Phoenix CubeSat Overview

I. Operating Administration or Agency

Arizona State University will be the operating administration for the Phoenix CubeSat. The satellite will be controlled only by students and faculty at the university who are properly trained on the mission operations procedures.

II. Project Overview

Phoenix is a 3U CubeSat developed by Arizona State University which aims to study the effects of Urban Heat Islands on US cities through daily infrared remote sensing. In addition, Phoenix is an educational mission to train the next generation of engineers and involve the community in spacecraft development and urban studies. The satellite is scheduled to launch on 10/09/2019 on an ISS resupply mission. Phoenix be deployed into a Low-Earth Orbit of 400 km altitude and a 51.6° inclination. It will remain operational for two years before undergoing atmospheric reentry. The satellite will be operated by undergraduate students at ASU for the duration of its mission lifetime, with oversight provided by the university. All control of the satellite will remain within the United States.

III. Communications Architecture

The satellite will utilize two frequencies for receiving commands and downlinking telemetry. UHF amateur frequencies (435-438 MHz) will be used for uplinking commands and downlinking regular housekeeping telemetry. A beacon parser application will be published to allow amateurs to verify aliveness and assess basic health. Image files will be downlinked over amateur S-Band frequencies (2400-2450 MHz). Datasheets for both the UHF and S-Band modules are included as attachments with this application.

Phoenix will use the Ground Station located at Arizona State University for all communications with the satellite. Uplink commands will occur as often as necessary, with S-Band downlinks occurring three times per week to collect all health data. All data will be public from capture onward, without any cost or restriction, and some functionality (ping and stored image retrieval) will be operable by amateurs. These commands will be published shortly after launch and commissioning.

Phoenix has been accepted by the IARU for the following frequencies. The official letter of coordination is included as an attachment.

- **UHF:**
  - IARU Coordination Frequency: 437.35 MHz
  - ITU Emission: 20K0F1D

- **S-Band:**
  - IARU Coordination Frequency: 2402.5 MHz
  - ITU Emission: 1M35G1DDN

III. Command & Control

Control codes for pointing, image capture, mode switch, and other mission critical operations will be ciphered with a rotating key one-time pad using a simple substitution scheme. The cipher dictionary will be kept in a private repository on GitHub protected by gpg public/private key pairs. Aside from this, Phoenix will have no other encryption.