AeroCube-5c and AeroCube-7 FCC Mission Statement

The AeroCube-7, also known as the Optical Communications and Sensor Demonstration (AeroCube-OCSD) mission will demonstrate the: high-speed optical transmission of data: 20-Mbytes over 60-seconds with a bit error rate (BER) of 10-4 or better to a 30-cm diameter telescope from low Earth orbit (LEO). AeroCube-5c will study tracking. It is a repeat to a prior mission (call sign WG2XVZ). This flight demonstration will consist of one AeroCube-7 and one AeroCube-5c that are ejected from a CubeSat deployer. The two vehicles will not be doing any proximity operations.

Both AeroCube-7 (2.2 kg) and AeroCube-5c (2 kg) are Nano class satellites about 4x4x6 inches in dimension. They will be launched on an Atlas V vehicle, planned for August 2015. The orbit is 500 km x 780 km with 64 degree inclination. To assess ground casualties and to double check the orbit lifetime and space collision probabilities calculated by The Aerospace Corporation experts, the NASA DAS2.02 program was utilized. DAS2.02 analysis calculates that the combined debris from both satellites meets the 25 year lifetime, 100 year total object lifetime and the casualty limit (see "**AC7+AC5c DAS2.02 Output v1**" Exhibit).

The AeroCube-7 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. The AeroCube-5c uses one ADVradio with the same power and characteristics as stated above for AeroCube-7.

When the AeroCube-7 and AeroCube-5c satellites are ejected, they will power on. However the radios will alternatively turn on 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-7 satellite. 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**."