

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 and station-keeping data from the spacecraft back to the ground on bands and equipment different than those authorized by the aforementioned license. A separate license request will be submitted for our ground station equipment.

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 desire to utilize amateur radio hardware to control the spacecraft, due to the limited resources available to the lab.

Our spacecraft for this mission is a 24x24x11 inch box, ~ 110 lbs in weight. The first part of the spacecraft communications system will consist of two Kenwood TH-D72A radios, each operating on one of the frequency ranges applied for in form 442 if granted. The second piece of spacecraft communications hardware is a Digi XTend-PKG radio operating on the 915 MHz band. (A custom RFIC unit, operating under the experimental license grant mentioned in the second paragraph will also be used.)

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 915 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. Licensing for the University of Texas radio systems is to be handled by their program separately from ours. 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 upon ground command.

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. The license application for use of this station with the above described satellite operations will be submitted in an application to follow this one.