Project ORBICLEAR

A Business Plan for Autonomous Space Debris Removal in Low Earth Orbit (LEO)

ORBICLEAR offers a scalable, eco-engineered solution designed to restore orbital safety and prevent the catastrophic cascade known as the Kessler Syndrome. This gives details our proprietary technology, financial model, and strategic roadmap for making space operations sustainable.

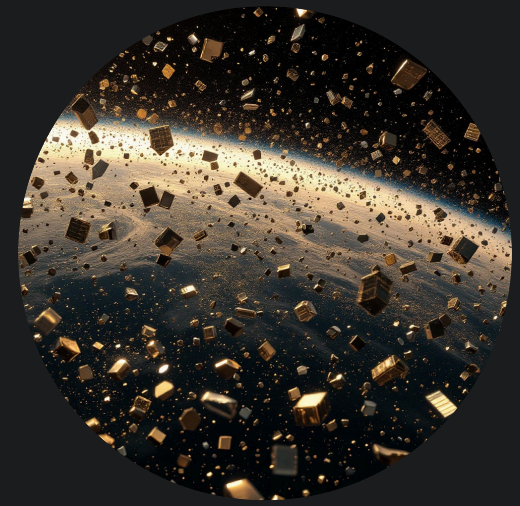
The Critical Problem: Overcrowding and Orbital Risk

High Density Debris

Low Earth Orbit (LEO) is critically congested, hosting over 36,000 tracked objects larger than 10 cm, alongside thousands of defunct satellites. This volume of debris exponentially increases the risk of collision.

Threat of Kessler Syndrome

The density of orbital debris threatens to trigger the Kessler Syndrome—a catastrophic chain reaction of collisions that would render safe orbital lanes unusable for generations, paralyzing global space commerce, communication, and research efforts.



Economic and Security Threat

The uncontrolled proliferation of space junk jeopardizes trillions in future space commerce. Protecting critical orbital infrastructure is paramount to global connectivity and national security interests.

ORBICLEAR Solution: Autonomous Capture and Deorbit

ORBICLEAR is deploying a compact, highly autonomous satellite system engineered specifically for efficient debris mitigation. Our proprietary technology integrates advanced AI with robust mechanical systems to ensure reliable capture and deorbiting.

AI-Based Object Recognition

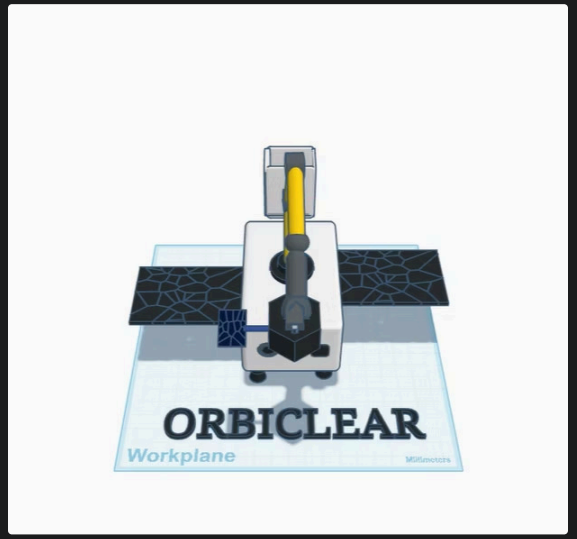
Utilizes sophisticated algorithms for real-time detection, tracking, and characterization of non-cooperative targets, ensuring precision capture maneuvers.

Modular Capture System

Features a robotic arm equipped with adaptive magnetic and mechanical grippers, capable of securing diverse debris shapes and sizes, from rocket bodies to defunct satellites.

High Throughput Mission Profile

Each ORBICLEAR unit is designed for maximum efficiency, capable of autonomously detecting, capturing, and safely deorbiting between 3 to 5 large debris objects per dedicated mission.



Our fully visualized 3D prototype, created in Tinkercad, demonstrates the compact, modular engineering and real-world feasibility of the ORBICLEAR satellite design.

Technical Workflow: Precision Debris Removal Sequence

The ORBICLEAR mission follows a five-step, highly automated protocol to ensure reliable and safe removal of hazardous orbital assets.

01

Step 1: Detection and Tracking

Onboard sensor array (LIDAR, radar, optical cameras) precisely detects and characterizes the target debris, calculating its trajectory and rotational state.

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Step 2: Orbital Matching and Approach

High-precision mini-ion or cold gas thrusters perform controlled maneuvers to achieve exact orbital synchronization with the target debris.

03

Step 3: Non-Cooperative Capture

The titanium and carbon fiber robotic arm deploys, utilizing adaptive magnetic and mechanical claws to securely grasp the non-cooperative debris object.

04

Step 4: Controlled Deorbit and Atmospheric Reentry

Once the defunct satellite is securely attached, ORBICLEAR initiates a controlled deorbit procedure. Using its propulsion and navigation system, it guides the collected debris into Earth's atmosphere over designated ocean zones. The debris then burns up upon reentry, ensuring safe and environmentally responsible disposal without causing surface impact.

05

Step 5: Mission Renewal and Return to Orbit

After completing the deorbit operation, ORBICLEAR uses its onboard thrusters to return to its service orbit. It recharges using solar energy and recalibrates its systems to prepare for the next cleanup mission, maintaining a continuous and sustainable debris removal cycle in Low Earth Orbit.

Core System Architecture and Materials

ORBICLEAR's engineering emphasizes lightweight durability and radiation-hardened components to ensure longevity and performance in the harsh LEO environment.

Structure and Frame

Lightweight aluminum alloy frame reinforced with carbon fiber composites for maximum strength-to-weight ratio.

Robotic Arm

Titanium joints and carbon fiber limbs provide precise, robust movement necessary for securing tumbling, non-cooperative debris.

Power and Energy

High-efficiency solar panels coupled with resilient lithium-ion battery banks ensure continuous power for propulsion and computing.

Propulsion System

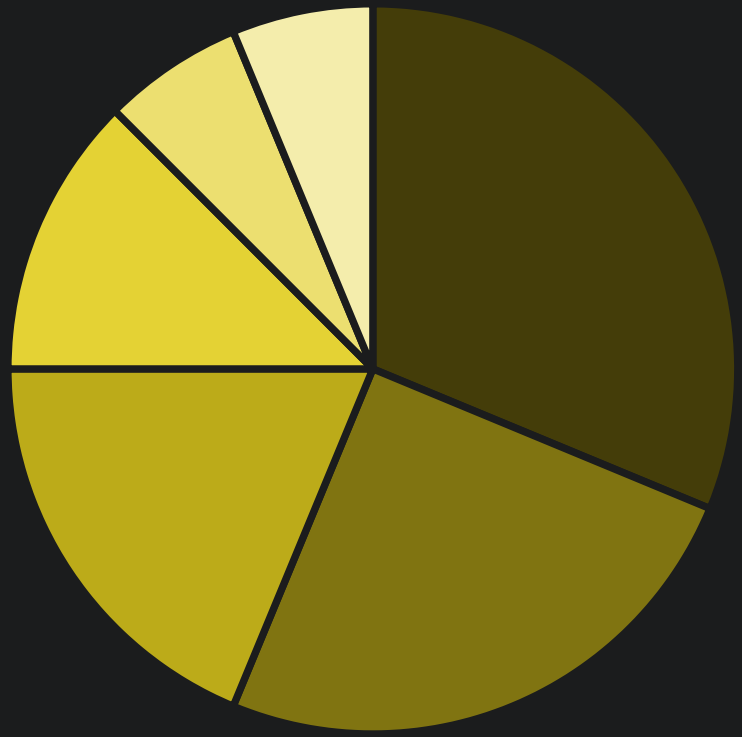
Utilizes efficient mini ion thrusters for orbital transfers and cold gas thrusters for high-precision rendezvous and capture maneuvers.

Onboard Intelligence

A specialized radiation-hardened AI processor chip runs our object recognition and autonomous navigation software.

Prototype Mission Cost Breakdown

The total cost for the initial ORBICLEAR prototype mission is estimated at ~$800K. Scaling production is projected to reduce the cost per unit significantly, enhancing market competitiveness.



- The largest single expense is the rideshare launch opportunity, accounting for $250K.
- Future Unit Cost: With volume manufacturing and optimization of supply chains, we anticipate the cost per unit will drop to approximately $400K, doubling our potential profit margins on contracts.

Revenue Model: Space Debris Removal as a Service (SDaaS)

Operator Contracts

Primary revenue generated from satellite operators for the removal of derelict satellites or large debris threatening their constellations. Fees range from $100K to $300K per object.

Government Partnerships

Securing contracts with major space agencies (NASA, ESA, ISRO) for national orbital cleanup programs and research initiatives.

Insurance Collaborations

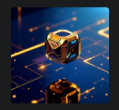
Developing agreements with space insurance providers (e.g., AXA, Marsh) for premium discounts in exchange for ORBICLEAR use and a revenue share on successful missions.

Data Licensing

Licensing our proprietary, high-resolution orbital tracking data gathered by our sensor arrays to commercial and governmental tracking services.

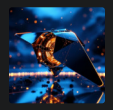
Target Market Landscape and Stakeholders

Our market strategy focuses on immediate commercial operators suffering from congestion risk and large government entities with regulatory mandates for clean space operations.



Satellite Operators

Immediate commercial clients including large constellation providers like SpaceX (Starlink), OneWeb, and Amazon (Project Kuiper), who prioritize protecting their assets.

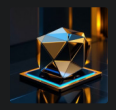


Global Space Agencies

Entities like NASA, ESA, and ISRO are mandated to reduce orbital debris from their historical missions and require advanced clean-up technologies.

Defense and Communication

Defense organizations, such as the US Space Force (USSF) and Indian Defence Satellite Systems, require clean and secure orbital paths for strategic assets.



Space Insurance Industry

Key financial partners including AXA, Marsh, and Swiss Re, who are motivated to reduce the catastrophic risks associated with debris collisions.

Strategic Roadmap: From Prototype to Orbital Network

We project a five-phase approach, accelerating from initial concept validation to achieving a fully operational, revenue-generating orbital cleanup network within five years.

Phase 1: Concept Validation (Current)

Completion of Tinkercad 3D prototype, detailed engineering visualization, and comprehensive simulation modeling for feasibility study.

Phase 2: Physical Prototype

Manufacturing of a full-scale, non-flight physical model for ground-based mechanical and sensor integration testing.

Phase 3: Sub-orbital Test Flight

Securing a low-cost rideshare launch for a sub-orbital or short-duration orbital test to validate propulsion, AI autonomy, and capture mechanism in vacuum conditions.

Phase 4: Full-Scale Deployment

Launch of the first operational ORBICLEAR unit to execute paid SDaaS contracts with commercial and governmental clients.

Phase 5: Orbital Cleanup Network

Establishing a dedicated constellation of ORBICLEAR units to provide continuous, regional debris mitigation services in the most congested orbital zones.

Competitive Advantage and Vision

Key Differentiators

Autonomous AI Control

Minimizes operational overhead and maximizes mission efficiency.

Modular Capture System

Adaptable grippers handle diverse and complex debris types.

Dual Removal Capability

Flexibility using both passive drag sails and active tug propulsion.

Scalable and Low-Cost

Designed for volume production, rapidly decreasing per-unit cost.

Eco-Engineered Materials

Commitment to sustainable practices and materials in space.

> Vision: To make space sustainable — one orbit at a time.

Summary: Restoring Orbital Safety

Project ORBICLEAR provides a technically feasible and economically compelling solution to the escalating space debris crisis. Our completed 3D prototype demonstrates mission clarity, and our SDaaS model secures diverse revenue streams. We are ready to transition from simulation to reality, paving the way for a safer, cleaner orbital environment.

AKATSUKI PROTOCOL

ORBITAL DEBRIS INTELLIGENCE UNIT

Akatsuki Protocol Team

Our team is dedicated to the successful development and deployment of the ORBICLEAR project, bringing together diverse expertise to tackle the challenges of space debris mitigation and ensure a sustainable orbital environment.

Team Members

Varsha S

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Sameera Taj K

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