

Rocket Database handbook

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Project 9: Rocket design with python

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1 Introduction

This documents contains a short explanation of the rocket database and a glossary for its proper handling. The database is stored as a .csv file. All the properties are explained in section 2. Parameters that are physical magnitudes, such as length or masses, show units in squared brackets.

Useful performance parameters, such as specific impulse and thrust, are separated in different columns for each stage. Two stages are considered: classification is done by adding 'S1' or 'S2' before the parameter. For example, the parameter 'S1 Isp [s]' is the specific impulse of the first stage, while the parameter 'S2 Isp [s]' is the specific impulse of the second stage. Single-staged rockets (currently there is only one, the rocket Miura 1) show their performance parameters in the 'S1' parameters, while the 'S2' ones are kept empty.

For using and modifying this database, it is recommended the used of **pandas** library in python.

```
import pandas as pd
```

Then, you can open the database and store it in a variable named **df** with the following syntax:

```
df = pd.read_csv('rocket_database.csv')
```

Note that the python script must be located in the same folder as the database, otherwise you will need to indicate the complete path inside the parenthesis.

For accessing a particular property, you need to reference its corresponding column by its name as it is expressed in the glossary in bold, including units (if there are). For example, for accessing the specific impulse of stage 1, its corresponding column can be accessed as:

```
df['S1 Isp [s]']
```

Afterwards, you can add your own rockets (either real or the ones from your own creation) and save them in the same, or another, .csv file. The way to access each particular parameter is with the following syntax:

2 Glossary

- **Name.** The name of the rocket.
- **Year.** The year of the first launch, although in some cases it might also refer to the construction year.
- **Country.** Country that has designed and built the rocket. For most european rockets, it is the country of the main company working on the rocket.
- **Mission.** Particular objective to be achieved by the rocket. It can be an orbit to reach (LEO, GEO, etc.) for taking a satellite or a more particular missions, such as sending people to the moon (Apollo 11 mission).
- **Stages number.** All rockets by default in the database have 2 stages except one: the Miura 1 rocket, with one stage.
- **Height [m].** Total length of the rocket, including all stages and nosecone. This parameter is not used in any calculation, only for graphical representation.
- **Diameter [m].** Rocket baseline diameter. Each stage has its own diameter, so this value can be any of both for performing a simple sketch of the rocket. This parameter is not used in any calculation, only for graphical representation.
- **Lift-off mass [tons].** Total mass of the rocket before launch. Expressed in tons.
- **Payload mass [kg].** Also known as useful mass, it is the mass carried by the rocket necessary to achieve a given mission. It can be a satellite, a probe, an astronaut, etc. Expressed in kg.
- **S1 length [m].** Length of the first stage. Expressed in meters.
- **S1 diameter [m].** Diameter of the first stage. Expressed in meters.
- **S1 thrust [kN].** Thrust provided by the first stage. Expressed in kilonewtons.
- **S1 Isp [s].** Specific impulse of the first stage. Expressed in seconds.
- **S1 m0 [tons].** Initial mass of the first stage. This parameter is not used in any calculation, only for graphical representation. Expressed in tons.
- **S1 mp [tons].** Propellant mass contained in the first stage. This parameter is not used in any calculation, only for graphical representation. Expressed in tons.
- **S2 length [m].** Length of the second stage. Expressed in meters.
- **S2 diameter [m].** Diameter of the second stage. Expressed in meters.
- **S2 thrust [kN].** Thrust provided by the second stage. Expressed in kilonewtons.
- **S2 Isp [s].** Specific impulse of the second stage. Expressed in seconds.
- **S2 m0 [tons].** Initial mass of the second stage. This parameter is not used in any calculation, only for graphical representation. Expressed in tons.
- **S2 mp [tons].** Propellant mass contained in the second stage. This parameter is not used in any calculation, only for graphical representation. Expressed in tons.