Protocatcher Satellite Technical Description

The overall goal of the mission, is to demonstrate optical power transmission capabilities from the Protostar spacecraft (licensed separately) to the Protocatcher spacecraft (the object of this license application), and collect performance data to inform future system development.

Protocatcher will be launched no earlier than October 2026 on the Transporter-18 rideshare mission, carried aboard the larger Protostar spacecraft. The Protostar spacecraft will be injected into an orbit of approximately 510 km in a Sun-Synchronous Orbit ("SSO") with an inclination of 97.4 degrees. Protocatcher will communicate through the Iridium constellation while on board Protostar, as well as after it is deployed from Protostar, about 3 months after launch. When it is deployed, experiments to support the mission will begin.

Upon completion of the experimental phase, Protocatcher will conclude mission operations and be passivated consistent with orbital debris mitigation requirements.

Atmospheric friction will slow the satellite and reduce the altitude of the orbit, until de-orbiting occurs about 1 year after it deploys into orbit. See the Orbital Debris Assessment Report for details.

The spacecraft is a 1U cubesat unit. It includes deployable panels carrying arrays for solar energy capture and for laser sensing. The panel extents are about 0.76 meters in each of two dimensions. The total mass is about 1.6 kg.

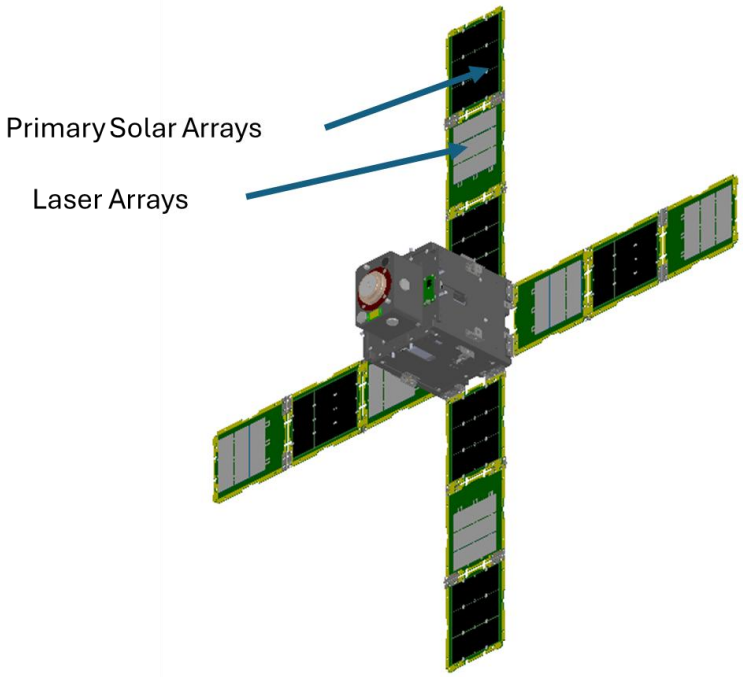

Figure 1 Protcatcher Overview

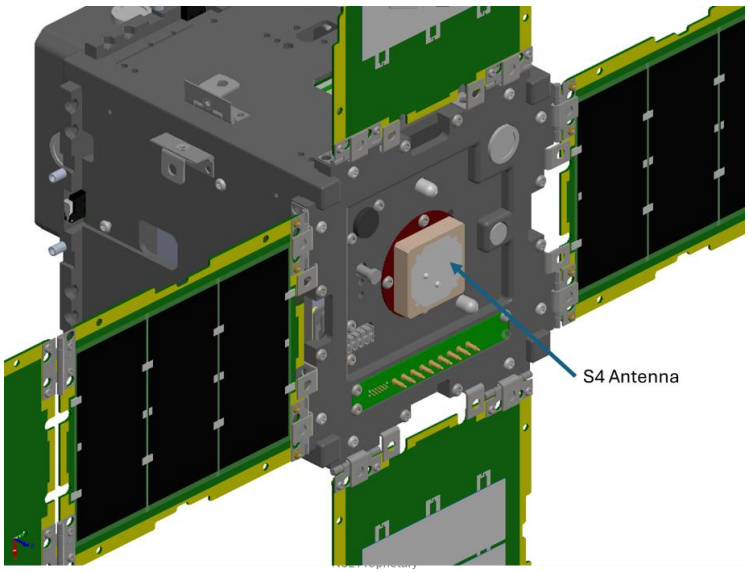

Figure 2 Protcatcher Radio Antenna Location

The satellite contains the following systems:

Guidance, Navigation and Control (GNC) Subsystem: The GNC is a three axis ADACS built into the structure to align with the earth's magnetic field line. The equipment complement of three axis magnetometer and two sun sensors are critical components in this subsystem. Additional hardware being flown but not required for flight control include a GPS receiver for ground tracking.

Command and Data Handling (CDH) Subsystem: The two critical printed circuit boards in the CDH subsystem are the Level Zero (L0) and the Flight Computer (FC) boards. The L0 board is the most critical spacecraft control hardware, and operates regardless of flight computer operating state. The L0 includes all communications interfaces to the transceiver's and the FC and performs basic spacecraft state of health maintenance.

Communications Subsystem (COMMS):

The COMMS includes one radio Iridium 9603 and a NLS1600 patch antenna. In conformance with § 5.107 Transmitter control requirements, all transmission from the satellite can be terminated by NSL through the Iridium means.

Electrical Power Subsystem (EPS): The EPS is a direct energy transfer system using a solar array producing approximately 17W of orbit average power to charge the 16.5 A-hr battery system. The solar arrays utilize standard Micro Link photovoltaic cells; the batteries are COTS Panasonic 18650B cells. The L0 board sends signals to the Power Switch Boards to control charging and load switching.

Thermal Control Subsystem (TCS): The TCS controls hardware temperature through cold biasing of the thermal design, utilizing heaters to stabilize temperatures. Sensors are wired to the L0 board, which hosts thermal control algorithms to control the heaters.

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Structure Subsystem: The structure is fabricated of 6061 Aluminum.

Propulsion Subsystem: No propulsion subsystem is included.

Experiment: The experimental hardware aboard Protocatcher includes two LEDs located on each of the front and rear faces of the spacecraft (for a total of four LEDs) and a 7.16 mm diameter corner cube retroreflector located on the front face to aid the Protostar spacecraft in tracking Protocatcher. InGaS quadrant photodiodes located on each face of Protocatcher sense laser illumination from Protostar to confirm successful pointing of the laser, and an experimental solar array consists of standard Micro Link photovoltaic cells which receive beamed power from Protostar.