

Form 442 Question 6 Exhibit: Nature and Necessity of Research

Description

Our research is in support of sensor development with the National Aeronautics and Space Administration's Johnson Space Center (NASA JSC), the test bed for which will be a microsatellite developed, constructed, and operated by AggieSat Lab.

An experimental license has been granted to AggieSat Lab (File #: 137-EX-ML-2012, Call Sign: WG2XFJ) for the purpose of one-way High Data Rate transfers from our satellite to our ground station. The purpose of this submission is to seek frequency authorization to transmit telemetry from our ground station to the spacecraft, and from the spacecraft back to the ground on bands and equipment different than those authorized by the aforementioned license.

This satellite is designed to fly a prototype GPS receiver, developed by NASA JSC, and take navigation data to determine the usefulness of using such a receiver for navigating with orbital spacecraft. Results of this project and further development have a direct impact on NASA's planned navigational aids for the Space Station operations, the Multi-Purpose Crew Vehicle (MPCV), and other commercial spacecraft in development.

NASA approached Texas A&M University to find a student group to develop this payload. The goals of this project are to provide useful engineering data to NASA JSC concerning this GPS receiver and educate university students in the design and operation of spacecraft.

Necessity of Research and Inadequacy of Current Facilities

This project requires navigation data to be taken in the space environment to characterize the ability of GPS to perform at speeds and altitudes orders of magnitude greater than typical Earth based applications. This requirement facilitates the need for a satellite platform and a satellite platform requires facilities capable of proper distance communications for operation.

The choice to use the bands requested in form 442 in the 144 MHz and 440MHz bands was driven by the original desire to utilize amateur radio to control the spacecraft. As the development has progressed, it has been determined that the nature of our project does not meet with the spirit of the rules of amateur radio. As it is not practical at this point in the mission to change hardware, this submission requests allocation for several frequencies that are compatible with the selected hardware.

Our spacecraft for this mission is a 24x24x11 inch box, ~ 110 lbs in weight. The spacecraft communications system will consist of two Kenwood TH-D72A radios operating in the frequency ranges as applied for in form 442 if granted. Additional spacecraft communications hardware (not included in this application for allocation) are a Digi XTend radio operating on the 900 MHz band, and a custom RFIC unit, operating

under the experimental license grant mentioned in the second paragraph. The ground station hardware, included to utilize the requested fixed station frequencies, is an Icom 910h.

The 144 MHz band frequencies will be used for the spacecraft command uplink, and the 440 MHz frequencies will be used as the spacecraft identification beacon and an alternate/emergency downlink unit. The Digi XTend in the 900 MHz band operates on Frequency Hopping Spread Spectrum protocol, and will be used exclusively for spacecraft crosslink communication with our partner satellite from the University of Texas. The custom RFIC unit will be used solely as high data rate downlinking transmitter as specified by the license, and will transmit one way from the spacecraft to our College Station, Texas ground station.

In addition to our research for NASA, a lower priority scientific experiment will be flown onboard on behalf of the Air Force Research Lab. Because of the proprietary nature of this experiment, the scientific experiment data will be transmitted on frequencies under the existing license grant.

Our first course of action was to ask for usage of NASA's extensive array of existing communications links. We were denied permission to use these links as they are needed to support high priority national programs and are also directly linked to the safety of manned spaceflight operations.

Our lab currently has a ground station capable of spacecraft tracking and UHF/VHF communication. This submission of Form 442 seeks allocation to have transmissions originate from the ground station and be received by the spacecraft, and vice versa.