

SPACE EXPLORATION MANAGEMENT SYSTEM

A Case Study Submitted to

**DEPARTMENT
of
COMPUTER SCIENCE AND SYSTEMS ENGINEERING**

Submitted by

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**SREE VIDYANIKETHAN ENGINEERING COLLEGE
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Sree Sainath Nagar, Tirupati

**DEPARTMENT OF COMPUTER SCIENCE AND SYSTEMS
ENGINEERING**

CERTIFICATE

This is to certify that the Case Study report entitled

**SPACE EXPLORATION MANAGEMENT
SYSTEM**

is the Bonafide work done by

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in the Department of **Computer Science and Systems Engineering**, and submitted to Computer Science and Systems Engineering during the academic year 2022-2023. This work has been carried out under my supervision.

Guide:

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INTERNAL EXAMINER

EXTERNAL EXAMINER

DEPARTMENT OF COMPUTER SCIENCE AND SYSTEMS ENGINEERING

VISION

To become a centre of excellence in Computer Sciences and Systems Engineering through teaching, training, research and innovation to create quality engineering professionals who can solve the growing complex problems of the society.

MISSION

- ✓ Established with the cause of development of technical education in advanced computer sciences and engineering with applications to systems there by serving the society and nation.
- ✓ Transfer of Knowledge through contemporary curriculum and fostering faculty and student development.
- ✓ Create keen interest for research and innovation among students and faculty by understanding the needs of the society and industry.
- ✓ Skill development among diversity of students in technical domains and profession for development of systems and processes to meet the demands of the industry and research.
- ✓ Imbibing values and ethics in students for prospective and promising engineering profession and develop a sense of respect for all.

PROGRAM EDUCATIONAL OBJECTIVES

1. Demonstrate competencies in the Computer Science domain and Management with an ability to comprehend, analyze, design and create software systems for pursuing advanced studies in the areas of interest.
2. Evolve as entrepreneurs or be employed by acquiring required skill sets for developing computer systems and solutions in multi-disciplinary areas.
3. Exhibit progression and professional skill development in Computer programming and systems development with ethical attitude through life-long learning.

PROGRAM SPECIFIC OUTCOMES

PSO1: Employ Systems Approach to model the solutions for real life problems, design and develop software systems by applying Modern Tools.

PSO2: Develop solutions using novel algorithms in High Performance Computing and Data Science.

PSO3: Use emerging technologies for providing security and privacy to design, deploy and manage network systems.

PROGRAM OUTCOMES

1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

II B. Tech. – II Semester

(20BT40531) DATABASE MANAGEMENT SYSTEMS LAB

COURSE OUTCOMES

CO1. Analyze the requirements of a given database problem and design viable ER-Models for implementation of database.

CO2. Create database schemas, select and apply suitable integrity constraints for querying databases using SQL interface.

CO3. Develop and interpret PL/SQL blocks to centralize database applications for maintainability and reusability.

CO4. Develop database applications for societal applications such as ticket reservation system, employee payroll system using modern tools.

CO5. Work independently and communicate effectively in oral and written forms.

DECLARATION

We hereby declare that this project report titled "SPACE EXPLORATION MANAGEMENT SYSTEM" is a genuine work carried out by us, in B.Tech (Computer Science and Systems Engineering) degree course of Jawaharlal Nehru Technological University Anantapur and has not been submitted to any other course or University for the award of any degree by us.

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea / data / fact / source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Signature of the students

1.

2.

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CHAPTER 1. INTRODUCTION

1.1 Introduction to the topic

The Space Exploration Management System (SEMS) is a cutting-edge framework designed to streamline and optimize the complex operations involved in space exploration. As humanity ventures further into the cosmos, the need for efficient management of resources, missions, and personnel becomes paramount. SEMS provides a comprehensive suite of tools and protocols that facilitate planning, coordination, and execution of space exploration endeavors. From mission planning and spacecraft design to crew selection and resource allocation, SEMS integrates data-driven decision-making processes with advanced technology to ensure the success and safety of space missions. By centralizing and automating critical management tasks, SEMS empowers space agencies and organizations to push the boundaries of space exploration while minimizing risks and maximizing efficiency.

1.2 Problem Statement

Despite significant advancements in space exploration, the lack of an effective and integrated management system poses numerous challenges. Current practices for planning, coordinating, and executing space missions are often fragmented, leading to inefficiencies, miscommunication, and increased risks. The absence of a centralized framework hampers decision-making processes, resource allocation, and crew selection. Additionally, manual and outdated methods result in time-consuming tasks, limiting the ability to capitalize on technological advancements. To overcome these obstacles, there is a critical need for a comprehensive Space Exploration Management System (SEMS) that can streamline operations, facilitate data-driven decision-making, and maximize efficiency while ensuring the success and safety of space missions.

1.3 Objectives

The objective of the Space Exploration Management System (SEMS) is to provide a robust and integrated framework that enhances the efficiency, coordination, and safety of space exploration missions. The key objectives of SEMS are as follows:

1. Streamline Operations: SEMS aims to streamline the planning, coordination, and execution of space missions by integrating various processes and tasks into a centralized system. This includes mission planning, spacecraft design, resource allocation, and crew selection.
2. Optimize Resource Allocation: SEMS seeks to optimize the allocation of resources such as funding, personnel, and equipment. By leveraging data-driven insights and advanced algorithms, SEMS enables efficient resource utilization, minimizing waste and maximizing mission success.
3. Facilitate Data-Driven Decision Making: SEMS provides access to comprehensive data and analytics, empowering space agencies and organizations to make informed decisions. By leveraging real-time information, SEMS supports agile decision-making processes to adapt to changing mission requirements.
4. Enhance Communication and Collaboration: SEMS facilitates effective communication and collaboration among various stakeholders involved in space exploration missions. By providing a centralized platform for sharing information, coordinating tasks, and fostering collaboration, SEMS improves overall mission coordination and reduces miscommunication.
5. Ensure Mission Safety: SEMS prioritizes the safety of astronauts and mission success. It integrates safety protocols, risk assessment mechanisms, and emergency response procedures, ensuring that potential hazards are identified, mitigated, and effectively managed.

Overall, the objective of SEMS is to revolutionize space exploration management by providing a comprehensive, integrated, and technologically advanced system that maximizes efficiency, safety, and mission success.

CHAPTER 2. DATABASE DESIGN

2.1 List of Attributes, entities and relationship

1. Entity Name: Missions

Attributes	Type
mission_id	int
mission_name	varchar(255)
launch_date	date
destination	varchar(255)
status	varchar(255)
funding	bigint
expenses	bigint

2. Entity Name: Astronauts

Attributes	Type
astronaut_id	int
name	varchar(255)
age	int
nationality	varchar(255)
specialization	varchar(255)
number_of_missions	int
mission_id	int
notable_achievements	varchar(255)

3. Entity Name: Spacecraft

Attributes	Type
id	int
name	varchar(255)
type	varchar(255)
launch_date	date
status	varchar(255)
mission_id	int

4. Entity Name: SpaceStations

Attributes	Type
id	int

name	varchar(255)
country	varchar(255)
launch_date	date
orbit_type	varchar(255)
altitude	int
mission_id	int

5. Entity Name: Rockets

Attributes	Type
RocketID	int
RocketName	varchar(50)
Manufacturer	varchar(50)
PayloadCapacity	int
LaunchDate	date
SuccessFailureStatus	varchar(50)
mission_ID	int

6. Entity Name: Satellites

Attributes	Type
id	int
name	varchar(255)
country	varchar(255)
launch_date	date
orbit_type	varchar(255)
altitude	int
purpose	varchar(255)
mission_id	int

7. Entity Name: Scientists

Attributes	Type
id	int
name	varchar(255)
gender	varchar(255)
birth_date	date
death_date	date
country	varchar(255)
field	varchar(255)
notable_achievements	varchar(255)

8. Entity Name: LaunchSites

Attributes	Type
------------	------

id	int
name	varchar(255)
type	varchar(255)
launch_date	date
status	varchar(255)
mission_id	int

9. Entity Name: Payloads

Attributes	Type
id	int
name	varchar(255)
type	varchar(255)
mass	float
dimensions	varchar(255)
launch_date	date
launch_site	int
rocket	int
status	varchar(255)

10. Entity Name: MissionControl

Attributes	Type
id	int
name	varchar(255)
location	varchar(255)
country	varchar(255)
latitude	decimal(10, 7)
longitude	decimal(10, 7)
altitude	int
mission_id	int

11. Entity Name: GroundStations

Attributes	Type
id	int
name	varchar(255)
location	varchar(255)
country	varchar(255)
latitude	decimal(10, 7)
longitude	decimal(10, 7)
altitude	int
mission_id	int

12. Entity Name: SpaceAgencies

Attributes	Type

id	int
name	varchar(255)
country	varchar(255)
founded	date
budget	int

13. Entity Name: ExplorationPrograms

Attributes	Type
id	int
name	varchar(255)
agency_id	int
description	varchar(255)
start_date	date
end_date	date

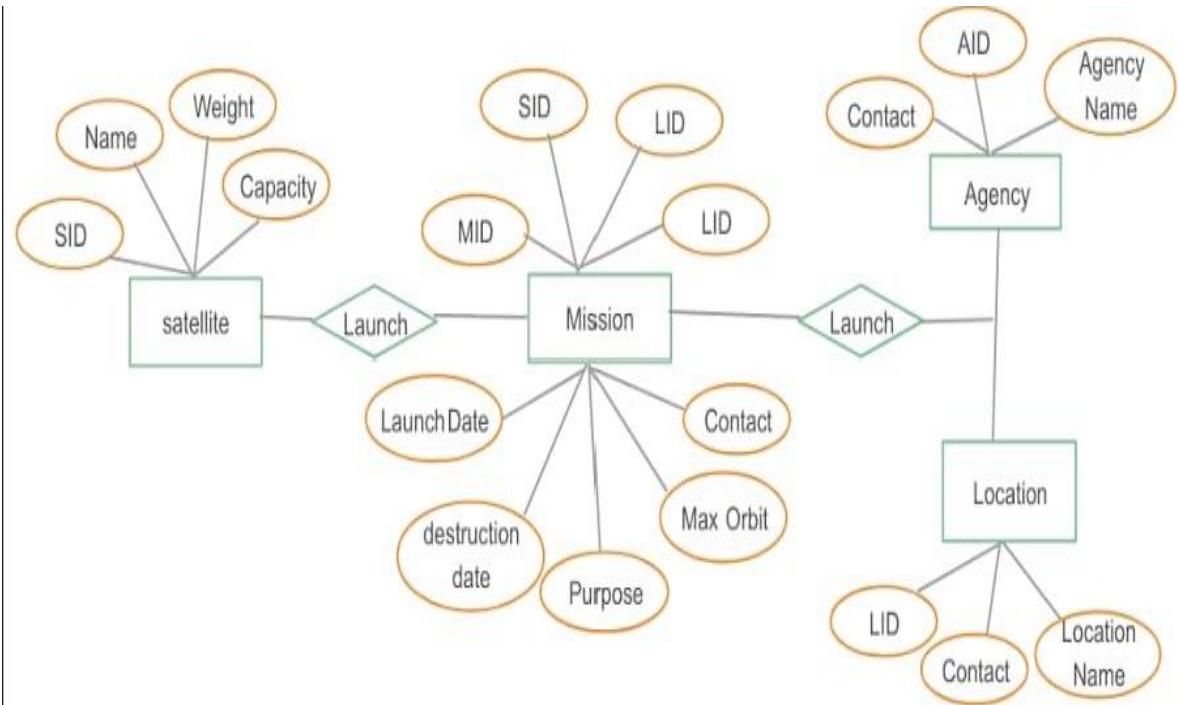
14. Entity Name: SpacecraftComponents

Attributes	Type
id	int
name	varchar(255)
description	varchar(255)
type	varchar(255)
spacecraft_id	int

15. Entity Name: MissionTimeline

Attributes	Type
id	int
mission_id	int
event_date	date
event_description	varchar(255)

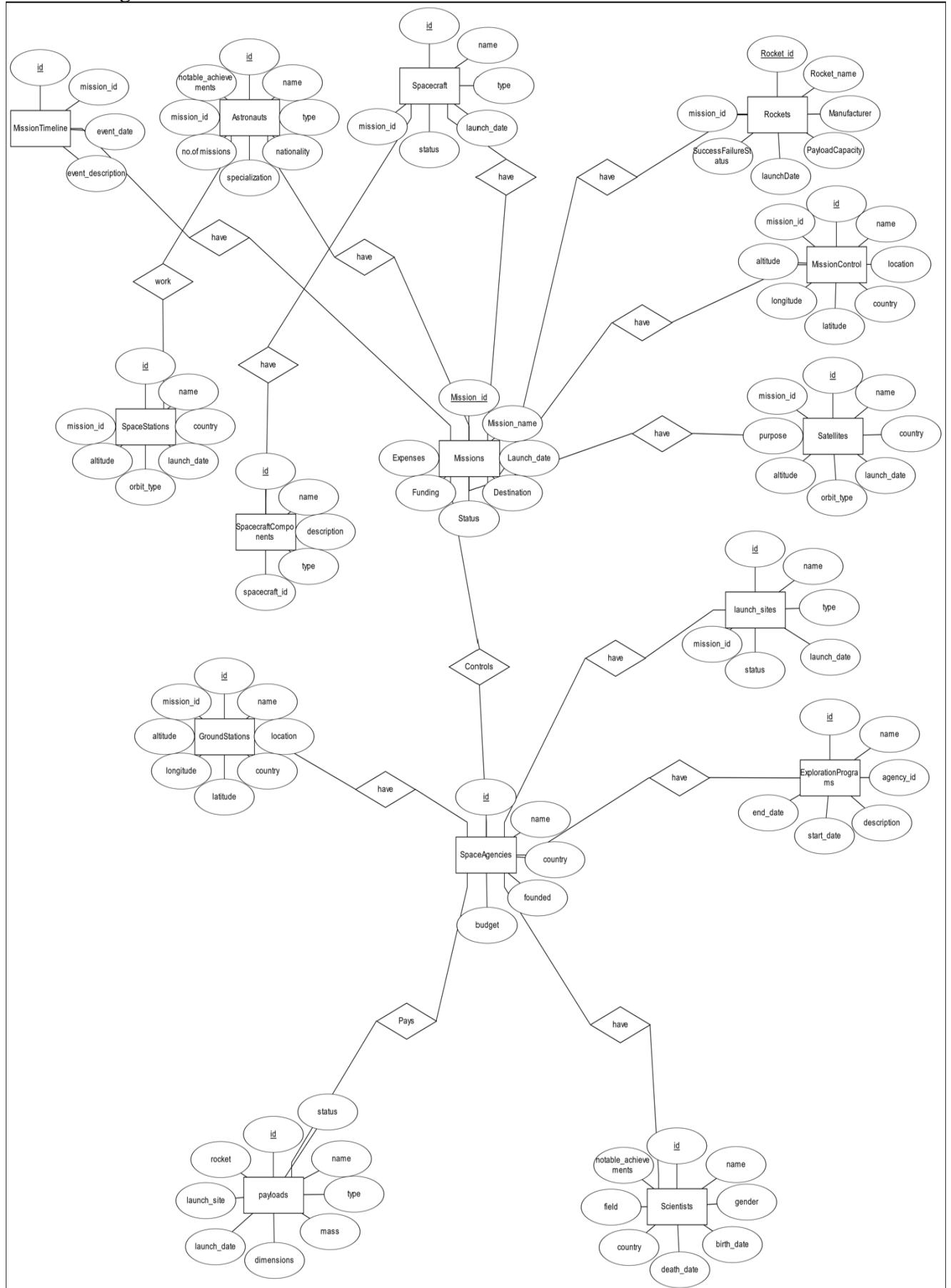
2.1.1 Entities and their relationships:



The above diagram is a simple representation of entities which shows the connectivity between all the entities and the relationship between various entities

To know in detail about the types of relationships that exist between all the entities and to know the different attributes that describes about the entity we design ER(entity relation) diagram.

2.2 E-R Diagram



CHAPTER 3. RELATIONAL MODEL

3.1 Database languages

Four categories of database languages :

1. Data definition language (DDL)

Data definition language (DDL) creates the framework of the database by specifying the database schema, which is the structure that represents the organization of data. Its common uses include the creation and alteration of tables, files, indexes and columns within the database. This language also allows users to rename or drop the existing database or its components.

Here's a list of DDL statements:

- CREATE: Creates a new database or object, such as a table, index or column.
- ALTER: Changes the structure of the database or object.
- DROP: Deletes the database or existing objects.
- RENAME: Renames the database or existing objects.

2. Data manipulation language (DML)

Data manipulation language (DML) provides operations that handle user requests, offering a way to access and manipulate the data that users store within a database. Its common functions include inserting, updating and retrieving data from the database.

Here's a list of DML statements:

- INSERT: Adds new data to the existing database table.
- UPDATE: Changes or updates values in the table.
- DELETE: Removes records or rows from the table.
- SELECT: Retrieves data from the table or multiple tables.

3. Data control language (DCL)

Data control language (DCL) controls access to the data that users store within a database. Essentially, this language controls the rights and permissions of the database system. It allows users to grant or revoke privileges to the database.

Here's a list of DCL statements:

- GRANT: Gives a user access to the database.
- REVOKE: Removes a user's access to the database.

4. Transaction control language (TCL)

Transaction control language (TCL) manages the transactions within a database. Transactions group a set of related tasks into a single, executable task. All the tasks must succeed in order for the transaction to work. Here's a list of TCL statements:

- COMMIT: Carries out a transaction.
- ROLLBACK: Restores a transaction if any tasks fail to execute.

3.2 Table Description

Following are the tables along with constraints used in **Space Exploration Management System** Database.

Missions Table:

- mission_id: An integer representing the unique identifier of the mission. (Primary Key)
- mission_name: A string field containing the name of the mission.
- launch_date: A date field indicating the launch date of the mission.
- destination: A string indicating the destination of the mission.
- status: A string indicating the status of the mission.
- funding: A bigint field representing the funding allocated for the mission.
- expenses: A bigint field indicating the expenses incurred for the mission.

Astronauts Table:

- astronaut_id: An integer representing the unique identifier of the astronaut. (Primary Key)
- name: A string field containing the name of the astronaut.
- age: An integer indicating the age of the astronaut.
- nationality: A string indicating the nationality of the astronaut.
- specialization: A string indicating the specialization of the astronaut.
- number_of_missions: An integer indicating the number of missions the astronaut has participated in.
- mission_id: An integer referencing the mission in which the astronaut is currently assigned. (Foreign Key to Missions table)

- notable_achievements: A string field containing notable achievements of the astronaut.

Spacecraft Table:

- id: An integer representing the unique identifier of the spacecraft. (Primary Key)
- name: A string field containing the name of the spacecraft.
- type: A string indicating the type of the spacecraft.
- launch_date: A date field indicating the launch date of the spacecraft.
- status: A string indicating the status of the spacecraft.
- mission_id: An integer referencing the mission to which the spacecraft is assigned. (Foreign Key to Missions table)

SpaceStations Table:

- id: An integer representing the unique identifier of the space station. (Primary Key)
- name: A string field containing the name of the space station.
- country: A string indicating the country in which the space station is located.
- launch_date: A date field indicating the launch date of the space station.
- orbit_type: A string indicating the orbit type of the space station.
- altitude: An integer indicating the altitude of the space station.
- mission_id: An integer referencing the mission to which the space station is associated. (Foreign Key to Missions table)

Rockets Table:

- RocketID: An integer representing the unique identifier of the rocket. (Primary Key)
- RocketName: A string field containing the name of the rocket.
- Manufacturer: A string indicating the manufacturer of the rocket.
- PayloadCapacity: An integer indicating the payload capacity of the rocket.
- LaunchDate: A date field indicating the launch date of the rocket.
- SuccessFailureStatus: A string indicating the success or failure status of the rocket.
- mission_ID: An integer referencing the mission in which the rocket was used. (Foreign Key to Missions table)

Satellites Table:

- id: An integer representing the unique identifier of the satellite. (Primary Key)
- name: A string field containing the name of the satellite.
- country: A string indicating the country to which the satellite belongs.
- launch_date: A date field indicating the launch date of the satellite.
- orbit_type: A string indicating the orbit type of the satellite.
- altitude: An integer indicating the altitude of the satellite.
- purpose: A string indicating the purpose or function of the satellite.
- mission_id: An integer referencing the mission to which the satellite is associated.
(Foreign Key to Missions table)

Scientists Table:

- id: An integer representing the unique identifier of the scientist. (Primary Key)
- name: A string field containing the name of the scientist.
- gender: A string indicating the gender of the scientist.
- birth_date: A date field indicating the birth date of the scientist.
- death_date: A date field indicating the death date of the scientist (if applicable).
- country: A string indicating the country of origin of the scientist.
- field: A string indicating the field of expertise of the scientist.
- notable_achievements: A string field containing notable achievements of the scientist.

LaunchSites Table:

- id: An integer representing the unique identifier of the launch site. (Primary Key)
- name: A string field containing the name of the launch site.
- country: A string indicating the country in which the launch site is located.
- latitude: A decimal field indicating the latitude coordinates of the launch site.
- longitude: A decimal field indicating the longitude coordinates of the launch site.
- altitude: An integer indicating the altitude of the launch site.

Payloads Table:

- id: An integer representing the unique identifier of the payload. (Primary Key)

- name: A string field containing the name of the payload.
- type: A string indicating the type of the payload.
- mass: A float indicating the mass of the payload.
- dimensions: A string indicating the dimensions of the payload.
- launch_date: A date field indicating the launch date of the payload.
- launch_site: An integer referencing the launch site from which the payload was launched. (Foreign Key to LaunchSites table)
- rocket: An integer referencing the rocket used to launch the payload. (Foreign Key to Rockets table)
- status: A string indicating the status of the payload.

MissionControl Table:

- id: An integer representing the unique identifier of the mission control. (Primary Key)
- name: A string field containing the name of the mission control.
- location: A string indicating the location of the mission control.
- country: A string indicating the country in which the mission control is located.
- latitude: A decimal field indicating the latitude coordinates of the mission control.
- longitude: A decimal field indicating the longitude coordinates of the mission control.
- altitude: An integer indicating the altitude of the mission control.
- mission_id: An integer referencing the mission controlled by the mission control. (Foreign Key to Missions table)

GroundStations Table:

- id: An integer representing the unique identifier of the ground station. (Primary Key)
- name: A string field containing the name of the ground station.
- location: A string indicating the location of the ground station.
- country: A string indicating the country in which the ground station is located.
- latitude: A decimal field indicating the latitude coordinates of the ground station.
- longitude: A decimal field indicating the longitude coordinates of the ground station.

- altitude: An integer indicating the altitude of the ground station.
- mission_id: An integer referencing the mission associated with the ground station.
(Foreign Key to Missions table)

SpaceAgencies Table:

- id: An integer representing the unique identifier of the space agency. (Primary Key)
- name: A string field containing the name of the space agency.
- country: A string indicating the country to which the space agency belongs.
- founded: A date field indicating the founding date of the space agency.
- budget: An integer indicating the budget allocated to the space agency.

ExplorationPrograms Table:

- id: An integer representing the unique identifier of the exploration program.
(Primary Key)
- name: A string field containing the name of the exploration program.
- agency_id: An integer referencing the space agency responsible for the exploration program. (Foreign Key to SpaceAgencies table)
- description: A string providing a description of the exploration program.
- start_date: A date field indicating the start date of the exploration program.
- end_date: A date field indicating the end date of the exploration program (if applicable).

SpacecraftComponents Table:

- id: An integer representing the unique identifier of the spacecraft component.
(Primary Key)
- name: A string field containing the name of the spacecraft component.
- description: A string providing a description of the spacecraft component.
- type: A string indicating the type of the spacecraft component.
- spacecraft_id: An integer referencing the spacecraft to which the component belongs. (Foreign Key to Spacecraft table)

MissionTimeline Table:

- id: An integer representing the unique identifier of the mission timeline event.
(Primary Key)
- mission_id: An integer referencing the mission to which the event belongs.
(Foreign Key to Missions table)
- event_date: A date field indicating the date of the mission timeline event.
- event_description: A string providing a description of the mission timeline event.

Note: The table descriptions include the table names, column names, data types, and constraints where applicable (Primary Key and Foreign Key constraints). The constraints ensure data integrity and enforce relationships between tables.

3.3 Relational Database Scheme

The relational database schema for *Space Exploration Management System* database is as follows:

1. Missions (mission_id, mission_name, launch_date, destination, status, funding, expenses)
2. Astronauts (astronaut_id, name, age, nationality, specialization, number_of_missions, mission_id, notable_achievements)
3. Spacecraft (id, name, type, launch_date, status, mission_id)
4. SpaceStations (id, name, country, launch_date, orbit_type, altitude, mission_id)
5. Rockets (RocketID, RocketName, Manufacturer, PayloadCapacity, LaunchDate, SuccessFailureStatus, mission_ID)
6. Satellites (id, name, country, launch_date, orbit_type, altitude, purpose, mission_id)
7. Scientists (id, name, gender, birth_date, death_date, country, field, notable_achievements)
8. LaunchSites (id, name, country, latitude, longitude, altitude)
9. Payloads (id, name, type, mass, dimensions, launch_date, launch_site, rocket, status)

10. MissionControl (id, name, location, country, latitude, longitude, altitude, mission_id)
11. GroundStations (id, name, location, country, latitude, longitude, altitude, mission_id)
12. SpaceAgencies (id, name, country, founded, budget)
13. ExplorationPrograms (id, name, agency_id, description, start_date, end_date)
14. SpacecraftComponents (id, name, description, type, spacecraft_id)
15. MissionTimeline (id, mission_id, event_date, event_description)

3.4 Relational Queries

Missions Table:

```

CREATE TABLE Missions (
mission_id INT NOT NULL IDENTITY(1,1),
mission_name VARCHAR(255) NOT NULL,
launch_date DATE NOT NULL,
destination VARCHAR(255),
status VARCHAR(255),
funding BIGINT,
expenses BIGINT,
PRIMARY KEY (mission_id)
);

INSERT INTO Missions (mission_name, launch_date, destination, status, funding,
expenses)
VALUES
('Apollo 11', '1969-07-20', 'Moon', 'Completed', 2540000000, 410000000),
('Apollo 13', '1970-04-11', 'Moon', 'Abandoned', 130000000, 0),
('Skylab 1', '1973-05-25', 'Low Earth Orbit', 'Completed', 260000000, 180000000),
('Space Shuttle Columbia', '1981-04-12', 'Low Earth Orbit', 'Completed', 1960000000,
1220000000),
('Space Shuttle Challenger', '1983-04-04', 'Low Earth Orbit', 'Destroyed', 550000000,
410000000),

```

('Space Shuttle Discovery', '1984-08-30', 'Low Earth Orbit', 'Completed', 2130000000, 1320000000),
 ('Space Shuttle Atlantis', '1985-10-08', 'Low Earth Orbit', 'Completed', 2130000000, 1320000000),
 ('Space Shuttle Endeavour', '1992-05-07', 'Low Earth Orbit', 'Completed', 2130000000, 1320000000),
 ('International Space Station', '1998-11-20', 'Low Earth Orbit', 'Active', 1000000000000, 1000000000000),
 ('Mars Exploration Rover Spirit', '2003-06-10', 'Mars', 'Abandoned', 450000000, 450000000),
 ('Mars Exploration Rover Opportunity', '2003-07-07', 'Mars', 'Abandoned', 450000000, 450000000),
 ('Juno', '2011-08-05', 'Jupiter', 'Active', 1100000000, 1100000000),
 ('New Horizons', '2006-01-19', 'Pluto', 'Completed', 720000000, 720000000),
 ('Perseverance', '2020-07-30', 'Mars', 'Active', 2700000000, 2700000000),
 ('Hope', '2020-07-20', 'Mars', 'Active', 200000000, 200000000),
 ('Chang'e 4', '2019-01-03', 'Moon', 'Active', 3400000000, 3400000000),
 ('Chang'e 5', '2020-12-01', 'Moon', 'Completed', 4400000000, 4400000000),
 ('Solar Orbiter', '2020-02-09', 'Sun', 'Active', 1500000000, 1500000000);
 select * from Missions;

Output:

	mission_id	mission_name	launch_date	destination	status	funding	expenses
1	1	Apollo 11	1969-07-20	Moon	Completed	2540000000	410000000
2	2	Apollo 13	1970-04-11	Moon	Abandoned	130000000	0
3	3	Skylab 1	1973-05-25	Low Earth Orbit	Completed	260000000	180000000
4	4	Space Shuttle Columbia	1981-04-12	Low Earth Orbit	Completed	1960000000	1220000000
5	5	Space Shuttle Challenger	1983-04-04	Low Earth Orbit	Destroyed	550000000	410000000
6	6	Space Shuttle Discovery	1984-08-30	Low Earth Orbit	Completed	2130000000	1320000000
7	7	Space Shuttle Atlantis	1985-10-08	Low Earth Orbit	Completed	2130000000	1320000000
8	8	Space Shuttle Endeavour	1992-05-07	Low Earth Orbit	Completed	2130000000	1320000000
9	9	International Space Station	1998-11-20	Low Earth Orbit	Active	1000000000000	1000000000000
10	10	Mars Exploration Rover Spirit	2003-06-10	Mars	Abandoned	450000000	450000000
11	11	Mars Exploration Rover Opportunity	2003-07-07	Mars	Abandoned	450000000	450000000
12	12	Juno	2011-08-05	Jupiter	Active	1100000000	1100000000
13	13	New Horizons	2006-01-19	Pluto	Completed	720000000	720000000
14	14	Perseverance	2020-07-30	Mars	Active	2700000000	2700000000
15	15	Hope	2020-07-20	Mars	Active	200000000	200000000
16	16	Chang'e 4	2019-01-03	Moon	Active	3400000000	3400000000
17	17	Chang'e 5	2020-12-01	Moon	Completed	4400000000	4400000000
18	18	Solar Orbiter	2020-02-09	Sun	Active	1500000000	1500000000

Astronauts Table:

```
CREATE TABLE Astronauts (
    astronaut_id INT NOT NULL IDENTITY(1,1) ,
    name VARCHAR(255) NOT NULL,
    age INT,
    nationality VARCHAR(255),
    specialization VARCHAR(255),
    number_of_missions INT,
    mission_id INT,
    notable_achievements VARCHAR(255) NOT NULL,
    PRIMARY KEY (astronaut_id),
    FOREIGN KEY (mission_id) REFERENCES Missions(mission_id)
);

INSERT INTO Astronauts (name, age, nationality, specialization, number_of_missions,
mission_id, notable_achievements)

VALUES

('Neil Armstrong', 38, 'United States', 'Pilot', 1, 1,'First person to walk on the Moon'),
('Buzz Aldrin', 39, 'United States', 'Pilot', 1, 1,'Second person to walk on the Moon'),
('Michael Collins', 39, 'United States', 'Command Module Pilot', 1, 1,'Command Module
Pilot on Apollo 11'),
('Jim Lovell', 42, 'United States', 'Commander', 1, 2,'Apollo 13 mission commander'),
('Fred Haise', 36, 'United States', 'Lunar Module Pilot', 1, 2,'Apollo 13 lunar module pilot'),
('Jack Swigert', 38, 'United States', 'Command Module Pilot', 1, 2,'Apollo 13 lunar module
pilot'),
('Valentina Tereshkova', 26, 'Soviet Union', 'Cosmonaut', 1, 3,'First woman in space'),
('Alan Shepard', 47, 'United States', 'Pilot', 2, 4,'First American in space'),
('Stuart Roosa', 37, 'United States', 'Command Module Pilot', 1, 4,'Carried tree seeds to
space'),
('Edgar Mitchell', 40, 'United States', 'Lunar Module Pilot', 1, 4,'Apollo 14 lunar module
pilot'),
('David Scott', 39, 'United States', 'Commander', 1, 5,'Apollo 15 mission commander'),
('James Irwin', 41, 'United States', 'Lunar Module Pilot', 1, 5,'Apollo 15 lunar module pilot'),
('Alfred Worden', 39, 'United States', 'Command Module Pilot', 1, 5,'Orbital Command
Module pilot, Apollo 15'),
('John Young', 42, 'United States', 'Commander', 1, 6,'Walked on the Moon, Apollo 16'),
('Charles Duke', 36, 'United States', 'Lunar Module Pilot', 1, 6,'Walked on the Moon, Apollo
16'),
```

('Thomas Mattingly', 37, 'United States', 'Command Module Pilot', 1, 6,'Apollo 13 Command Module Pilot'),
('Eugene Cernan', 38, 'United States', 'Commander', 1, 7,'Last person to walk on the Moon'),
('Harrison Schmitt', 37, 'United States', 'Lunar Module Pilot', 1, 7,'Geologist on Apollo 17'),
('Ron Evans', 38, 'United States', 'Command Module Pilot', 1, 7,'Apollo 17 Command Module Pilot'),
('Yuri Gagarin', 27, 'Soviet Union', 'Pilot', 1, 8,'First person in space'),
('Gherman Titov', 25, 'Soviet Union', 'Pilot', 1, 9,'Second human in space'),
('Andriyan Nikolayev', 33, 'Soviet Union', 'Pilot', 1, 10,'First married man in space'),
('Pete Conrad', 37, 'United States', 'Commander', 1, 11,'Third person to walk on the moon'),
('Alan Bean', 39, 'United States', 'Lunar Module Pilot', 1, 11,'Fourth person to walk on the moon'),
('Richard Gordon', 40, 'United States', 'Command Module Pilot', 1, 11,'Performed a spacewalk during the Gemini 11 mission'),
('Charles Conrad', 39, 'United States', 'Commander', 1, 12,'Walked on the Moon during the Apollo 12 mission'),
('Joseph Kerwin', 36, 'United States', 'Science Pilot', 1, 12,'First physician to fly in space'),
('Paul Weitz', 37, 'United States', 'Command Module Pilot', 1, 12,'Performed spacewalks during Skylab missions'),
('James McDivitt', 39, 'United States', 'Commander', 1, 13,'Commanded the Gemini 4 mission'),
('David Scott', 37, 'United States', 'Command Module Pilot', 1, 13,'Commanded the Apollo 15 mission');

select * from Astronauts;

Output:

	astronaut_id	name	age	nationality	specialization	number_of_missions	mission_id	notable_achievements
1	1	Neil Armstrong	38	United States	Pilot	1	1	First person to walk on the Moon
2	2	Buzz Aldrin	39	United States	Pilot	1	1	Second person to walk on the Moon
3	3	Michael Collins	39	United States	Command Module Pilot	1	1	Command Module Pilot on Apollo 11
4	4	Jim Lovell	42	United States	Commander	1	2	Apollo 13 mission commander
5	5	Fred Haise	36	United States	Lunar Module Pilot	1	2	Apollo 13 lunar module pilot
6	6	Jack Swigert	38	United States	Command Module Pilot	1	2	Apollo 13 lunar module pilot
7	7	Valentina Ter... ...kay	26	Soviet Union	Cosmonaut	1	3	First woman in space
8	8	Alan Shepard	47	United States	Pilot	2	4	First American in space
9	9	Stuart Roosa	37	United States	Command Module Pilot	1	4	Carried tree seeds to space
10	10	Edgar Mitchell	40	United States	Lunar Module Pilot	1	4	Apollo 14 lunar module pilot
11	11	David Scott	39	United States	Commander	1	5	Apollo 15 mission commander
12	12	James Irwin	41	United States	Lunar Module Pilot	1	5	Apollo 15 lunar module pilot
13	13	Alfred Worden	39	United States	Command Module Pilot	1	5	Orbital Command Module pilot, Apollo 15
14	14	John Young	42	United States	Commander	1	6	Walked on the Moon, Apollo 16
15	15	Charles Duke	36	United States	Lunar Module Pilot	1	6	Walked on the Moon, Apollo 16
16	16	Thomas Matti... ...son	37	United States	Command Module Pilot	1	6	Apollo 13 Command Module Pilot
17	17	Eugene Cernan	38	United States	Commander	1	7	Last person to walk on the Moon
18	18	Harrison Sch... ...aughan	37	United States	Lunar Module Pilot	1	7	Geologist on Apollo 17
19	19	Ron Evans	38	United States	Command Module Pilot	1	7	Apollo 17 Command Module Pilot
20	20	Yuri Gagarin	27	Soviet Union	Pilot	1	8	First person in space
21	21	Gherman Titov	25	Soviet Union	Pilot	1	9	Second human in space
22	22	Andriyan Nik... ...ev	33	Soviet Union	Pilot	1	10	First married man in space
23	23	Pete Conrad	37	United States	Commander	1	11	Third person to walk on the moon
24	24	Alan Bean	39	United States	Lunar Module Pilot	1	11	Fourth person to walk on the moon
25	25	Richard Gord... ...on	40	United States	Command Module Pilot	1	11	Performed a spacewalk during the Gemini 11 mission
26	26	Charles Conrad	39	United States	Commander	1	12	Walked on the Moon during the Apollo 12 mission
27	27	Joseph Kerwin	36	United States	Science Pilot	1	12	First physician to fly in space
28	28	Paul Weitz	37	United States	Command Module Pilot	1	12	Performed spacewalks during Skylab missions
29	29	James McDivitt	39	United States	Commander	1	13	Commanded the Gemini 4 mission
30	30	David Scott	37	United States	Command Module Pilot	1	13	Commanded the Apollo 15 mission

Spacecraft Table:

```
CREATE TABLE Spacecraft (
    id INT NOT NULL IDENTITY(1,1) ,
    name VARCHAR(255) NOT NULL,
    type VARCHAR(255) NOT NULL,
    launch_date DATE NOT NULL,
    status VARCHAR(255) NOT NULL,
    mission_id INT,
```

```
PRIMARY KEY (id),
FOREIGN KEY (mission_id) REFERENCES Missions(mission_id)
);
```

```
INSERT INTO Spacecraft (name, type, launch_date, status, mission_id)
VALUES
('Apollo 11 Command Module', 'Command Module', '1969-07-16', 'Completed', 1),
('Apollo 11 Lunar Module', 'Lunar Module', '1969-07-20', 'Completed', 1),
('Apollo 13 Command Module', 'Command Module', '1970-04-11', 'Abandoned', 2),
('Apollo 13 Lunar Module', 'Lunar Module', '1970-04-13', 'Abandoned', 2),
('Skylab 1 Orbital Workshop', 'Space Station', '1973-05-25', 'Completed', 3),
('Space Shuttle Columbia Orbiter', 'Space Shuttle', '1981-04-12', 'Completed', 4),
('Space Shuttle Challenger Orbiter', 'Space Shuttle', '1983-04-04', 'Destroyed', 5),
('Space Shuttle Discovery Orbiter', 'Space Shuttle', '1984-08-30', 'Completed', 6),
('Space Shuttle Atlantis Orbiter', 'Space Shuttle', '1985-10-08', 'Completed', 7),
('Space Shuttle Endeavour Orbiter', 'Space Shuttle', '1992-05-07', 'Completed', 8),
('International Space Station Node 1', 'Space Station Module', '1998-11-20', 'Completed', 9),
('Mars Exploration Rover Spirit', 'Rover', '2003-06-10', 'Abandoned', 10),
('Mars Exploration Rover Opportunity', 'Rover', '2003-07-07', 'Abandoned', 11),
('Juno Spacecraft', 'Spacecraft', '2011-08-05', 'Active', 12),
('New Horizons Spacecraft', 'Spacecraft', '2006-01-19', 'Completed', 13),
('Perseverance Rover', 'Rover', '2020-07-30', 'Active', 14),
('Hope Orbiter', 'Orbiter', '2020-07-20', 'Active', 15),
('Chang''e 4 Lander', 'Lander', '2019-01-03', 'Active', 16),
('Chang''e 5 Orbiter', 'Orbiter', '2020-12-01', 'Completed', 17),
('Solar Orbiter', 'Spacecraft', '2020-02-09', 'Active', 18);
```

```
select * from Spacecraft;
```

Output:

	id	name	type	launch_date	status	mission_id
1	1	Apollo 11 Command Module	Command Module	1969-07-16	Completed	1
2	2	Apollo 11 Lunar Module	Lunar Module	1969-07-20	Completed	1
3	3	Apollo 13 Command Module	Command Module	1970-04-11	Abandoned	2
4	4	Apollo 13 Lunar Module	Lunar Module	1970-04-13	Abandoned	2
5	5	Skylab 1 Orbital Workshop	Space Station	1973-05-25	Completed	3
6	6	Space Shuttle Columbia Or...	Space Shuttle	1981-04-12	Completed	4
7	7	Space Shuttle Challenger ...	Space Shuttle	1983-04-04	Destroyed	5
8	8	Space Shuttle Discovery O...	Space Shuttle	1984-08-30	Completed	6
9	9	Space Shuttle Atlantis Orbi...	Space Shuttle	1985-10-08	Completed	7
10	10	Space Shuttle Endeavour ...	Space Shuttle	1992-05-07	Completed	8
11	11	International Space Station...	Space Station M...	1998-11-20	Completed	9
12	12	Mars Exploration Rover S...	Rover	2003-06-10	Abandoned	10
13	13	Mars Exploration Rover O...	Rover	2003-07-07	Abandoned	11
14	14	Juno Spacecraft	Spacecraft	2011-08-05	Active	12
15	15	New Horizons Spacecraft	Spacecraft	2006-01-19	Completed	13
16	16	Perseverance Rover	Rover	2020-07-30	Active	14
17	17	Hope Orbiter	Orbiter	2020-07-20	Active	15
18	18	Chang'e 4 Lander	Lander	2019-01-03	Active	16
19	19	Chang'e 5 Orbiter	Orbiter	2020-12-01	Completed	17
20	20	Solar Orbiter	Spacecraft	2020-02-09	Active	18

SpaceStations Table:

```

CREATE TABLE SpaceStations (
    id INT NOT NULL IDENTITY(1,1) ,
    name VARCHAR(255) NOT NULL,
    country VARCHAR(255) NOT NULL,
    launch_date DATE NOT NULL,
    orbit_type VARCHAR(255) NOT NULL,
    altitude INT NOT NULL,
    mission_id INT,
    PRIMARY KEY (id),
    FOREIGN KEY (mission_id) REFERENCES Missions(mission_id)
);

INSERT INTO SpaceStations (name, country, launch_date, orbit_type, altitude,
mission_id)
VALUES
('Skylab', 'United States', '1973-05-25', 'Low Earth Orbit', 438, 1),

```

('Mir', 'Soviet Union', '1986-02-20', 'Low Earth Orbit', 254, 2),
 ('International Space Station', 'United States', '1998-11-20', 'Low Earth Orbit', 408, 3),
 ('Tiangong', 'China', '2021-04-29', 'Low Earth Orbit', 340, 4),
 ('Skylab 2', 'United States', '1974-05-25', 'Low Earth Orbit', 438, 5),
 ('Mir 2', 'Soviet Union', '1987-02-20', 'Low Earth Orbit', 254, 6),
 ('International Space Station 2', 'United States', '2000-11-20', 'Low Earth Orbit', 408, 7),
 ('Tiangong 2', 'China', '2022-04-29', 'Low Earth Orbit', 340, 8),
 ('Skylab 3', 'United States', '1975-05-25', 'Low Earth Orbit', 438, 9),
 ('Mir 3', 'Soviet Union', '1988-02-20', 'Low Earth Orbit', 254, 10),
 ('International Space Station 3', 'United States', '2002-11-20', 'Low Earth Orbit', 408, 11),
 ('Tiangong 3', 'China', '2023-04-29', 'Low Earth Orbit', 340, 12),
 ('Skylab 4', 'United States', '1976-05-25', 'Low Earth Orbit', 438, 13),
 ('Mir 4', 'Soviet Union', '1989-02-20', 'Low Earth Orbit', 254, 14),
 ('International Space Station 4', 'United States', '2004-11-20', 'Low Earth Orbit', 408, 15),
 ('Tiangong 4', 'China', '2024-04-29', 'Low Earth Orbit', 340, 16),
 ('Skylab 5', 'United States', '1977-05-25', 'Low Earth Orbit', 438, 17),
 ('Mir 5', 'Soviet Union', '1990-02-20', 'Low Earth Orbit', 254, 18);

Select * from Spacestations;

Output:

	id	name	country	launch_date	orbit_type	altitude	mission_id
1	1	Skylab	United States	1973-05-25	Low Earth Orbit	438	1
2	2	Mir	Soviet Union	1986-02-20	Low Earth Orbit	254	2
3	3	International Space Station	United States	1998-11-20	Low Earth Orbit	408	3
4	4	Tiangong	China	2021-04-29	Low Earth Orbit	340	4
5	5	Skylab 2	United States	1974-05-25	Low Earth Orbit	438	5
6	6	Mir 2	Soviet Union	1987-02-20	Low Earth Orbit	254	6
7	7	International Space Station 2	United States	2000-11-20	Low Earth Orbit	408	7
8	8	Tiangong 2	China	2022-04-29	Low Earth Orbit	340	8
9	9	Skylab 3	United States	1975-05-25	Low Earth Orbit	438	9
10	10	Mir 3	Soviet Union	1988-02-20	Low Earth Orbit	254	10
11	11	International Space Station 3	United States	2002-11-20	Low Earth Orbit	408	11
12	12	Tiangong 3	China	2023-04-29	Low Earth Orbit	340	12
13	13	Skylab 4	United States	1976-05-25	Low Earth Orbit	438	13
14	14	Mir 4	Soviet Union	1989-02-20	Low Earth Orbit	254	14
15	15	International Space Station 4	United States	2004-11-20	Low Earth Orbit	408	15
16	16	Tiangong 4	China	2024-04-29	Low Earth Orbit	340	16
17	17	Skylab 5	United States	1977-05-25	Low Earth Orbit	438	17
18	18	Mir 5	Soviet Union	1990-02-20	Low Earth Orbit	254	18

Rockets Table:

```
CREATE TABLE Rockets (
    RocketID INT PRIMARY KEY,
    RocketName VARCHAR(50),
    Manufacturer VARCHAR(50),
    PayloadCapacity INT,
    LaunchDate DATE,
    SuccessFailureStatus VARCHAR(50),
    mission_ID INT,
    FOREIGN KEY (mission_ID) REFERENCES Missions(mission_ID)
);

INSERT INTO Rockets (RocketID, RocketName, Manufacturer, PayloadCapacity,
LaunchDate, SuccessFailureStatus, Mission_ID)
VALUES
    (1, 'Falcon 9', 'SpaceX', 22000, '2022-01-01', 'Success', 1),
    (2, 'Atlas V', 'United Launch Alliance', 18150, '2022-02-15', 'Success', 2),
    (3, 'Delta IV Heavy', 'United Launch Alliance', 28500, '2022-03-10', 'Failure', 3),
    (4, 'GSLV Mk III', 'Indian Space Research Organization', 10000, '2022-04-20', 'Success',
4),
    (5, 'Soyuz', 'Roscosmos', 7200, '2022-05-05', 'Success', 5),
    (6, 'Long March 5', 'China National Space Administration', 25000, '2022-06-18',
'Success', 6),
    (7, 'Falcon Heavy', 'SpaceX', 64000, '2022-07-25', 'Success', 7),
    (8, 'H-IIA', 'Mitsubishi Heavy Industries', 10000, '2022-08-10', 'Failure', 8),
    (9, 'Electron', 'Rocket Lab', 300, '2022-09-05', 'Success', 9),
    (10, 'Vega', 'Arianespace', 1500, '2022-10-20', 'Success', 10),
    (11, 'PSLV', 'Indian Space Research Organization', 3200, '2022-11-15', 'Success', 11),
    (12, 'Proton', 'Roscosmos', 23500, '2022-12-01', 'Failure', 12),
    (13, 'Falcon 1', 'SpaceX', 670, '2023-01-10', 'Success', 13),
    (14, 'Zenit', 'Yuzhmash', 13150, '2023-02-15', 'Success', 14),
```

(15, 'Angara A5', 'Khrunichev State Research Space Center', 24500, '2023-03-05', 'Failure', 15),

(16, 'Pegasus', 'Northrop Grumman', 450, '2023-04-12', 'Success', 16),

(17, 'GSLV Mk II', 'Indian Space Research Organization', 2500, '2023-05-20', 'Success', 17),

(18, 'Ariane 5', 'Arianespace', 21000, '2023-06-08', 'Success', 18);

select * from Rockets;

Output:

	RocketID	RocketName	Manufacturer	PayloadCapacity	LaunchDate	SuccessFailureStatus	mission_ID
1	1	Falcon 9	SpaceX	22000	2022-01-01	Success	1
2	2	Atlas V	United Launch Alliance	18150	2022-02-15	Success	2
3	3	Delta IV Heavy	United Launch Alliance	28500	2022-03-10	Failure	3
4	4	GSLV Mk III	Indian Space Research Organization	10000	2022-04-20	Success	4
5	5	Soyuz	Roscosmos	7200	2022-05-05	Success	5
6	6	Long March 5	China National Space Administration	25000	2022-06-18	Success	6
7	7	Falcon Heavy	SpaceX	64000	2022-07-25	Success	7
8	8	H-IIA	Mitsubishi Heavy Industries	10000	2022-08-10	Failure	8
9	9	Electron	Rocket Lab	300	2022-09-05	Success	9
10	10	Vega	Arianespace	1500	2022-10-20	Success	10
11	11	PSLV	Indian Space Research Organization	3200	2022-11-15	Success	11
12	12	Proton	Roscosmos	23500	2022-12-01	Failure	12
13	13	Falcon 1	SpaceX	670	2023-01-10	Success	13
14	14	Zenit	Yuzhmash	13150	2023-02-15	Success	14
15	15	Angara A5	Khrunichev State Research Space Center	24500	2023-03-05	Failure	15
16	16	Pegasus	Northrop Grumman	450	2023-04-12	Success	16
17	17	GSLV Mk II	Indian Space Research Organization	2500	2023-05-20	Success	17
18	18	Ariane 5	Arianespace	21000	2023-06-08	Success	18

Satellites Table:

```
CREATE TABLE Satellites (
    id INT NOT NULL IDENTITY(1,1) ,
    name VARCHAR(255) NOT NULL,
    country VARCHAR(255) NOT NULL,
    launch_date DATE NOT NULL,
```

```

orbit_type VARCHAR(255) NOT NULL,
altitude INT NOT NULL,
purpose VARCHAR(255) NOT NULL,
mission_id INT,
PRIMARY KEY (id),
FOREIGN KEY (mission_id) REFERENCES Missions(mission_id)
);

INSERT INTO Satellites (name, country, launch_date, orbit_type, altitude, purpose,
mission_id)
VALUES
('Galileo', 'European Union', '1989-10-18', 'Geosynchronous', 23222, 'Earth observation', 1),
('Terra', 'United States', '1999-12-18', 'Sun-synchronous', 705, 'Earth observation', 2),
('Aqua', 'United States', '2002-05-04', 'Sun-synchronous', 705, 'Earth observation', 3),
('SMOS', 'European Union', '2002-11-21', 'Sun-synchronous', 705, 'Earth observation', 4),
('Cryosat', 'European Union', '2005-03-27', 'Polar', 786, 'Ice observation', 5),
('GOCE', 'European Union', '2009-03-17', 'Polar', 255, 'Gravity field observation', 6),
('Jason-1', 'United States', '2001-01-12', 'Oceanography', 1336, 'Oceanography', 7),
('Jason-2', 'United States', '2008-06-20', 'Oceanography', 1336, 'Oceanography', 8),
('TerraSAR-X', 'Germany', '2007-02-15', 'Polar', 514, 'Earth observation', 9),
('TanDEM-X', 'Germany', '2010-04-21', 'Polar', 35786, 'Earth observation', 10),
('Sentinel-1A', 'European Union', '2014-03-31', 'Polar', 695, 'Earth observation', 11),
('Sentinel-1B', 'European Union', '2016-03-25', 'Polar', 695, 'Earth observation', 12),
('Sentinel-2A', 'European Union', '2015-06-23', 'Sun-synchronous', 786, 'Earth observation',
13),
('Sentinel-3A', 'European Union', '2016-02-22', 'Polar', 1100, 'Oceanography', 14),
('Sentinel-3B', 'European Union', '2018-04-25', 'Polar', 1100, 'Oceanography', 15),
('ALOS-2', 'Japan', '2014-05-22', 'Polar', 681, 'Earth observation', 16),
('Gaia', 'European Union', '2013-12-19', 'Heliocentric', 1500000, 'Astrometry', 17),
('Planck', 'European Union', '2009-05-14', 'Heliocentric', 1500000, 'Cosmology', 18)
select * from Satellites

```

Output:

	id	name	country	launch_date	orbit_type	altitude	purpose	mission_id
1	1	Galileo	European Union	1989-10-18	Geosynchronous	23222	Earth observation	1
2	2	Terra	United States	1999-12-18	Sun-synchronous	705	Earth observation	2
3	3	Aqua	United States	2002-05-04	Sun-synchronous	705	Earth observation	3
4	4	SMOS	European Union	2002-11-21	Sun-synchronous	705	Earth observation	4
5	5	Cryosat	European Union	2005-03-27	Polar	786	Ice observation	5
6	6	GOCE	European Union	2009-03-17	Polar	255	Gravity field observation	6
7	7	Jason-1	United States	2001-01-12	Oceanography	1336	Oceanography	7
8	8	Jason-2	United States	2008-06-20	Oceanography	1336	Oceanography	8
9	9	TerraSAR-X	Germany	2007-02-15	Polar	514	Earth observation	9
10	10	TanDEM-X	Germany	2010-04-21	Polar	35786	Earth observation	10
11	11	Sentinel-1A	European Union	2014-03-31	Polar	695	Earth observation	11
12	12	Sentinel-1B	European Union	2016-03-25	Polar	695	Earth observation	12
13	13	Sentinel-2A	European Union	2015-06-23	Sun-synchronous	786	Earth observation	13
14	14	Sentinel-3A	European Union	2016-02-22	Polar	1100	Oceanography	14
15	15	Sentinel-3B	European Union	2018-04-25	Polar	1100	Oceanography	15
16	16	ALOS-2	Japan	2014-05-22	Polar	681	Earth observation	16
17	17	Gaia	European Union	2013-12-19	Heliocentric	1500...	Astrometry	17
18	18	Planck	European Union	2009-05-14	Heliocentric	1500...	Cosmology	18

Scientists Table:

```

CREATE TABLE Scientists (
    id INT NOT NULL IDENTITY(1,1) ,
    name VARCHAR(255) NOT NULL,
    gender VARCHAR(255) NOT NULL,
    birth_date DATE NOT NULL,
    death_date DATE,
    country varchar(255) not null,
    field VARCHAR(255) NOT NULL,
    notable_achievements VARCHAR(255) NOT NULL,
    PRIMARY KEY (id)
);

INSERT INTO Scientists (name, gender, birth_date, death_date, country, field,
notable_achievements)
VALUES
('Wernher von Braun', 'Male', '1912-03-23', '1977-06-16', 'Germany', 'Rocketry',
'Pioneering work in rocket development'),
('Konstantin Tsiolkovsky', 'Male', '1857-09-17', '1935-09-19', 'Russia', 'Astronautics',
'Father of theoretical astronautics'),

```

('Hermann Oberth', 'Male', '1894-06-25', '1989-12-28', 'Romania', 'Rocketry', 'Contributions to rocketry and astronautics'),

('Robert H. Goddard', 'Male', '1882-10-05', '1945-08-10', 'United States', 'Rocketry', 'Developed and patented the world"s first liquid-fueled rocket'),

('Sergei Korolev', 'Male', '1907-01-12', '1966-01-14', 'Soviet Union', 'Astronautics', 'Chief designer of the Soviet space program'),

('Jocelyn Bell Burnell', 'Female', '1943-07-15', NULL, 'United Kingdom', 'Astrophysics', 'Discovered the first pulsar'),

('Carl Sagan', 'Male', '1934-11-09', '1996-12-20', 'United States', 'Astrophysics', 'Popularized astronomy and space science'),

('Katherine Johnson', 'Female', '1918-08-26', '2020-02-24', 'United States', 'Mathematics', 'Performed calculations for NASA"s early space missions'),

('Stephen Hawking', 'Male', '1942-01-08', '2018-03-14', 'United Kingdom', 'Theoretical Physics', 'Contributions to the understanding of black holes and the universe'),

('Margaret Hamilton', 'Female', '1936-08-17', NULL, 'United States', 'Software Engineering', 'Led the development of on-board flight software for NASA"s Apollo program'),

('Edward Teller', 'Male', '1908-01-15', '2003-09-09', 'Hungary', 'Physics', 'Contributions to nuclear and theoretical physics'),

('Annie Jump Cannon', 'Female', '1863-12-11', '1941-04-13', 'United States', 'Astronomy', 'Developed a stellar classification system'),

('Edwin Hubble', 'Male', '1889-11-20', '1953-09-28', 'United States', 'Astronomy', 'Discovered the expansion of the universe'),

('Eugene Shoemaker', 'Male', '1928-04-28', '1997-07-18', 'United States', 'Planetary Science', 'Contributions to the study of impact craters and the moon'),

('Vera Rubin', 'Female', '1928-07-23', '2016-12-25', 'United States', 'Astronomy', 'Provided evidence for the existence of dark matter'),

('George Carruthers', 'Male', '1939-10-01', '2020-12-26', 'United States', 'Astrophysics', 'Invented the ultraviolet camera used in the Apollo 16 mission'),

('Lisa Randall', 'Female', '1962-06-18', NULL, 'United States', 'Theoretical Physics', 'Contributions to particle physics and cosmology'),

('Roger Penrose', 'Male', '1931-08-08', NULL, 'United Kingdom', 'Mathematics', 'Contributions to general relativity and black hole theory');

Select * from Scientists;

OUTPUT:

	id	name	gender	birth_date	death_date	country	field	notable_achievements
1	1	Wernher von Braun	Male	1912-03-23	1977-06-16	Germany	Rocketry	Pioneering work in rocket development
2	2	Konstantin Tsiolkovsky	Male	1857-09-17	1935-09-19	Russia	Astronautics	Father of theoretical astronautics
3	3	Hermann Oberth	Male	1894-06-25	1989-12-28	Romania	Rocketry	Contributions to rocketry and astronautics
4	4	Robert H. Goddard	Male	1882-10-05	1945-08-10	United States	Rocketry	Developed and patented the world's first liquid-fueled rocket
5	5	Sergei Korolev	Male	1907-01-12	1966-01-14	Soviet Union	Astronautics	Chief designer of the Soviet space program
6	6	Jocelyn Bell Burnell	Female	1943-07-15	NULL	United Kin...	Astrophys...	Discovered the first pulsar
7	7	Carl Sagan	Male	1934-11-09	1996-12-20	United States	Astrophys...	Popularized astronomy and space science
8	8	Katherine Johnson	Female	1918-08-26	2020-02-24	United States	Mathemat...	Performed calculations for NASA's early space missions
9	9	Stephen Hawking	Male	1942-01-08	2018-03-14	United Kin...	Theoretic...	Contributions to the understanding of black holes and the universe
10	10	Margaret Hamilton	Female	1936-08-17	NULL	United States	Software ...	Led the development of on-board flight software for NASA's Apollo program
11	11	Edward Teller	Male	1908-01-15	2003-09-09	Hungary	Physics	Contributions to nuclear and theoretical physics
12	12	Annie Jump Cannon	Female	1863-12-11	1941-04-13	United States	Astronomy	Developed a stellar classification system
13	13	Edwin Hubble	Male	1889-11-20	1953-09-28	United States	Astronomy	Discovered the expansion of the universe
14	14	Eugene Shoemaker	Male	1928-04-28	1997-07-18	United States	Planetary ...	Contributions to the study of impact craters and the moon
15	15	Vera Rubin	Female	1928-07-23	2016-12-25	United States	Astronomy	Provided evidence for the existence of dark matter
16	16	George Carruthers	Male	1939-10-01	2020-12-26	United States	Astrophys...	Invented the ultraviolet camera used in the Apollo 16 mission
17	17	Lisa Randall	Female	1962-06-18	NULL	United States	Theoretic...	Contributions to particle physics and cosmology
18	18	Roger Penrose	Male	1931-08-08	NULL	United Kin...	Mathemat...	Contributions to general relativity and black hole theory

LaunchSites Table:

```

CREATE TABLE LaunchSites (
    id INT NOT NULL IDENTITY(1,1) ,
    name VARCHAR(255) NOT NULL,
    country VARCHAR(255) NOT NULL,
    latitude DECIMAL(10, 7) NOT NULL,
    longitude DECIMAL(10, 7) NOT NULL,
    altitude INT NOT NULL,
    PRIMARY KEY (id)
);

INSERT INTO LaunchSites (name, country, latitude, longitude, altitude)
VALUES
('Cape Canaveral Air Force Station', 'United States', 28.537289, -80.685197, 0),
('Vandenberg Air Force Base', 'United States', 34.672728, -120.677457, 0),

```

('Jiuquan Satellite Launch Center', 'China', 40.465721, 104.089745, 1545),
 ('Baikonur Cosmodrome', 'Kazakhstan', 46.557056, 63.405278, 1500),
 ('Satish Dhawan Space Centre', 'India', 13.0625, 80.140278, 0),
 ('European Spaceport', 'French Guiana', 5.5, -52.2, 0),
 ('Kura Space Center', 'Russia', 60.0625, 169.3125, 0),
 ('Xichang Satellite Launch Center', 'China', 28.215722, 99.865278, 3216),
 ('Tonopah Test Range', 'United States', 37.223482, -115.584666, 0),
 ('White Sands Missile Range', 'United States', 32.334444, -106.458333, 0),
 ('Svobodny Cosmodrome', 'Russia', 47.775, 126.974444, 0),
 ('Sary Shagan Test Range', 'Kazakhstan', 45.65, 71.766667, 0),
 ('Plomerussa Air Base', 'Netherlands', 52.708889, 4.885278, 0),
 ('Mid-Atlantic Regional Spaceport', 'United States', 37.175, -76.197222, 0),
 ('Andøya Space Center', 'Norway', 69.217222, 15.662222, 0),
 ('Esrangle Space Center', 'Sweden', 66.551389, 20.738611, 0),
 ('Kiruna Spaceport', 'Sweden', 67.85, 20.716667, 0),
 ('New Zealand Space Agency Launch Site', 'New Zealand', -43.5, 172.5, 0);

select * from launchsites;

Output:

	id	name	country	latitude	longitude	altitude
1	1	Cape Canaveral Air Force Station	United States	28.5372890	-80.6851970	0
2	2	Vandenberg Air Force Base	United States	34.6727280	-120.6774570	0
3	3	Jiuquan Satellite Launch Center	China	40.4657210	104.0897450	1545
4	4	Baikonur Cosmodrome	Kazakhstan	46.5570560	63.4052780	1500
5	5	Satish Dhawan Space Centre	India	13.0625000	80.1402780	0
6	6	European Spaceport	French Guiana	5.5000000	-52.2000000	0
7	7	Kura Space Center	Russia	60.0625000	169.3125000	0
8	8	Xichang Satellite Launch Center	China	28.2157220	99.8652780	3216
9	9	Tonopah Test Range	United States	37.2234820	-115.5846660	0
10	10	White Sands Missile Range	United States	32.3344440	-106.4583330	0
11	11	Svobodny Cosmodrome	Russia	47.7750000	126.9744440	0
12	12	Sary Shagan Test Range	Kazakhstan	45.6500000	71.7666670	0
13	13	Plomerussa Air Base	Netherlands	52.7088890	4.8852780	0
14	14	Mid-Atlantic Regional Spaceport	United States	37.1750000	-76.1972220	0
15	15	Andøya Space Center	Norway	69.2172220	15.6622220	0
16	16	Esrangle Space Center	Sweden	66.5513890	20.7386110	0
17	17	Kiruna Spaceport	Sweden	67.8500000	20.7166670	0
18	18	New Zealand Space Agency Launch Site	New Zealand	-43.5000...	172.5000000	0

Payloads Table:

```
CREATE TABLE Payloads (
    id INT NOT NULL IDENTITY(1,1),
    name VARCHAR(255) NOT NULL,
    type VARCHAR(255) NOT NULL,
    mass FLOAT NOT NULL,
    dimensions VARCHAR(255) NOT NULL,
    launch_date DATE NOT NULL,
    launch_site INT,
    rocket INT,
    status VARCHAR(255) NOT NULL,
    PRIMARY KEY (id),
    FOREIGN KEY (launch_site) REFERENCES LaunchSites(id),
    FOREIGN KEY (rocket) REFERENCES Rockets(RocketID)
);
```

```
INSERT INTO Payloads (name, type, mass, dimensions, launch_date, launch_site, rocket, status)
```

```
VALUES
```

```
('Galileo', 'Spacecraft', 2, '1.8 x 1.8 x 2.2 meters', '1989-10-18', 1, 1, 'Launched'),
('Hubble Space Telescope', 'Space telescope', 11, '4.3 x 11.5 x 4.5 meters', '1990-04-24', 2, 2, 'Launched'),
('Chandra X-ray Observatory', 'Space telescope', 8.4, '1.4 x 4.2 x 1.2 meters', '1999-07-23', 3, 3, 'Launched'),
('Spitzer Space Telescope', 'Space telescope', 8.5, '1.5 x 4.2 x 1.4 meters', '2003-08-25', 4, 4, 'Launched'),
('New Horizons', 'Spacecraft', 10, '4.7 x 2.2 x 2.1 meters', '2006-01-19', 5, 5, 'Launched'),
('Juno', 'Spacecraft', 3.6, '4.2 x 1.5 x 1.2 meters', '2011-08-05', 6, 6, 'Launched'),
('Perseverance', 'Rover', 1.025, '1.8 x 1.0 x 2.7 meters', '2020-07-30', 7, 7, 'Launched'),
('InSight', 'Rover', 850, '1.6 x 1.4 x 1.5 meters', '2018-11-26', 8, 8, 'Launched'),
('OSIRIS-REx', 'Sample return spacecraft', 2.1, '4.5 x 2.1 x 2.1 meters', '2016-10-27', 9, 9, 'Launched'),
('DART', 'Double Asteroid Redirection Test', 5.5, '2.3 x 1.2 x 1.2 meters', '2021-10-23', 10, 10, 'Launched'),
```

('James Webb Space Telescope', 'Space telescope', 6.5, '6.5 x 14.3 x 4.2 meters', '2021-12-25', 11, 11, 'Launched'),

('Lunar Gateway', 'Space station', 45, '70 x 70 x 30 meters', '2024-01-01', 12, 12, 'Under construction'),

('Space Launch System', 'Rocket', 2, '122.2 meters', '2022-01-01', 13, 13, 'Under development'),

('SpaceX Starship', 'Rocket', 120, '120 meters', '2023-01-01', 14, 14, 'Under development'),

('New Glenn', 'Rocket', 7, '95 meters', '2024-01-01', 15, 15, 'Under development'),

('Ariane 6', 'Rocket', 6.7, '68 meters', '2022-01-01', 16, 16, 'Under development'),

('Falcon 9', 'Rocket', 1.6, '70 meters', '2010-01-01', 17, 17, 'In service'),

('Falcon Heavy', 'Rocket', 27, '122 meters', '2018-01-01', 18, 18, 'In service');

Select * from Payloads;

Output:

	id	name	type	mass	dimensions	launch_date	launch_site	rocket	status
1	1	Galileo	Spacecraft	2	1.8 x 1.8 x 2.2 meters	1989-10-18	1	1	Launched
2	2	Hubble Space Telescope	Space telescope	11	4.3 x 11.5 x 4.5 meters	1990-04-24	2	2	Launched
3	3	Chandra X-ray Observatory	Space telescope	8.4	1.4 x 4.2 x 1.2 meters	1999-07-23	3	3	Launched
4	4	Spitzer Space Telescope	Space telescope	8.5	1.5 x 4.2 x 1.4 meters	2003-08-25	4	4	Launched
5	5	New Horizons	Spacecraft	10	4.7 x 2.2 x 2.1 meters	2006-01-19	5	5	Launched
6	6	Juno	Spacecraft	3.6	4.2 x 1.5 x 1.2 meters	2011-08-05	6	6	Launched
7	7	Perseverance	Rover	1....	1.8 x 1.0 x 2.7 meters	2020-07-30	7	7	Launched
8	8	InSight	Rover	850	1.6 x 1.4 x 1.5 meters	2018-11-26	8	8	Launched
9	9	OSIRIS-REx	Sample return spacecraft	2.1	4.5 x 2.1 x 2.1 meters	2016-10-27	9	9	Launched
10	10	DART	Double Asteroid Redirection Test	5.5	2.3 x 1.2 x 1.2 meters	2021-10-23	10	10	Launched
11	11	James Webb Space Telescope	Space telescope	6.5	6.5 x 14.3 x 4.2 meters	2021-12-25	11	11	Launched
12	12	Lunar Gateway	Space station	45	70 x 70 x 30 meters	2024-01-01	12	12	Under construction
13	13	Space Launch System	Rocket	2	122.2 meters	2022-01-01	13	13	Under development
14	14	SpaceX Starship	Rocket	120	120 meters	2023-01-01	14	14	Under development
15	15	New Glenn	Rocket	7	95 meters	2024-01-01	15	15	Under development
16	16	Ariane 6	Rocket	6.7	68 meters	2022-01-01	16	16	Under development
17	17	Falcon 9	Rocket	1.6	70 meters	2010-01-01	17	17	In service
18	18	Falcon Heavy	Rocket	27	122 meters	2018-01-01	18	18	In service

MissionControl Table:

```
CREATE TABLE MissionControl (
    id INT NOT NULL IDENTITY(1,1) ,
    name VARCHAR(255) NOT NULL,
    location VARCHAR(255) NOT NULL,
    country VARCHAR(255) NOT NULL,
    latitude DECIMAL(10, 7) NOT NULL,
    longitude DECIMAL(10, 7) NOT NULL,
    altitude INT NOT NULL,
    mission_id INT,
    PRIMARY KEY (id),
    FOREIGN KEY (mission_id) REFERENCES Missions(mission_id)
);
```

```
INSERT INTO MissionControl (name, location, country, latitude, longitude, altitude,
mission_id)
VALUES
('Kennedy Space Center', 'Cape Canaveral, Florida', 'United States', 28.5774, -80.6501, 0,
1),
('Johnson Space Center', 'Houston, Texas', 'United States', 29.7509, -95.3695, 0, 2),
('European Space Agency's Kourou Space Center', 'Kourou, French Guiana', 'France',
5.2222, -52.2222, 0, 3),
('Jiuquan Satellite Launch Center', 'Jiuquan, Gansu', 'China', 40.4000, 96.7000, 0, 4),
('Baikonur Cosmodrome', 'Kazakhstan', 'Kazakhstan', 46.6000, 63.3000, 0, 5),
('Satish Dhawan Space Centre', 'Sriharikota, Andhra Pradesh', 'India', 13.7469, 80.2234, 0,
6),
('Vandenberg Air Force Base', 'Vandenberg, California', 'United States', 34.6342, -
120.6018, 0, 7),
('Pleasanton Launch Site', 'Pleasanton, California', 'United States', 37.7760, -122.0878, 0,
8),
('White Sands Missile Range', 'Alamogordo, New Mexico', 'United States', 32.4838, -
106.3850, 0, 9),
('Wallops Flight Facility', 'Wallops Island, Virginia', 'United States', 37.9085, -75.3800, 0,
10),
```

('Esrage Space Center', 'Kiruna, Sweden', 'Sweden', 67.8833, 20.2167, 0, 11),
 ('Andøya Space Center', 'Andøya, Norway', 'Norway', 69.2500, 16.0000, 0, 12),
 ('New Mexico Spaceport', 'Spaceport America, New Mexico', 'United States', 32.7945, -106.0456, 0, 13),
 ('Mid-Atlantic Regional Spaceport', 'Wallops Island, Virginia', 'United States', 37.9085, -75.3800, 0, 14),
 ('Spaceport Cornwall', 'Newquay, Cornwall', 'United Kingdom', 49.8500, -5.9500, 0, 15),
 ('Spaceport Sweden', 'Kumlinge, Aland Islands', 'Sweden', 60.1167, 19.9167, 0, 16),
 ('Spaceport Sweden', 'Kiruna, Sweden', 'Sweden', 67.8833, 20.2167, 0, 17),
 ('Spaceport Japan', 'Abashiri, Hokkaido', 'Japan', 43.9333, 143.8333, 0, 18);
 select * from missioncontrol;

Output:

	id	name	location	country	latitude	longitude	altitude	mission_id
1	1	Kennedy Space Center	Cape Canaveral, Florida	United States	28.5774000	-80.6501000	0	1
2	2	Johnson Space Center	Houston, Texas	United States	29.7509000	-95.3695000	0	2
3	3	European Space Agency's Kourou Space Center	Kourou, French Guiana	France	5.2222000	-52.2222000	0	3
4	4	Jiuquan Satellite Launch Center	Jiuquan, Gansu	China	40.4000000	96.7000000	0	4
5	5	Baikonur Cosmodrome	Kazakhstan	Kazakhstan	46.6000000	63.3000000	0	5
6	6	Satish Dhawan Space Centre	Sriharikota, Andhra Pradesh	India	13.7469000	80.2234000	0	6
7	7	Vandenberg Air Force Base	Vandenberg, California	United States	34.6342000	-120.6018...	0	7
8	8	Pleasington Launch Site	Pleasanton, California	United States	37.7760000	-122.0878...	0	8
9	9	White Sands Missile Range	Alamogordo, New Mexico	United States	32.4838000	-106.3850...	0	9
10	10	Wallops Flight Facility	Wallops Island, Virginia	United States	37.9085000	-75.3800000	0	10
11	11	Esrage Space Center	Kiruna, Sweden	Sweden	67.8833000	20.2167000	0	11
12	12	Andøya Space Center	Andøya, Norway	Norway	69.2500000	16.0000000	0	12
13	13	New Mexico Spaceport	Spaceport America, New Mexico	United States	32.7945000	-106.0456...	0	13
14	14	Mid-Atlantic Regional Spaceport	Wallops Island, Virginia	United States	37.9085000	-75.3800000	0	14
15	15	Spaceport Cornwall	Newquay, Cornwall	United Kingdom	49.8500000	-5.9500000	0	15
16	16	Spaceport Sweden	Kumlinge, Aland Islands	Sweden	60.1167000	19.9167000	0	16
17	17	Spaceport Sweden	Kiruna, Sweden	Sweden	67.8833000	20.2167000	0	17
18	18	Spaceport Japan	Abashiri, Hokkaido	Japan	43.9333000	143.83330...	0	18

GroundStations Table:

```
CREATE TABLE GroundStations (
    id INT NOT NULL IDENTITY(1,1) ,
    name VARCHAR(255) NOT NULL,
    location VARCHAR(255) NOT NULL,
    country VARCHAR(255) NOT NULL,
    latitude DECIMAL(10, 7) NOT NULL,
    longitude DECIMAL(10, 7) NOT NULL,
    altitude INT NOT NULL,
    mission_id INT,
    PRIMARY KEY (id),
    FOREIGN KEY (mission_id) REFERENCES Missions(mission_id)
);
```

```
INSERT INTO GroundStations (name, location, country, latitude, longitude, altitude, mission_id)
```

```
VALUES
```

```
('Goldstone Deep Space Communications Complex', 'Barstow, California', 'United States', 35.2025, -116.8278, 0, 1),
```

```
('Madrid Deep Space Communications Complex', 'Madrid, Spain', 'Spain', 40.4167, -3.7000, 0, 2),
```

```
('Canberra Deep Space Communications Complex', 'Canberra, Australia', 'Australia', -35.2833, 149.1250, 0, 3),
```

```
('Parkes Observatory', 'Parkes, New South Wales', 'Australia', -33.5833, 147.8667, 0, 4),
```

```
('DSS-43', 'Ushuaia, Argentina', 'Argentina', -54.8333, -67.9500, 0, 5),
```

```
('DSS-6', 'Boca Chica, Puerto Rico', 'Puerto Rico', 18.4667, -65.5667, 0, 6),
```

```
('DSS-14', 'Cebreros, Spain', 'Spain', 40.5000, -4.4667, 0, 7),
```

```
('DSS-16', 'Medicina, Italy', 'Italy', 44.6667, 11.2667, 0, 8),
```

```
('DSS-17', 'Goldstone, California', 'United States', 35.2025, -116.8278, 0, 9),
```

```
('DSS-18', 'Shobdon, United Kingdom', 'United Kingdom', 52.2500, -2.8833, 0, 10),
```

```
('DSS-24', 'Yokosuka, Japan', 'Japan', 35.2833, 139.6250, 0, 11),
```

```
('DSS-25', 'Canberra, Australia', 'Australia', -35.2833, 149.1250, 0, 12),
```

('DSS-26', 'Goldstone, California', 'United States', 35.2025, -116.8278, 0, 13),
 ('DSS-27', 'Madrid, Spain', 'Spain', 40.4167, -3.7000, 0, 14),
 ('DSS-28', 'Canberra, Australia', 'Australia', -35.2833, 149.1250, 0, 15),
 ('DSS-34', 'Cebreros, Spain', 'Spain', 40.5000, -4.4667, 0, 16),
 ('DSS-36', 'Medicina, Italy', 'Italy', 44.6667, 11.2667, 0, 17),
 ('DSS-46', 'Shobdon, United Kingdom', 'United Kingdom', 52.2500, -2.8833, 0, 18);
 Select * from GroundStations;

Output:

	id	name	location	country	latitude	longitude	altitude	mission_id
1	1	Goldstone Deep Space Communications Complex	Barstow, California	United States	35.2025000	-116.8278000	0	1
2	2	Madrid Deep Space Communications Complex	Madrid, Spain	Spain	40.4167000	-3.7000000	0	2
3	3	Canberra Deep Space Communications Complex	Canberra, Australia	Australia	-35.2833000	149.1250000	0	3
4	4	Parkes Observatory	Parkes, New South Wales	Australia	-33.5833000	147.8667000	0	4
5	5	DSS-43	Ushuaia, Argentina	Argentina	-54.8333000	-67.9500000	0	5
6	6	DSS-6	Boca Chica, Puerto Rico	Puerto Rico	18.4667000	-65.5667000	0	6
7	7	DSS-14	Cebreros, Spain	Spain	40.5000000	-4.4667000	0	7
8	8	DSS-16	Medicina, Italy	Italy	44.6667000	11.2667000	0	8
9	9	DSS-17	Goldstone, California	United States	35.2025000	-116.8278000	0	9
10	1...	DSS-18	Shobdon, United Kingdom	United Kingdom	52.2500000	-2.8833000	0	10
11	1...	DSS-24	Yokosuka, Japan	Japan	35.2833000	139.6250000	0	11
12	1...	DSS-25	Canberra, Australia	Australia	-35.2833000	149.1250000	0	12
13	1...	DSS-26	Goldstone, California	United States	35.2025000	-116.8278000	0	13
14	1...	DSS-27	Madrid, Spain	Spain	40.4167000	-3.7000000	0	14
15	1...	DSS-28	Canberra, Australia	Australia	-35.2833000	149.1250000	0	15
16	1...	DSS-34	Cebreros, Spain	Spain	40.5000000	-4.4667000	0	16
17	1...	DSS-36	Medicina, Italy	Italy	44.6667000	11.2667000	0	17
18	1...	DSS-46	Shobdon, United Kingdom	United Kingdom	52.2500000	-2.8833000	0	18

SpaceAgencies Table:

```
CREATE TABLE SpaceAgencies (
    id INT NOT NULL IDENTITY(1,1) ,
    name VARCHAR(255) NOT NULL,
    country VARCHAR(255) NOT NULL,
    founded DATE NOT NULL,
    budget INT NOT NULL,
    PRIMARY KEY (id)
);
```

```
INSERT INTO SpaceAgencies (name, country, founded, budget)
```

```
VALUES
```

```
('NASA', 'United States', '1958-07-29', 22.621),
('Roscosmos', 'Russia', '1992-01-01', 7.6),
('ESA', 'Europe', '1975-03-15', 6.7),
('JAXA', 'Japan', '2003-01-01', 4.5),
('ISRO', 'India', '1972-08-15', 2.4),
('CSA', 'Canada', '1969-01-01', 2.2),
('CASC', 'China', '1993-01-01', 1.9),
('CNES', 'France', '1962-01-01', 1.8),
('ASI', 'Italy', '1981-01-01', 1.6),
('UKSA', 'United Kingdom', '1964-01-01', 1.5),
('DNEOS', 'South Korea', '2006-01-01', 1.4),
('AEB', 'Brazil', '1961-01-01', 1.3),
('Arianespace', 'Europe', '1980-01-01', 1.2),
('SpaceX', 'United States', '2002-06-28', 1.1),
('Blue Origin', 'United States', '2000-09-06', 1.0),
('Virgin Galactic', 'United Kingdom', '2004-09-04', 0.9),
('OneWeb', 'United Kingdom', '2012-09-01', 0.8);
```

```
Select * from SpaceAgencies;
```

Output:

	id	name	country	founded	budget
1	1	NASA	United States	1958-07-29	22
2	2	Roscosmos	Russia	1992-01-01	7
3	3	ESA	Europe	1975-03-15	6
4	4	JAXA	Japan	2003-01-01	4
5	5	ISRO	India	1972-08-15	2
6	6	CSA	Canada	1969-01-01	2
7	7	CASC	China	1993-01-01	1
8	8	CNES	France	1962-01-01	1
9	9	ASI	Italy	1981-01-01	1
10	10	UKSA	United Kingdom	1964-01-01	1
11	11	DNEOS	South Korea	2006-01-01	1
12	12	AEB	Brazil	1961-01-01	1
13	13	Arianespace	Europe	1980-01-01	1
14	14	SpaceX	United States	2002-06-28	1
15	15	Blue Origin	United States	2000-09-06	1
16	16	Virgin Galactic	United Kingdom	2004-09-04	0
17	17	OneWeb	United Kingdom	2012-09-01	0

ExplorationPrograms Table:

```
CREATE TABLE ExplorationPrograms (
    id INT NOT NULL IDENTITY(1,1) ,
    name VARCHAR(255) NOT NULL,
    agency_id INT NOT NULL,
    description VARCHAR(255) NOT NULL,
    start_date DATE NOT NULL,
    end_date DATE,
    PRIMARY KEY (id),
    FOREIGN KEY (agency_id) REFERENCES SpaceAgencies(id)
);
```

```
INSERT INTO ExplorationPrograms (name, agency_id, description, start_date, end_date)
VALUES
('Project Apollo', 1, 'A program to land humans on the Moon and return them safely to Earth.', '1961-09-17', '1972-12-14'),
```

('Project Gemini', 1, 'A program to test the technologies and procedures needed for human spaceflight.', '1961-03-23', '1966-12-15'),

('Project Mercury', 1, 'A program to put humans into space and return them safely to Earth.', '1958-04-05', '1963-05-25'),

('International Space Station', 2, 'A large spacecraft in low Earth orbit that is a joint project of 15 countries.', '1998-11-20', '9999-12-31'),

('Lunar Exploration Program', 3, 'A program to explore the Moon.', '1973-01-01', '9999-12-31'),

('Venus Exploration Program', 3, 'A program to explore Venus.', '1962-01-01', '9999-12-31'),

('Mars Exploration Program', 3, 'A program to explore Mars.', '1960-01-01', '9999-12-31'),

('Jupiter Exploration Program', 3, 'A program to explore Jupiter.', '1973-01-01', '9999-12-31'),

('Saturn Exploration Program', 3, 'A program to explore Saturn.', '1973-01-01', '9999-12-31'),

('Uranus Exploration Program', 3, 'A program to explore Uranus.', '1973-01-01', '9999-12-31'),

('Neptune Exploration Program', 3, 'A program to explore Neptune.', '1973-01-01', '9999-12-31'),

('Pluto Exploration Program', 3, 'A program to explore Pluto.', '1973-01-01', '9999-12-31'),

('Comet Exploration Program', 3, 'A program to explore comets.', '1973-01-01', '9999-12-31'),

('Asteroid Exploration Program', 3, 'A program to explore asteroids.', '1973-01-01', '9999-12-31'),

('Deep Space Exploration Program', 3, 'A program to explore deep space.', '1973-01-01', '9999-12-31'),

('Space Shuttle Program', 1, 'A program to launch and retrieve spacecraft from low Earth orbit.', '1981-04-12', '2011-07-21'),

('Orion Program', 1, 'A program to develop a new spacecraft that can carry humans to the Moon and beyond.', '2005-10-02', '9999-12-31'),

('Space Launch System', 1, 'A program to develop a new rocket that can launch heavy payloads into space.', '2011-06-20', '9999-12-31');

Select * from ExplorationPrograms;

Output:

	id	name	agency_id	description	start_date	end_date
1	1	Project Apollo	1	A program to land humans on the Moon and return them safely to Earth.	1961-09-17	1972-12-14
2	2	Project Gemini	1	A program to test the technologies and procedures needed for human spaceflight.	1961-03-23	1966-12-15
3	3	Project Mercury	1	A program to put humans into space and return them safely to Earth.	1958-04-05	1963-05-25
4	4	International Space Station	2	A large spacecraft in low Earth orbit that is a joint project of 15 countries.	1998-11-20	9999-12-31
5	5	Lunar Exploration Program	3	A program to explore the Moon.	1973-01-01	9999-12-31
6	6	Venus Exploration Program	3	A program to explore Venus.	1962-01-01	9999-12-31
7	7	Mars Exploration Program	3	A program to explore Mars.	1960-01-01	9999-12-31
8	8	Jupiter Exploration Program	3	A program to explore Jupiter.	1973-01-01	9999-12-31
9	9	Saturn Exploration Program	3	A program to explore Saturn.	1973-01-01	9999-12-31
10	10	Uranus Exploration Program	3	A program to explore Uranus.	1973-01-01	9999-12-31
11	11	Neptune Exploration Program	3	A program to explore Neptune.	1973-01-01	9999-12-31
12	12	Pluto Exploration Program	3	A program to explore Pluto.	1973-01-01	9999-12-31
13	13	Comet Exploration Program	3	A program to explore comets.	1973-01-01	9999-12-31
14	14	Asteroid Exploration Program	3	A program to explore asteroids.	1973-01-01	9999-12-31
15	15	Deep Space Exploration Program	3	A program to explore deep space.	1973-01-01	9999-12-31
16	16	Space Shuttle Program	1	A program to launch and retrieve spacecraft from low Earth orbit.	1981-04-12	2011-07-21
17	17	Orion Program	1	A program to develop a new spacecraft that can carry humans to the Moon and beyond.	2005-10-02	9999-12-31
18	18	Space Launch System	1	A program to develop a new rocket that can launch heavy payloads into space.	2011-06-20	9999-12-31

SpacecraftComponents Table:

```
CREATE TABLE SpacecraftComponents (
    id INT NOT NULL IDENTITY(1,1) ,
    name VARCHAR(255) NOT NULL,
    description VARCHAR(255) NOT NULL,
    type VARCHAR(255) NOT NULL,
    spacecraft_id INT,
    PRIMARY KEY (id),
    FOREIGN KEY (spacecraft_id) REFERENCES Spacecraft(id)
);
```

```
INSERT INTO SpacecraftComponents (name, description, type, spacecraft_id)
VALUES
```

('Space Shuttle Orbiter', 'The Space Shuttle Orbiter is the reusable spacecraft that was used to launch and retrieve other spacecraft from low Earth orbit.', 'Spacecraft', 1),

('Space Shuttle Solid Rocket Boosters', 'The Space Shuttle Solid Rocket Boosters are the two large rockets that provide the majority of the thrust for the Space Shuttle launch.', 'Rocket Boosters', 1),

('Space Shuttle External Tank', 'The Space Shuttle External Tank is the large tank that provides the liquid hydrogen and oxygen fuel for the Space Shuttle engines.', 'Tank', 1),

('International Space Station', 'The International Space Station is a large spacecraft in low Earth orbit that is a joint project of 15 countries.', 'Spacecraft', 2),

('Hubble Space Telescope', 'The Hubble Space Telescope is a large space telescope that is used to observe objects in space.', 'Telescope', 3),

('Galileo Spacecraft', 'The Galileo Spacecraft was used to explore Jupiter and its moons.', 'Spacecraft', 4),

('Voyager 1', 'The Voyager 1 spacecraft is the farthest human-made object from Earth. It is currently in interstellar space.', 'Spacecraft', 5),

('Voyager 2', 'The Voyager 2 spacecraft is the second farthest human-made object from Earth. It is currently in the Kuiper Belt.', 'Spacecraft', 6),

('Pioneer 10', 'The Pioneer 10 spacecraft was the first human-made object to fly past Jupiter.', 'Spacecraft', 7),

('Pioneer 11', 'The Pioneer 11 spacecraft was the first human-made object to fly past Saturn.', 'Spacecraft', 8),

('New Horizons', 'The New Horizons spacecraft was the first human-made object to fly past Pluto.', 'Spacecraft', 9),

('Juno', 'The Juno spacecraft is currently orbiting Jupiter. It is the first spacecraft to study Jupiter's atmosphere in detail.', 'Spacecraft', 10),

('Curiosity', 'The Curiosity rover is currently exploring Mars. It is the first rover to use a drill to collect samples from the Martian surface.', 'Rover', 11),

('Opportunity', 'The Opportunity rover explored Mars for over 15 years. It was the longest-serving rover on Mars.', 'Rover', 12),

('Spirit', 'The Spirit rover explored Mars for over six years. It was the second longest-serving rover on Mars.', 'Rover', 13),

('Perseverance', 'The Perseverance rover is currently exploring Mars. It is the first rover to search for signs of ancient life on Mars.', 'Rover', 14),

('Ingenuity', 'The Ingenuity helicopter is the first helicopter to fly on Mars. It is currently flying on Mars to test the feasibility of using helicopters for exploration.', 'Helicopter', 15),

('Dragon', 'The Dragon spacecraft is a reusable spacecraft that is used to transport cargo to and from the International Space Station.', 'Spacecraft', 16),

('Starliner', 'The Starliner spacecraft is a reusable spacecraft that is under development by Boeing. It is designed to transport astronauts to and from the International Space Station.', 'Spacecraft', 17);

Select * from Spacecraft Components;

Output:

	id	name	description	type	spacecraft_id
1	1	Space Shuttle Orbiter	The Space Shuttle Orbiter is the reusable spacecraft that was used to launch and retrieve other spacecraft from low Earth orbit.	Spacecraft	1
2	2	Space Shuttle Solid Rocket Boosters	The Space Shuttle Solid Rocket Boosters are the two large rockets that provide the majority of the thrust for the Space Shuttle.	Rocket Boosters	1
3	3	Space Shuttle External Tank	The Space Shuttle External Tank is the large tank that provides the liquid hydrogen and oxygen fuel for the Space Shuttle.	Tank	1
4	4	International Space Station	The International Space Station is a large spacecraft in low Earth orbit that is a joint project of 15 countries.	Spacecraft	2
5	5	Hubble Space Telescope	The Hubble Space Telescope is a large space telescope that is used to observe objects in space.	Telescope	3
6	6	Galileo Spacecraft	The Galileo Spacecraft was used to explore Jupiter and its moons.	Spacecraft	4
7	7	Voyager 1	The Voyager 1 spacecraft is the farthest human-made object from Earth. It is currently in interstellar space.	Spacecraft	5
8	8	Voyager 2	The Voyager 2 spacecraft is the second farthest human-made object from Earth. It is currently in the Kuiper Belt.	Spacecraft	6
9	9	Pioneer 10	The Pioneer 10 spacecraft was the first human-made object to fly past Jupiter.	Spacecraft	7
10	10	Pioneer 11	The Pioneer 11 spacecraft was the first human-made object to fly past Saturn.	Spacecraft	8
11	11	New Horizons	The New Horizons spacecraft was the first human-made object to fly past Pluto.	Spacecraft	9
12	12	Juno	The Juno spacecraft is currently orbiting Jupiter. It is the first spacecraft to study Jupiter's atmosphere in detail.	Spacecraft	10
13	13	Curiosity	The Curiosity rover is currently exploring Mars. It is the first rover to use a drill to collect samples from the Martian surface.	Rover	11
14	14	Opportunity	The Opportunity rover explored Mars for over 15 years. It was the longest-serving rover on Mars.	Rover	12
15	15	Spirit	The Spirit rover explored Mars for over six years. It was the second longest-serving rover on Mars.	Rover	13
16	16	Perseverance	The Perseverance rover is currently exploring Mars. It is the first rover to search for signs of ancient life on Mars.	Rover	14
17	17	Ingenuity	The Ingenuity helicopter is the first helicopter to fly on Mars. It is currently flying on Mars to test the feasibility of using it for future missions.	Helicopter	15
18	18	Dragon	The Dragon spacecraft is a reusable spacecraft that is used to transport cargo to and from the International Space Station.	Spacecraft	16
19	19	Starliner	The Starliner spacecraft is a reusable spacecraft that is under development by Boeing. It is designed to transport astronauts to and from the International Space Station.	Spacecraft	17

MissionTimeline Table:

```
CREATE TABLE MissionTimeline (
    id INT NOT NULL IDENTITY(1,1) ,
    mission_id INT,
    event_date DATE NOT NULL,
    event_description VARCHAR(255) NOT NULL,
    PRIMARY KEY (id),
    FOREIGN KEY (mission_id) REFERENCES Missions(mission_id)
);
```

```
INSERT INTO MissionTimeline (mission_id, event_date, event_description)
VALUES
```

```
(1, '1969-07-20', 'Apollo 11 - Moon Landing'),
(1, '1969-07-24', 'Apollo 11 - Splashdown'),
(2, '1970-04-11', 'Apollo 13 - Abandoned'),
(3, '1973-05-25', 'Skylab 1 - Mission Start'),
(3, '1974-02-08', 'Skylab 1 - Mission End'),
(4, '1981-04-12', 'Space Shuttle Columbia - Launch'),
(4, '1981-04-14', 'Space Shuttle Columbia - First Landing'),
(5, '1983-04-04', 'Space Shuttle Challenger - Launch'),
(5, '1986-01-28', 'Space Shuttle Challenger - Disaster'),
(6, '1984-08-30', 'Space Shuttle Discovery - Launch'),
(6, '1988-09-18', 'Space Shuttle Discovery - Final Landing'),
(7, '1985-10-08', 'Space Shuttle Atlantis - Launch'),
(7, '2011-07-21', 'Space Shuttle Atlantis - Final Landing'),
(8, '1992-05-07', 'Space Shuttle Endeavour - Launch'),
(8, '2011-06-01', 'Space Shuttle Endeavour - Final Landing'),
(9, '1998-11-20', 'International Space Station - Start of Assembly'),
(10, '2003-06-10', 'Mars Exploration Rover Spirit - Mission Start'),
(10, '2010-05-25', 'Mars Exploration Rover Spirit - Mission End'),
(11, '2003-07-07', 'Mars Exploration Rover Opportunity - Mission Start'),
(11, '2018-06-11', 'Mars Exploration Rover Opportunity - Mission End'),
(12, '2011-08-05', 'Juno - Arrival at Jupiter'),
(13, '2006-01-19', 'New Horizons - Pluto Flyby'),
(14, '2020-07-30', 'Perseverance - Mars Landing'),
(15, '2020-07-20', 'Hope - Mars Arrival'),
(16, '2019-01-03', 'Chang"e 4 - Moon Landing'),
(17, '2020-12-01', 'Chang"e 5 - Moon Sample Return'),
(18, '2020-02-09', 'Solar Orbiter - Launch');
```

```
Select * from MissionTimeline;
```

Output:

	id	mission_id	event_date	event_description
1	1	1	1969-07-20	Apollo 11 - Moon Landing
2	2	1	1969-07-24	Apollo 11 - Splashdown
3	3	2	1970-04-11	Apollo 13 - Abandoned
4	4	3	1973-05-25	Skylab 1 - Mission Start
5	5	3	1974-02-08	Skylab 1 - Mission End
6	6	4	1981-04-12	Space Shuttle Columbia - Launch
7	7	4	1981-04-14	Space Shuttle Columbia - First Landing
8	8	5	1983-04-04	Space Shuttle Challenger - Launch
9	9	5	1986-01-28	Space Shuttle Challenger - Disaster
10	10	6	1984-08-30	Space Shuttle Discovery - Launch
11	11	6	1988-09-18	Space Shuttle Discovery - Final Landing
12	12	7	1985-10-08	Space Shuttle Atlantis - Launch
13	13	7	2011-07-21	Space Shuttle Atlantis - Final Landing
14	14	8	1992-05-07	Space Shuttle Endeavour - Launch
15	15	8	2011-06-01	Space Shuttle Endeavour - Final Landing
16	16	9	1998-11-20	International Space Station - Start of Assembly
17	17	10	2003-06-10	Mars Exploration Rover Spirit - Mission Start
18	18	10	2010-05-25	Mars Exploration Rover Spirit - Mission End
19	19	11	2003-07-07	Mars Exploration Rover Opportunity - Mission Start
20	20	11	2018-06-11	Mars Exploration Rover Opportunity - Mission End
21	21	12	2011-08-05	Juno - Arrival at Jupiter
22	22	13	2006-01-19	New Horizons - Pluto Flyby
23	23	14	2020-07-30	Perseverance - Mars Landing
24	24	15	2020-07-20	Hope - Mars Arrival
25	25	16	2019-01-03	Chang'e 4 - Moon Landing
26	26	17	2020-12-01	Chang'e 5 - Moon Sample Return
27	27	18	2020-02-09	Solar Orbiter - Launch

SQL QUERIES:

Query1: Retrieve the details of the missions that are completed.

```
SELECT * FROM missions WHERE status = 'completed';
```

Output:

	mission_id	mission_name	launch_date	destination	status	funding	expenses
1	1	Apollo 11	1969-07-20	Moon	Completed	2540000000	410000000
2	3	Skylab 1	1973-05-25	Low Earth Orbit	Completed	260000000	180000000
3	4	Space Shuttle Columbia	1981-04-12	Low Earth Orbit	Completed	1960000000	1220000000
4	6	Space Shuttle Discovery	1984-08-30	Low Earth Orbit	Completed	2130000000	1320000000
5	7	Space Shuttle Atlantis	1985-10-08	Low Earth Orbit	Completed	2130000000	1320000000
6	8	Space Shuttle Endeavour	1992-05-07	Low Earth Orbit	Completed	2130000000	1320000000
7	13	New Horizons	2006-01-19	Pluto	Completed	720000000	720000000
8	17	Chang'e 5	2020-12-01	Moon	Completed	4400000000	4400000000

Query2: Retrieve the details of the missions to the Moon.

```
SELECT * FROM missions WHERE destination = 'Moon';
```

Output:

	mission_id	mission_name	launch_date	destination	status	funding	expenses
1	1	Apollo 11	1969-07-20	Moon	Completed	2540000000	410000000
2	2	Apollo 13	1970-04-11	Moon	Abandoned	130000000	0
3	16	Chang'e 4	2019-01-03	Moon	Active	3400000000	3400000000
4	17	Chang'e 5	2020-12-01	Moon	Completed	4400000000	4400000000

Query3: Retrieve the details of the missions to Mars.

```
SELECT * FROM missions WHERE destination = 'Mars';
```

Output:

	mission_id	mission_name	launch_date	destination	status	funding	expenses
1	10	Mars Exploration Rover Spirit	2003-06-10	Mars	Abandoned	450000000	450000000
2	11	Mars Exploration Rover Opportunity	2003-07-07	Mars	Abandoned	450000000	450000000
3	14	Perseverance	2020-07-30	Mars	Active	2700000000	2700000000
4	15	Hope	2020-07-20	Mars	Active	200000000	200000000

Query4: Retrieve the details of the missions to Jupiter.

```
SELECT * FROM missions WHERE destination = 'Jupiter';
```

Output:

	mission_id	mission_name	launch_date	destination	status	funding	expenses
1	12	Juno	2011-08-05	Jupiter	Active	1100000000	1100000000

Query5: Retrieve the details of the missions to Pluto.

```
SELECT * FROM missions WHERE destination = 'Pluto';
```

Output:

	mission_id	mission_name	launch_date	destination	status	funding	expenses
1	13	New Horizons	2006-01-19	Pluto	Completed	7200000000	7200000000

Query6: Retrieve the details of the missions to the Sun.

```
SELECT * FROM missions WHERE destination = 'Sun';
```

Output:

	mission_id	mission_name	launch_date	destination	status	funding	expenses
1	18	Solar Orbiter	2020-02-09	Sun	Active	15000000000	15000000000

Query7: Retrieve the details of the astronauts who have been on multiple missions.

```
SELECT a.astronaut_id, a.name, a.number_of_missions
```

```
FROM Astronauts a
```

```
WHERE a.number_of_missions > 1;
```

Output:

	astronaut_id	name	number_of_missions
1	8	Alan Shepard	2

Query8: Retrieve the details of the astronauts from the United States.

```
SELECT *
```

```
FROM Astronauts
```

```
WHERE nationality = 'United States';
```

Output:

	astronaut_id	name	age	nationality	specialization	number_of_missions	mission_id	notable_achievements
1	1	Neil Armstrong	38	United States	Pilot	1	1	First person to walk on the Moon
2	2	Buzz Aldrin	39	United States	Pilot	1	1	Second person to walk on the Moon
3	3	Michael Collins	39	United States	Command Module Pilot	1	1	Command Module Pilot on Apollo 11
4	4	Jim Lovell	42	United States	Commander	1	2	Apollo 13 mission commander
5	5	Fred Haise	36	United States	Lunar Module Pilot	1	2	Apollo 13 lunar module pilot
6	6	Jack Swigert	38	United States	Command Module Pilot	1	2	Apollo 13 lunar module pilot
7	8	Alan Shepard	47	United States	Pilot	2	4	First American in space
8	9	Stuart Roosa	37	United States	Command Module Pilot	1	4	Carried tree seeds to space
9	10	Edgar Mitchell	40	United States	Lunar Module Pilot	1	4	Apollo 14 lunar module pilot
10	11	David Scott	39	United States	Commander	1	5	Apollo 15 mission commander
11	12	James Irwin	41	United States	Lunar Module Pilot	1	5	Apollo 15 lunar module pilot
12	13	Alfred Worden	39	United States	Command Module Pilot	1	5	Orbital Command Module pilot, Apollo 15
13	14	John Young	42	United States	Commander	1	6	Walked on the Moon, Apollo 16
14	15	Charles Duke	36	United States	Lunar Module Pilot	1	6	Walked on the Moon, Apollo 16
15	16	Thomas Mattingly	37	United States	Command Module Pilot	1	6	Apollo 13 Command Module Pilot
16	17	Eugene Cernan	38	United States	Commander	1	7	Last person to walk on the Moon
17	18	Harrison Schmitt	37	United States	Lunar Module Pilot	1	7	Geologist on Apollo 17
18	19	Ron Evans	38	United States	Command Module Pilot	1	7	Apollo 17 Command Module Pilot
19	23	Pete Conrad	37	United States	Commander	1	11	Third person to walk on the moon
20	24	Alan Bean	39	United States	Lunar Module Pilot	1	11	Fourth person to walk on the moon
21	25	Richard Gordon	40	United States	Command Module Pilot	1	11	Performed a spacewalk during the Gemini 11 mission

Query9: Retrieve the details of the astronauts who specialize in spacewalks.

```
SELECT *
FROM Astronauts
WHERE specialization = 'Pilot'
```

Output:

	astronaut_id	name	age	nationality	specialization	number_of_missions	mission_id	notable_achievements
1	1	Neil Armstrong	38	United States	Pilot	1	1	First person to walk on the Moon
2	2	Buzz Aldrin	39	United States	Pilot	1	1	Second person to walk on the Moon
3	8	Alan Shepard	47	United States	Pilot	2	4	First American in space
4	20	Yuri Gagarin	27	Soviet Union	Pilot	1	8	First person in space
5	21	Gherman Titov	25	Soviet Union	Pilot	1	9	Second human in space
6	22	Andriyan Nikolayev	33	Soviet Union	Pilot	1	10	First married man in space
7	43	Robert Crippen	43	United States	Pilot	1	18	First Space Shuttle pilot

Query10: Retrieve the total number of missions for each astronaut.

```
SELECT name, SUM(number_of_missions) AS total_missions
FROM Astronauts
GROUP BY name
```

Output:

	name	total_missions
1	Alan Bean	1
2	Alan Shepard	2
3	Alexei Leonov	1
4	Alfred Worden	1
5	Andriyan Nikolayev	1
6	Buzz Aldrin	1
7	Charles Conrad	1
8	Charles Duke	1
9	David Scott	2
10	Donald Slayton	2

Query11: Retrieve the details of the spacecraft used in each mission.

```
SELECT m.mission_name, m.launch_date AS mission_date, m.destination, s.name AS
spacecraft_name, s.status
FROM Missions m
JOIN Spacecraft s ON m.mission_id = s.mission_id
```

Output:

	mission_name	mission_date	destination	spacecraft_name	status
1	Apollo 11	1969-07-20	Moon	Apollo 11 Command Module	Completed
2	Apollo 11	1969-07-20	Moon	Apollo 11 Lunar Module	Completed
3	Apollo 13	1970-04-11	Moon	Apollo 13 Command Module	Abandoned
4	Apollo 13	1970-04-11	Moon	Apollo 13 Lunar Module	Abandoned
5	Skylab 1	1973-05-25	Low Earth Orbit	Skylab 1 Orbital Workshop	Completed
6	Space Shuttle Columbia	1981-04-12	Low Earth Orbit	Space Shuttle Columbia Orbiter	Completed
7	Space Shuttle Challenger	1983-04-04	Low Earth Orbit	Space Shuttle Challenger Orbiter	Destroyed
8	Space Shuttle Discovery	1984-08-30	Low Earth Orbit	Space Shuttle Discovery Orbiter	Completed
9	Space Shuttle Atlantis	1985-10-08	Low Earth Orbit	Space Shuttle Atlantis Orbiter	Completed
10	Space Shuttle Endeavour	1992-05-07	Low Earth Orbit	Space Shuttle Endeavour Orbiter	Completed
11	International Space Station	1998-11-20	Low Earth Orbit	International Space Station No...	Completed
12	Mars Exploration Rover Spirit	2003-06-10	Mars	Mars Exploration Rover Spirit	Abandoned
13	Mars Exploration Rover Opportunity	2003-07-07	Mars	Mars Exploration Rover Oppo...	Abandoned
14	Juno	2011-08-05	Jupiter	Juno Spacecraft	Active
15	New Horizons	2006-01-19	Pluto	New Horizons Spacecraft	Completed

Query12: Retrieve the details of the space stations where missions were conducted.

```
SELECT m.mission_name, ss.name, ss.country
FROM Missions m
JOIN SpaceStations ss ON m.mission_id = ss.mission_id;
```

Output:

	mission_name	name	country
1	Apollo 11	Skylab	United States
2	Apollo 13	Mir	Soviet Union
3	Skylab 1	International Space Station	United States
4	Space Shuttle Columbia	Tiangong	China
5	Space Shuttle Challenger	Skylab 2	United States
6	Space Shuttle Discovery	Mir 2	Soviet Union
7	Space Shuttle Atlantis	International Space Station 2	United States
8	Space Shuttle Endeavour	Tiangong 2	China
9	International Space Station	Skylab 3	United States
10	Mars Exploration Rover Spirit	Mir 3	Soviet Union
11	Mars Exploration Rover Opportunity	International Space Station 3	United States
12	Juno	Tiangong 3	China
13	New Horizons	Skylab 4	United States
14	Perseverance	Mir 4	Soviet Union
15	Hope	International Space Station 4	United States

Query13: Retrieve the details of the rockets used in each mission.

```
SELECT m.mission_name, r.RocketName  
FROM Missions m  
JOIN Rockets r ON m.mission_ID = r.mission_ID;
```

Output:

	mission_name	name	country
1	Apollo 11	Skylab	United States
2	Apollo 13	Mir	Soviet Union
3	Skylab 1	International Space Station	United States
4	Space Shuttle Columbia	Tiangong	China
5	Space Shuttle Challenger	Skylab 2	United States
6	Space Shuttle Discovery	Mir 2	Soviet Union
7	Space Shuttle Atlantis	International Space Station 2	United States
8	Space Shuttle Endeavour	Tiangong 2	China
9	International Space Station	Skylab 3	United States
10	Mars Exploration Rover Spirit	Mir 3	Soviet Union
11	Mars Exploration Rover Opportunity	International Space Station 3	United States
12	Juno	Tiangong 3	China
13	New Horizons	Skylab 4	United States
14	Perseverance	Mir 4	Soviet Union
15	Hope	International Space Station 4	United States

Query14: Retrieve the details of the satellites launched by the United States.

```
SELECT name, launch_date, orbit_type, purpose  
FROM Satellites  
WHERE country = 'United States';
```

Output:

	name	launch_date	orbit_type	purpose
1	Terra	1999-12-18	Sun-synchronous	Earth observation
2	Aqua	2002-05-04	Sun-synchronous	Earth observation
3	Jason-1	2001-01-12	Oceanography	Oceanography
4	Jason-2	2008-06-20	Oceanography	Oceanography

Query15: Retrieve the details of the satellites launched after a certain date.

```
SELECT name, launch_date, orbit_type, purpose  
FROM Satellites  
WHERE launch_date > '2006-01-29';
```

Output:

	name	launch_date	orbit_type	purpose
1	GOCE	2009-03-17	Polar	Gravity field observation
2	Jason-2	2008-06-20	Oceanography	Oceanography
3	TerraSAR-X	2007-02-15	Polar	Earth observation
4	TanDEM-X	2010-04-21	Polar	Earth observation
5	Sentinel-1A	2014-03-31	Polar	Earth observation
6	Sentinel-1B	2016-03-25	Polar	Earth observation
7	Sentinel-2A	2015-06-23	Sun-synchronous	Earth observation
8	Sentinel-3A	2016-02-22	Polar	Oceanography
9	Sentinel-3B	2018-04-25	Polar	Oceanography
10	ALOS-2	2014-05-22	Polar	Earth observation
11	Gaia	2013-12-19	Heliocentric	Astrometry
12	Planck	2009-05-14	Heliocentric	Cosmology

Query16: Retrieve the total number of satellites for each country.

```
SELECT country, COUNT(*) AS total_satellites
FROM Satellites
GROUP BY country;
```

Output:

	country	total_satellites
1	European Union	11
2	Germany	2
3	Japan	1
4	United States	4

Query17: Retrieve the total funding for all missions.

```
SELECT SUM(funding) AS total_funding
FROM Missions;
```

Output:

	total_funding
1	126750000000

Query18: Retrieve the total expenses for all missions.

```
SELECT SUM(expenses) AS total_expenses
FROM Missions;
```

Output:

	total_expenses
1	121100000000

Query19: Retrieve the total funding for each celestial body.

```
SELECT m.destination AS celestial_body, SUM(m.funding) AS total_funding  
FROM Missions m  
GROUP BY m.destination;
```

Output:

	celestial_body	total_funding
1	Jupiter	1100000000
2	Low Earth Orbit	109160000000
3	Mars	3800000000
4	Moon	10470000000
5	Pluto	720000000
6	Sun	1500000000

Query20: Retrieve the average funding for missions to the Moon.

```
SELECT AVG(funding) AS average_funding  
FROM Missions  
WHERE destination = 'Moon';
```

Output:

	average_funding
1	2617500000

Query21: Retrieve the average expenses for missions to Mars.

```
SELECT AVG(expenses) AS average_expenses  
FROM Missions  
WHERE destination = 'Mars';
```

Output:

	average_expenses
1	950000000

Query22: Retrieve the average funding and expenses for each destination.

```
SELECT destination, AVG(funding) AS average_funding, AVG(expenses) AS  
average_expenses  
FROM Missions  
GROUP BY destination;
```

Output:

	destination	average_funding	average_expenses
1	Jupiter	1100000000	1100000000
2	Low Earth Orbit	15594285714	15110000000
3	Mars	950000000	950000000
4	Moon	2617500000	2052500000
5	Pluto	720000000	720000000
6	Sun	1500000000	1500000000

Query23: Retrieve the details of the latest mission launched.

```
SELECT TOP 1 mission_name, launch_date, destination, status, funding, expenses
FROM Missions
ORDER BY launch_date DESC;
```

Output:

	destination	average_funding	average_expenses
1	Jupiter	1100000000	1100000000
2	Low Earth Orbit	15594285714	15110000000
3	Mars	950000000	950000000
4	Moon	2617500000	2052500000
5	Pluto	720000000	720000000
6	Sun	1500000000	1500000000

Query24: Retrieve the details of the oldest mission launched.

```
SELECT TOP 1 mission_name, launch_date, destination, status, funding, expenses
FROM Missions
ORDER BY launch_date ASC;
```

Output:

	mission_name	launch_date	destination	status	funding	expenses
1	Apollo 11	1969-07-20	Moon	Completed	2540000000	410000000

Query25: Create a view to display the details of all completed missions.

```
CREATE VIEW CompletedMissionsView AS
SELECT mission_name, launch_date, destination, status, funding, expenses
FROM Missions
WHERE status = 'Completed';
```

Output:

Commands completed successfully.

Query26: Retrieve the average funding and expenses for each destination using aggregate functions and group by.

```
SELECT destination, AVG(funding) AS avg_funding, AVG(expenses) AS avg_expenses  
FROM Missions  
GROUP BY destination;
```

Output:

	destination	avg_funding	avg_expenses
1	Jupiter	1100000000	1100000000
2	Low Earth Orbit	15594285714	15110000000
3	Mars	950000000	950000000
4	Moon	2617500000	2052500000
5	Pluto	720000000	720000000
6	Sun	1500000000	1500000000

Query27: Retrieve the details of the mission with the lowest expenses using subqueries and order by.

```
SELECT *  
FROM Missions  
WHERE expenses = (  
    SELECT MIN(expenses)  
    FROM Missions  
);
```

Output:

	mission_id	mission_name	launch_date	destination	status	funding	expenses
1	2	Apollo 13	1970-04-11	Moon	Abandoned	1300000000	0

Query28: Retrieve the details of the astronauts who have been on missions to the Moon and Mars using joins.

```
SELECT a.name, a.age, a.nationality, a.specialization, a.number_of_missions,  
m.destination  
FROM Astronauts a  
JOIN Missions m ON a.mission_id = m.mission_id  
WHERE m.destination IN ('Moon', 'Mars');
```

Output:

	name	age	nationality	specialization	number_of_missions	destination
1	Neil Armstrong	38	United States	Pilot	1	Moon
2	Buzz Aldrin	39	United States	Pilot	1	Moon
3	Michael Collins	39	United States	Command Module Pilot	1	Moon
4	Jim Lovell	42	United States	Commander	1	Moon
5	Fred Haise	36	United States	Lunar Module Pilot	1	Moon
6	Jack Swigert	38	United States	Command Module Pilot	1	Moon
7	Andriyan Nikolayev	33	Soviet Union	Pilot	1	Mars
8	Pete Conrad	37	United States	Commander	1	Mars
9	Alan Bean	39	United States	Lunar Module Pilot	1	Mars
10	Richard Gordon	40	United States	Command Module Pilot	1	Mars
11	Frank Borman	41	United States	Commander	1	Mars
12	William Anders	35	United States	Lunar Module Pilot	1	Mars
13	James Lovell	39	United States	Command Module Pilot	1	Mars
14	Thomas Stafford	39	United States	Commander	1	Mars
15	Vance Brand	40	United States	Command Module Pilot	1	Mars

Query29: Retrieve the details of the satellites launched by the United States after a certain date using subqueries and joins.

```
SELECT s.name, s.launch_date, s.country
FROM Satellites s
WHERE s.country = 'United States'
AND s.launch_date > '2006-01-01';
```

Output:

	name	launch_date	country
1	Jason-2	2008-06-20	United States

Query30: Retrieve the names and genders of scientists who were born in a specific country and made notable achievements.

```
SELECT name, gender FROM Scientists WHERE country = 'United States' AND
notable_achievements IS NOT NULL;
```

Output:

	name	gender
1	Robert H. Goddard	Male
2	Carl Sagan	Male
3	Katherine Johnson	Female
4	Margaret Hamilton	Female
5	Annie Jump Cannon	Female
6	Edwin Hubble	Male
7	Eugene Shoemaker	Male
8	Vera Rubin	Female
9	George Carruthers	Male
10	Lisa Randall	Female

Query31: Create a view to display the details of all active missions.

```
CREATE VIEW ActiveMissionsView AS
SELECT mission_name, launch_date, destination, status, funding, expenses
FROM Missions
WHERE status = 'Active';
```

Output:

Commands completed successfully.

Query32: Create a view to display the details of all astronauts from the United States.

```
CREATE VIEW AstronautsUSView AS
SELECT *
FROM Astronauts
WHERE nationality = 'United States';
```

Output:

Commands completed successfully.

Query33: Create a view to display the details of all astronauts specializing in spacewalks.

```
CREATE VIEW AstronautsSpacewalkView AS
SELECT *
FROM Astronauts
WHERE specialization = 'Spacewalk';
```

Output:

Commands completed successfully.

Query34: Create a trigger to update the mission status when its funding changes.

```
CREATE TRIGGER UpdateMissionStatus
ON Missions
AFTER UPDATE
AS
BEGIN
    IF UPDATE(funding)
        BEGIN
            UPDATE Missions
            SET status = CASE
                WHEN inserted.funding >= 0 THEN 'Active'
                ELSE 'Inactive'
            END
            FROM inserted
            WHERE Missions.mission_id = inserted.mission_id;
        END
    END;
```

Output:

Commands completed successfully.

Query35: Create a trigger to insert a new record in the spacecraft table when a mission is completed.

```
CREATE TRIGGER InsertSpacecraftOnMissionCompletion
ON Missions
AFTER UPDATE
AS
BEGIN
    IF UPDATE(status)
        BEGIN
            DECLARE @MissionID INT;
            DECLARE @Status VARCHAR(50);
```

```

SELECT @MissionID = mission_id, @Status = status
FROM inserted;

IF @Status = 'Completed'
BEGIN
    INSERT INTO Spacecraft (mission_id, name, status)
    SELECT @MissionID, 'New Spacecraft', 'Active';
END
END;

```

Output:

Commands completed successfully.

Query36: Create a trigger to delete the records of astronauts who have not been on any mission.

```

CREATE TRIGGER DeleteAstronautsOnNoMission
ON Astronauts
AFTER DELETE
AS
BEGIN
    IF NOT EXISTS (SELECT 1 FROM Missions WHERE mission_id IN (SELECT
mission_id FROM deleted))
        BEGIN
            DELETE FROM Astronauts
            WHERE name IN (SELECT name FROM deleted);
        END
    END;

```

Output:

Commands completed successfully.

Query37: Create a cursor to retrieve the details of all missions one by one.

```

-- Declare variables
DECLARE @MissionID INT;

```

```

DECLARE @MissionName VARCHAR(255);
DECLARE @LaunchDate DATE;
DECLARE @Destination VARCHAR(255);
DECLARE @Status VARCHAR(255);
DECLARE @Funding BIGINT;
DECLARE @Expenses BIGINT;

-- Declare cursor
DECLARE MissionCursor CURSOR FOR
SELECT mission_id, mission_name, launch_date, destination, status, funding, expenses
FROM Missions;

-- Open the cursor
OPEN MissionCursor;

-- Fetch the first row
FETCH NEXT FROM MissionCursor INTO @MissionID, @MissionName,
@LaunchDate, @Destination, @Status, @Funding, @Expenses;

-- Process the rows
WHILE @@FETCH_STATUS = 0
BEGIN
    -- Print or use the mission details
    PRINT 'Mission ID: ' + CAST(@MissionID AS VARCHAR(10));
    PRINT 'Mission Name: ' + @MissionName;
    PRINT 'Launch Date: ' + CONVERT(VARCHAR(10), @LaunchDate, 120);
    PRINT 'Destination: ' + @Destination;
    PRINT 'Status: ' + @Status;
    PRINT 'Funding: ' + CAST(@Funding AS VARCHAR(20));
    PRINT 'Expenses: ' + CAST(@Expenses AS VARCHAR(20));
    PRINT '-----';

```

```
-- Fetch the next row  
  
    FETCH NEXT FROM MissionCursor INTO @MissionID, @MissionName,  
    @LaunchDate, @Destination, @Status, @Funding, @Expenses;  
  
END
```

-- Close and deallocate the cursor

```
CLOSE MissionCursor;  
DEALLOCATE MissionCursor;
```

Output:

Mission ID: 1

Mission Name: Apollo 11

Launch Date: 1969-07-20

Destination: Moon

Status: Completed

Funding: 2540000000

Expenses: 410000000

Mission ID: 2

Mission Name: Apollo 13

Launch Date: 1970-04-11

Destination: Moon

Status: Abandoned

Funding: 130000000

Expenses: 0

Mission ID: 3

Mission Name: Skylab 1

Launch Date: 1973-05-25

Destination: Low Earth Orbit

Status: Completed

Funding: 260000000

Expenses: 180000000

Mission ID: 4

Mission Name: Space Shuttle Columbia

Launch Date: 1981-04-12

Destination: Low Earth Orbit

Status: Completed

Funding: 1960000000

Expenses: 1220000000

Mission ID: 5

Mission Name: Space Shuttle Challenger

Launch Date: 1983-04-04

Destination: Low Earth Orbit

Status: Destroyed

Funding: 550000000

Expenses: 410000000

Mission ID: 6

Mission Name: Space Shuttle Discovery

Launch Date: 1984-08-30

Destination: Low Earth Orbit

Status: Completed

Funding: 2130000000

Expenses: 1320000000

Mission ID: 7

Mission Name: Space Shuttle Atlantis

Launch Date: 1985-10-08

Destination: Low Earth Orbit

Status: Completed

Funding: 2130000000

Expenses: 1320000000

Mission ID: 8

Mission Name: Space Shuttle Endeavour

Launch Date: 1992-05-07

Destination: Low Earth Orbit

Status: Completed

Funding: 2130000000

Expenses: 1320000000

Mission ID: 9

Mission Name: International Space Station

Launch Date: 1998-11-20

Destination: Low Earth Orbit

Status: Active

Funding: 100000000000

Expenses: 100000000000

Mission ID: 10

Mission Name: Mars Exploration Rover Spirit

Launch Date: 2003-06-10

Destination: Mars

Status: Abandoned

Funding: 450000000

Expenses: 450000000

Mission ID: 11

Mission Name: Mars Exploration Rover Opportunity

Launch Date: 2003-07-07

Destination: Mars

Status: Abandoned

Funding: 450000000

Expenses: 450000000

Mission ID: 12

Mission Name: Juno

Launch Date: 2011-08-05

Destination: Jupiter

Status: Active

Funding: 1100000000

Expenses: 1100000000

Mission ID: 13

Mission Name: New Horizons

Launch Date: 2006-01-19

Destination: Pluto

Status: Completed

Funding: 720000000

Expenses: 720000000

Mission ID: 14

Mission Name: Perseverance

Launch Date: 2020-07-30

Destination: Mars

Status: Active

Funding: 2700000000

Expenses: 2700000000

Mission ID: 15

Mission Name: Hope

Launch Date: 2020-07-20

Destination: Mars

Status: Active

Funding: 200000000

Expenses: 200000000

Mission ID: 16

Mission Name: Chang'e 4

Launch Date: 2019-01-03

Destination: Moon

Status: Active

Funding: 3400000000

Expenses: 3400000000

Mission ID: 17

Mission Name: Chang'e 5

Launch Date: 2020-12-01

Destination: Moon

Status: Completed

Funding: 4400000000

Expenses: 4400000000

Mission ID: 18

Mission Name: Solar Orbiter

Launch Date: 2020-02-09

Destination: Sun

Status: Active

Funding: 1500000000

Expenses: 1500000000

Query38: Create a cursor to calculate the total expenses for each mission.

-- Declare variables

DECLARE @MissionID INT;

DECLARE @Expenses BIGINT;

DECLARE @TotalExpenses BIGINT = 0;

-- Declare cursor

DECLARE MissionCursor CURSOR FOR

SELECT mission_id, expenses

FROM Missions;

-- Open the cursor

OPEN MissionCursor;

-- Fetch the first row

FETCH NEXT FROM MissionCursor INTO @MissionID, @Expenses;

-- Process the rows

WHILE @@FETCH_STATUS = 0

BEGIN

-- Accumulate expenses for each mission

SET @TotalExpenses = @TotalExpenses + @Expenses;

-- Fetch the next row

FETCH NEXT FROM MissionCursor INTO @MissionID, @Expenses;

END

```

-- Close and deallocate the cursor
CLOSE MissionCursor;
DEALLOCATE MissionCursor;
-- Display the total expenses for each mission
SELECT mission_id, @TotalExpenses AS total_expenses
FROM Missions;

```

Output:

	mission_id	total_expenses
1	1	121100000000
2	2	121100000000
3	3	121100000000
4	4	121100000000
5	5	121100000000
6	6	121100000000
7	7	121100000000
8	8	121100000000
9	9	121100000000
10	10	121100000000
11	11	121100000000
12	12	121100000000
13	13	121100000000
14	14	121100000000
15	15	121100000000
16	16	121100000000
17	17	121100000000
18	18	121100000000

Query39: Create a nested query to retrieve the details of the mission with the highest funding.

```

SELECT *
FROM Missions
WHERE funding = (
    SELECT MAX(funding)
    FROM Missions );

```

Output:

	mission_id	mission_name	launch_date	destination	status	funding	expenses
1	9	International Space Station	1998-11-20	Low Earth Orbit	Active	1000000000000	1000000000000

Query40: Create a nested query to retrieve the details of the astronaut with the most number of missions.

```
SELECT *
FROM Astronauts
WHERE number_of_missions = (
    SELECT MAX(number_of_missions)
    FROM Astronauts
);
```

Output:

	astronaut_id	name	age	nationality	specialization	number_of_missions	mission_id	notable_achievements
1	8	Alan Shepard	47	United States	Pilot	2	4	First American in space

Query41: Create a nested query to retrieve the total number of missions to each destination.

```
SELECT destination, COUNT(*) AS total_missions
FROM Missions
GROUP BY destination
ORDER BY total_missions DESC;
```

Output:

	destination	total_missions
1	Low Earth Orbit	7
2	Mars	4
3	Moon	4
4	Pluto	1
5	Sun	1
6	Jupiter	1

Query42: Create a correlated nested query to retrieve the details of the mission with the highest expenses.

```
SELECT mission_id, mission_name, launch_date, destination, status, funding, expenses
FROM Missions m1
WHERE expenses = (
    SELECT MAX(expenses)
    FROM Missions m2
    WHERE m2.mission_id = m1.mission_id);
```

Output:

	mission_id	mission_name	launch_date	destination	status	funding	expenses
1	1	Apollo 11	1969-07-20	Moon	Completed	2540000000	410000000
2	2	Apollo 13	1970-04-11	Moon	Abandoned	130000000	0
3	3	Skylab 1	1973-05-25	Low Earth Orbit	Completed	260000000	180000000
4	4	Space Shuttle Columbia	1981-04-12	Low Earth Orbit	Completed	1960000000	1220000000
5	5	Space Shuttle Challenger	1983-04-04	Low Earth Orbit	Destroyed	550000000	410000000
6	6	Space Shuttle Discovery	1984-08-30	Low Earth Orbit	Completed	2130000000	1320000000
7	7	Space Shuttle Atlantis	1985-10-08	Low Earth Orbit	Completed	2130000000	1320000000
8	8	Space Shuttle Endeavour	1992-05-07	Low Earth Orbit	Completed	2130000000	1320000000
9	9	International Space Station	1998-11-20	Low Earth Orbit	Active	100000000000	100000000000
10	10	Mars Exploration Rover Spirit	2003-06-10	Mars	Abandoned	450000000	450000000
11	11	Mars Exploration Rover Opportunity	2003-07-07	Mars	Abandoned	450000000	450000000
12	12	Juno	2011-08-05	Jupiter	Active	1100000000	1100000000
13	13	New Horizons	2006-01-19	Pluto	Completed	720000000	720000000
14	14	Perseverance	2020-07-30	Mars	Active	2700000000	2700000000
15	15	Hope	2020-07-20	Mars	Active	200000000	200000000
16	16	Chang'e 4	2019-01-03	Moon	Active	3400000000	3400000000
17	17	Chang'e 5	2020-12-01	Moon	Completed	4400000000	4400000000
18	18	Solar Orbiter	2020-02-09	Sun	Active	1500000000	1500000000

Query43: Create a correlated nested query to retrieve the details of the astronaut with the most recent mission.

```

SELECT *
FROM Astronauts a1
WHERE mission_id = (
    SELECT MAX(mission_id)
    FROM Astronauts a2
    WHERE a2.name = a1.name
);

```

Output:

	astronaut_id	name	age	nationality	specialization	number_of_missions	mission_id	notable_achievements
1	20	Yuri Gagarin	27	Soviet Union	Pilot	1	8	First person in space
2	33	William Anders	35	United States	Lunar Module Pilot	1	14	Apollo 8 astronaut, took iconic "Earthrise" photograph
3	41	Vance Brand	43	United States	Command Module Pilot	1	17	Successful completion of three space missions.
4	39	Valeri Kubasov	39	Soviet Union	Engineer	1	16	Soyuz-Apollo joint mission, Soviet astronaut
5	7	Valentina Tereshkova	26	Soviet Union	Cosmonaut	1	3	First woman in space
6	35	Thomas Stafford	39	United States	Commander	1	15	Commander of Apollo 10 mission
7	16	Thomas Mattingly	37	United States	Command Module Pilot	1	6	Apollo 13 Command Module Pilot
8	9	Stuart Roosa	37	United States	Command Module Pilot	1	4	Carried tree seeds to space
9	31	Russell Schweickart	37	United States	Lunar Module Pilot	1	13	Performed the first spacewalk of the Apollo program
10	19	Ron Evans	38	United States	Command Module Pilot	1	7	Apollo 17 Command Module Pilot
11	43	Robert Crippen	43	United States	Pilot	1	18	First Space Shuttle pilot
12	25	Richard Gordon	40	United States	Command Module Pilot	1	11	Performed a spacewalk during the Gemini 11 mission
13	23	Pete Conrad	37	United States	Commander	1	11	Third person to walk on the moon
14	28	Paul Weitz	37	United States	Command Module Pilot	1	12	Performed spacewalks during Skylab missions
15	1	Neil Armstrong	38	United States	Pilot	1	1	First person to walk on the Moon
16	3	Michael Collins	39	United States	Command Module Pilot	1	1	Command Module Pilot on Apollo 11
17	27	Joseph Kerwin	36	United States	Science Pilot	1	12	First physician to fly in space
18	42	John Young	47	United States	Commander	1	18	Moon landing and spacewalk on Apollo 16
19	4	Jim Lovell	42	United States	Commander	1	2	Apollo 13 mission commander
20	29	James McDivitt	39	United States	Commander	1	13	Commanded the Gemini 4 mission

Query44: Create a correlated nested query to retrieve the total number of astronauts for each country.

```
SELECT a.nationality AS country, COUNT(*) AS total_astronauts
```

```
FROM Astronauts a
```

```
GROUP BY a.nationality;
```

Output:

	country	total_astronauts
1	Soviet Union	6
2	United States	37

Query45: Retrieve the average age of astronauts for each mission.

```
SELECT Missions.mission_id, Missions.mission_name, AVG(Astronauts.age) AS avg_age
```

```
FROM Missions
```

```
LEFT JOIN Astronauts ON Missions.mission_id = Astronauts.mission_id
```

```
GROUP BY Missions.mission_id, Missions.mission_name;
```

Output:

	mission_id	mission_name	avg_age
1	1	Apollo 11	38
2	2	Apollo 13	38
3	3	Skylab 1	26
4	4	Space Shuttle Columbia	41
5	5	Space Shuttle Challenger	39
6	6	Space Shuttle Discovery	38
7	7	Space Shuttle Atlantis	37
8	8	Space Shuttle Endeavour	27
9	9	International Space Station	25
10	10	Mars Exploration Rover Spirit	33
11	11	Mars Exploration Rover Opportunity	38
12	12	Juno	37
13	13	New Horizons	37
14	14	Perseverance	38
15	15	Hope	43
16	16	Chang'e 4	41
17	17	Chang'e 5	45
18	18	Solar Orbiter	45

Query46: Trigger to update the number of missions for an astronaut whenever a new mission is assigned.

```
CREATE TRIGGER UpdateMissionCount
ON Astronauts
AFTER INSERT
AS
BEGIN
    UPDATE Astronauts
    SET number_of_missions = number_of_missions + 1
    WHERE astronaut_id IN (SELECT astronaut_id FROM inserted);
END;
```

Output:

Commands completed successfully.

Query47: Retrieve all missions with their associated spacecraft.

```
SELECT Missions.mission_id, Missions.mission_name, Spacecraft.name FROM Missions
LEFT JOIN Spacecraft ON Missions.mission_id = Spacecraft.mission_id;
```

Output:

	mission_id	mission_name	avg_age
1	1	Apollo 11	38
2	2	Apollo 13	38
3	3	Skylab 1	26
4	4	Space Shuttle Columbia	41
5	5	Space Shuttle Challenger	39
6	6	Space Shuttle Discovery	38
7	7	Space Shuttle Atlantis	37
8	8	Space Shuttle Endeavour	27
9	9	International Space Station	25
10	10	Mars Exploration Rover Spirit	33
11	11	Mars Exploration Rover Opportunity	38
12	12	Juno	37
13	13	New Horizons	37
14	14	Perseverance	38
15	15	Hope	43
16	16	Chang'e 4	41
17	17	Chang'e 5	45
18	18	Solar Orbiter	45

Query48: Create a function that returns the name of the most recent mission launched.

```
CREATE FUNCTION GetLatestMissionName()
RETURNS VARCHAR(255)
AS
BEGIN
    DECLARE @latest_mission_name VARCHAR(255);

    SELECT TOP 1 @latest_mission_name = mission_name
    FROM Missions
    ORDER BY launch_date DESC;

    RETURN @latest_mission_name;
END;
DECLARE @latest_mission_name VARCHAR(255);

SELECT @latest_mission_name = dbo.GetLatestMissionName();
```

```
SELECT @latest_mission_name AS latest_mission_name;
```

Output:

	latest_mission_name
1	Chang'e 5

Query49: Create a function that retrieves the number of astronauts with a specific specialization.

```
CREATE      FUNCTION      GetAstronautCountBySpecialization(@specialization
VARCHAR(255))
RETURNS INT
AS
BEGIN
    DECLARE @astronaut_count INT;
```

```

SELECT @astronaut_count = COUNT(*)
FROM Astronauts
WHERE specialization = @specialization;

RETURN @astronaut_count;
END;

DECLARE @specialization VARCHAR(255) = 'Astrophysics';
DECLARE @astronaut_count INT;

SELECT @astronaut_count = dbo.GetAstronautCountBySpecialization(@specialization);

```

SELECT @astronaut_count AS astronaut_count;

Output:

	astronaut_count
1	0

Query50: Retrieve the list of functions in the database.

```

SELECT name
FROM sys.objects
WHERE type = 'FN';

```

Output:

	name
1	GetLatestMissionName
2	GetAstronautCountBySpecialization

CHAPTER 4. CONCLUSION AND FUTUREWORK

4.1 Conclusion

In conclusion, the Space Exploration Management System database provides a comprehensive and structured approach to managing various aspects of space exploration missions. By organizing data into tables and establishing relationships between entities, the database allows for efficient tracking and retrieval of mission information, astronauts, spacecraft, payloads, and more. The implementation of functions enables calculations, reporting, and analysis, providing valuable insights into mission performance and resource management.

While the current database schema lays a strong foundation for managing space exploration activities, there are several areas for future work and improvement. Enhancements such as implementing security measures, integrating with external systems, automating workflows, and enabling collaboration and communication will further optimize the database's functionality and usability. Additionally, the expansion of entities and relationships can accommodate emerging trends in space exploration, ensuring that the database remains relevant and adaptable to future missions.

By continuously refining and enhancing the Space Exploration Management System database, space agencies and organizations can effectively manage their missions, make informed decisions, and contribute to the advancement of space exploration endeavors.

4.2 Future Work

1. Enhancing Security: Implementing security measures such as user authentication and authorization to ensure the confidentiality and integrity of the data.
2. Data Analytics and Reporting: Developing advanced queries and reporting functions to analyze mission data, track performance metrics, and generate insightful reports for decision-making purposes.
3. Integration with External Systems: Integrating the database with external systems, such as telemetry data sources or satellite tracking systems, to provide real-time updates and enhance the accuracy of mission information.
4. Workflow Automation: Implementing workflow automation features to streamline mission management processes, including task assignment, status tracking, and notifications.
5. Data Archiving and Retention: Designing a data archiving and retention strategy to manage historical mission data and comply with regulatory requirements.
6. Collaboration and Communication: Adding functionality for collaboration and communication between mission stakeholders, including astronauts, scientists, and mission control personnel, to facilitate seamless coordination and information sharing.
7. Integration with Visualization Tools: Integrating the database with visualization tools or dashboards to present mission data in a visually appealing and easily understandable format.
8. Expansion of Entities and Relationships: Depending on the evolving needs of space exploration, considering the addition of new entities and relationships to capture emerging aspects such as lunar missions, asteroid exploration, or commercial space ventures.

These future enhancements will further optimize the Space Exploration Management System database, improve its usability, and support the evolving requirements of space exploration endeavors.