DAILI FCC Mission Statement

The Daytime Atmospheric and Ionospheric Limb Imager (DAILI) program consists of one nanosatellite that will implement a newly developed technique to measure the absolute O_2 density profiles between approximately 140 and 180 km during daytime at mid and low latitudes.

The DAILI satellite has been developed by The Aerospace Corporation (Aerospace) in support of 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 FA8802-19-C-0001). This mission was funded by a NASA Heliophysics Technology and Instrument Development for Science grant and is for the purpose of conducting space science.

The DAILI satellite a 6U form factor weighing approximately 5.7 kg and is 11 x 11 x 76 centimeters in dimension. It will be launched on an SPx24 Commercial Resupply Service mission to the International Space Station (ISS) with an estimated launch date of December 2021. The satellite will be deployed from the JEM airlock on the ISS at 420 km circular altitude at an inclination of 51.6° three months after arriving.

The DAILI satellite has three star trackers and one science imager. The sole purpose of the star cameras is for attitude control determination and verification. The science imager is 180 x 180 pixels and is aimed at the horizon of the earth's atmosphere. The waiver we have received from NOAA specifies that we are not required to obtain a NOAA license nor even to notify NOAA regarding the use of cameras on satellite flown in our capacity as a private, non-profit FFRDC, which applies in this case.

At the higher end of the orbit altitude range (420 km), DAS 3.1.0 predicts an orbital lifetime of less than 1 year (area-to-mass ratio of ~0.010 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, which is below the 0.001 threshold required (see "**DAILI DAS310 Output**" exhibit). DAS 3.1.0 analysis predicts that no objects will reach the ground after reentry. Therefore, the risk of human casualty is less than 1:10,000 requirement.

The DAILI satellite 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-10 body with a 1.8 dBi gain. Only one radio is on at a time.

When the DAILI satellite is ejected, it 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 DAILI 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 10W amplifier. The second ground station is a portable 2-meter diameter dish. This has 23 dB gain, a 12 deg beamwidth and uses a complementary radio with a 10W amplifier. The portable stations are 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 satellite and all experiments on board.