OSS-1 (Orbital Small Station – 1)

- OSS-1 (Orbital Small Station–1) is a mini space station capable of operating fully autonomously in Low Earth Orbit (LEO).
- The project integrates power generation, AI-controlled mission planning, attitude determination, and communications systems into a single compact platform.
- Its purpose is to provide a continuous and reliable station infrastructure by minimizing human intervention in space missions.
- The design of OSS-1 has been developed in accordance with NASA CubeSat standards and orbital safety protocols.

| Rahman ŞAHİN

Goal & Vision

- The core objective of OSS-1 is to develop a low-cost yet highly capable autonomous mini station.
- This system independently performs tasks such as data collection, analysis, energy optimization, and environmental awareness.
- The experience gained in energy management, communications, and attitude control from the SpaceButLive project has been directly transferred to OSS-1.
- This architecture increases the scalability of space missions and leads the way for a new generation of small stations.

System Architecture

- Existing ISS systems suffer from high cost, continuous human oversight, and energy inefficiency.
- OSS-1 addresses these issues with its small size, autonomous architecture, and optimized power management.
- The system has a volume of 1 m^3 and a mass of 95 kg, powered by 300 W solar panels and a 150 Wh $LiFePO_4$ battery.
- AI-based control software manages power distribution and data prioritization in real time.
- Result: low maintenance requirements, long mission duration, and high reliability.

Autonomy & Artificial Intelligence

- OSS-1 consists of four main modules: front, middle, rear, and side.
- The front module houses the sensors, high-resolution cameras, and the communications antenna.
- The middle module contains the AI-Core processor and the mission control unit.
- The rear module includes energy storage, power regulation, and the micro-propulsion system.
- The side modules are deployable solar panels.
- The structure is carbon-composite and protected with an anti-UV coating.
- Power buses are redundant, and data is transmitted over an X-Band link at 256 kbps.
- Orbit: 525 km sun-synchronous orbit (SSO), 90-minute period, approximately 15 revolutions per day.

Safety, Durability & Energy

- OSS-1’s AI-Core analyzes sensor data and makes real-time decisions.
- Using data from the IMU, thermal sensors, a star tracker, and light sensors, it performs attitude, power, and mission planning.
- The system has been optimized through reinforcement-learning-based simulations.
- Upon anomaly detection, it applies power or attitude adjustments and, if needed, recovers via a reset-on-fault mechanism.
- The AI also optimizes communication scheduling, data prioritization, and power consumption.
- As a result, OSS-1 can operate stably for weeks without human intervention.