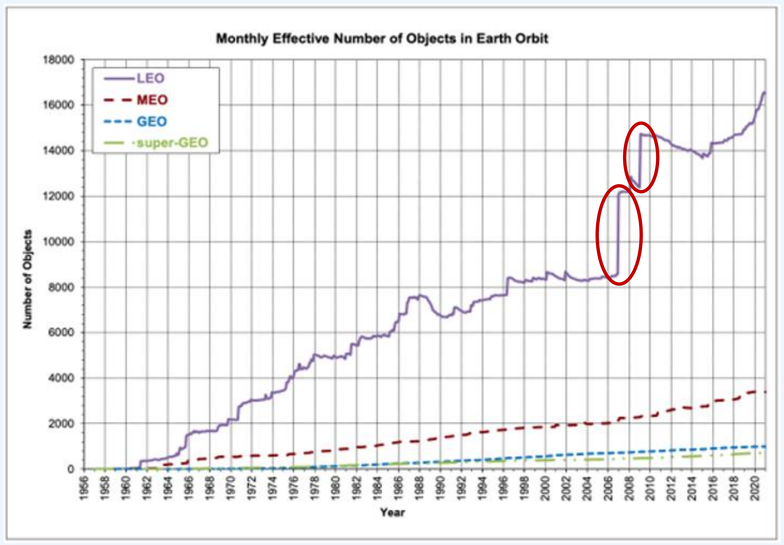
The purpose of the research was to investigate U.S. policy and business solutions that focus on Lower Earth Orbit (LEO) commercial debris limitation and create possible business cases for companies to reduce space debris of their own making; to find potential national solutions that support the business case; and to add to the growing conversation on space sustainability.

Three Top Measures of Debris Mitigation
Debris limitation
Active debris removal
Space situational awareness (SSA) and defensive maneuvers

Table 1: Overview of measures

Introduction

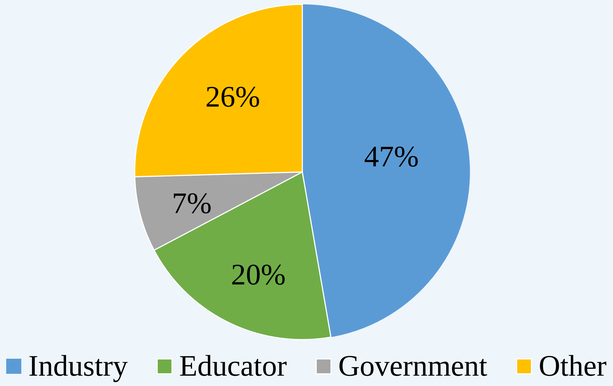
"Space debris includes any nonfunctional human-made object in space, including rocket parts that have been abandoned in orbit after having completed their mission, defunct satellites, fragments from unintentional and intentional orbital collisions and items released during operations." Debris creation is due to collision and the Kessler Syndrome where defunct satellites are still in orbit and will have increased by 50% in 2 years. There is insufficient compliance to national and international guidelines.and there is also no business case to remove debris of own making.



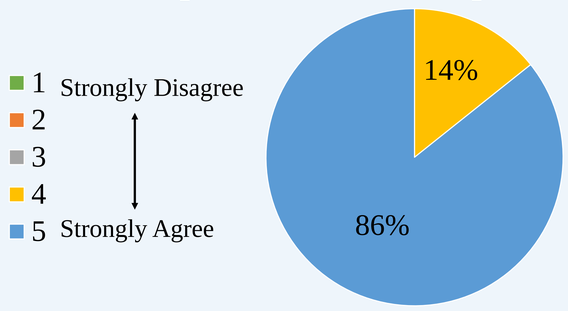
Solutions to be Examined

Tax incentives, Space tax to operate in LEO, Government Subsidies, Deposit refund schemes (combine a tax with subsidy), Voluntary Compliance, Tax on Space Debris, Liability Insurance, In-orbit space insurance premium reduction, Country Mandate, are solutions we have examined throughout our research.

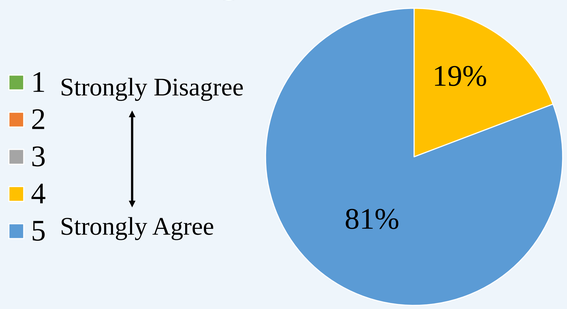
Respondent Demographics



Industry View on Companies Being Responsible for their Space Debris



Companies Should be Responsible for Limiting Debris of their own Making



Methodology

To conduct this research, a variety of sources were used to gather information. Throughout the duration of the project, our team mentor, Dr. Tinoco, assisted us with our research. Many of the documents and data used were provided online from NASA, ESA, and Space Debris User Portal amongst many others. We also collected our data from interviews with industry and government experts where we distributed our developed IRB-approved survey. Our targeted population included industry, government, academia with space/space debris knowledge where our survey response rate was 47.8%. In our results, 100% of respondents agree that something needs to be done to resolve the problem, 80% agree that voluntary measures to limit space debris are not enough, and > 80% agree that the LEO economy will be negatively impacted by space debris.

Discussion

Our survey results gathered that space debris is an issue that needs to be addressed. LEO economy will also likely be impacted if not resolved. However, the industry believes that companies should be responsible for the debris they create and how it is handled. These results were surprising due to the collective agreement on voluntary measures not being enough, yet the industry agreed that it should be the responsibility of companies. Another surprising discovery was the opinion that space debris limitation would NOT impact competitiveness.

Conclusion

Tax incentives and country mandates were the most popular positive incentive. This leads us to conclude that we can implement positive incentives for companies to follow rather than negative incentives for limiting space debris. Insurance incentives or incentives based on the Space Sustainability Rating (SSR), might entice companies more than a collective tax based on how the industry responded.

Acknowledgments

This project is partially supported by the National Aeronautics & Space Administration through the University of Central Florida's NASA FLORIDA SPACE GRANT, the ERAU Office of Undergraduate Research, and the Corporate Philanthropy Council.

References

Based upon request.