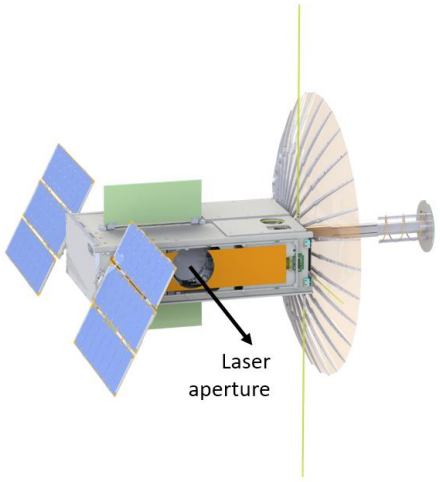
Radix Satellite Technical Description

The overall goal of the Radix mission, is to test a laser communications downlink.

The satellite will be launched as a secondary payload aboard Orbital Sciences CRS Cygnus OA-9, from Kennedy Space Center, May 1 2018, and taken to the International Space Station. It will be deployed from the ISS in a 400 km circular orbit, on an inclination from the equator of 51.6 degrees, no earlier than June 1, 2018. Transmission will begin 45 minutes after deployment, and cease 6 months after that. Atmospheric friction will slow the satellite and reduce the altitude of the orbit, until de-orbiting occurs about 1.27 years after launch. See the Orbital Debris Assessment Report for details.

The spacecraft is a single unit with the dimensions of 6 stacked 10 cm X 10 cm X 10 cm CubeSat modules (giving an overall dimension of 10 cm X 20 cm X 30 cm.) The total mass is about 9.8 Kg.

Figure 1 Radix Overview



The satellite contains the following systems:

Guidance, Navigation and Control (GNC) Subsystem: Attitude determination and control system includes three reaction wheels, a 3-axis magnetometer, and two IR Earth Horizon Sensors. Nominally, the spacecraft will fly with its solar panels in a sun-point configuration.

Command and Data Handling (CDH) Subsystem: A Flight Computer (FC), consisting of a low-power microcontroller, sensor suite, and several communication interfaces will command and control all components of the satellite. The FC receives instructions from the ground station through a dedicated TT&C radio, and issues commands to all other subsystems for operation of the cubesat. Additionally, the FC collects telemetry from all subsystems and forwards that information to the ground station through the TT&C radio.

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Electrical Power Subsystem (EPS): A COTS battery assembly of 8 lithium ion cells will provide 20 watts on average with a peak of 65 watts. Battery assembly will be charged at time of integration and two deployable solar arrays will recharge the assembly on-orbit. Power management and distribution electronics onboard the spacecraft control the charge of the battery and flow of power to other spacecraft elements.

Thermal Control Subsystem (TCS): Analysis and test has shown that the Radix satellite will require passive cooling and that all electrical subsystems will generate sufficient heat as to mitigate the need for active heating. Passive cooling consists of thermal strapping of hot components, and thermal shimming of all electrical hardware assemblies to the chassis walls. The spacecraft chassis is designed to act as a thermal radiator, with application of silver-coated Teflon tape on exterior surfaces for high emissivity and low absorptivity thermal control. Temperature sensors are integrated into all major subsystems, allowing for thermal monitoring from the ground to inform operational thermal control, such as duty cycling and low-power cooling cycles. The batteries contain a closed-loop thermal control system with integrated resistor heaters that act independently of flight software.

Structure Subsystem: The structure is fabricated of aluminum.

Propulsion Subsystem: No propulsion subsystem is included.

Payload Subsystem: The primary payload onboard is the optical communications demonstration payload for optical data downlink.