Solar System Explorer

A Long-Range Human Spacecraft for Deep Space Missions

---

1. Mission Overview

The Solar System Explorer is a crewed interplanetary vessel designed for long-duration missions to Mars, the outer planets, and beyond. Built for endurance, autonomy, and crew safety, the Explorer can operate independently for up to two years, perform in-situ fuel production, and deploy artificial gravity for long-term habitability. It is the next logical step beyond Aegis Station — a mobile orbital civilization built to push the frontier outward.

---

2. Design Philosophy

Rather than treat deep space like a short hop, the Explorer embraces the scale of solar system operations with systems optimized for resilience and renewal. This includes:

- **Hybrid propulsion** for both rapid departure and efficient cruise
- **Rotating habitation pods** for partial gravity
- **Support for in-situ resource use**, reducing dependence on Earth
- **Redundant systems**, with modular independence
- **Micrometeoroid strategy** focused on survival, not avoidance:
    - Real-time evasion of micrometeoroid showers is not feasible.
    - The ship uses Whipple shielding, trajectory planning, and system redundancy to minimize risk from impacts.
    - Storm shelter protocols send the crew to the central core during periods of elevated danger.

---

3. Crew Habitation & Artificial Gravity

The Explorer includes four 15° rotating ring segment pods, deployed during long cruise phases to provide artificial gravity.

Feature	Value
Boom Length	50 meters
Gravity at Floor	~0.4g
Spin Rate	~1.5 RPM

Feature	Value
Arc Length per Pod	~13.1 meters
Interior Volume	~98 m³ per pod
Functions	Crew quarters, lab, gym, med
Transfer Architecture	Rotating tunnel w/ vestibule

Pods are retractable and only extended during non-thrusting flight. The rotating tunnel interface allows continuous crew access without halting spin.

---

4. Propulsion & Power

The Explorer uses a **hybrid propulsion system** to balance thrust and efficiency:

Drive System	Function
High-Thrust Stage	NTR or chemical, for escape burns
MPD / Ion Drives	Cruise, station-keeping, braking
Reactor Power	2–5 MW gas-cooled fission
Power Distribution	Central + rotary transfer

The nuclear electric system supports continuous operation of high-efficiency thrusters and onboard systems.

---

5. Fuel & ISRU Integration

A defining feature of the Explorer is its **onboard fuel production**:

- Electrolysis system produces LOX + LH_2 from collected H_2O
- Cryogenic storage tanks support long-term refueling
- Water collected via external tankers or landers
- Enables complete in-situ turnaround without Earth resupply

---

6. Radiation Protection

- Local shielding around crew pods: polyethylene + water wall
- Radiation storm shelter in the central core
- Retreat protocol during solar particle events

- Crew exposure mitigated through mission timing and shielding geometry

---

7. Main Ship Specifications

Component	Value / Configuration
Length	~100–110 meters
Span (deployed pods)	~120–130 meters
Core Diameter	~6–8 meters
Mass (dry)	~150–200 tons
Propellant Mass	~50–100 tons (varies by mission)
Water Storage	Shielding + fuel input (~50+ tons)
Hab Pods	4 × 15° spinning segments
Transfer System	Rotating tunnel with pressure vestibule
Docking Capacity	Multiple landers, tankers, resupply craft

---

8. Support Craft Integration

The Explorer is designed to operate in tandem with a fleet of auxiliary vehicles:

- **Landers** – for crew and cargo transfer to planetary/moon surfaces
- **Tankers** – deliver water/ice to orbit for onboard fuel production
- **Mining Drones** – extract water from ice deposits and regolith

These vehicles dock with the Explorer via standardized interfaces and can operate autonomously.

---

9. Long-Term Vision

The Solar System Explorer is more than a ship — it is a platform. Its modular structure allows refits, expansion, and eventual deployment of daughter ships. Future variants could:

- Explore the Kuiper Belt
- Support outposts on Europa, Titan, or Ceres
- Form the backbone of a mobile space economy