Space Junk: The Debris Strikes Back

Madelyn Pollack, Dr. Brian Odom

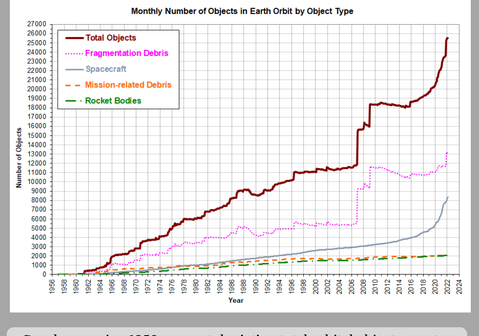
University of Maryland, Baltimore County; NASA History Program Office

Introduction

Space junk, orbital debris, space trash. No matter what term one uses to describe these man-made orbiting objects no longer capable of performing their assigned functions, they cause a constant danger to active missions in the near-Earth environment. The amount of debris in the orbital environment increases each year. According to NASA's Orbital Debris Program Office (ODPO), there were 9,000 metric tons of material orbiting the Earth. This number can be broken down into items larger than 10 cm (25,000), items between 1 and 10 cm (500,000), and items larger than 1 mm (>100 million). It is of note, however, that there are items of even smaller sizes that are not trackable; even those pieces can cause damage to active spacecraft due to average impact speeds of approximately 10 km/s. This can increase up to about 15 km/s, or about 10 times the rate of a speeding bullet. It is estimated that every single day, one catalogued piece of debris (at least 1 mm in size) falls to Earth.[1]

Background/Methodology

This research is designed as a historical analysis into public opinion and awareness of orbital debris since the start of the Space Age. I began by acquiring a working understanding of orbital debris science. I read materials describing relevant events chronologically, then investigated the non-expert conversation on those key events. Using written public opinion in conjunction with public opinion polls, I am working to deepen my understanding of the impact of orbital debris events on widespread American consciousness. The results will be compiled in a writing piece discussing further the information presented here.



Graph spanning 1956-present depicting total orbital objects greater than 10 cm, separated by object type.[2]

Major Orbital Debris Events

October 4, 1957
Launch of Sputnik I (USSR)
First satellite in space; people who "saw" it from Earth really saw its discarded rocket body.

Scan to hear Sputnik's beep![3]

1961, 1963
Project West Ford (US)
Communications satellite project; placed millions of needles in orbit.

1978
"Kessler Syndrome"
Term coined to describe a never-ending cycle of debris-creating collisions.

January 24, 1978
Cosmos 954 Reentry (USSR)
Fall of defunct Soviet satellite's nuclear reactor; left debris trail in Canada.

July 11, 1979
Skylab Reentry (US)
Crash of defunct U.S. station in Australia.

March 23, 2001
Mir Reentry (USSR)
Soviet space station fall into the Pacific Ocean.

January 11, 2007
ASAT Test (China)
Anti-satellite missile brought down a defunct orbiter, creating more orbital debris.

February 10, 2009
Cosmos/Iridium Collision (Russia/US)
Defunct Cosmos 2251 crashed into active Iridium 33 satellite; worst collision event to date.[3]

October 4, 2013
Release of *Gravity* film (US)
Fictional movie depicting the Kessler Syndrome and dangers of orbital debris.

November 15, 2021
ASAT Test (Russia)
Debris-creating event by planned anti-satellite operation.

Objectives

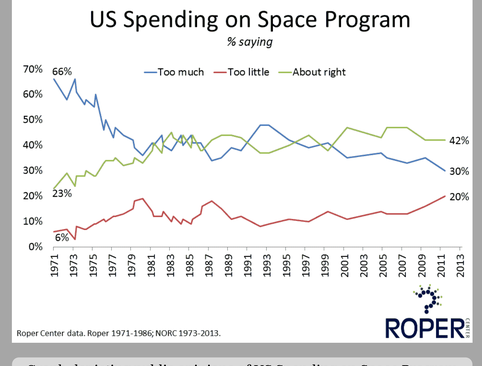
- Develop an understanding of orbital debris and its significance.
- Investigate public reactions to major orbital debris events, and the effect, if any, on opinions about space exploration in general in the U.S.
- Analyze orbital debris from a historical/humanities lens rather than from a science/engineering perspective.
- Interpret newspaper articles and public opinion polls as measures of popular attitudes toward orbital debris and space exploration.

Reflection

Orbital debris is not a topic that has been widely covered by historians. Engaging in this research has been a learning opportunity not only because of the chance to become immersed in an unfamiliar subject, but also because it bridges STEM and the humanities. Bringing science into an inter-disciplinary historical conversation is one of the best and most practical ways to achieve a well-rounded education and appreciation for a multitude of academic disciplines.

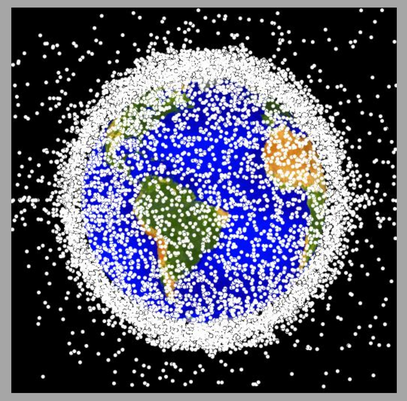
Although this research investigation is still a work in progress, certain patterns have become visible. Most important of which, is the continuing positive reputation NASA enjoys in light of its mishaps.[5]

Despite the multitude of debris events and public disapproval in the news media of falling space junk, there is no apparent correlation with public opinion of space spending in the U.S., as shown by the data from the Roper Center at Cornell University.



Graph depicting public opinions of US Spending on Space Program from 1971-2013.[6]

"See" Debris From Space



Computer-generated image of orbital debris as of January 1, 2019.[7]

Scan to see currently-tracked orbital debris (2019).[8]

Footnotes

[1] "Frequently Asked Questions," NASA Orbital Debris Program Office, https://orbitaldebris.jsc.nasa.gov/faq/.
[2] "Monthly Number of Objects in Earth Orbit by Object Type," NASA Orbital Debris Program Office, line graph, https://orbitaldebris.jsc.nasa.gov/modeling/legend.html.
[3] "Sputnik: Beep," National Aeronautics and Space Administration, mp3 audio, 0:04 min., http://www.nasa.gov/mp3/578626main_sputnik-beep.mp3.
[4] "FAQ," NASA Orbital Debris Program Office.
[5] Roger D. Launius, "Public opinion polls and perceptions of US human spaceflight," *Space Policy* 19, no. 3 (2003): 163-175, https://doi.org/10.1016/S0265-9646(03)00039-0.
[6] "US Spending on Space Program," Roper Center, line graph, https://ropercenter.cornell.edu/fly-me-moon-public-and-nasa.
[7] *leo-2019-512.jpg*, January 1, 2019, NASA Orbital Debris Program Office, computer-generated image, https://www.orbitaldebris.jsc.nasa.gov/photo-gallery/.
[8] Ibid.

Acknowledgements

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