

# Space The Final Frontier

Presentation By  
Imer Belica & Amanda Liang

# Problem Statement

Space, the final frontier.

Exploring it can be pretty costly, so this project intends to help analyze the cost of past missions and look at the differences between Private and State run missions.

This kind of data analysis can be helpful for companies interested in space as well as investors into such companies and organizations.

We will be able to perform cost analysis on a multitude of variables and determine what the main factors of cost in space travel are.

# Goals

- Determine whether state or private enterprises are the superior in terms of cost efficiency for space missions
- Determine the point of diminishing return on investment of space missions
- Investigate cost outliers

# Hypothesis

- Future missions costs will be lower and the cost over time will follow a logarithmic model due to the exponential improvements in the field of technology
- Private enterprises will have superior cost efficiency when compared to the state sector due to the fact that budgeting is a higher priority and regulations are not as strict for private enterprises.
- There will be a point of diminishing return for space mission investments

# Data Description

All space missions 1957-2020

Original Data: 4323 rows x 8 features

After Cleaning: 949 rows x 8 features

	Unnamed	Company Name	Location	Datum	Detail	Status Rocket	Rocket	Status Mission	Private or State Run	Z-Score
0	0.0	0.0	SpaceX	LC-39A, Kennedy Space Center, Florida, USA	Fri Aug 07, 2020 05:12	Falcon 9 Block 5   Starlink V1 L9 & BlackSky	StatusActive	50.00	Success	P -0.557444
1	1.0	1.0	CASC	Site 9401 (SLS-2), Jiuquan Satellite Launch Ce...	Thu Aug 06, 2020 04:01	Long March 2D   Gaofen-9 04 & Q-SAT	StatusActive	29.75	Success	S -0.698909
2	3.0	3.0	Roscosmos	Site 200/39, Baikonur Cosmodrome, Kazakhstan	Thu Jul 30, 2020 21:25	Proton-M/Briz-M   Ekspress-80 & Ekspress-103	StatusActive	65.00	Success	S -0.452655
3	4.0	4.0	ULA	SLC-41, Cape Canaveral AFS, Florida, USA	Thu Jul 30, 2020 11:50	Atlas V 541   Perseverance	StatusActive	145.00	Success	P 0.106219
4	5.0	5.0	CASC	LC-9, Taiyuan Satellite Launch Center, China	Sat Jul 25, 2020 03:13	Long March 4B   Ziyuan-3 03, Apocalypse-10 & N...	StatusActive	64.68	Success	S -0.454891
...	...	...	...	...	...	...	...	...	...	...
944	3855.0	3855.0	US Air Force	SLC-4W, Vandenberg AFB, California, USA	Fri Jul 29, 1966 18:43	Titan IIIB   KH-8	StatusRetired	59.00	Success	S -0.494571
945	3971.0	3971.0	US Air Force	SLC-20, Cape Canaveral AFS, Florida, USA	Thu May 06, 1965 15:00	Titan IIIA   LES 2 & LCS 1	StatusRetired	63.23	Success	S -0.465020
946	3993.0	3993.0	US Air Force	SLC-20, Cape Canaveral AFS, Florida, USA	Thu Feb 11, 1965 15:19	Titan IIIA   LES 1	StatusRetired	63.23	Success	S -0.465020
947	4000.0	4000.0	US Air Force	SLC-20, Cape Canaveral AFS, Florida, USA	Thu Dec 10, 1964 16:52	Titan IIIA   Transtage 2	StatusRetired	63.23	Success	S -0.465020
948	4020.0	4020.0	US Air Force	SLC-20, Cape Canaveral AFS, Florida, USA	Tue Sep 01, 1964 15:00	Titan IIIA   Transtage 1	StatusRetired	63.23	Failure	S -0.465020

949 rows x 11 columns

# Process

## Pre-processing - data cleaning

- We got rid of rows with missing costs since this feature is the base of our analysis
- Some dates had a time stamp while others did not so we cut the times from all the columns
- Outlier handling- Removing data with z-scores higher than three to not skew the calculated yearly averages as much

# Process

## Data Bias Acknowledgement

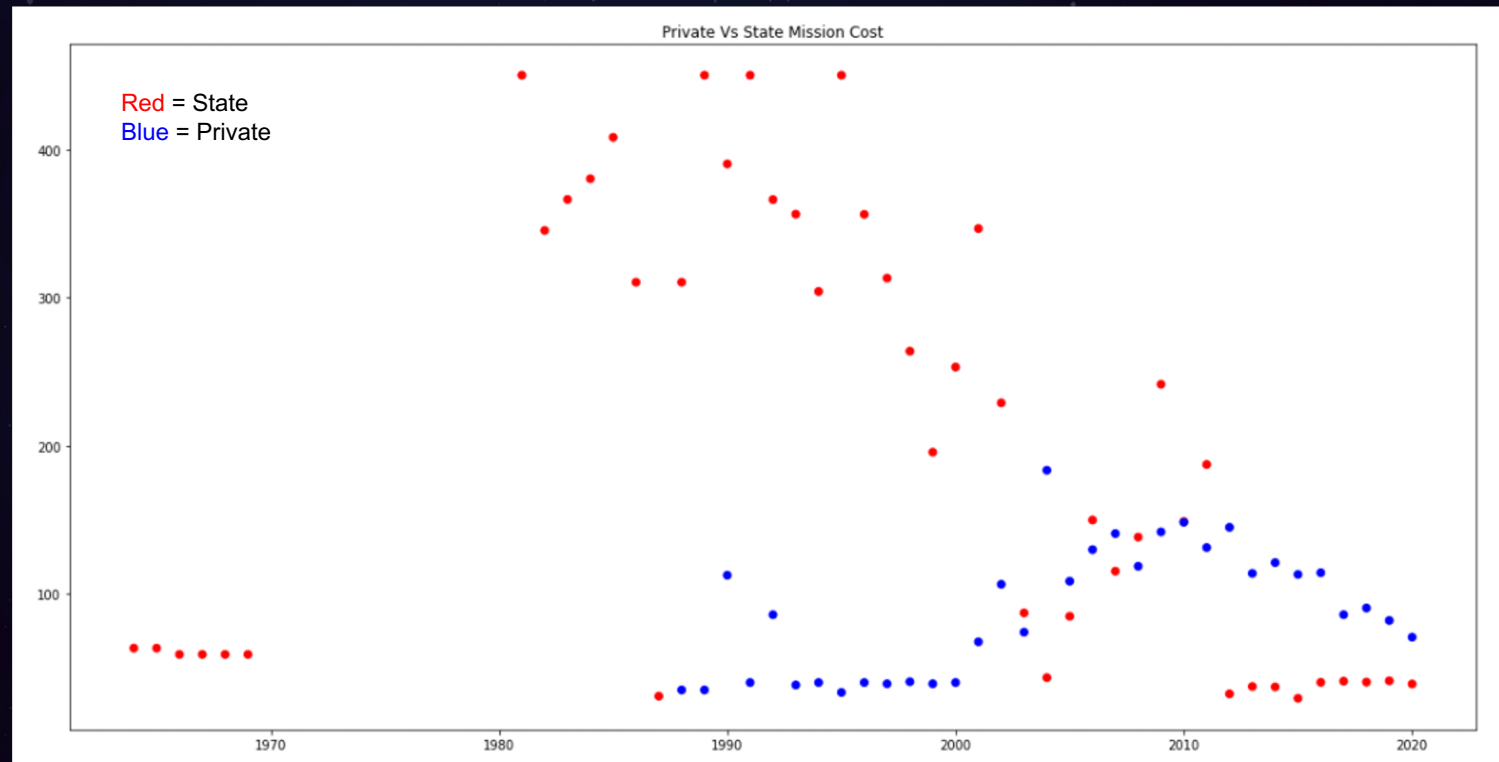
- Since most of the older records lack costs, focusing on the newer records may be better for predictions
- Since the older records that have recorded costs are mostly from NASA, the older data will also have an American-centric bias and does not provide info on other countries at the time
- Since most of the missions recorded are successful, the calculations and predictions based off failing missions will be less accurate



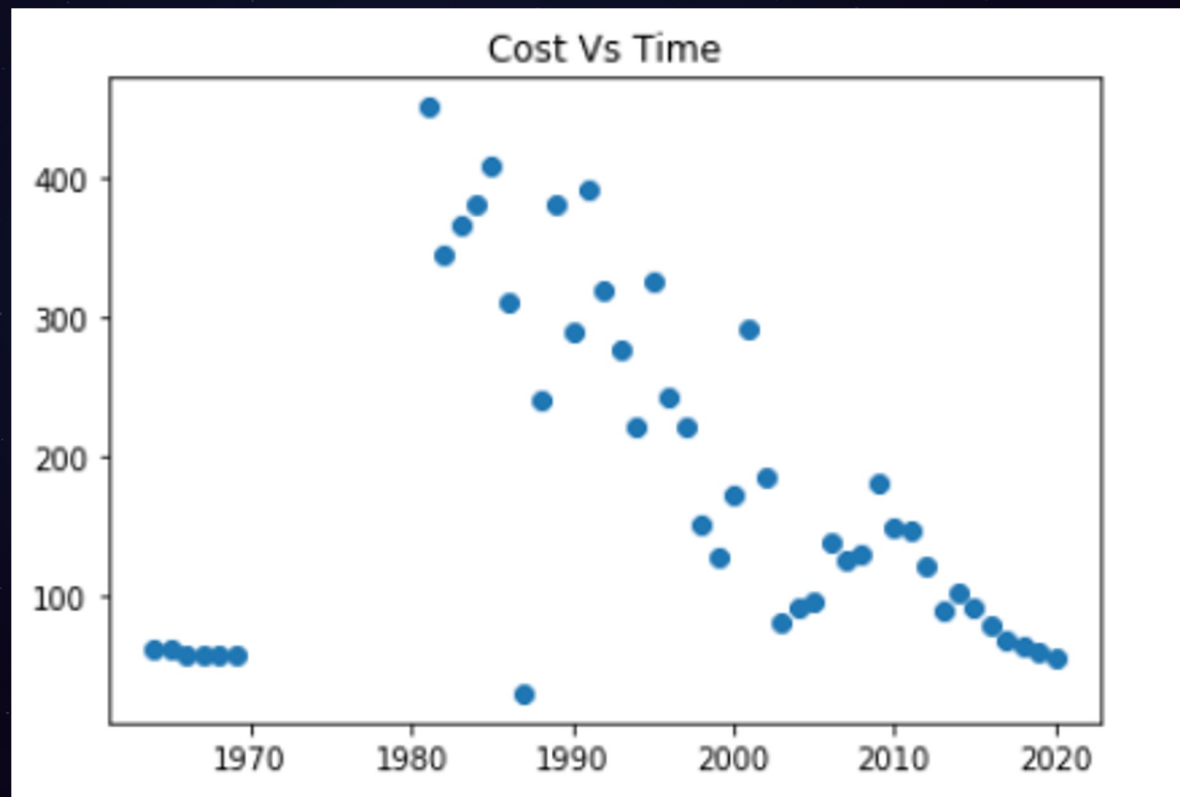
# Results



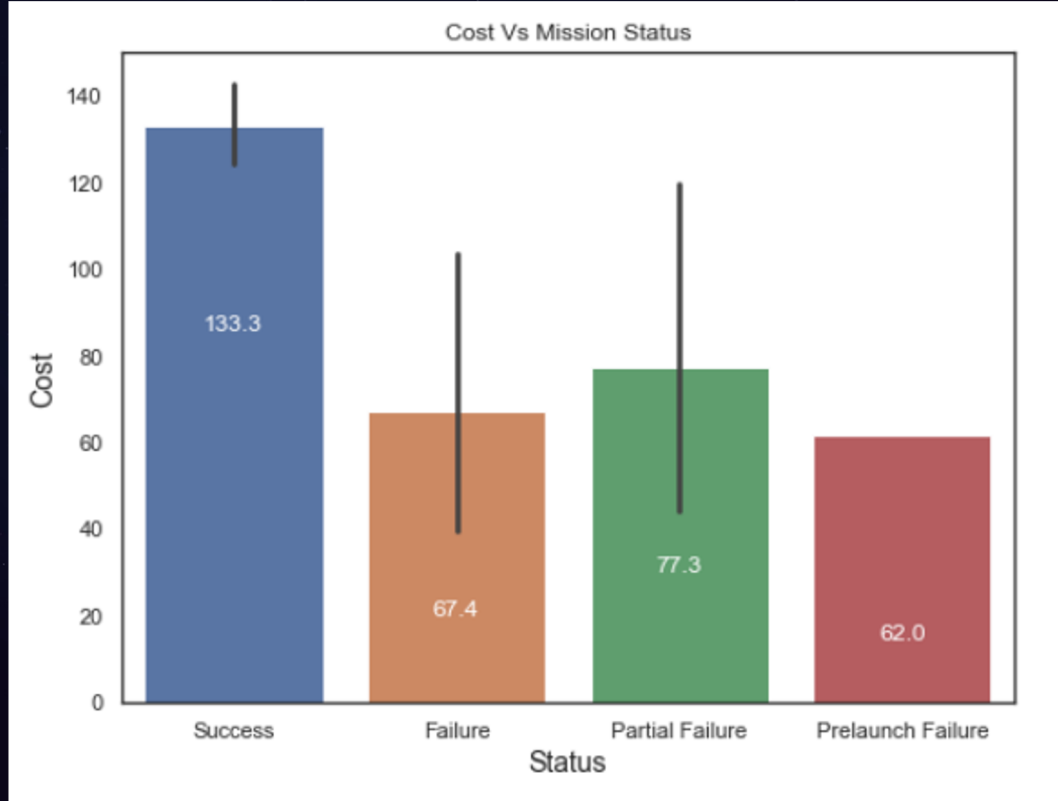
# Private Vs State Cost



# Cost Over Time



# Cost Vs Mission Status



# Conclusion

- The cost of space missions seems to have a negative correlation with time as there is a clear logarithmic decay in the average cost of space missions since 1957
- Comparing the cost of missions between state and private run enterprises there appears to be a pattern in that private run missions tend to have a lower cost associated with them
- Mission status appears to have a positive correlation with cost. Looking at the average cost associated with failed missions and the average costs associated with successful missions one can easily observe that successful missions seem to be more costly