

Space Exploration: Agencies, Entities, and Expansion

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Overview

The Soviet Union's *Sputnik 1* was launched in 1957. Ever since, there have been thousands of substantial innovations and launches in the name of space exploration.

We all realize that the ever-changing field has grown since its origins, but how much has it truly adapted? To answer this question, we have compiled data from several different datasets demonstrating the changes in numbers from the start to present day, and what effects that will have on the future.

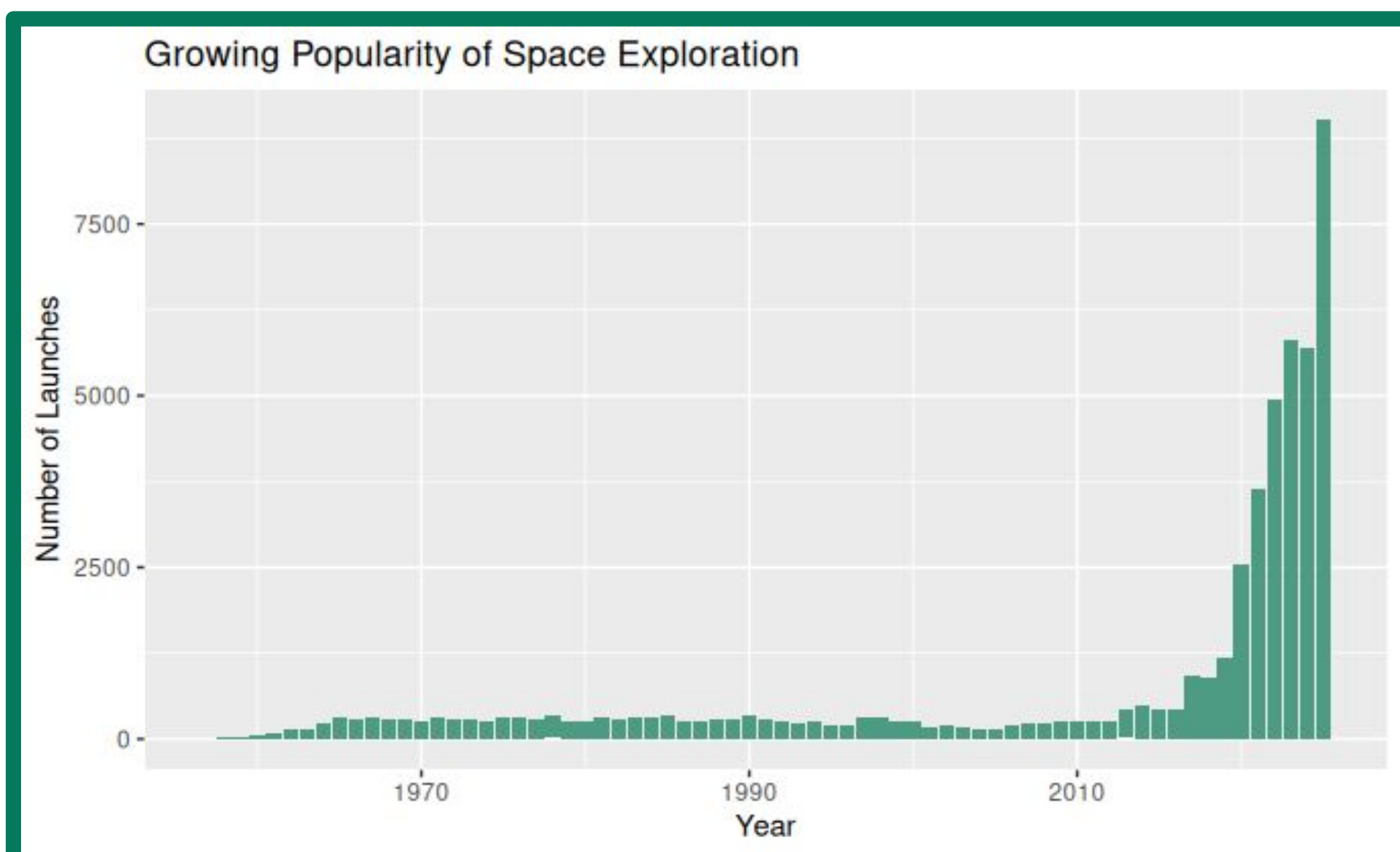


Figure 1 shows the overall upwards trend in space exploration

Materials and Methods

Data Collection

- Our World in Data; used to collect csv files with our data
- The Economist; collected additional data
- General Catalog of Artificial Space Objects; used to collect datasets

Data Preparation

- RStudio; used for coding and cleaning our data
- Quarto; used for compiling and presenting our data, also used for our proposal
- Various Forms of Generative AI; assisted with code involving dplyr and ggplot2
- We also translated various forms of observations to enable alternative forms of data (e.g. dates in string format to numerical format, or columns from individual characters to binary for easily available sorting)

Format

- Google Slides; formatted our poster
- posit.cloud; saved work in RStudio, stored documents, and generated graphs

Results

We analyzed data for various different agencies across the years, and how they've impacted safety, and failure rates.

We also examined the contributions that different countries and budgets have on space exploration.

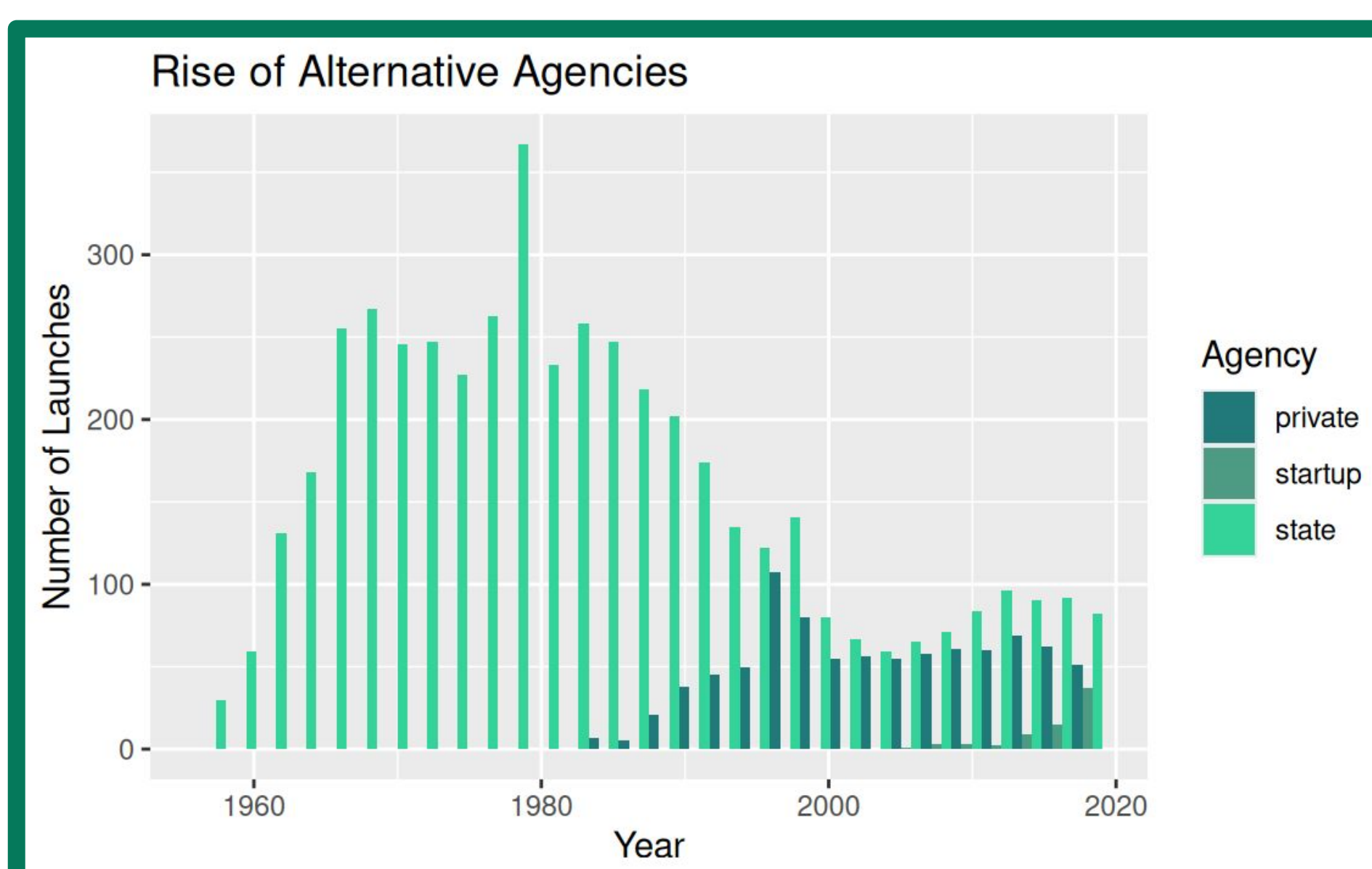


Figure 2 demonstrates the increase popularity of non-state owned space companies

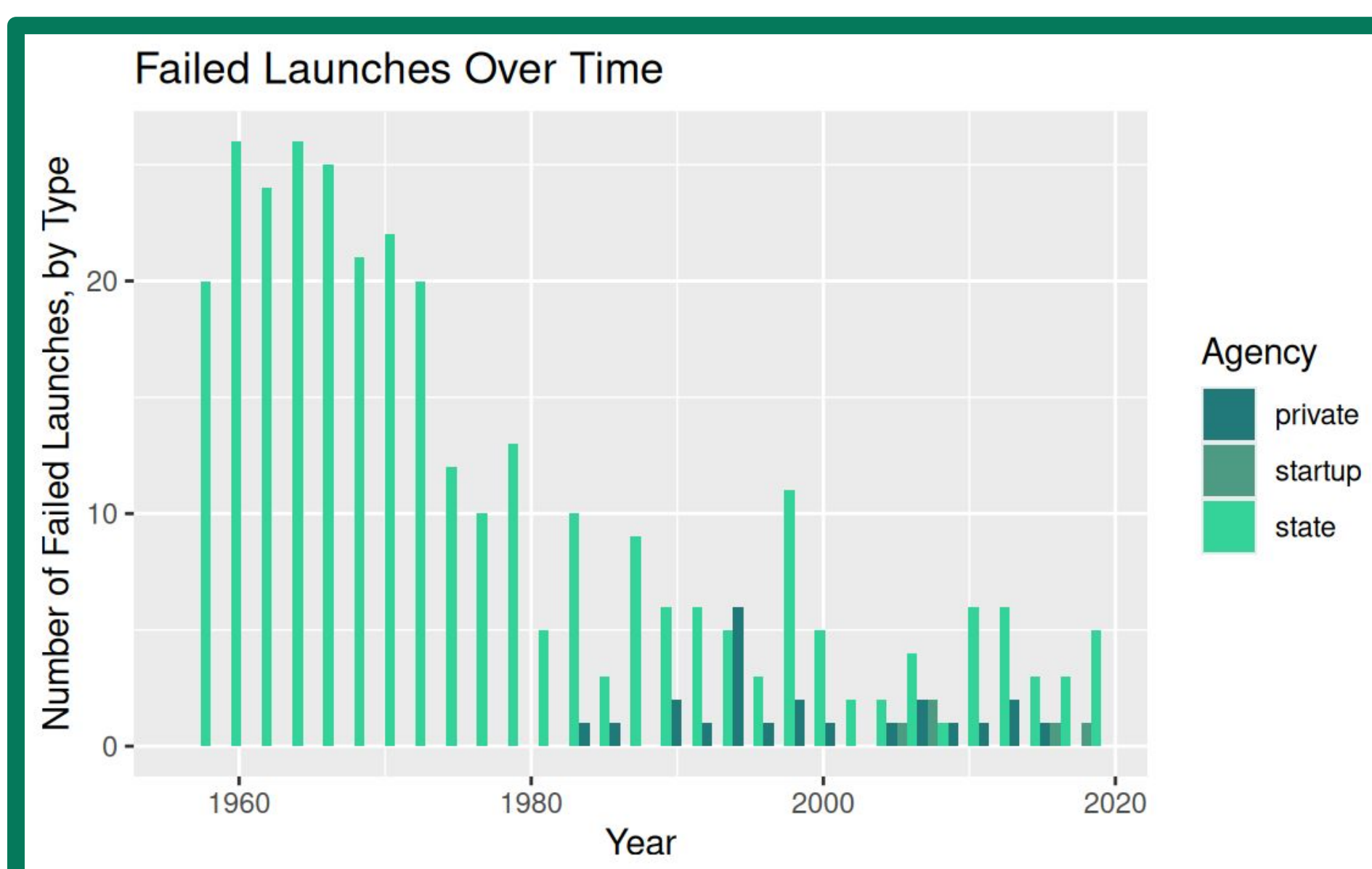


Figure 3 illustrates the downward trend of failures, grouped by agency type

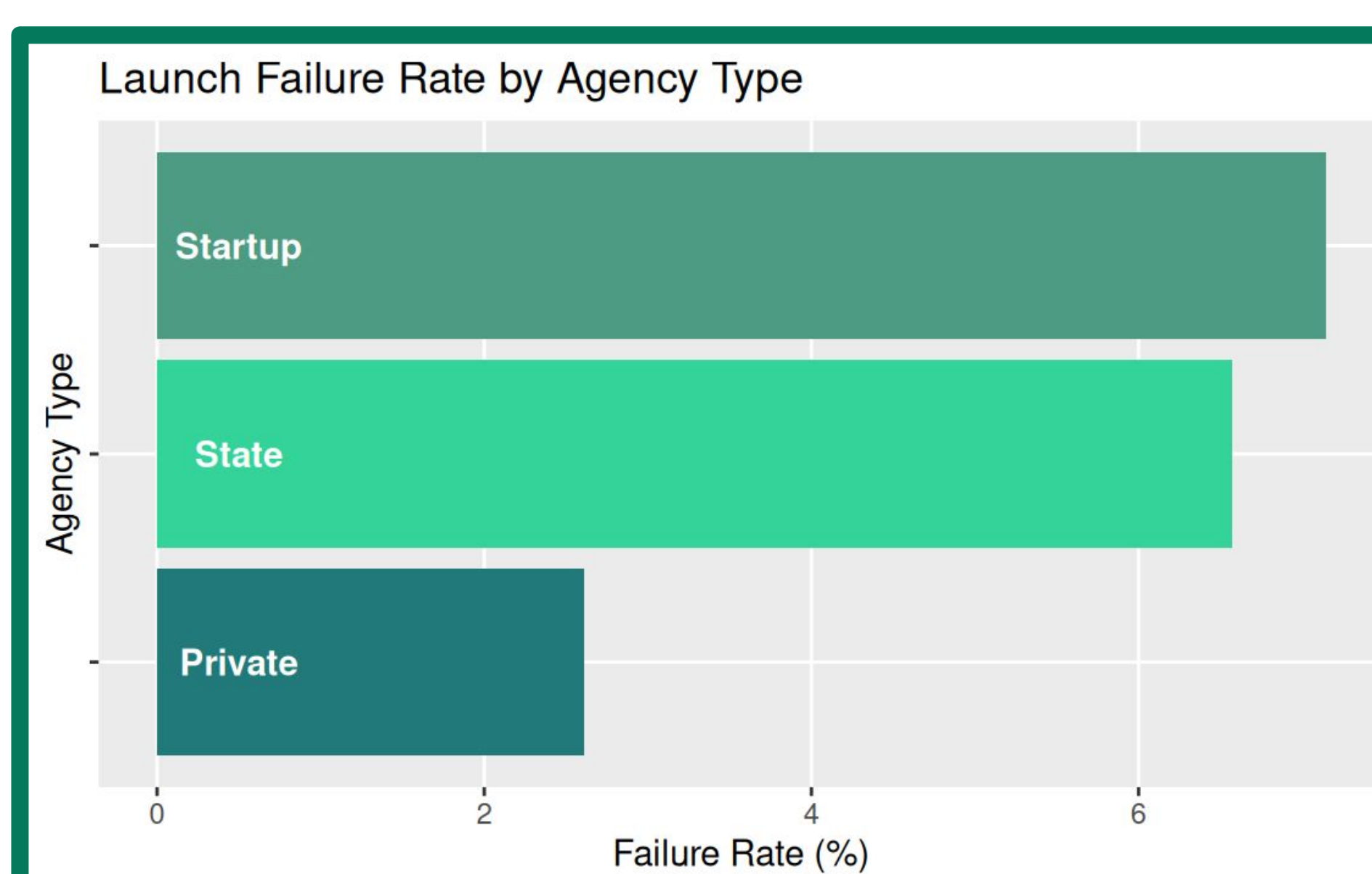


Figure 4 demonstrates the increase in popularity of non-state owned space companies

Line Charts and Maps

Here, we have models of the correlations between various different entities.

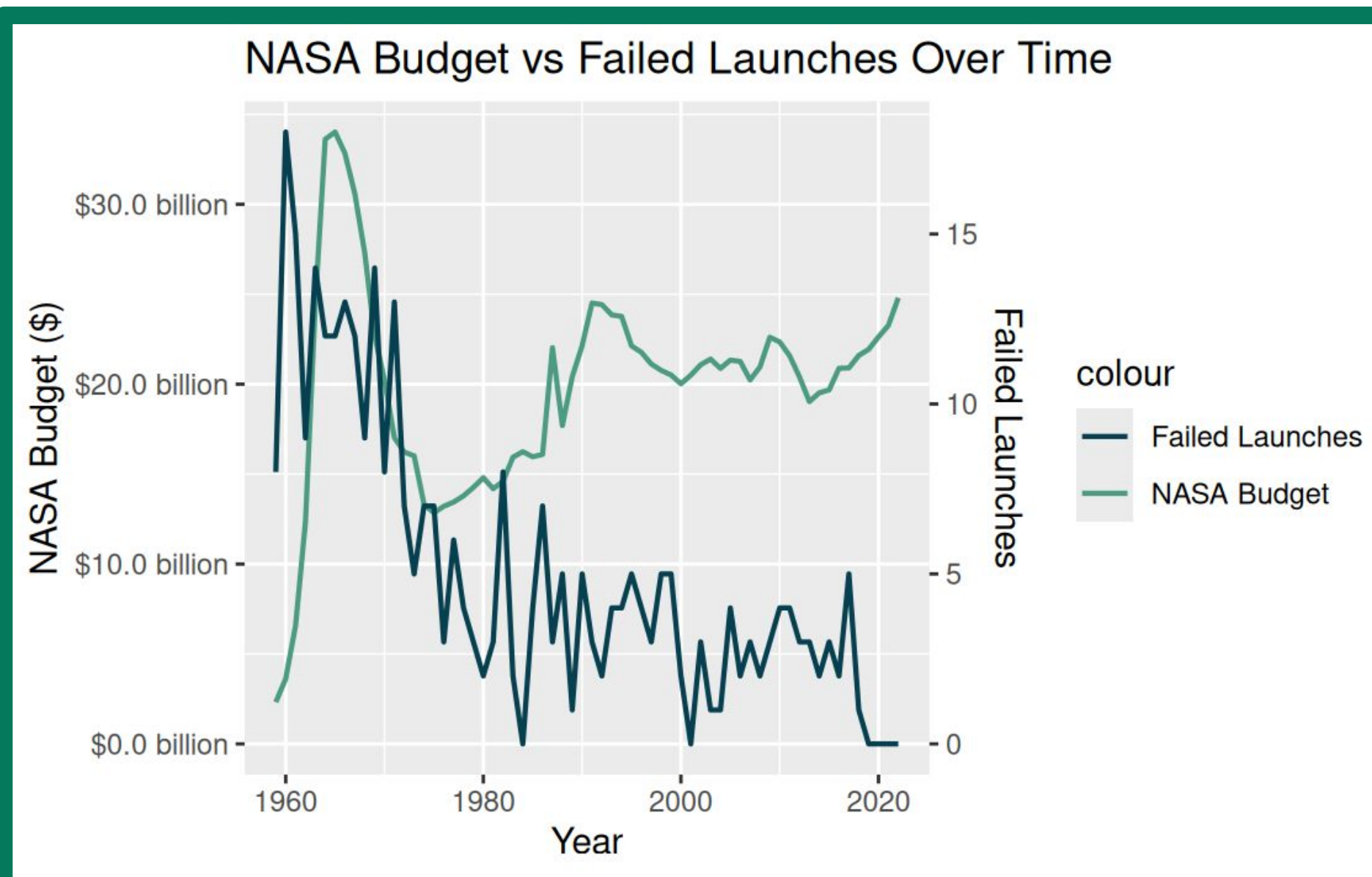


Figure 5 zooms in on NASA's budget, and it's correlation to their decreasing failure rates

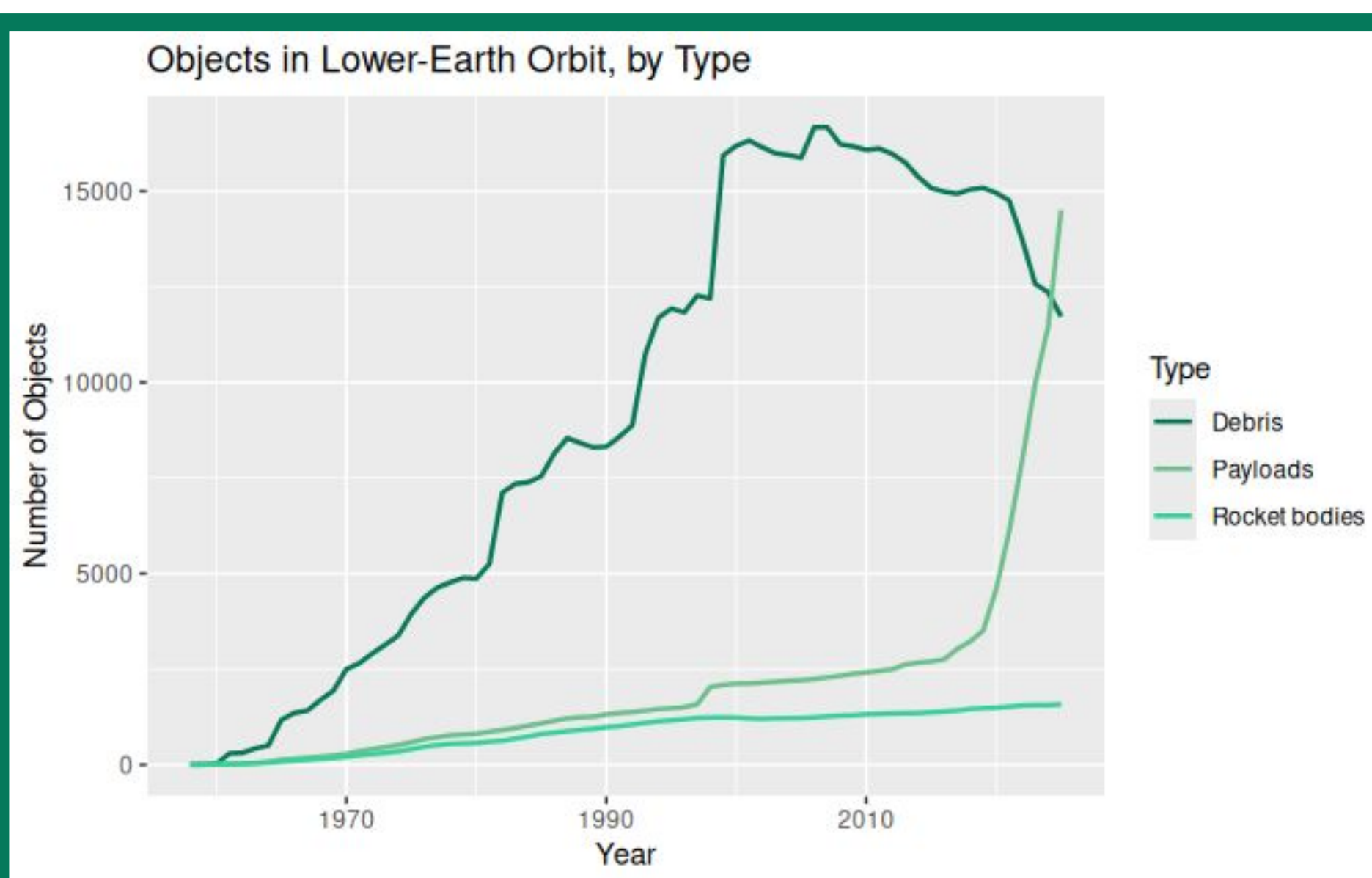


Figure 6 compares the types of bodies in space, and sorts them by the counts of debris¹, payloads², and rocket bodies³

Debris¹ Human-created objects that orbit space, after no longer serving any purpose
Payloads² Portion of the space craft that is responsible of achieving a mission's main goal
Rocket Bodies³ Part of a spaceship that helps the payload escape Earth's gravity—usually discarded after it accomplishes its goal

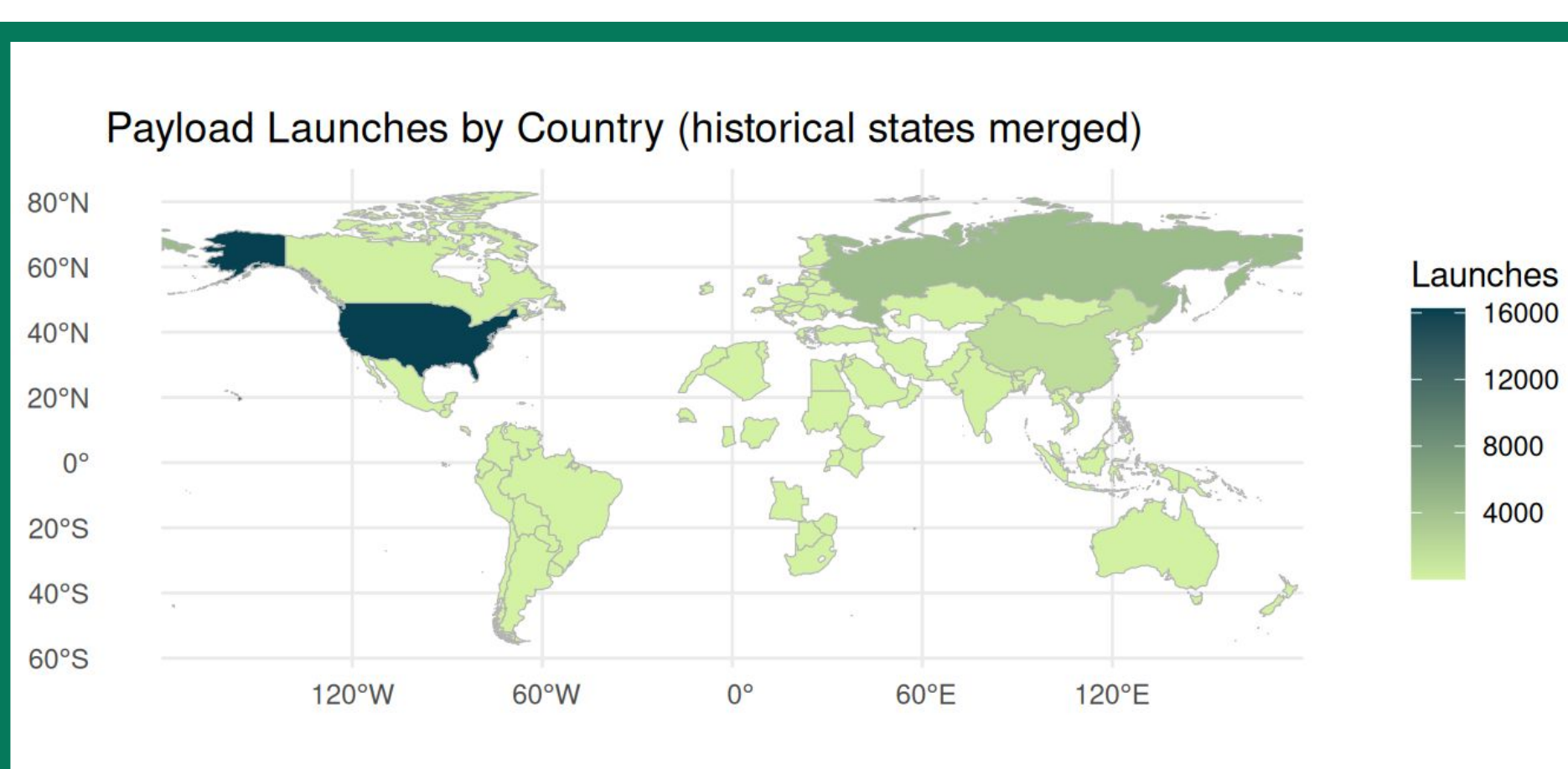


Figure 7 looks specifically at payload-type launches, and what state bodies sent them into the atmosphere

Conclusion

Figures 2, 3, and 4

- The growing popularity in space exploration (as can be seen in **Figure 1**) led to a huge growing interest amongst private agencies starting in the 90s
- The launch failures, as a whole, have gone down over time

Figures 3 and 5

- NASA's budget had less of an impact on safety than could have been anticipated

Figures 6 and 7

- Debris (unused space material) has made up the vast majority of bodies in low-earth orbit until payloads recently surpassed it
- The global contributions to space exploration, more specifically: the contributions of payloads, comes primarily from the United States, Russia, and China

We've also come to the conclusion that the potential for scaling space exploration in the future is inevitable, due to the contributions that have been made thus far.

References

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