

Supplemental Information
Experimental License Filing #0131EXPL2015
University of Colorado Boulder
MinXSS cubesat

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Overview

This license request is to support the MinXSS CubeSat (<http://lasp.colorado.edu/home/minxss/>) mission that has been funded by the NASA Heliophysics program. MinXSS has been selected for launch as part of the NASA Educational Launch of Nanosatellites program (http://www.nasa.gov/mission_pages/smallsats/elana/) and is currently manifested to launch on the SpaceX CRS-7 mission scheduled for June 22nd. The CubeSat will be delivered to the International Space Station with a scheduled deployment from the ISS via the Nanoracks (<http://nanoracks.com/>) system in the July August time frame. The orbital lifetime is expected to range from 4-6 months depending on the atmospheric density and the altitude of the International Space Station at the time of deployment. We are requesting a 1 year license as the time of launch may change and the actual deployment time from the ISS is unknown. A group of CubeSats have spent near a year on the ISS waiting for deployment recently.

Exhibit #1

Include as an exhibit a narrative statement describing the government project, agency and contract number.

The Miniature X-Ray spectrometer cubesat is funded by the NASA Heliophysics program. The project title is "Miniature X-ray Solar Spectrometer (MinXSS) CubeSat Mission" and the award number is NNX14AN84G.

Details about the nature of the project can be found in Exhibit #2.

Exhibit #2

A description of the nature of the research project being conducted.

The primary objective of the Miniature X-ray Solar Spectrometer (MinXSS) CubeSat is to better understand the energy distribution of solar flare soft X-ray (SXR) emissions and its impact on Earth's ionosphere, thermosphere, and mesosphere (ITM). The peak solar energy in the SXR is expected to be emitted near 2 nm, yet we have limited spectral measurements near that wavelength to verify this expectation. Energy from SXR radiation is deposited mostly in the ionospheric E-region, from ~80 to ~150 km, but the precise altitude is strongly dependent on the

SXR spectrum because of the steep slope and structure of the photoionization cross sections of atmospheric gases in this wavelength range. Despite many decades of solar SXR observations, almost all have been broadband low-resolution measurements with insufficient spectral resolution to fully understand the varying contributions of emission lines amongst the underlying thermal and non-thermal continua. Consequently, these broadband measurements do not constrain where in Earth's atmosphere the solar SXR energy is deposited; this is the driving motivation for MinXSS to measure the solar SXR spectrum. Furthermore, the interpretation of broadband measurements requires the use of solar spectral models, even to obtain the correct total energy flux. Significant differences are seen between the broadband measurements, sometimes more than a factor of two, apparently due to the lack of precise knowledge of the distribution in the SXR spectrum. The importance of the MinXSS mission is (1) providing new spectral observations of the solar SXR near the maximum of solar cycle 24, (2) improving the understanding of how highly variable solar X-rays affect the ITM, and (3) advancing the knowledge of flare energetics in the SXR.

A secondary objective of MinXSS is to train students as the next generation Science, Technology, Engineering, and Mathematics (STEM) workforce. The students will learn – through formal university classes and with hands-on experience – about scientific instrumentation, satellite technology, and science data analysis and modeling techniques. The MinXSS project began as a graduate student project two years ago in the Space Hardware Design (CubeSat) course developed in the Aerospace Engineering Sciences (AES) department of the University of Colorado (CU).

Exhibit #3

A showing that the communications facilities requested are necessary for the research project.

Our request in this filing is to use the same ground station as was used for the Colorado Space Weather Experiment (CSSWE) CubeSat (licenses WG2XDS based on filings 0081-EX-PL-2012, 0225-EX-RR-2013 and 0223-EX-RR-2014). The new element of this filing is for the mobile space segment (MinXSS CubeSat). It should be noted that the space segment for the WG2XDS will end at end of the current license term in July 2015. If possible we would like to amend the MinXSS CubeSat to the current WG2XDS license but if this is not possible we are requesting a new license for the MinXSS space segment and our current ground station in Boulder.

Exhibit #4

A showing that existing communications facilities are inadequate.

Our current ground station in Boulder is sufficient to support our operations but to achieve the science goals, as outlined above, a new space segment (the MinXSS CubeSat) is required. Thus the communications facility on the CubeSat are required.