AeroCube-9 FCC Mission Statement

This flight demonstration consists of a single 3U CubeSatellite ejected from a CubeSat deployer. The AeroCube-9 mission will demonstrate in space a new and highly sensitive 2x8 HgCdTe electron Avalanche Photo Diode (e-APD) array that has high quantum efficiency and single photon level response at IR wavelengths from 1 to 4 microns.

The AeroCube-9 is a Nano class satellite, weighs approximately 4.2 kg and is 10x10x30 cm in dimension. It will be launched on an Atlas V vehicle, slated for September 2016. The orbit is 550 km x 580 km with 98 degree inclination. DAS 2.0.2 predicts a lifetime of 13 years (area-to-mass ratio of 0.011 m^2/kg) and a spacecraft probability of collision with space objects larger than 10 cm in diameter during the orbital lifetime of the spacecraft of 0.000001, well below the 0.001 threshold required (see "**AC9 DAS2.02 Output**" Exhibit). DAS 2.0.2 analysis predicts the risk of human casualty for the expected year of uncontrolled reentry and the orbital inclination of less than 1/10000, which also meets the requirement.

The AeroCube-9 satellite has two radios. The AdvRadio is built by The Aerospace Corporation around a Texas Instruments CC1101 transceiver chip. It operates at a fixed 914.7 MHz frequency (see "**AdvRadio bandwidth**" Exhibit) and outputs 1.3 W. The second radio is also built by The Aerospace Corporation and is called the AeroCube Software Defined Radio (SDRadio). It also operates at a fixed 914.7 MHz frequency (see "**SDRadio bandwidth**" Exhibit) and outputs 1.3 W.

When the AeroCube-9 satellite is ejected, it will power on in its lowest power mode. The radio is always in receive mode only. As the satellite flies over a ground station, the station continuously beacons towards the satellite. When the satellite radio hears the beacon, along with the proper serial number code, it responds and a link will be established. At that point, the ground station asks the satellite for information, typically payload data or onboard telemetry. The satellite responds by downlinking the requested information. When the link is lost due to the satellite passing out of view and the satellite was transmitting, the satellite will try up to 3 seconds to complete the last packet transmitted. The satellite then reverts to a passive receive mode and waits for the next beacon from a ground station.

We would like to use two types of ground stations to communicate with the AeroCube-9 satellites. The first is a 5-meter diameter dish antenna at The Aerospace Corporation in El Segundo, CA. At 914.7 MHz, it has 30 dB gain, 5 deg beamwidth and uses a complementary radio with a 9W amplifier. The second ground station is a portable 2-meter diameter dish. This has 22 dB gain, a 15 deg beamwidth and uses a complementary radio with a 9W amplifier. This portable station would be located in an RF quiet area that improves the ground footprint of the ground station network. A typical satellite pass is 8 minutes long, twice per day - so the system spends a lot of time not in use. The antenna parameters and ground station locations are shown in the exhibit "**FAA sketch and antenna figures**."