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ROCKET LAUNCH

SAFE ASTRO-MISSIONS

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PROJECT DETAILS

WHAT DOES IT DO?

Our code simplifies the complexity involved in the launch process of a rocket. The majority of the process is automated and only limited information is expected from the user. Using this we can come to conclusion on wheter the space shuttle / rocket is safe to launch? And if safe then when will the date and weather both be favourable.

OUR GOAL

We aim towards making it easy and argonomic for enthusiasts as well as professionals for space missions. Moreover the bigger goal is to prevent failed missions or launches which may or may not lead to human deaths , property distruction , wastage of precious and expensive rocket fuel.

LONG TERM GOAL

To implement more parameters for missions , attaning accuracy for date and time. Moving forward we also plan to implement more planets and galaxies into the calculations

PART 1: CALCULATING WEIGHT

RELATION BETWEEN MASS AND WEIGHT

Mass and weight are two different aspects of measuring a body. The relation between them is defined by -

$$W = mg$$

We make use of Earths Gravity acceleration for calculation of weight

WHY IS THE IMPLMENTATION IMPORTANT

Taking this formula into consideration is necessary to make it possible for launch calculations from different planets where the gravity may vary to a great extent when compared to Earth.

HOW DO WE CALCULATE EARTH'S GRAVITATIONAL ACCELRATION

We make use of the below formula to attain Earth's gravitational force.

$$g = G\frac{M}{r^2}$$

PART 1: CALCULATING THRUST

MINIMUM THRUST REQUIRED TO PASS KÁRMÁN LINE

Main hurdle during any launch is to be able to cross the KARMAN line to enter the space and escape Earth's gravitational force of attraction.

Minimum Thrust required - **3.5 million kilograms (7.2 million pounds)**

For further details please refer REFERENCE 1.1

IDEAL WEIGHT TO THRUST RATIO

Weight to thrust ratio also plays a important role in maintain stability and argonomics . If the ratio is less then the weight then the rocket won't be able to successfuly launch , whereas if the ratio is too high and it just leads to excess fuel usage.

WHAT IS THE IDEAL TWR

For rockets TWR may vary , the ideal is considered between **1.3 to 1.5** , refer to REFERNCE 1.2

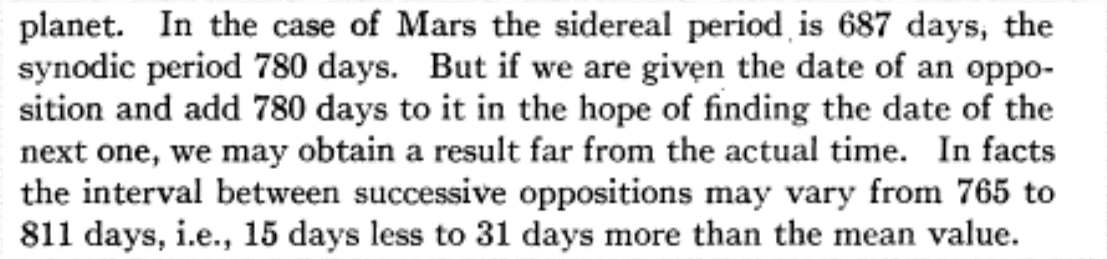
PART 2: SYNODIC PERIOD

WHAT IS SYNODIC PERIOD?

The synodic period of a planet is the the time required for a body within the solar system, such as a planet, the Moon, or an artificial Earth satellite, to return to the same or approximately the same position relative to the Sun as seen by an observer on the Earth.

SYNODIC PERIOD OF MARS

synodic period of mars may vary between 765 to 811 days , for the simplicity and scope of this project we have used 780 days. Please refer REFERNCE 2.1



planet. In the case of Mars the sidereal period is 687 days, the synodic period 780 days. But if we are given the date of an opposition and add 780 days to it in the hope of finding the date of the next one, we may obtain a result far from the actual time. In facts the interval between successive oppositions may vary from 765 to 811 days, i.e., 15 days less to 31 days more than the mean value.

PART 2: ALL POSSIBLE LAUNCH DATES

HOW DO WE CALCULATE ALL LAUNCH DATES

Our calculation engine works form year 1st January 2000. The first synodic day , or the day when the distance between Earth and Mars was the least is **12/6/2001** . Taking this into consideration we calculate the next possible launch days possible which satisfy our criteria.

CONVERTING DAYS BACK TO A PROPER DATE

After finding the day from 1/01/2000 which comes after our launch date and is a synodic day is retrieved is converted back to a proper usable date.
The criteria for converting back to a date:

- Whether the month has 28,29,31 or 30 days.
- Considering leap years
- How leap years can have an effect over days in a month and year.

PART 3: WEATHER DETAILS

FACTORS TOOK INTO CONSIDERATION:

After calculation of date we analyze weather conditions on the given day , we take into consideration the following factors :

- Windspeed
- Weather
- Temperature

REQUIRED PARAMETERS

Adequate parameters are determined from past launches and publicly accessible data from NASA.

- Windspeed- less then 37 km/hr
- Weather- Sunny
- Temperature - between 10 C and 33 C

PART 4: C++ CONCEPTS

MAKING THIS PROJECT WAS A LEARNING CURVE FOR US AND WE LEARNED IN DETAIL ABOUT THE FOLLOWING CONCEPTS OF C++

- **ARRAYS**
- **CLASS**
- **FSTREAM**
- **STRINGS**
- **CONSTRUCTORS**
- **POLYMORPHISM**
- **LOOPS**
- **FUNCTIONS**
- **CONVERSION AMONG DATA TYPES**

REFERENCE INDEX

LINK 1.1

https://www.nasa.gov/audience/foreducators/k-4/features/F_Escape_Velocity.html#:~:text=A%20spacecraft%20leaving%20the%20surface,hour)%2C%20to%20enter%20orbit.

LINK 1.2

https://spaceflight-simulator.fandom.com/wiki/Thrust-to-weight_ratio

LINK 2.1

https://adsabs.harvard.edu/full/1947JRASC..41..274C