Kaladin Satellite Technical Description

The overall goal of Array Labs' Kaladin mission is to mature technology and operational concepts for use in future low earth orbit missions, including Array Labs' future commercial earth observation missions. Array Labs has developed a novel surface coating which is expected to increase the effect of attitude on the amount of drag a spacecraft in LEO experiences, enhancing the ability for LEO spacecraft to intentionally increase or decrease drag forces during a mission. Kaladin will have this coating applied to its external surfaces.

The satellite will be launched as a secondary payload aboard a Falcon 9, Transporter 11 from Vandenberg SFB, no earlier than July 1, 2024. It will be inserted into a circular sun-synchronous orbit at 510 km, on an inclination from the equator of 102 degrees. Radio operation will begin 2 minutes after separation from the launch vehicle. Atmospheric friction will slow the satellite and reduce the altitude of the orbit, until de-orbiting occurs less than 1 year after launch. See the Orbital Debris Assessment Report for details.

The spacecraft is a single 3U CubeSat which includes deployable solar arrays and a deployable UHF antenna. With all systems fully deployed, the spacecraft will have overall dimensions of 34.5 cm X 43.3 cm X 39.6 cm. The total mass is about 3.1 Kg.

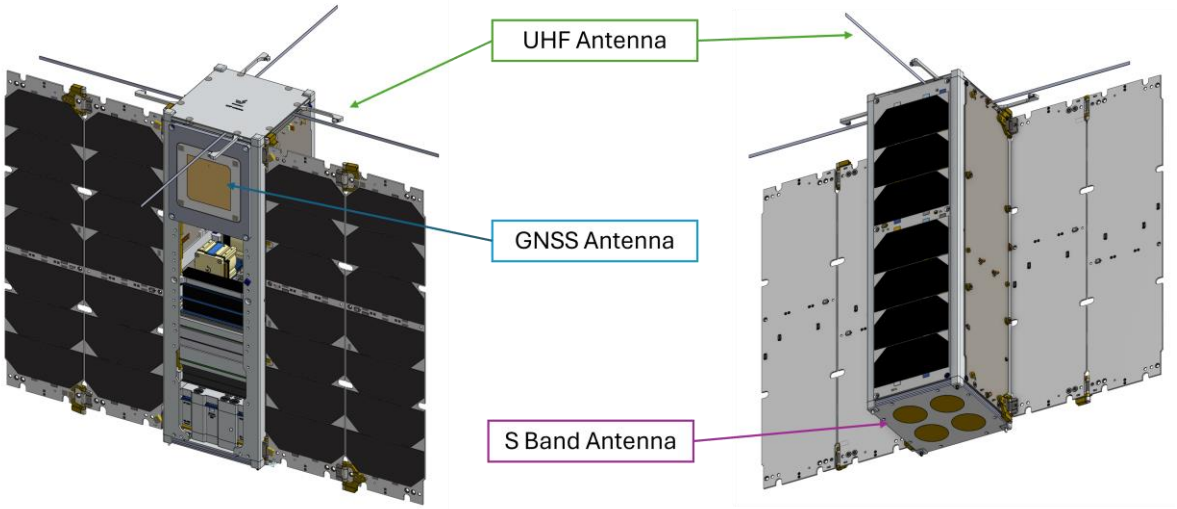

Figure 1 Kaladin Overview

The satellite contains the following systems:

Structural Subsystem: The spacecraft's structure provides support and attachment points for each module. It is manufactured from an Aluminum 6082 alloy and is compliant with the CubeSat standard. The structural subsystem also includes two deployable solar arrays and four deployable UHF antenna components. The deployables are all COTS components which have flight heritage on previous missions.

Electrical Power System (EPS): The EPS module includes two deployable solar arrays, one static solar panel, a battery module, and a power management board. The deployable solar arrays are actuated by a burn wire mechanism which does not produce any debris. It will deploy no earlier than 120 seconds after Kaladin separates from the launch vehicle. The battery module includes 4

Sony US 18650VTC6 cells with a total capacity of 42 Wh. The power management board regulates battery charging from the solar arrays and provides power from the battery to the rest of the spacecraft. The EPS is connected to deployment switches which physically prevent current from being drawn when Kaladin is stowed within the deployer on the launch vehicle.

Communications: The communications subsystem includes a UHF transceiver, UHF antenna, S Band transceiver, and S band antenna.

The UHF transceiver is the 2nd Generation UHF transceiver model manufactured by Endurosat. The UHF transceiver will activate a beacon feature enabled upon separation from the launch vehicle, at which time an on-board timer will begin. The beacon will be automatically disabled once this timer reaches 7 days. In conformance with § 5.107 Transmitter control requirements, the UHF transmitter can be disabled via telecommand at any time, including by sending a command to disable the automatic beacon.

The S Band transceiver is the S Band Transceiver TMTC model manufactured by Endurosat. The S Band transceiver will not transmit until a telecommand is received from the ground instructing it to transmit. In conformance with § 5.107 Transmitter control requirements, emissions from the S band transceiver can also be terminated by transmitting a telecommand.

Command and Data Handling Subsystem (C&DH): Commands received by the UHF and S band transceivers are processed by the radio modules. The on-board computer module (OBC) will also be collecting engineering telemetry data from all modules and autonomously keeping the spacecraft in a safe state. The OBC will store telemetry data between passes and then relay historical telemetry data to the ground during passes over ground station.

Attitude Determination and Control Subsystem (ADCS): The ADCS subsystem uses a COTS ADCS module from CubeSpace. The module will be capable of determining the spacecraft's attitude in inertial space. It will also be able to control Kaladin's attitude across 3 axes. During the mission, the ADCS will be commanded to hold specific attitude relative to the spacecraft's velocity direction to investigate the effect of incidence angle on aerodynamic interactions with the upper atmosphere.