

PURPOSE OF EXPERIMENT

Virgin Galactic, LLC (“Virgin Galactic”) hereby requests experimental authorization for five years, commencing September 15, 2020, to conduct testing of its suborbital Space Flight System.¹

As described in more detail below, Virgin Galactic will conduct ground and in-flight testing in the VHF, L-, and S-bands. Crewed flight tests of the Space Flight System will involve both solo flights of the WhiteKnightTwo (“WK2”) carrier aircraft and flights of WK2 and a SpaceShipTwo (“SS2”) suborbital vehicle. Ground testing will occur before and after each flight, in addition to periodic testing independent of scheduled flights. The test operations will take place at Spaceport America in New Mexico (FAA Identifier 9NM9), and the Mojave Air and Spaceport in California (FAA Identifier KMHV).

In advance of each test flight, Virgin Galactic will coordinate its use of frequencies with the Department of Defense Area Frequency Coordinator (“DoD-AFC”) for the White Sands Missile Range (“WSMR”) or Armstrong Flight Research Center (“AFRC”). Virgin Galactic expects to complete such coordination at least twenty-four hours before each test.

1. The Space Flight System

The Space Flight System is a reusable, two-stage, horizontal take-off suborbital launch system—consisting of WK2, a custom-built, carrier aircraft, and SS2, the world’s first passenger carrying spaceship built by a private company.

The WK2 is a four-engine, dual-fuselage jet aircraft, designed to air-launch SS2 at an altitude of approximately 50,000 feet. The WK2’s 140-foot main wing houses large speed brakes that allow WK2 to mimic SS2’s aerodynamic characteristics in the gliding portions of SS2’s flight, which provides Virgin Galactic’s pilots with a safe, affordable, and repeatable way to train for SS2’s final approach. SS2 is a reusable, winged spacecraft designed to carry up to eight people into suborbital space safely.

2. In-Flight Testing

Virgin Galactic plans to complete two types of in-flight testing of the Space Flight System’s communications systems under this experimental authorization: (1) solo test flights of WK2, and (2) flights of WK2/SS2. Each are described in more detail below.

(a) WK2 Flights

Over the course of the authorization, Virgin Galactic plans to conduct several crewed, non-commercial flight tests of the WK2 aircraft. These tests are designed to familiarize pilots with the WK2 aircraft, independent of its mated suborbital vehicle. Such flights will be conducted to train pilots on flight systems, test upgrades to WK2 flight systems, and provide pilots with simulated SS2 approach flight profiles.

¹ 47 C.F.R. § 5.54.

Virgin Galactic currently has crewed test flights of the WK2 aircraft scheduled for October 1st and 7th, 2020.² Each flight from ground to landing will take approximately four hours. The flights will take place out of Spaceport America in New Mexico and will be coordinated with WSMR prior to operations.

(b) WK2/SS2 Flights

Over the course of the authorization, Virgin Galactic plans to conduct several crewed, non-commercial flight tests involving both vehicle components of the Space Flight System. These tests will involve WK2 and captive carry, glide, and powered flights of the SS2 vehicle. In a captive carry test, the SS2 vehicle will remain mated to WK2 for the entire flight. In a glide test, the WK2 aircraft will release the SS2 vehicle once it has reached launch altitude, allowing the SS2 to glide back to the runway at the designated spaceport. During a powered flight test, after being released by WK2, SS2 will ignite its hybrid rocket motor in order to reach suborbital space before returning to the runway at the designated spaceport.

Virgin Galactic currently has a crewed, powered test flight of WK2/SS2 scheduled for October 22, 2020.³ The flight from ground to landing will take approximately two hours. The flight will take place out of Spaceport America in New Mexico and will be coordinated with WSMR and the FAA Albuquerque Air Route Traffic Control Center prior to operations.

3. Requested Frequencies

Radio frequency testing under this authorization will focus on the communications systems onboard the Space Flight System and the associated ground systems at the spaceports in New Mexico and California. During ground and in-flight tests, the Space Flight System will transmit in the 123.225 MHz, 123.375 MHz, 123.450 MHz, and 123.525 MHz frequencies in the VHF band,⁴ either the 1445.5 MHz, 1451.5 MHz, 1462.5 MHz, 1470.5 MHz, or 1480.5 MHz frequencies in the L-band,⁵ and the 2360-2390 MHz segment of the S-band.⁶ Virgin Galactic also seeks authorization to conduct on-the-ground testing using all three bands prior to and

² If necessary, Virgin Galactic will seek special temporary authority to cover these activities.

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⁴ Virgin Galactic will also utilize open frequencies to communicate with Spaceport America, Mojave Air and Spaceport, and WSMR/AFRC.

⁵ The frequency will be determined during coordination with WSMR or AFRC, and Virgin Galactic will only transmit on one of the L-band center frequencies during testing. The frequency is generally 1462.5 MHz.

⁶ Virgin Galactic will only utilize a 15.6 MHz channel in the S-band during operations.

following the test flight, and for periodic testing of the ground stations independent of test flights.

Virgin Galactic plans to utilize L-band for WK2's telemetry, S-band for SS2's telemetry, and VHF for direct communications with WK2 and SS2 pilots.

4. Antennas

(a) Spaceport Transmit Antennas

There are three VHF antennas that support operations out of Spaceport America in New Mexico, and two that support operations out of Mojave Air and Spaceport in California. The five VHF antennas, as well as a receive-only fixed antenna at each spaceport, are used prior to and immediately following launch for radiofrequency ("RF") checkouts of the command path to the Space Flight System. Initial RF checkouts at the launch complexes are completed the day before flights and take approximately two hours. All day-of-flight RF checkout tests at the launch complexes are performed within approximately seven hours of take-off.⁷ All communication links will be shut-down approximately 15-30 minutes after landing.

(b) WK2 Transmit Antennas

Two L-band and three VHF antennas are affixed to the WK2 aircraft. The L-band and VHF antennas are used prior to flight for RF checkout, and will transmit downlink telemetry and communications, respectively, during flight.

(c) SS2 Transmit Antennas

Two tri-band and two VHF antennas are affixed to each of the SS2 spacecraft. The tri-band and VHF antennas are used prior to flight for RF checkout, and will transmit downlink telemetry and communications, respectively, during flight.

As part of this authorization, Virgin Galactic seeks to conduct ground tests of the S-band frequencies on the tri-band antenna described in this experimental license application. The tri-band antenna will communicate with the receive-only antenna at Spaceport America in New Mexico. The tests will be coordinated with WSMR prior to operations. The first such test will occur prior to the October 22, 2020 powered test flight.

5. Public Interest

Granting the instant application request to authorize testing of downlinks would serve the public interest by allowing each vehicle to provide data from flight critical systems to the ground where subject matter experts can evaluate the data in real-time. The dual L- and S-band bandwidth will allow for greater situational awareness for both WK2 and SS2 simultaneously during flight

⁷ Non-powered flights, including glide and captive carry tests, will have shorter duration pre-flight checkouts.

operations and will also provide a secondary communications downlink for WK2 after separation from SS2.

For Virgin Galactic, safety of life is the highest priority. Providing unique telemetry downlinks for each Space Flight System vehicle enhances the reliability of the communications throughout each stage of flight. The proposed on-the-ground pre-and post-flight testing will permit Virgin Galactic to complete modifications to the fleet necessary to operate with both L- and S-band telemetry downlinks during each relevant stage of the flight.

6. Coordination

Virgin Galactic will coordinate its VHF, L-, and S-band operations with the DoD-AFC for the WSMR or AFRC office prior to operation.

7. Stop Buzzer Point of Contact

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