

World View
Experimental License Application
File No: 0566-EX-CN-2017

Explanation of Experiment

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 sought and obtained an STA, WL9XGO, for operations in Tucson and Page, Arizona 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. The license was also used to prepare properly for a safe launch and operation using ground-based testing prior to the launch.

In late June, World View launched its stratollite to achieve the mission for which WL9XGO was filed. Difficult weather conditions caused the flight to be terminated very shortly after lift-off. As a result, World View is filing this application to extend its experimental operations in Tucson and Page, Arizona to continue its experimentation with the transmission of video telemetry from the stratollite platform.

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 of the airborne system will be only 3 hours per day when in flight. Flights will be scheduled sporadically, and weather permitting
- 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 iconic American company Kentucky Fried Chicken (KFC). KFC has been introducing 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.

In June, World View scheduled the Zinger launch first for June 21, then moved the launch to June 22 due to weather concerns. That launch was also scrubbed, and the launch was moved to June 24 from the Page, Arizona site. Once again, the launch was scrubbed due to weather issues. Another launch was scheduled and finally took place on June 29, 2017. Unfortunately, due to technical issues, the flight was canceled prematurely. World View is working to reschedule the flight.

In order to advance the company's business objectives, World View needs to continue experimenting with how to deliver video telemetry from the edge of space in real-time. Therefore, it needs to continue to be licensed to use the radios on this license.

See Figure 1 below for an image of World View's stratospheric balloons.



Figure 1. World View Stratospheric Balloon

Because of the challenging weather patterns in and around Tucson, Arizona in the summer (monsoons, excessive heat, etc.) World View is seeking to extend its authorization to test from both southern Arizona and northern Arizona, which will maximize the chances of successful testing. World View has a number of experiments to conduct to determine how best to deliver video telemetry from the stratolite platform.

Once the stratollite is successfully launched, 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 based out of the World View headquarters in Tucson, AZ. From there, when the balloon is in flight, the ground stations will drive to stay as nearly below the balloon as possible to ensure the success of the operation. 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 the flight. Part of World View's business model is to make the edge of space accessible and thus inspirational to many more people than have been able to experience that perspective before.

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:

In preparation for future flights, World View will continue 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.

Links to be tested: uplink at 900 MHz, uplink at 2.4 GHz, downlink at 2.4 GHz.

Downlink: The proposed testing requires World View to test the functioning of its 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 ground-based distance testing of the downlink signal will only be sporadic. About 4-5 hours once a week or so as the radios need testing for improved system integration.

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 radio used for ground testing to the remote system will use the higher gain tracking dish antenna to reach the balloon payload. This uplink will have an ERP of 3.7 kW, using a highly-directed antenna. 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 - balloon flights:

World View is planning to use this license for numerous test flights over the next 24 months to move its business forward to develop expertise in the integrated radio and telemetry communications needed for its future commercial flights.

Downlink: After the launch, the downlink will be in use for up to 10 days, during the desired transmission periods of each flight. It is anticipated that those transmission periods will last only about 3 hours per day. 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 10 watts, with an ERP of 20.2 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 radio on the ground will use the higher gain tracking dish antenna to reach the balloon payload. This uplink will have an ERP of 3.7 kW, using a highly-directed antenna. 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 four areas of operation for the phases of the mission.

Site 1: Ground-based testing at 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: Ground-based remote testing of link from Mt. Lemmon to the World View headquarters. This testing will be conducted for approximately 4 hours per day for 3 days. The transmitting antenna will use a minimum amount of power, with an antenna that has only 5.19dB 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 for launch in Tucson: 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 future flights provide the successful telemetry required.

Site 4 – Mobile Operations for launch in Page: This is also the operational phase of the project. All operations will be mobile. Site 4 will be used when the balloon will launch from Page, Arizona. World View has some control over the trajectory of the balloon in flight, and it will direct the balloon from Page down to Tucson for the duration of the flight.

The Page location is essential to optimizing launch windows due to the weather concerns that affect southern Arizona.

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 and ground operations that take place in the areas shown in *Figures 3 and 4* 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.

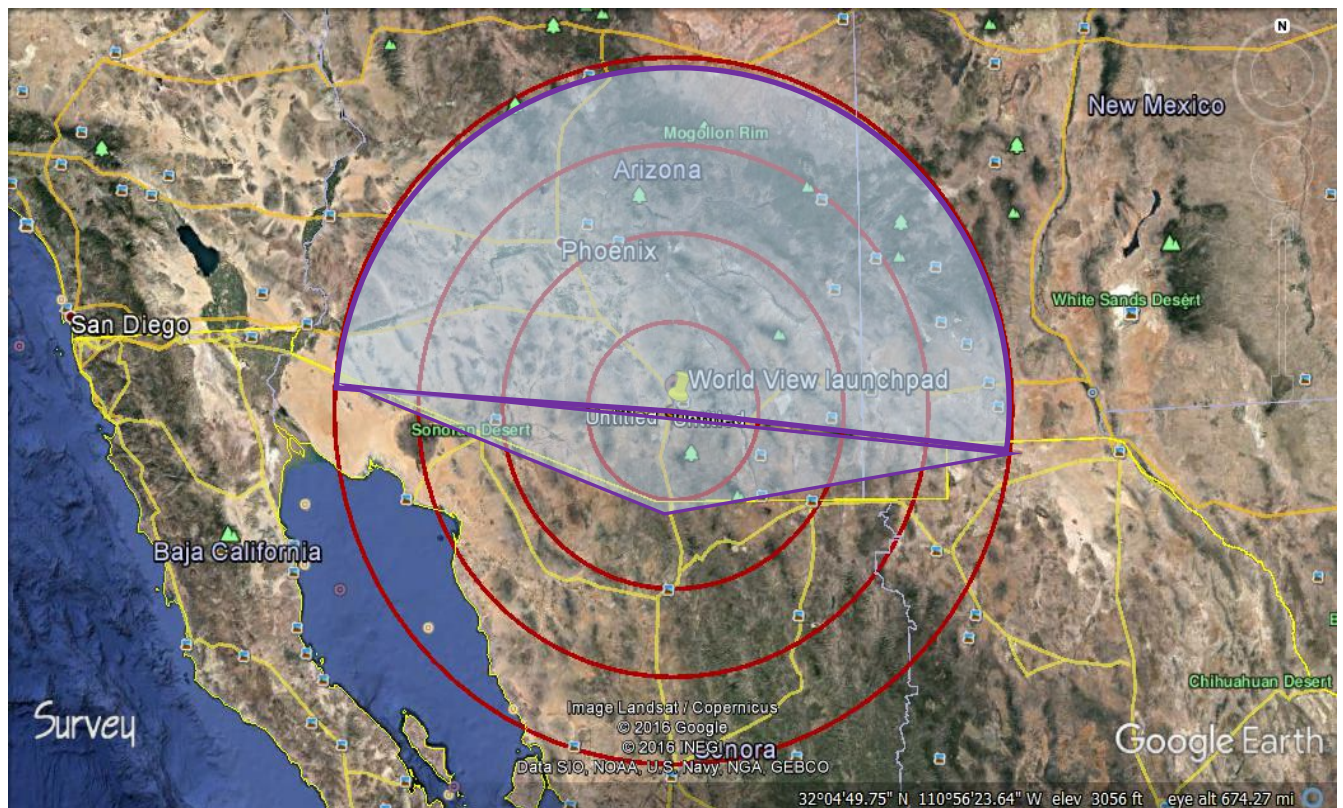


Figure 3. Area of operations, showing 50, 100, 150, and 200 mile radii from World View (the shaded areas, outlined in purple, are the proposed area of operations)

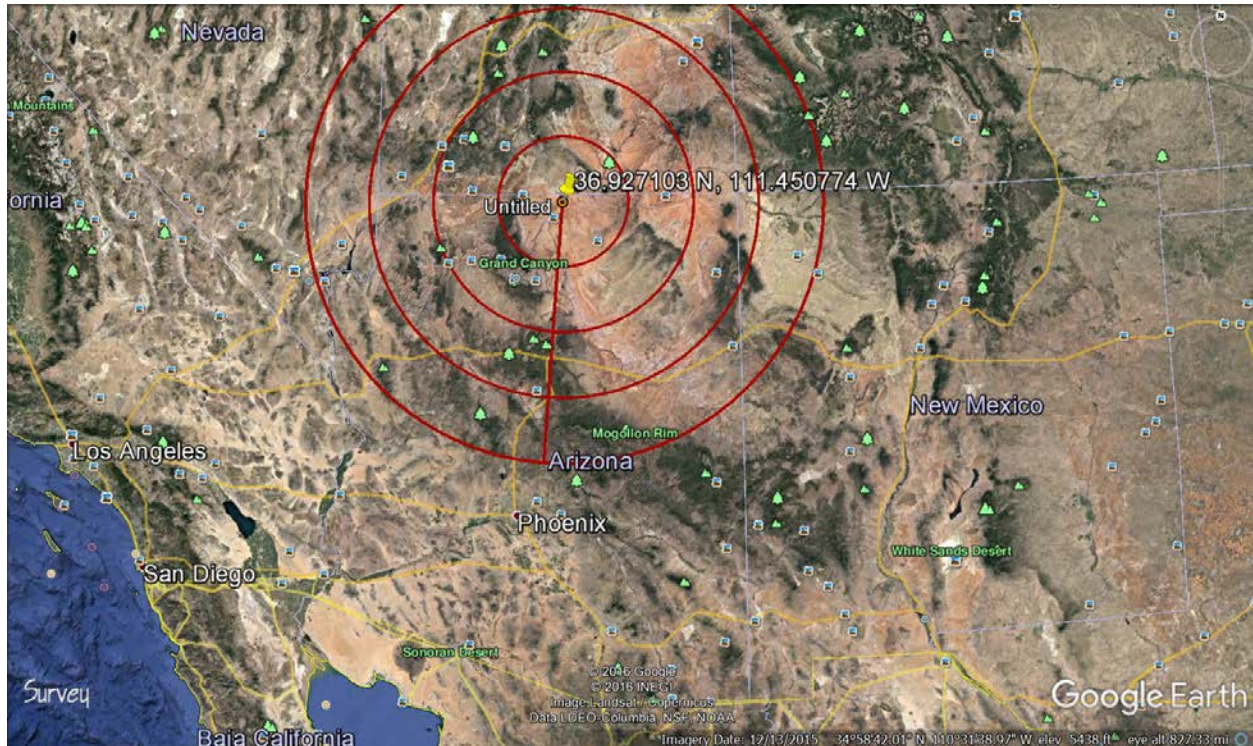


Figure 4. Area of operations, showing 50, 100, 150, and 200 mile radii from Page, AZ (operations will be contained primarily in the corridor from Page to Tucson, AZ)

During any flight operations, 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 sought a temporary authorization for operations through mid-July 2017. Adverse weather conditions precluded the extent of testing that World View had planned. At this point, World View is seeking authorization for multiple tests over the next 24 months to allow for multiple flights and tests when the weather permits. The radios will not be in use constantly during that time. 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.