AeroCube-12 FCC Mission Statement

The AeroCube-12 program consists of two nanosatellites that will demonstrate the technological capability of new star-tracker imaging, a variety of nanotechnology payloads, advanced solar cells, and an electric propulsion system on one of the two satellites (AC12-B).

The AeroCube-12 satellites have been developed by The Aerospace Corporation (Aerospace) for our purpose of conducting experiments in space per our charter as a private, non-profit corporation operating a Federally Funded Research and Development Center in support of the US Air Force (contract number FA8802-14-C-0001). All payload components were developed by Aerospace for our purpose of conducting in-space technology demonstration experiments.

The AeroCube-12 satellites are Nano class satellites, each of which weighs approximately 4 kg and are 4x4x12 inches in dimension. They will be launched on an Antares 230/Cygnus Commercial Resupply Service mission to the International Space Station (ISS) with an estimated launch date of May 2018. The orbit will be circular at either 450 km or 500 km with an inclination of 51.6°. DAS 2.0.2 predicts an orbital lifetime of less than 3 years (area-to-mass ratio of ~0.03 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 less than 0.000001, well below the 0.001 threshold required (see "**AC12 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.

Each of the two AeroCube-12 satellites has star trackers and other attitude control verification imagers. The cameras were designed by The Aerospace Corporation. The primary purpose of the cameras are for attitude control determination and verification. The waiver we have received from NOAA specifies that we are not required obtain a NOAA license, nor even to notify NOAA regarding the use of cameras on satellites flown in our capacity as a private, non-profit FFRDC, which applies in this case.

Each of the two AeroCube-12 satellites has two radios for redundancy. 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. Each radio attaches to an omnidirectional patch antenna on the AeroCube-12 body with a 0 dBi gain. Only one radio is on at a time.

When the AeroCube-12 satellites are ejected, they will power on. However the radio will be in receive mode only. As the satellite flies over a ground station, the station will continuously beacon towards the satellite. When the satellite radio hears the beacon, along with the proper serial number code, it will respond and a link will be established. At that point, the ground station will ask the satellite for information, typically payload data or onboard telemetry. The satellite will respond 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 will then revert to a passive receive mode and wait for the next beacon from a ground station.

We would like to use two types of ground stations to communicate with the AeroCube-12 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**."

This license is being requested under 47 CFR Part 5.3 (c) for "experiments under contractual agreement with the United States Government." The experimental radio service as requested is defined under 47 CFR Part 5.5 as "for purposes of providing essential communications for research projects that could not be conducted without the benefit of such communications." Aerospace will be the sole operator of the satellites and all experiments on board.