

MATH2270/MATH2237 Assignment 1

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- ☒ I have read and understood the Declaration and Statement of Authorship above.

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Space junk poses a significant hazard to active satellites, spacecraft, and crewed missions in orbit. Collisions with space junk can result in catastrophic outcomes, including the destruction of operational satellites, the creation of additional debris, and endangerment of crewed spacecraft. As seen in the 2 maps, there is a stark contrast between the years 1966 and 2020 based on the countries making satellites in the first place, and then ultimately turning into space junk. During the era of world war, none of the countries were into space exploration except for Russia, formerly called USSR and the North American continent. In 2020, almost every continent has a significant share of countries that are launching satellites.

According to the United Nations Office of Outer Space affairs data insights in 2024, given the advancements in weather technologies and GPS, the annual objects launched into space has seen an exponential growth from 2016. with around 2500 objects in space currently, with the United States contributing to almost 80% of the world's space objects launched, followed by other developed and developing countries such as UK, China and Russia.

The cumulative data graph by the United States Space Force shows that in the year 1982, the number of tracked objects larger than 10 cm in Earth's orbit was around 8,500. By 2023, this number had increased to over 23,000. This represents nearly a threefold increase in the number of large, tracked objects over the time period. Up to 2014 there is a steady increase of space objects, but beyond 2016, the upward slope is dangerously steep. For a comparison, picture over 34,000 buses floating around in space. Even small debris can have significant kinetic energy due to its high velocity. The growth rate of space debris has been estimated to be around 5% per year, with occasional spikes due to major events like satellite collisions. Collisions with even small fragments can disable or destroy these vital systems, disrupting services such as telecommunications, weather forecasting, and navigation. Protecting these assets from debris impacts is crucial for maintaining space-based services and capabilities. Debris re-entering the Earth's atmosphere can also potentially cause damage or injury if it lands in populated areas. Addressing the challenge of space junk requires international cooperation and coordination among space agencies and governments.

References

Union of Concerned Scientists (2005). Who has satellites? Then and now.

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United States Space Force (2023) – processed by Our World in Data. Tracked objects in low Earth orbit, by type. <https://ourworldindata.org/grapher/low-earth-orbits-objects>