Attachment 1
Purpose of Experiment

Bigelow Aerospace, LLC ("Bigelow Aerospace" or "BA") requests experimental authority to operate Earth-to-space and space-to- Earth communications links at 14.05-14.12 GHz and 11.8-11.9 GHz in the Ku-band in conjunction with its ongoing experimental spacecraft program. This experimental program, already in progress using other spectrum, is testing the development, viability, and uses for expandable space platforms. Up to two spacecraft will operate in low-Earth orbit ("LEO") at an altitude of 450 kilometers, at 41 degrees inclination. There will be only one space station per orbital plane. Ku-band transmit/receive Earth stations will be co-located with the existing Bigelow Aerospace U.S. facilities in Nevada, Hawaii, Alaska and Maine. The Ku-band capability requested here represents the next step in BA's planned program toward eventual human-habited space stations. Other spectrum bands used by Bigelow Aerospace are currently used for telemetry and telecommand links and for high-speed data and video transmission. However, once the missions move from autonomous to crewed, there will be a need for bidirectional communications links in order that both crew and customers can have real-time voice and video links to Earth. The frequencies requested here are well-suited to this use as they are already allocated to the fixed-satellite service, including nongeostationary satellite operations.

The ground stations will be circularly polarized tracking antennas that will point their narrow-beam transmissions in the direction of the low-Earth orbiting satellite station as the station crosses the sky. When the satellite station is not in view, the ground station will not be transmitting.

A. Background of Bigelow Aerospace and Summary of the Program of Research and Experimentation

Founded in the Spring of 1999, Bigelow Aerospace is an entrepreneurial space development company headquartered in Las Vegas, Nevada. BA's goal is to open the frontier of space to all people by drastically reducing the costs and enhancing the efficacy and utility of space-based activities. The company's primary focus is on the development of robust, next-generation expandable space habitats.

As a concept, expandable space habitats were initially suggested in the 1960s. Some study of the possibility of an 'inflatable' space station was done, but the idea was abandoned due to a lack of structural strength and integrity. However, with the advent of advanced soft goods, such as Kevlar, expandable space habitats became a real possibility. In the 1990s, NASA initiated a program called 'TransHab' which was an attempt to develop an expandable space habitat and prove that such a system could offer significant benefits, such as decreased mass, increased volume (after deployment), and enhanced protection from secondary radiation. Despite showing great promise, TransHab was canceled by NASA due largely to budgetary and political concerns.

In 1999, Bigelow Aerospace took up the gauntlet of expandable space habitat development and has been pursuing the new technology as a better and more cost effective method of producing an economical, next-generation space habitat for both public and private use. BA's effort has been funded entirely by financing from its founder and President, Robert T. Bigelow.

In order to pursue its primary goal of developing and deploying an expandable space platform that can safely and affordably support a human presence, BA embarked upon a program of launching a series of subscale technology demonstrators to validate its ideas and engineering concepts. The first of these subscale modules, dubbed, Genesis-I, was successfully launched on July 12, 2006, and the second, Genesis-II, was launched on June 28, 2007. The Genesis mission goals are to validate basic design concepts and to conduct the first ever pressurization of expandable space habitat prototypes in orbit. Both the launch and pressurization processes have been conducted flawlessly in each instance, and the Genesis program has succeeded beyond BA's expectations in proving the validity of the underlying technology. Both spacecraft continue to send telemetry, images, and spacecraft health data to BA and such information is helping to prove the long-term durability of expandable space platforms.

In regard to communications, prior to the Genesis launches, BA sought and obtained FCC approval to use frequencies in the UHF and VHF bands in connection with the spacecraft's operation (See Call Signs WD2XND and WD2XWW). BA also makes use of the 2 GHz S-band spectrum for transmitting mission data, including high-resolution photographs, back to Earth. These frequencies have been used with the permission of NASA and are part of NASA's primary mission spectrum in the 2200 to 2290 MHz band. However, because the S-band frequencies are not available for use by a private, commercial entity, BA sought and obtained experimental authority to operate using X-band frequencies at 8450-8500 MHz, allocated to the Space Research service, as a means of transmitting important scientific data and video from space-to-Earth (Call Sign WE2XFH). In addition, as noted above, Bigelow Aerospace's ultimate objective of launching crewed space habitats necessitates having access to other spectrum for bidirectional communications between Earth and crew and residents of the on-orbit spacecraft. The Ku-band spectrum requested here is intended to meet Bigelow Aerospace's future needs for bandwidth sufficient to permit the space-to-Earth and Earth-to-space transmission of communications traffic.

In particular, Bigelow Aerospace seeks to augment its testing program by adding authority to operate both uplinks and downlinks in the Ku-band transmit and receive frequencies at 14.05 to 14.12 GHz and 11.8 to 11.9 GHz. A Ku-band payload would operate on the BA spacecraft, and Bigelow proposes to operate four directional tracking antennas within the U.S. Additional technical parameters are provided on FCC Form 442.

The innovative technology to be supported by this spectrum use is already proving its potential. The existing experimental authorizations being used by BA are now yielding substantial dividends by validating the capabilities and advantages of expandable space platforms.

Approval of operations utilizing the slices of Ku-band spectrum requested here will facilitate Bigelow Aerospace's experimental program and enable the company to complete the necessary testing of its first habitable spacecraft, called 'Sundancer', as well as future larger modules (referred to as BA-330s) which together will bring the concept of expandable space habitats to full fruition. Once their utility is proven, expandable habitats could become the cornerstone in a new era of space development, enabling economical commercial LEO activities as well as affordable government exploration of the Moon, Mars, and beyond.

B. Specific Objectives Sought To Be Accomplished

1. Continue to validate and explore the design capabilities and engineering concepts of BA subscale expandable spacecraft in an actual, orbital environment.

2. To conduct long-term testing to validate system durability and longevity.

3. To monitor the long-term radiation, thermal, and pressure conditions of expandable structures, including but not limited to:

   • Detecting any wrinkles with wavelengths greater than 1 cm and amplitudes greater than 5 mm;
   • Measuring temperatures at different locations;
   • Measuring cumulative ionizing radiation doses at several locations;
   • Measuring the internal pressure of various structures; and
   • Demonstrating the capability of the design materials to maintain a pressurization volume for an extended period of time in the LEO environment.

4. To develop the experience and infrastructure and communications capability necessary to support future crewed Bigelow Aerospace missions.

5. To determine the radiation dose that a resident astronaut might receive.

6. To produce video images of the deployment process including solar panels and the pressurization of the primary structure itself.

7. To validate the use of Ku-band frequencies for the transmission of real-time communications between space habitat crews and residents and colleagues and family on Earth.

C. Contribution to the Development, Extension, Expansion, or Utilization of the Radio Art.

Through its overall experimental program, Bigelow Aerospace will be able to conduct the necessary tests and validation studies to assess the feasibility of long-term deployment of the full-scale, prototype, Sundancer and BA 330 modules. The experimental facilities sought in this application form an integral part of the overall testing program, and constitute a critical link toward establishing the viability of future robust commercial and public operations.

If successful, expandable habitats will greatly lower the cost of conducting space activities while enhancing their efficacy. This will lead to new and innovative private sector uses such as space tourism, microgravity research and development, and other commercial applications, and will also allow for government agencies such as NASA and NOAA to bolster their space-based operations and programs. The information gathered and products developed aboard orbital expandable space habitats could someday make life better for all of us here on Earth.