United Nations Space Exploration Division
Team 24

Intro to the Mini-World:

This mini-world encompasses data and logistics related to space exploration missions and shuttle launches from all countries or nations around the world. This miniworld facilitates easier co-operations between space agencies related to launching rockets and makes way for a more cohesive approach to space exploration. For example, multiple space agencies from different nations can decide on payloads for an upcoming shuttle launch in a much more effective manner.

This would also help countries with relatively young space agencies launch probes,satellites..etc with the help of other mature space agencies. The UN would be maintaining and controlling this database, and could in turn, prevent illegal space launches(that is, if the space agency decides to put in an entry for an illegal launch).

The emergence of the space arms race has made it necessary to monitor the operations of space agencies to prevent the militarisation of space objects and maintain world peace.

Assumptions and Constraints:

A space agency has a unique <name, country> pair, regardless of if it is government owned or private. If it is private, its associated country is the country in which it is registered.
A mission is identified by its unique name.
An astronaut is identified by a surrogate key (since they can have the same name and their two countries can use the same identification format leading to both having the same identification number.)
Every country that has a government run space body or a private company registered within its UN recognised territory has a government ambassador. Every space agency has a representative. The government ambassador of a country is the direct supervisor of the representative of a company registered in that country.
Employees of the division are identified by a unique employee number issued by the HR division of the United Nations. They oversee the administration and working of the division.
A rocket is identified by its model name and the agency that developed it. Rockets developed by the same agency cannot have the same model name but those developed by different agencies can have the same name.

Users:

- **Space Agencies**(will usually have access to space missions launch date,payload information, details related to payload constraints, purpose of launch, needed/requested materials or expertise)(they will use the database for

collaborating with other space agencies or to request help from other space agencies)

- **National Space Agencies**
- **Private Space Agencies**(usually will have access to a little less data, basically won't have access to data that is politically sensitive,or confidential)

- **Universities** or **Scientists** or **Labs** or **Observatories**(will have access to data similar to that of space agencies excluding specific details of payloads and technical specifications. Will have general access to scientific purpose of launch)(they will use the database to provide scientific data and help in missions, and request experiments on missions)
- **Casual Users**(usually normal people using a space agencies website, has basic data on past launches and future planned launches)
- **Astronauts** (to check if there are any astronaut openings for missions and see what their past missions were)
- **Government Bodies** of nations
  - The **Military** (to send military related payloads like gps, secure communication satellites and also restrict certain payloads on rockets)
  - **Security Agency** (to send surveillance satellites and check info on confidential missions)
  - **Ambassadors** for a country (they approve of all requests and communication between space agencies)
- **UN Departments**

For Example, **UNEP** keeps track of fuel combustion,fuel cleanliness , carbon footprint..etc

UNSC keeps track of illegal launches(weapon launches...etc)

Database Requirements:

Entities:

- **Space Agencies:**

  Name,
  Country(last 2 are composite keys) ,
  Public/Private(*Not NULL*),
  Location(*multi-valued*) (*Not NULL*),
  Number of employees(*Not NULL*),
  Number of successful missions,
  Total number of missions,
  Number of failed missions,
  Number of active missions
  (l*ast 4 are derived attributes from* ***Mission***),

- **Mission**:

  Name,
  Mission description:(*Composite*) (Purpose, Celestial body)(*Not NULL*),

Current Payload weight available,
Timeline(In progress/Past/Future)(*Not NULL*),
Status (Failed/Successful),
Agencies involved (*multi-valued, derived,Not NULL*),
Astronauts Required (Yes/No),
Open for collaboration (Yes/No).

- **Payload**(*weak*):
  Experiment name,
  Weight(*Not NULL*),
  Organization sending it(*Not NULL*).
- **Resources**(*weak*):
  Resource name,
  Quantity,
  Requesting Agency(*foreign key*),
  Country requested from (which country they need to acquire those particular resources from)
- **Astronauts**:
  Name(*Not NULL*),
  Nationality,
  Mission status(on mission, reserve, retired)(*Not NULL*),
  (Uses artificial key).
- **Government/space agency ambassadors** (to ensure that trading and collaborations between space agencies/ traders in different countries occurs fairly and legally) :
  Name,
  Agency(*Foreign key*),
  Contact Number,
  Nationality(*Not NULL*).
- **Employees of the division**:
  Employee ID,
  Name,
  Nationality
- **Rocket** (*weak*):
  Model name,
  Agency(*Foreign key*),
  Fuel type,
  Fuel efficiency,
  Maximum payload capacity,
  Reusability,
  Engines,
  Cost,
  Year of first use,(*can be past /future if the rocket is still in development*)
  Status(in use, in development, retired).

Relationships:

(Cardinality shown in parentheses)

- **COLLABORATION** (3-way between space agencies)[*full participation*], space agencies(1), mission(n)[*full participation*])
- Astronaut(1)[*full participation*] **CONTRACTED_BY** a space agency(n) for a mission(1) (3-way)
- Payload(n) [*full participation*] **SENT_ON** a mission(1).(*Identifying relationship for payload*)
- Ambassadors(1) **REPRESENT** a space agency(1)[*full participation*].
- Rocket(n) [*full participation*] **USED_FOR** a mission(1)[*full participation*].
- Rocket(1) **CARRIED** payload(n)[*full participation*]
- Astronauts(n)[not full participation because we store astronauts in training too] **TRAVELLED_ON** Rocket(1) for a mission(1) (3-way)
- Resources(n)[*full participation*] **REQUIRED_FOR** mission(1)[full participation].(*Identifying relationship for Resources*)
- Rocket(n)[*full participation*] **DEVELOPED_BY** space agency(1).(*Identifying relationship for rocket*)
- **RESOURCE_REQUEST**: Government Ambassador(1)[Receiving from], Government Ambassador(1)[Requesting from], Division Employee(1)[has to oversee for smooth collaboration] request from space agency(1)[whichever is asking for the resource] particular resources(n)[*full participation*].
- Government Ambassador(1)[*full participation*] **SUPERVISES** space agency ambassadors(n)[f*ull participation*] if the company is registered in that country.(in the interest of national security)(*recursive relation*)

Functional Requirements:

- **Selection**:
  - Get all space agencies participating in a mission
  - All rockets developed by *space agency 1* that have taken *space agency 2* payload to the moon

- **Projection**:
  - Get space missions which can support payloads more than *N* kgs
  - Find missions a *space agency* has sent to the moon after a certain year

- **Aggregate**:
  - Get the average success ratio of a particular space agency over the past *N* years
  - Get the space agency with the maximum success rate
  - Most fuel efficient rocket

    - Astronaut that has completed the most missions

- **Insertion**:
    - Inserting an entry for a mission along with payload specifications
    - Add a space agency and their associated representative

- **Updation**:
    - Updating date of launch and payload requirements
    - A space agency adding resources or expertise needed in a particular field for a mission
    - Update the government ambassador for a country

- **Deletion**:
    - Deleting an entry of a planned mission which was scrapped
    - Deleting a rocket if its development is canceled

- **Analysis**:
    - Get a report of all external materials and products acquired for a mission by a space agency, to maybe detect illegal mission payloads(space weapons)
    - Number of rockets developed by *space agency* that are reusable and have completed at least 5 missions
    - Total metric tonnes of fuel consumed by a space agency / country across all missions in an year for UNEP analysis and recommendations

- **Search**:
    - Partially searching for the purpose of a mission (like mission related to humans being sent to space, or planetary exploration with probes, ...etc)
    - Partially search for a payload by experiment name, example: Search for zero gravity