# Solar System Explorer

A Long-Range Human Spacecraft for Deep Space Missions

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## 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 platform built to push the frontier outward.

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## 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:

- 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

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.

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## 3. Crew Habitation & Artificial Gravity

The Explorer includes four 15° rotating ring segment pods, deployed during long cruise phases to provide artificial gravity. Pods are retractable and only extended during non-thrusting flight. A rotating tunnel interface allows continuous crew access without halting spin.

| Feature | Value |
|---|---|
| Boom length | 50 meters |
| Gravity at floor | ~0.4g |

| | |
|---|---|
| Spin rate | ~1.5 RPM |
| Arc length per pod | ~13.1 meters |
| Interior volume | ~98 $m^3$ per pod |
| Functions | Crew quarters, lab, gym, med |
| Transfer architecture | Rotating tunnel with vestibule |

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## 4. Propulsion & Power

The Explorer uses a hybrid propulsion system to balance thrust and efficiency. The nuclear electric system supports continuous operation of high-efficiency thrusters and onboard systems.

| **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 |

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## 5. Fuel & ISRU Integration

A defining feature of the Explorer is its onboard fuel production capability, enabling complete in-situ turnaround without Earth resupply:

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

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## 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

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## 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 |

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## 8. Support Craft Integration

The Explorer is designed to operate in tandem with a fleet of auxiliary vehicles, all interfacing via standardized docking ports and capable of autonomous operation:

- **Landers** — Crew and cargo transfer to planetary or moon surfaces
- **Tankers** — Deliver water and ice to orbit for onboard fuel production
- **Mining drones** — Extract water from ice deposits and regolith

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## 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

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