

# Assumptions

## 1. Description

This database is designed to manage and organize data for an interstellar transportation and exploration system where each star system hosts a space station, and spaceships operate much like personal vehicles. The database tracks star systems, space stations, spaceships, spaceships, and crew members, with each spaceship having a dedicated, fixed crew that includes a designated owner.

## 2. Client

The client is Federal Space Agency (business agent). A governmental or regulatory body responsible for overseeing all space travel and transportation within and across star systems. They would use the database to maintain a central record of spaceships, crew, travel logs, docking schedules, and compliance information to ensure the safe and legal operation of space traffic.

## 3. Goal

The goal of this **Space Station Management Database** is to serve as a comprehensive and structured system for tracking and managing various elements and operations within an interstellar space exploration and station management ecosystem.

## 4. Users

- **Space Station Administrator** - Manages a space station's operations, overseeing docking schedules, resource distribution, and mission assignments.
- **Fleet Commander** - Oversees multiple spaceships and coordinates large-scale missions across systems.
- **Supply Chain Manager** – Operates in the gray areas of intergalactic law, looking for vulnerable ships and cargo that was stolen or illegally obtained.
- **Space Agency Authority** – Monitors the number of docked ships across universe, can check for carried cargo (amount and legality)
- **Spaceship owners** – Viewing docking history, undergone maintenances and mission history

## 5. Assumptions / Limitations

I assume that the Client is a Space Federal Agent from the future. This implies that people own and use spaceships as personal means of communication (the same way we use cars nowadays). Database does not handle flights of spaceships (from -> to, duration of flight, etc.). Database also

does not handle the operation of trading supplies between stations and spaceships (but stores data about type and quantity of cargo in each on dates of dockings).

## 6. Purposes

- **Crew and Ownership Management** - Track and organize crew members assigned to each spaceship, including roles, ranks, and experience. Identify the **owner** of each spaceship, using a specialized crew designation, to manage ownership responsibilities and permissions within the system.
- **Docking and Station Management** - Track which star system each space station belongs to and support navigation and logistics planning within and across star systems.
- **Security and Compliance Monitoring** - Facilitate monitoring of ship ownership, docking times, and crew roles, aiding in security checks and regulatory compliance. Enable authorities to query docking and crew details for specific spaceships in case of emergency responses or inspections.
- **Supply Planning** - Track spaceships' movements (dockings) and supply levels, enabling effective resource allocation. Ensure that each space station can monitor and replenish supplies, allowing for well-prepared ships and missions.

## 7. Use case Scenarios

- **Tracking a suspicious ship**

User: Space Traffic Officer (FSA)

Objective: Investigate a ship suspected of smuggling illegal goods

- Query Ship Movements:** The Officer logs into the system and searches for a specific ship, the *Nebula Runner*, flagged in a recent investigation. The system retrieves the ship's docking history across multiple space stations, including times, cargo manifests, and mission data.
- Analyze Cargo Logs:** The Officer notices that the ship's cargo manifests seem inconsistent, particularly with frequent unexplained supply restocks. They review the supplies that the *Nebula Runner* has been transporting, including food, fuel, and an unusually high amount of "miscellaneous goods."
- Check Related Ships:** The Officer cross-references the *Nebula Runner*'s movements with other ships that docked at the same stations within a short window. This reveals a pattern: multiple ships with similar docking schedules have been flagged for suspicious activity.
- Prepare a Raid:** Based on the data, the Officer schedules a patrol ship to intercept the *Nebula Runner* at its present docking location. The system is updated with the mission, and the ship is flagged for inspection upon arrival.

- **Managing a supply run**

User: Supply chain Manager (Station Administrator)

Objective: Organize the transportation of medical supplies between space stations

- Monitor Supply Levels:** The Manager logs in and queries the inventory levels for medical supplies across several space stations in different systems. One station in the Proxima system is running low on key medical supplies.
- Find Available Cargo Ships:** The Manager searches for available cargo ships docked at nearby stations that have enough room to carry the needed supplies. They find one ship with available cargo space docked at a station in the Alpha Centauri system.
- Track Delivery:** The Manager assigns the delivery mission to the cargo ship.
- Confirm Delivery:** Once the supplies arrive, the Manager logs into the system to verify the delivery and update inventory levels at the Proxima station.

- **Spaceship owner maintenance**

User: Spaceship owner

Objective: Plan and perform maintenance service on a space station due to malfunction

- Identify Malfunction:** Spaceship owners observe a malfunction during a flight and decide to check whether specific part was serviced in recent months. He logs in and queries the maintenance list for his spaceship – observing that there were no services done in a long time.
- Schedule Maintenance:** The coordinator creates a new maintenance record, specifying tasks and dates. The system assigns the task to the appropriate space station and records it in the maintenance log.
- Assign Mechanic:** The coordinator assigns a mechanic to the scheduled task. The system records each mechanic's assignment and area of expertise.

## 8. Example Queries

- How many passenger spaceships has docked to “Aldermore Space Hub” between 21-04-2239 and 18-07-2239?
- What were the last ten dockings of spaceship with production number 29183008?
- How much uranium was in the spaceships cargo bays that docked to “Aithal Garrison” on 29-12-2208
- How many maintenance services were more expensive than 3500\$ that were performed on station “Ordon Terminal”?
- List all the maintenance records that were performed by worker with ID 107557 regarding fixing boosters

## 9. Entities Description

Note: It's very hard to estimate the number of records in many entities, since it would be an enormously large database due to the number of systems in the universe.

- **Spaceship**

Represents various spaceships, their capacities, fuel types, and status.

- **ShipProdNumber (Alphanumeric string with length 12): Unique production number for each spaceship.**
- Name (String up to 40 letters): The name of the spaceship; stored as a string.
- Capacity (Integer between 0 and 100000): Maximum occupancy or storage capacity stored in kilograms.
- Fleet (String up to 20 letters): The fleet or group the spaceship belongs to.
- ShipType (String up to 50 letters): Type or class of the spaceship.
- FuelType (String up to 15 letters): The type of fuel used by the spaceship.
- Status (String up to 15 letters): The operational status of the spaceship; stored as a string.

- **Mission**

Represents each mission assigned to the space station, including its name, objective, and time frame (Size ~ 10000 records).

- **MissionID (Unique Integer containing 5 digits): Unique identifier for each mission.**
- MissionName (String up to 30 letters): The name of the mission.
- Objective (TEXT): The purpose or goal of the mission.
- StartDate (Date type): The date the mission begins.
- EndDate (Date type): The date the mission ends.

- **Crew Member**

Represents each mission assigned to the space station, including its name, objective, and time frame.

- **CrewMemberID (Unique Integer containing 10 digits): Unique identifier for each crew member.**
- Role (String up to 15 letters): The position or job of the crew member; stored as a string.
- ExperienceLevel (String up to 20 letters): Indicates the skill level of the crew member.

- **People**

General entity to store information about people on the space station.

- **IdentificationNumber (Unique integer containing 12 digits): Unique identifier for each person.**
- Name (String up to 15 letters): The first name of the person
- Surname (String up to 20 letters): The surname or last name.
- Nationality (String up to 30 letters): The nationality or origin.

- **Mechanics**

Subtype of People who perform maintenance tasks, with a license and expertise areas (Size ~ 3000 records).

- **LicenseNumber (Unique Integer containing 5 digits): Unique license number for each mechanic**
- AreaOfExperience (String up to 20 letters): Field or specialization of the mechanic; stored as a string.

- **Maintenance**

Tracks maintenance activities performed by mechanics on the space station.

- **MaintenanceID (Unique integer containing 8 digits): Unique identifier for each maintenance task; stored as an integer or string.**
- PerformedBy (FK): Identifier for the mechanic responsible for maintenance
- MaintenanceTitle (String up to 20 letters): Short title for the maintenance task; stored as a string.
- Description (TEXT Type): Detailed description of the task.
- MaintenanceDate (Date type): Date the maintenance was performed.
- Cost (Cost type): The cost of performing the maintenance.

- **Docking Record**

Records docking events, including docked and undocked times and duration.

- **DockingID (Unique integer containing 6 digits): Unique identifier for each docking record.**
- DockedDate (Date type): Date when the docking occurred.
- UndockedDate (Date type): Date when undocking occurred.

- **Docking Bay**

Represents docking bays available in the space station for spaceships (Size ~ 5000 records).

- **BayNumber (Unique integer containing 3 digits): Unique number for each docking bay.**
- StationID (Foreign Key): Identifier for the associated space station.
- Capacity (Integer between 1 and 20): Maximum capacity of the docking bay.
- BayStatus (String up to 10 letters): Operational status of the docking bay.

- **Space Station**

Represents space stations, including name, location, capacity, and ownership (Size ~ 1000 records).

- **StationID (Unique integer containing 5 digits): Unique identifier for each space station; stored as an integer or string.**
- StationName (String up to 30 letters): The name of the space station; stored as a string.
- Coordinates (TEXT type): Position in space, possibly in 3D coordinates.
- Capacity (Integer between 1 and 1000): Maximum number of people it can hold.
- Fraction (String up to 20 letters): Affiliation or ownership of the space station.

- **Ship Cargo Bay**

Tracks items stored in the spaceship's cargo bay.

- **ShipProdNumber (Foreign Key): Links to the spaceship associated with this cargo bay.**
- **ItemID (Foreign Key): Identifier for items contained in the cargo bay.**
- Quantity (Integer): Amount of the item.
- **SnapshotDate (Date type): Date of inventory check.**
- IsCurrent (Boolean): Flag indicating if the record is current

- **Station Warehouse**

Tracks supplies stored in the space station's warehouse.

- **StationID (Foreign Key): Links to the space station associated with this warehouse.**
- **ItemID (Foreign Key): Identifier for items contained in the cargo bay.**

- Quantity (Integer): Amount of the item.
- **SnapshotDate (Date type): Date of inventory check.**
- IsCurrent (Boolean): Flag indicating if the record is current

- **Supplies**

Represents supplies stored within the space station or spaceship (Size ~ 2000 records).

- **ItemID (Unique Integer containing 4 digits): Unique identifier for each supply item.**
- Name (String up to 20 letters): Name of the item.
- Type (String up to 20 letters): Category or type of the item.
- ExpirationDate (Date type): Date the item expires, if applicable.
- CostPerUnit (Currency type): Price per unit.

- **Planet**

Represents planets, which may be subclasses of Gas Giants or Terrestrial Planets.

- **PlanetID (Unique string composition up to 15 letters): Unique name of the planet.**
- PlanetName (VARCHAR): Name of the planet
- Diameter (Float): Diameter of the planet, stored in kilometers.
- Mass: (Float) Mass of the planet, stored in Tons
- Inhabited (Boolean type): Flag indicating if the planet is inhabited

- **Gas Giant**

Represents gas giant planets, with additional attributes specific to gas giants

- **PlanetName (Foreign Key): Links to the Planet entity.**
- RingSystem (Boolean type): Boolean flag for the presence of a ring system.
- CoreComposition (TEXT type): Composition of the planet's core.

- **Terrestrial Planet**

Represents terrestrial planets, with attributes specific to solid surfaces.

- **PlanetName (Foreign Key): Links to the Planet entity.**
- SurfaceType (String up to 15 letters): Type of surface (e.g., rocky, desert).
- WaterPresence (Boolean type): Flag for the presence of water

- **Moon**

Represents moons orbiting planets, with details like orbital period and distance.

- **MoonID (Unique integer containing 5 digits): Unique identifier for the moon.**
- MoonName (String up to 15 letters): Name of the moon.

- Diameter (Float type): Diameter of the moon, stored in kilometers.
- Mass (Float type): Mass of the moon, stored in tons.
- OrbitalPeriod (Float type) : Time taken to orbit the planet, stored in days.
- DistanceFromPlanet (Float type): Distance from its parent planet, stored in kilometers.

- **System**

Represents star systems, containing planets and stars.

- **SystemID (Unique integer containing 4 digits): Unique identifier for the star system.**
- Name (String up to 15 letters): Name of the star system.
- Type (String up to 20 letters): Type of system (e.g., binary, single star).
- Age (Float type): Age of the system, stored in years.

- **Star**

Represents neutron stars with specific attributes.

- **StarID (Unique integer containing 5 digits): Unique identifier for each star.**
- StarName (String up to 15 letters): Name of the star.
- StarMass (Float type): Mass of the star, stored in tons.
- Temperature (Float type): Temperature of the star, stored in Celsius.
- Luminosity (Float type): Brightness of the star, stored in lux.

- **Neuron Star**

Represents neutron stars with specific attributes.

- **StarID (Foreign Key): Links to the Stars entity.**
- SpinRate (Float type): Rate at which the star spins.
- MagneticFieldStrength (Float type): Strength of the magnetic field.

- **Main Sequence**

Represents main-sequence stars with characteristics relevant to this classification.

- **StarID (Foreign Key): Links to the Stars entity.**
- HeliumContent (Float type): Amount of helium in the star.
- HydrogenBurningRate (Float type): Rate of hydrogen burning.

## 10. Relationship description



**Assigned\_to** (Spaceship 1 – 0 ... n Mission): Each spaceship can have zero or many missions assigned to it, but one mission can only be assigned to one spaceship

**Operates** (Spaceship 1 – 0 ... n Crew Member): Each spaceship can have zero or many crew members since there are unmanned spaceships. Each crew member can only operate on one spaceship.

**Records** (Spaceship 1 – 0 ... n Docking Record): Each spaceship can have zero or many docking records (it can be new), but one docking record can only be assigned to one spaceship.

**Occurs\_at** (Docking Bay 1 – 0 ... n Docking Record): Each Docking Record occurs at a Docking Bay, but each Docking Bay can have multiple Docking Records over time.

**Has** (Spaceship 1 – 0 ... n Docking Bay): Each Space Station has one or more Docking Bays.

**Undergoes** (Spaceship 1 – 0 ... n Maintenance): Each spaceship can have zero or many maintenance services done to it, but one maintenance service can only be assigned to one spaceship.

**Performs** (Mechanics 1 – 0 ... n Maintenance): Each mechanic can perform many maintenance services, but one maintenance service is only performed by one mechanic.

**Hosts** (Space Station 1 – 0 ... n Maintenance): Each space station can host many maintenance services, but one maintenance service can only be performed on one space station.

**Has** (Spaceship 1- 0 ... n Ship Cargo Bay): Each Spaceship has a single or multiple Ship Cargo Bays, where each Ship Cargo Bay is associated with only one Spaceship.

**Contains** (Supplies 1 – 0 ... n Ship Cargo Bay): Each Supply item can appear multiple times in the Ship Cargo Bay, with each occurrence linked to a different spaceship.

**Contains** (Supplies 1 – 0 ... n Station Warehouse): Each Supply item can appear multiple times in the Station Warehouse, with each occurrence linked to a different station.

**Has** (Space Station 1- 0 ... n Station Warehouse): Each Space Station has one or more Station Warehouses, and each Station Warehouse is associated with only one Space Station.

**Hosts** (System 1 – 0 ... 1 Space Station): Each System can have zero or only one Space Station, but one space station can only be in one system.

**Contains** (System 1 – 0 ... n Planet): Each system contains zero or many planets, but one planet can only occur in one system.

**Has** (Planet 1 – 0 ... n Moon): Each planet can have zero or many moons, but one moon can only be assigned to one planet.

**Has** (System 1 – 1 ... n Stars): Each system can have one or more stars, but one star can only be a part of one system.

## 11. RDB Schema

**Mission** (MissionID, MissionName, Objective, StartDate, EndDate, ShipProdNumber, [ShipProdNumber REF Spaceship](#))

**People** (IdentificationNumber, Name, Surname, Nationality)

**Crew Member** (CrewMemberID, Name, Role, Nationality, ExperienceLevel, [IdentificationNumber REF People](#))

**Mechanics** (LicenseNumber, AreaOfExperience, ExperienceLevel, [IdentificationNumber REF People](#))

**Spaceship** (ShipProdNumber, Name, Capacity, Fleet, ShipType, FuelType, Status)

**Docking Record** (DockingID, DockedDate, UndockedDate, Duration, [ShipProdNumber REF Spaceship](#), [BayNumber](#), [StationID REF DockingBay](#), [SpaecStation](#))

**Docking Bay** (BayNumber, StationID, Capacity, Status, [Station ID RED SpaceSystem](#))

**Space Station** (StationID, SystemID, StationName, Coordinates, Capacity, Fraction)

**System** (SystemID, Name, Age, Type,)

**Stars** (StarID, StarName, StarMass, Temperature, Luminosity, [SystemID REF System](#))

**Neutron Star** (SpinRate, Magnetic Field Strength, [StarID REF Stars](#))

**Main Sequence** (HeliumContent, Hydrogen Burning Rate, [StarID REF Stars](#))

**Moon** (MoonID, MoonName, Diameter, Mass, OrbitalPeriod, DistanceFromPlanet, [PlanetName REF Planet](#))

**Planet** (PlanetName, Diameter, Mass, Inhabited, [SystemID REF System](#))

**Gas Giant** (RingSystem, CoreComposition, [PlanetName REF Planet](#))

**Terrestrial Planet** (SurfaceType, WaterPressence, [PlanetName REF Planet](#))

**Maintenance** (MaintenancelD, PerformedBy, Description, MaintenanceDate, Cost, [LicenseNumber REF Mechanics](#), [ShipProdNumber REF Spaceship](#), [StationID REF Space Station](#))

**Ship Cargo Bay** (ShipProdNumber, ItemID, Quantity, SnapshotDate, IsCurrent)

**Station Warehouse** (StationID, ItemID, Quantity, SnapshotDate, IsCurrent)

**Supplies** (ItemID, Name, Type, ExpirationDate, CostPerUnit)

# ERD MODEL FOR SPACE STATIONS

