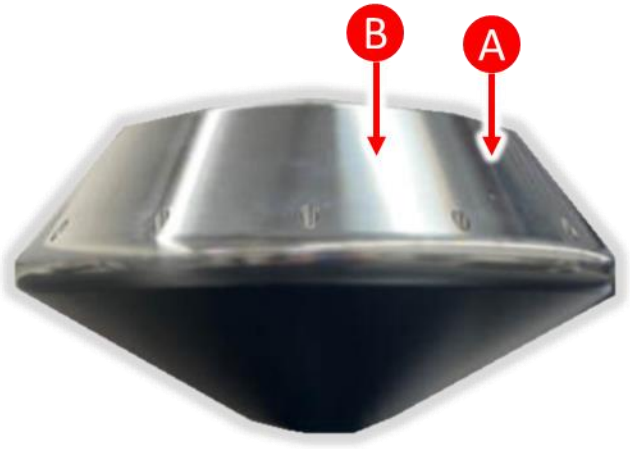
RAY Technical Description

The overall goal of the RAY mission is to test and validate many of the technologies that Inversion is developing for its re-entry vehicles. RAY consists of a service module and a capsule that, at the end of the mission, will detach from the service module, deorbit, and return to Earth.

The satellite will be launched as a rideshare payload aboard a SpaceX Falcon 9, from Cape Canaveral, FL, no earlier than January 1, 2024. It will be inserted into an SSO orbit at 500 km apogee and 500 km perigee, on an inclination from the equator of 97.4 degrees. Transmission will begin upon deploy into orbit and cease upon reentry. Reentry will be initiated between 2 weeks and 5 months after deployment into orbit. A single propellant system burn will put the spacecraft into a controlled reentry trajectory. Immediately following the burn, the capsule detaches from the service module. The service module demises upon reentry. The capsule survives reentry and will be recovered from the Pacific Ocean off the coast of California.

The spacecraft has dimensions of 93.99 cm x 71.12 cm x 73.11 cm. The capsule mass is about 19.82 kg, and the service module mass is about 43.59 kg, of which about 11.33 kg is propellant.

Figure 1: RAY Capsule Antenna Placement
Antennas mounted inside the R/F transparent shell of the capsule.
A: S Band Rx Antenna, B: S Band Tx Antenna



The satellite contains the following systems:

Structure Subsystem: The capsule is constructed primarily of forebody and aftbody aluminum structure halves. The service module consists of two aluminum isogrid panels mounting the capsule and propellant tanks and a T-shaped aluminum honeycomb panel hosting the solar panels.

Propulsion Subsystem: RAY contains one bipropellant rocket engine powered by non-toxic propellants located on the Service Module. The propellants are supplied from two spherical aluminum fuel tanks and two spherical aluminum oxidizer tanks, which are pressurized by four

spherical helium pressurant tanks. The bipropellant rocket engine is used to de-orbit RAY following the on-orbit portion of its mission. See the ODAR for more information.

Thermal Protection System (TPS) Subsystem: RAY's capsule is covered in TPS heatshield materials on both its forebody and aftbody designed to allow RAY to survive re-entry. RAY's service module does not contain any TPS materials, as it is not designed to survive re-entry.

Recovery Subsystem: The RAY capsule contains a parachute that will deploy after the capsule re-enters Earth's atmosphere. Deployed with the parachute is a buoy assembly that contains an Iridium radio, GPS, battery, and antenna. Once the parachute is deployed a microswitch is triggered, allowing power to flow from the battery to the Iridium unit, and it will begin transmitting GPS coordinates of the capsule to Inversion via the Iridium constellation. Transmission may be terminated by command from Inversion via the Iridium constellation.

Guidance, Navigation and Control (GNC) Subsystem: The GNC system uses reaction wheels and cold-gas thrusters to perform its de-spin and pointing maneuvers throughout its mission. The navigational sensors onboard include a magnetometer, Inertial Measurement Unit (IMU), GPS receiver with patch antennas, sun sensors, and a star tracker. There are three GPS sensors total. One is located on the service module, one inside the capsule, and one in the recovery subsystem.

Communication (COMM) Subsystem: The spacecraft communicates via an S-band Transceiver, to relay data back to the ground and allow for Inversion to upload commands to RAY while on-orbit. The transceiver uses multiple separate patch antennas, to transmit and receive. See antenna location diagrams above. . In conformance with § 5.107 Transmitter control requirements, all transmission from the satellite can be terminated by uplink command via S band.

The KSAT Global Ground Station network provides ground station support.

As further described in the recovery system, the capsule will utilize an Iridium radio. This radio activates upon deploy to provide Inversion with GPS coordinates, after splashdown in the ocean. The Iridium radio transmits through an antenna to the Iridium constellation. In conformance with § 5.107 Transmitter control requirements, all transmission from the satellite can be terminated by command sent via the Iridium constellation.

Avionics Subsystem: The Avionics system contains an onboard Flight Computer (FC) and Payload Controller (PC) computation units that are responsible for interfacing with the telemetry and command of the spacecraft and interfacing between the GNC controller and its sensors and actuators.

Electrical Power Subsystem (EPS): The EPS is a direct energy transfer system using a solar array to charge the battery system. The EPS is self-contained and controls its own charging and load switching.