World View
Experimental STA Application
File No: 0560-EX-ST-2017

Explanation of Experiment and Need for STA

Company Description/Overview:

World View, a Tucson, Arizona based company, was founded to build and launch stratospheric, lighter-than-air balloons carrying a range of payloads. World View's customers range from the US Department of Defense to private citizens to commercial enterprises looking to take advantage of a platform that can bring them to the edge of space.

World View is seeking this STA for authorization to operate a number of radio systems that will carry telemetry data from its stratospheric balloon and deliver command and control signals to the balloon during its mission. To prepare properly for a safe launch and operation, this application also seeks authorization for ground-based testing prior to the launch.

Need for an STA:

An STA is appropriate when the proposed program of experimentation will last less than six months. World View is proposing to test from May 29 to July 14, 2017. This timeframe will cover both ground testing and the actual launch and flight of the balloon for the designated mission.

Technical Synopsis:

- Spectrum requested: Command and Control only: 902-928 MHz;Telemetry 2.402-2.478 GHz and command uplink use also
- Power levels: C&C – 1 watt, with high gain yagi antenna, telemetry: 10 W downlink
- Limited time of use: testing will take place for approximately 3 hours per day
- Limited area of operation: airborne operations within 200 miles of Tucson, limited to US operations, and the flight will avoid military installations

Description of Project:

On April 14, 2017, World View was approached-to assist the iconicAmerican company Kentucky Fried Chicken (KFC). KFC is in the midst of the introduction of a new product: the Zinger Sandwich. KFC's Zinger product launch plan included taking the sandwich literally to the edge of space as part of the artistic concept. The original company KFC had

hired to assist with that portion of the product launch backed out of the project, leading KFC to reach out to World View.

In the past 14 days, World View has been working with KFC to put together a stratospheric balloon launch to take the Zinger to the edge of space. See Figure 1 below for an image of World View's stratospheric balloons. World View has been selecting technology, working to integrate the concept of operations into the World View platform, and planning for a successful mission on time, in June 2017. This is a short timeframe, but it is required by World View's customer.

Figure 1. World View Stratospheric Balloon

When the mission is underway in June, the balloon will be launched from Benson, Arizona. From there, it will ascend to and operate between 65,000 and 80,000 feet. The balloon will float over the surrounding Tucson region. All the radio transmitters and receivers on the ground will be at the World View headquarters in Tucson. Experimentation with the balloon and communication systems technology , is subject to stratospheric wind conditions which require a 200 mile radius of operations, and a flight duration of up to 10 days. During that time, the cameras on the balloon will be engaged to video key aspects of an innovative advertising campaign, taking KFC's product to the edge of space. Being in the stratosphere is essential to showing the product at the edge of space.

The high resolution digital images will be transmitted down to the ground station at World View's headquarters. The overall system will use compression to optimize the use of spectrum for these transmissions.

Ground testing:

For about two weeks, World View will be conducting system integration testing at and near its facilities in Tucson, Arizona. These tests will start indoors in the World View building. After the first testing in the laboratory to test the radios on the bench, World View is planning a local test to mimic the operation of the communications systems when the balloon is in flight.

Downlink: The proposed testing requires an examination of the functioning of the tracking receive antenna. For this testing, World View is proposing to take its payload approximately 26 miles from its headquarters up to the top of Mt. Lemmon, which has an elevation over 9000 feet. From there, World View will drive along the mountain ridge approximately 2 miles, back and forth. The payload will transmit at 2.4 GHz back to World View's headquarters, simulating the downlink of video. This will allow the high-gain, tracking antenna at World View's headquarters to be properly tested for its performance in receiving the telemetry data from the balloon when it is launched. This testing is expected to last approximately 2 days, with the radio use sporadic on each day, but certainly no more than 4-5 hours per day.

Uplink: Command and control instructions will be transmitted to the off-site, remote test radios over both a 902-928 MHz link and over the 2.4 GHz link. Both of these radio systems are modified off the shelf systems. The 900 MHz link employs a Yagi antenna with 14 dBi of gain to communicate with the balloon to provide reliable communications for the safety of operations. The 2.4 GHz link will use the higher gain tracking dish antenna to reach the remote payload. While normally each radio system would operate under the provisions of Part 15 Section 15.247 of the Commission's Rules. With the addition of the higher gain antennas, the systems exceed the limited ERP and the radio links need to be licensed for this use. Because the systems use a high gain antennas, pointed upward to Mt. Lemmon, and the radios are listen-before-transmit, the chances of interference to other users of radios in this band are very low.

Operational Mission - 10 days of balloon flight:

Downlink: After the launch, the downlink will be in use for up to 10 days, during the desired transmission periods. These are around Sunrise, mid-day, and Sunset for approximately 1 hour each. During those periods, the downlink will be used to transmit high-resolution imagery from the balloon to the ground station, where it will be used as part of the product advertising. The downlink will use the 2.4 GHz radio system to transmit at 6 watts, with an ERP of 12.1 watts. Given the altitude of the balloon, which will be 13 miles or more from earth, the signal at ground level will be very low

Command and control uplink: Command and control instructions will be transmitted to the off-site, remote test radios over both a 902-928 MHz link and over the 2.4 GHz link. Both of these radio systems are modified off the shelf systems. The 900 MHz link employs a Yagi antenna with 14 dBi of gain to communicate with the balloon to provide reliable communications for the safety of operations. The 2.4 GHz link will use the higher gain tracking dish antenna to reach the remote payload. While normally each radio system would operate under the provisions of Part 15 Section 15.247 of the Commission's Rules. With the addition of the higher gain antennas, the systems exceed the limited ERP and the radio links need to be licensed for this use. Because the systems use a high gain antennas, pointed upward to the stratospheric balloon, and the radios are listen-before-transmit, the chances of interference to other users of radios in this band are very low.

Area of operations:

This project has three discrete areas of operation for the three discrete phases of the mission, all local to Tucson, Arizona.

Site 1: the World View headquarters in Tucson. Here, testing will be conducted indoors as part of the systems integration effort. The radios will be turned on and tested to ensure that they are operating properly. The time of use is expected to be only a few minutes per day for the first week of work.

Site 2: Testing a link from Mt. Lemmon to the World Viewheadquarters. This testing will be conducted for approximately 4 hours per day for 3days. The transmitting antenna will use a minimum amount of power, with an antenna that has only5.19dB of gain. The receive antenna, with tracking capabilities, has high gain. This testing will allow World View's team to fine-tune the link between the remote transmitter and the tracking receiver. The portion of the testing is essential to ensuring that the project will work when the balloon is in flight. Control signals will be sent from World View's headquarters, and the telemetry will be received at the same site. Figure 2 below shows Spaceport Tucson adjacent to the World View facility.

Figure 2. Spaceport Tucson & World View's Facility

Site 3 – Mobile Operations: This is the operational phase of the project. All operations will be mobile. The balloon will launch from Benson, Arizona. World View has some control over the trajectory of the balloon in flight, and it can assure operations within a limited radius. All operations will be conducted in US airspace. To maximize the effectiveness of the limited launch window, World View is seeking a 200 mile radius of operations (See Figure 3 below) in which to operate. This will allow for sufficient flexibility during transmission activities. This will also ensure that the flight provides the successful telemetry that has prompted World View's customer to seek this solution.

To optimize the functioning of the radio systems, World View has built a mobile command center that helps it to communicate with the balloon when it is in flight. The mobile command center carries both the command and control uplink and the telemetry link radio systems. World View is planning to send the command center out to track the balloon during the operational phase of this project. While the mobile command center will stay on major US roadways, it will be aim to be as close as possible to operating directly below the balloon as possible. This helps to ensure that the communications links using directional antennas perform at their best. The antennas on the balloon are not steerable, making it important for the mobile command center to be as close to below the balloon as possible.

During this phase, there will be airborne operations within the area of operations and there will be ground-based operating within the area shown below.

Because of the nature of this project, the radius of operations describes where the operations could be. It is important to note that within that radius, the radios will be in use in a very localized spot for an hour, and then turned off. The radios will never be in use across the whole area at the same time. The spectrum use is only local.

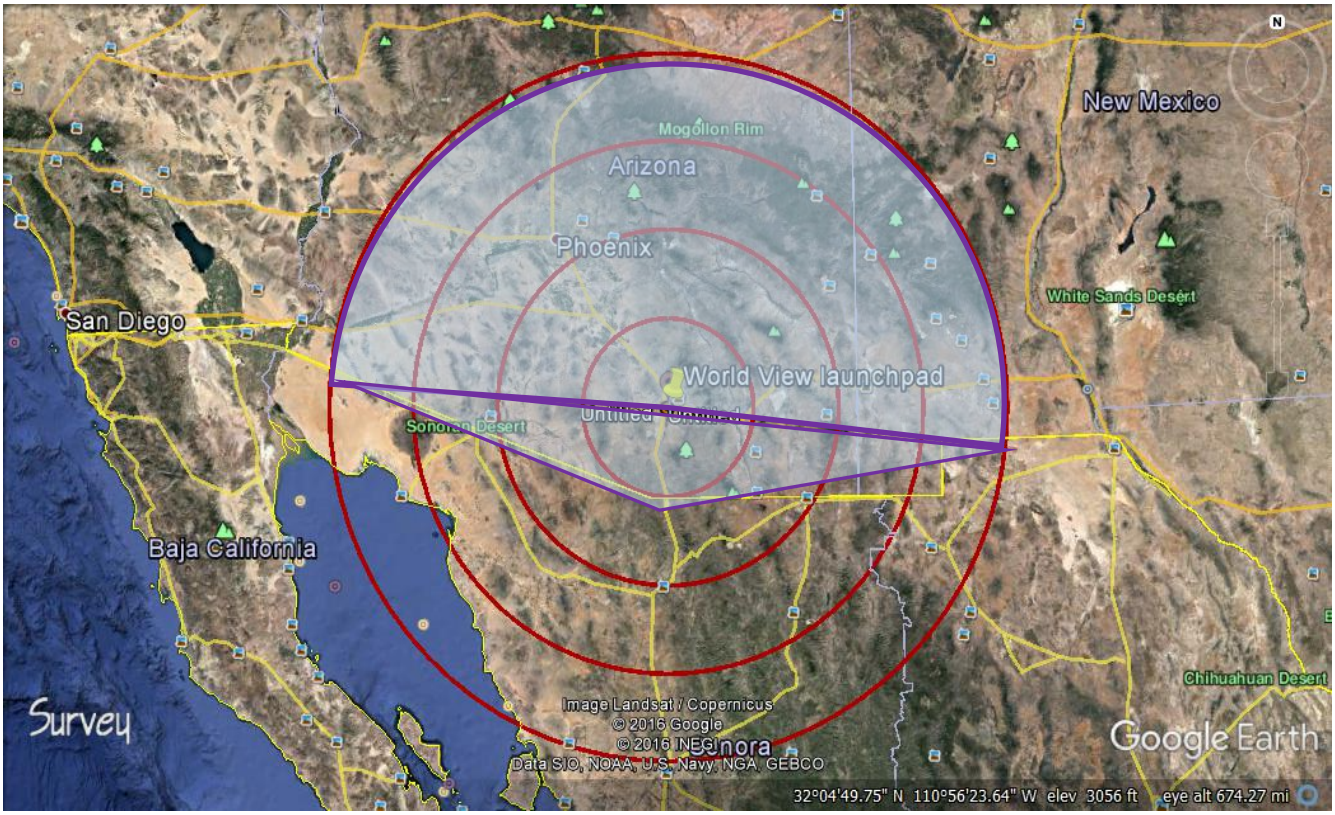

Figure 3. Area of operations, showing 50, 100, 150, and 200 mile radii from World View (the shaded areas, outlined in purple, are the proposed area of operations)

During this phase, the radio on the balloon will be transmitting telemetry information down to the tracking antenna at World View. Given the elevation of the transmitter on the balloon, the received signal on the ground is expected to drop to a negligible level, and should be perceived only by the high gain receive antenna that World View will be using.

Minimization of risk of interference:

To minimize any potential interference, World View has worked to design a system that puts the most gain into the receive antenna rather than adding power to the transmitter.

Additionally, these radios are all listen-before-transmit. They will find a clear channel before sending information, mitigating any potential interference to other users of the spectrum.

Stop Buzzer Point of Contact:

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Summary and Conclusion:

World View was approached by KFC on April 14 to assist with the edge-of-space aspect of KFC's new Zinger sandwich product launch. World View is seeking a temporary experimental authorization for use of its radio system during the testing and operational phases of this project. The STA is needed from May 29 to July14, 2017. The radios will not be in use constantly during that time. The STA is needed for three areas of operation: two for testing and one for the operational balloon flight. World View's proposed operations are limited in geographic scope. The communications links are designed to use low powered transmitters and high gain receive antennas to ensure that the telemetry data will be effectively transmitted, while minimizing the possibility of interference to others in the area.

For additional information or if there are any questions regarding this application, please contact Travis Palmer or Anne Cortez at alc@conspecinternational.com or 520-360-0925.