DSS for Selecting Small Satellite Launch Vehicle Providers

SYS 660-A, Decision & Risk Analysis with Prof. Ting Liao

(GROUP 3)

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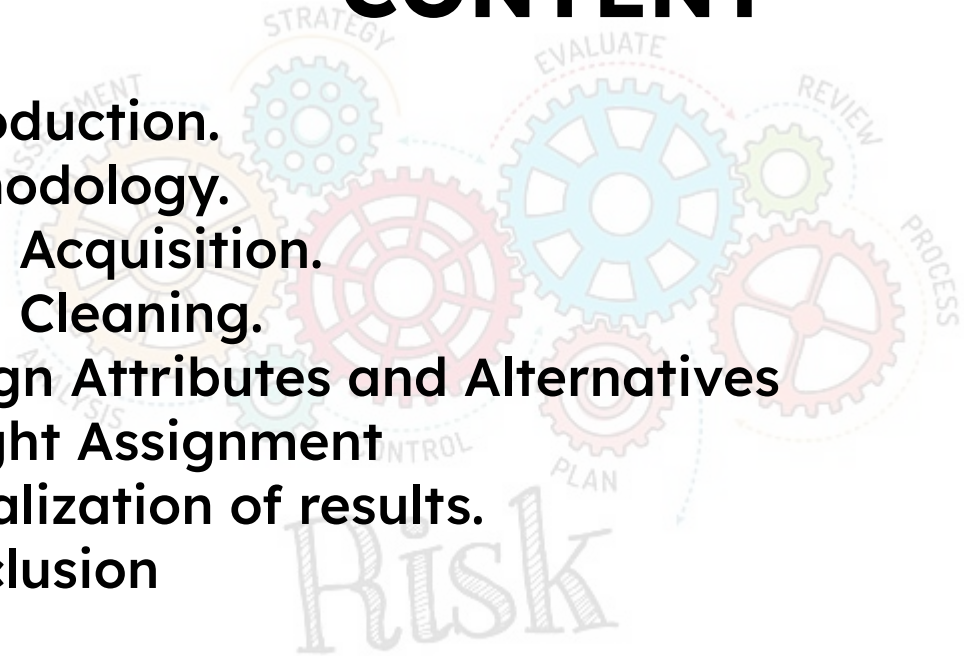
CONTENT



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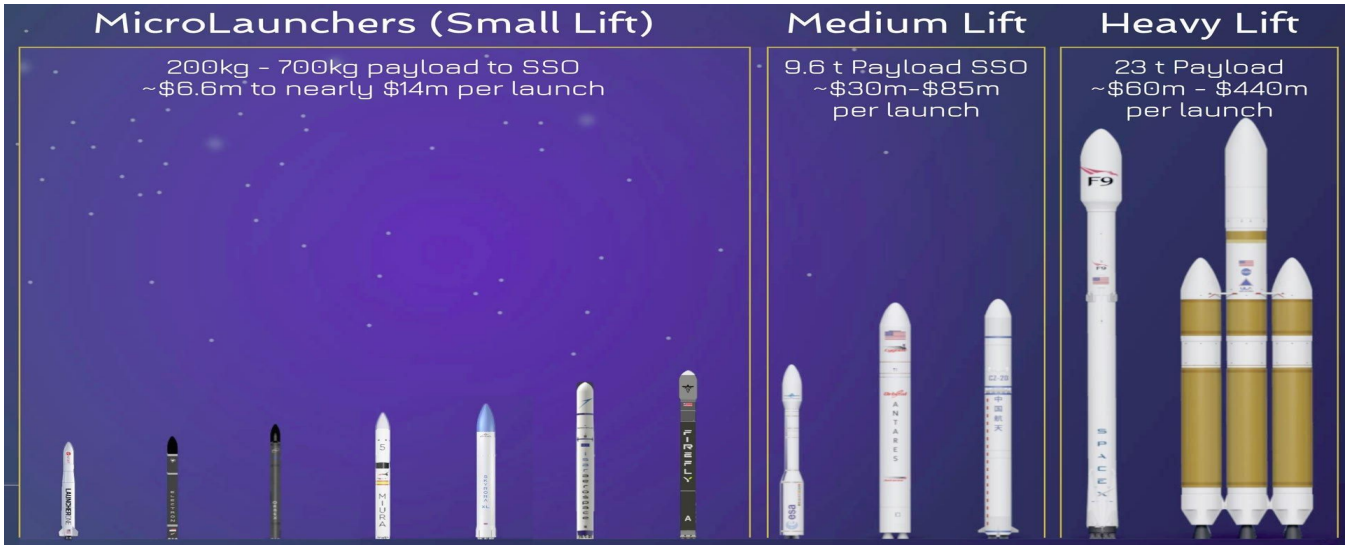
INTRODUCTION

- Small satellite launch operations involve the deployment of small satellites into space using specialized launch vehicles.
- Small satellites are relatively low in mass and size compared to traditional satellites, and their launch operations typically cater to payloads weighing anywhere from a few kilograms to a few hundred kilograms.



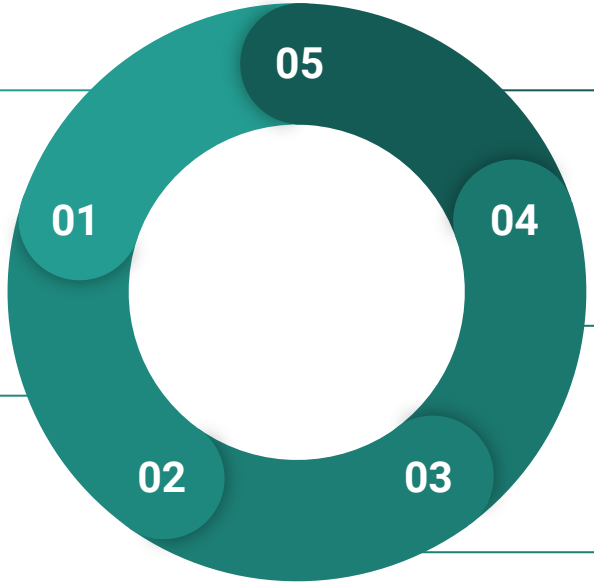
Methodology

Problem Definition

Understand the core challenges and requirements in selecting a satellite launch provider.

Data Collection

This data have been collected from various sources and has been cleaned, normalization, and structuring before analysis.



Visualization and Reporting

Sensitivity Analysis & Monte Carlo Simulation

Conduct sensitivity analysis to evaluate how changes in attribute weights or variations in attributes affect the overall rankings. This analysis helps in understanding the robustness of the rankings against changes.
Simulate various scenarios using Monte Carlo methods. This involves generating random samples for attributes based on their distributions. Simulating different scenarios helps in understanding the range of potential outcomes.

Utility Function Definition

Create utility functions for each attribute. These functions map the raw attribute values to a utility scale that reflects their importance in decision-making. For instance, a lower cost might have a higher utility value.

Data Acquisition

- Gathered data on available small satellite launch providers, including their launch history, cost, reliability, and technical capabilities.

- Integrated the data into the DSS for analysis.(Asking Industry leader, suppliers and historic prices for to gather such data)

Design Attributes and Alternatives

01	VEHICLE	Name of the launch vehicle.
02	COUNTRY	Country of origin.
03	LEO Capacity	Payload capacity to Low Earth Orbit in kilograms
04	SSO Capacity	Payload capacity to Sun-Synchronous Orbit in kilograms.
05	LEO Price	Price per kilogram for launching to LEO in thousands of dollars.

Design Attributes and Alternatives

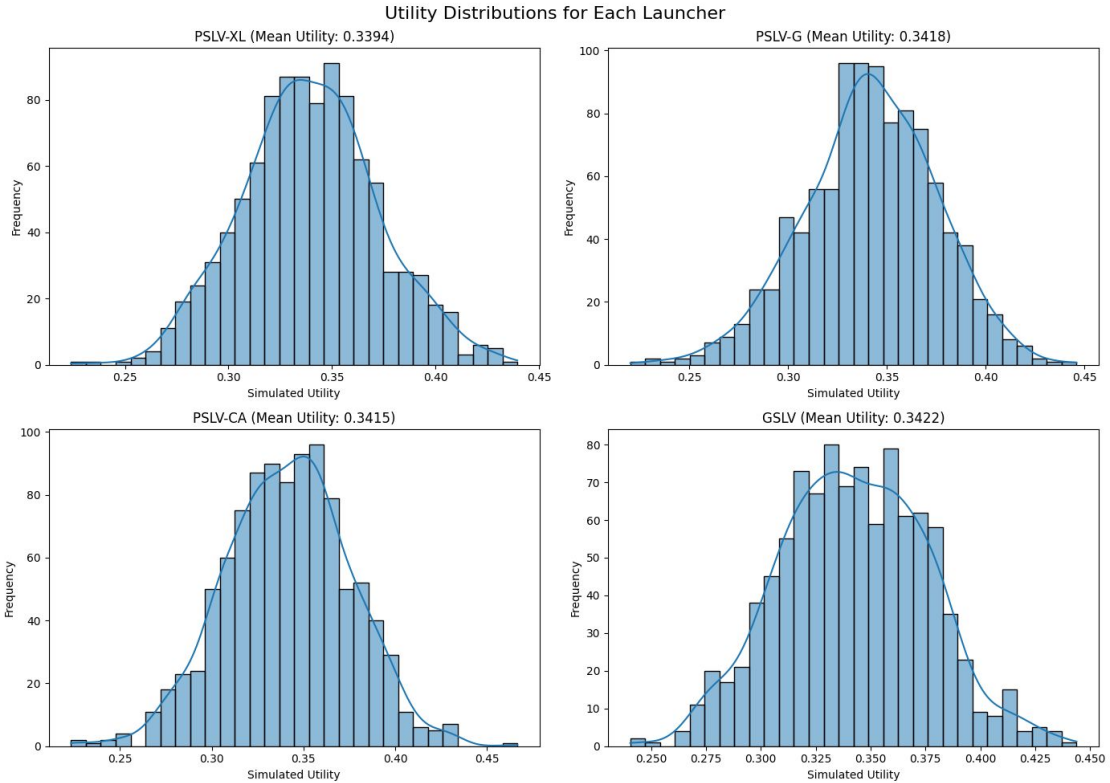
01	SSO Price	Price per kilogram for launching to SSO in thousands of dollars.
02	TOTAL LAUNCHES	Total number of launches
03	RELIABILITY	Reliability percentage of the vehicle.
04	FREQUENCY	Launch Frequency.

Weight Assignment

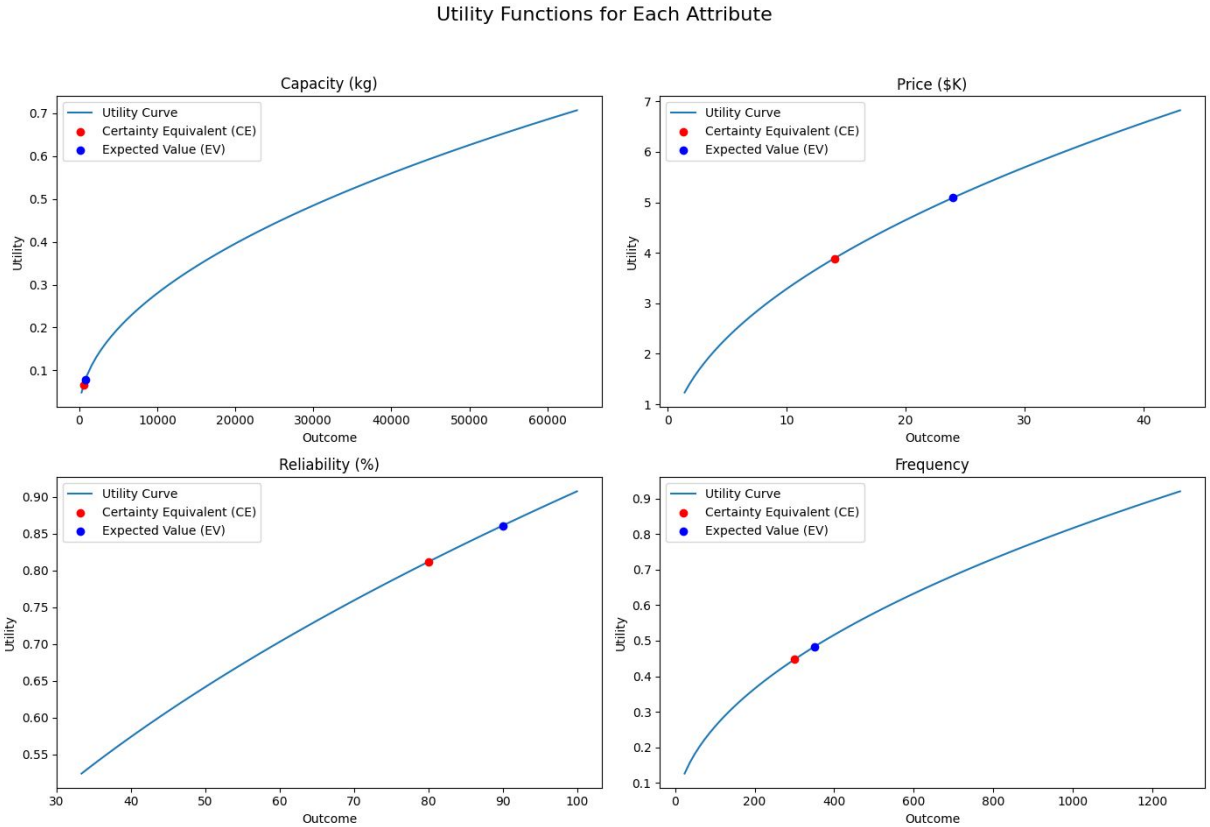
- Utilized a weighted scoring method derived from Analytic Hierarchy Process (AHP) principles to assign relative importance to each criterion.

	Worst Case	Best Case	Rank	Swing Weight
LEO Capacity (kg)	300	63800	1	30
SSO Capacity (kg)	161	7960	1	30
GTO Capacity (kg)	5200	26700	1	30
LEO Price ($K)	1.41	43.1	2	20
SSO Price ($K)	2.8	100.4	2	20
GTO Price ($K)	2.35	25.7	2	20
Total Launches	3	289	4	15
Reliability (%)	33.33	100	3	25
Frequency	24	1270	5	10

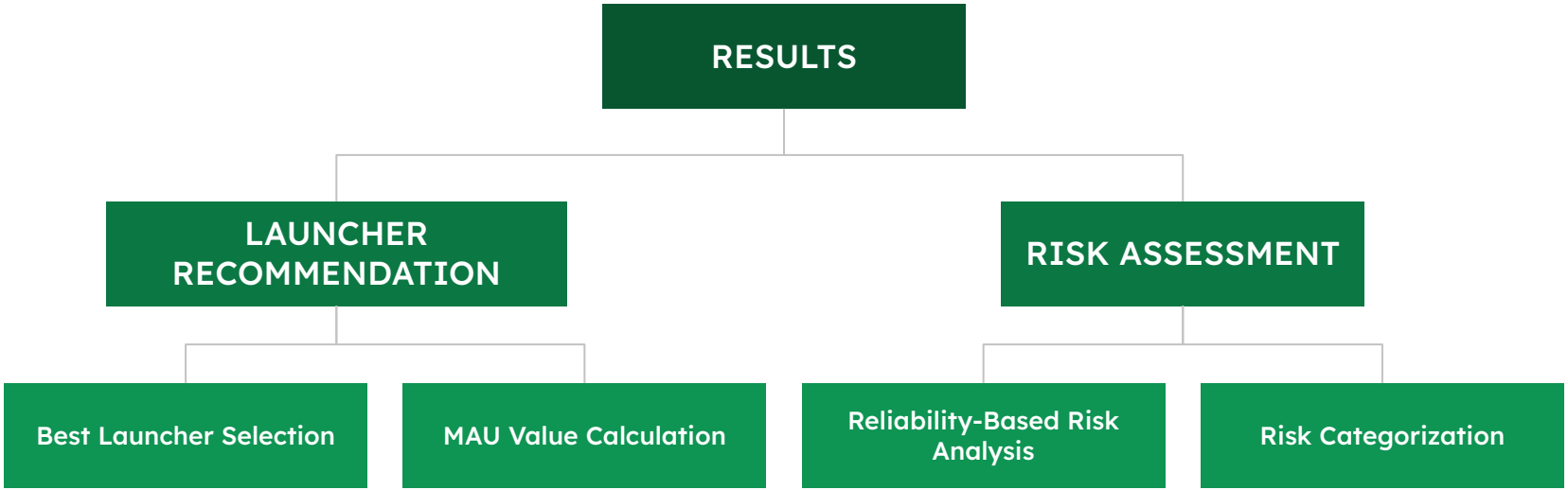
Visualization of Results



Visualization of Results



The results generated by this script can be categorized into two main sections:



Conclusion

- **Empowering Satellite Missions: The developed Decision Support System (DSS) stands as a pivotal tool, empowering users to make informed decisions, optimize satellite missions, and maximize investment value.**

- **User-Centric Approach: Through a user-friendly interface and inclusive criteria consideration, the DSS ensures efficient satellite deployments while accommodating various constraints and objectives.**

- **Enhanced Efficiency: The successful implementation of the DSS promises enhanced efficiency in satellite mission planning, driving cost optimization and mission success.**

QUESTIONS

THANK YOU

References:

1. https://www.newspace.im/launchers
2. https://www.nasa.gov/what-are-smallsats-and-cubesats