



## Electronic Filing

March 12, 2004

FEDERAL COMMUNICATIONS COMMISSION  
Experimental Radio Service  
P.O. Box 358320  
Pittsburgh, PA 15251-5320

Dear Sir or Madam:

This letter is to request a Special Temporary Authority (STA) to operate a transmitter for narrowband transmissions in the band between 406 and 450 MHz using a Remote Operated Aircraft (ROA) around Moses Lake, WA. In accordance with 47 CFR chapter 1, (10-1-00 edition), section 5.61, the attached Exhibit A – System Description is being provided to support the application.

Blue Origin will be performing communication/telemetry link testing, as required by FAA regulations for emergency/abort shut-down procedures. The testing involves using a ground to air carrier and tone link, narrow band (200 kHz or less), operating over the pass band mentioned above. The transmitter will be located on the ground and fixed. It will communicate with a receiver located on the aircraft. All activities will be properly coordinated and approved with the FAA facility at Grant County Airport in Moses Lake, WA. The testing will be for a limited period of time. The ground testing dates for system check-out are set for intermittent times between April-May 2004 and the flight testing will be between July 15, 2004 and December 31<sup>st</sup>, 2004. On behalf of Blue Origin, Comsearch respectfully requests the FCC to expedite the approval of this STA request. If you have any questions please call.

Sincerely,  
COMSEARCH

Kenneth G. Ryan  
Director, Spectrum Management Services  
(703) 726-5685  
[kryan@comsearch.com](mailto:kryan@comsearch.com)

## **Exhibit A– System Description**

### **A.1 - Name, address, phone number of the applicant.**

Mark C. Russell  
Blue Origin LLC  
17 South Nevada Street  
Seattle, WA 98134-1121

(206) 254-0880 x41  
mrussell@blue.aero

### **A.2 - Description of why a Special Temporary Authority (STA) is needed.**

Blue Origin will be testing the Vertical Take-Off and Landing technology of a Remote Operated Aircraft (ROA). As part of the FAA Certificate of Authorization (COA) procedure, the aircraft is required to have a lost-link emergency/abort shut-down procedure. A communication/telemetry link to the aircraft allows for normal and safe operations of the vehicle. However, there will be an independent, non-destructive, commercial off the shelf (COTS), flight termination system (FTS) aboard the aircraft. In the event of a lost communication link, departure from the planned flight path, or a commanded emergency abort, the FTS will shut down the propulsion units (terminate thrust).

### **A.3 Description of the operation to be conducted and its purpose**

A complete description of the test is included as Exhibit A.

### **A.4 Time and dates of proposed operation.**

The testing schedule is as follows:

Ground Testing Dates for FTS Check-out: April – May 2004

Flight Testing: July 15<sup>th</sup> through December 31<sup>st</sup> , 2004

### **A.5 Class of station**

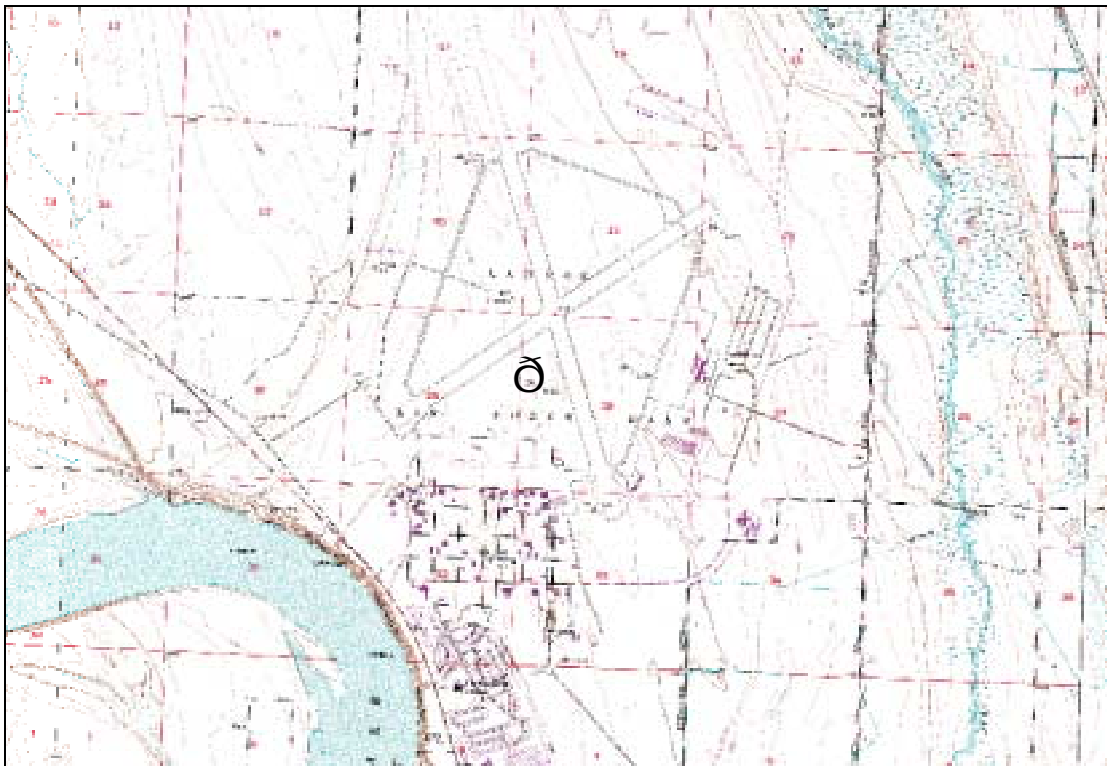
During operation the transmitter will be located on the ground and will be fixed all of the time.

**A.6 Description of the location and, if applicable, geographic coordinates of the proposed operation.**

Testing will occur at Grant County Airport in Moses Lake, WA.

The coordinates are 47° 11' 17" N., 119° 19' 20"

A topo map of the area, with approximate transmitter site location marked, is shown below:



**A.7 Equipment to be used, including name of manufacturer, model and number of units.**

The transmitter will consist of a unity gain omnidirectional antenna and a 5 watt transmitter. The FTS receiver is a Herley HFTR60-1, see attached specification sheet.

**A.8 Frequencies Desired**

The testing can occur over a narrow band channel between 406 MHz and 450 MHz. In order to minimize any potential for interference Blue Origin will can use this flexibility to avoid any in-band users. A search of spectrum determined that there are government and non-government users in the band. Exhibit C contains additional details on the spectrum usage.

## A.9 Maximum effective radiated power (ERP) or equivalent isotropically radiated power (EIRP)

The link calculations for the test are described in the table below:

RF Operating Frequency MHz		425.00	
Distance [Xmttr to Rcvr] Statute miles		0.50	
Transmitter Power dBm		37.00	
Transmitter Cable Losses dB		-3.00	
Transmit Antenna Gain/Loss		0.00	
RF Path Losses dB		-83.15	
Receive Antenna Gain/Loss dB		0.00	
Receiver Cable Losses dB		-3.00	
Receiver Threshold dBm		-107.00	
Received Signal Strength dBm		-52.1472	
RF Link Margin dB		54.85282	
Link analysis for:			
- 5 watt transmitter, unity gain omnidirectional antennas Rx & Xmtt			
- 0.5 statute mile distance to UAV under test			
- Typical Test Range Link Margins are 12 dB			

## A.10 Emission designator and description of emission (bandwidth, modulation, etc.)

The ground-based transmitter continuously transmits a carrier signal to the aircraft during flight. The aircraft-mounted receiver listens for the carrier signal as well as a specific tone sequence which would indicate a ground command for emergency abort. If the carrier signal is continuously “heard”, the flight proceeds normally as planned. If at any time the receiver loses the signal, a lost-link procedure is automatically performed on the aircraft.

Also, in the event of an emergency abort command from the ground station, the receiver decodes the tone sequence and initiates the emergency abort procedure.

The pass band for all tone and carrier signals will be less than 200 kHz.

#### **A.11 Overall height of antenna structure above the ground**

The ground-mounted transmitter will not have an elevation greater than 6'.

## **Attachment A – Blue Origin Aircraft Operations Description**

Blue Origin LLC is requesting an FAA (Federal Aviation Administration) COA (Certificate of Authorization) for operation of an ROA (Remotely Operated Aircraft).

The aircraft is a research and development demonstrator for VTOL (Vertical Take-Off and Landing) technology. The aircraft is relatively slow-flying (<30 knots) and will be operated over a limited range (<1.0 mile and <2000 ft altitude limit). The aircraft is powered by four, 3000 lbs thrust, turbojet engines and has a maximum allowable take-off weight of 8600 lbs. The aircraft has no lifting surfaces yielding an effective lift/drag (L/D) equal to zero (0).

As part of the FAA COA procedure, the aircraft is required to have a lost-link emergency/abort shut-down procedure. A communication/telemetry link to the aircraft allows for normal and safe operations of the vehicle. However, there will be an independent, non-destructive, commercial off the shelf (COTS), flight termination system (FTS) aboard the aircraft. In the event of a lost communication link, departure from the planned flight path, or a commanded emergency abort, the FTS will shut down the propulsion units (terminate thrust).

**Brief FTS Description** - The FTS has two components: 1. A receiver/tone decoder, mounted on the aircraft and; 2. A ground based transmitter. The ground-based transmitter continuously transmits a carrier signal to the aircraft during flight. The aircraft-mounted receiver listens for the carrier signal as well as a specific tone sequence which would indicate a ground command for emergency abort. If the carrier signal is continuously “heard”, the flight proceeds normally as planned. If at any time the receiver loses the signal, a lost-link procedure is automatically performed on the aircraft. Also, in the event of an emergency abort command from the ground station, the receiver decodes the tone sequence and initiates the emergency abort procedure.

All flight testing operations will be coordinated and approved with the FAA facility at Grant County Airport, Moses Lake, Washington.

### **Ground Testing Dates:**

FTS system check-out. Ground and aircraft-based checkout.

April –May 2004: Intermittent

### **Flight Testing:**

July 15<sup>th</sup>, 2004 thru December 31<sup>st</sup>, 2004.

## **Exhibit B – Equipment Spec Sheet**

## Exhibit C - Spectrum Usage

A search of U.S. The Table of Allocations indicated the following Government and Non-government users:

406.1 – 410 MHz

Government: FIXED, MOBILE, RADIO ASTRONOMY. Associated footnotes: US13 US74 US117 G5 G6

Non-government: RADIO ASTRONOMY. Footnotes: US13 US74 US117

410 – 420 MHz

Government: FIXED, MOBILE. Associated footnotes: US13 G5

Non-government: No allocation. Footnotes: US13

420 – 450 MHz

Government: RADIOLOCATION. Associated footnotes: 664 668 US7 US87 US217 US228 US230 G2 G8

Non-government: Amateur. Footnotes: 664 668 US7 US87 US217 US228 US230 NG135

The associated footnotes do not specifically exempt non-government usage in the area of Moses Lake, Wa.

### Table of Allocation Footnotes between 406 and 450 MHz:

664 In the bands 435–438 MHz, 1 260–1 270 MHz, 2 400–2 450 MHz, 3 400–3 410 MHz (in Regions 2 and 3 only) and 5 650–5 670 MHz, the amateur-satellite service may operate subject to not causing harmful interference to other services operating in accordance with the Table (see No. 435). Administrations authorizing such use shall ensure that any harmful interference caused by emissions from a station in the amateur-satellite service is immediately eliminated in accordance with the provisions of No. 2741. The use of the bands 1 260–1 270 MHz and 5 650–5 670 MHz by the amateur-satellite service is limited to the Earth-to-space direction. band 470–485 MHz is also allocated to the space research (space-to-Earth) and the space operation (space-to-Earth) services on a primary basis subject to agreement obtained under the procedure set forth in Article 14, subject to not causing harmful interference to existing and planned broadcasting stations.



668 Subject to agreement obtained under the procedure set forth in Article 14, the band 449.75–450.25 MHz may be used for the space operation service (Earth-to-space) and the space research service (Earth-to-space).

US7–In the band 420–450 MHz and within the following areas, the peak envelope power output of a transmitter employed in the amateur service shall not exceed 50 watts, unless expressly authorized by the Commission after mutual agreement, on a case-by-case basis, between the Federal Communications Commission Engineer in Charge at the applicable district office and the military area frequency coordinator at the applicable military base. For areas (e) thru (j), the appropriate military coordinator is located at Peterson AFB, CO.

- (a) Those portions of Texas and New Mexico bounded on the south by latitude 31°45 North, on the east by 104°00' West, on the north by latitude 34°30 North, and on the west by longitude 107°30 West;
- (b) The entire State of Florida including the Key West area and the areas enclosed within a 200-mile radius of Patrick Air Force Base, Florida (latitude 28°21 North, longitude 80°43 West), and within a 200-mile radius of Eglin Air Force Base, Florida (latitude 30°30 North, longitude 86°30' West);
- (c) The entire State of Arizona;
- (d) Those portions of California and Nevada south of latitude 37°10 North, and the areas enclosed within a 200 mile radius of the Pacific Missile Test Center, Point Mugu, California (latitude 34°09 North, longitude 119°11 West);
- (e) In the State of Massachusetts within a 160-kilometer (100 mile) radius around locations at Otis Air Force Base, Massachusetts (latitude 41°45 North, longitude 70°32 West);
- (f) In the State of California within a 240-kilometer (150 mile) radius around locations at Beale Air Force Base, California (latitude 39°08 North, longitude 121°26 West);
- (g) In the State of Alaska within a 160 kilometer (100 mile) radius of Clear, Alaska (latitude 64 degrees, 17 north, longitude 149 degrees 10 west).
- (h) In the State of North Dakota within a 160 kilometer (100 mile) radius of Concrete, North Dakota (latitude 48 degrees 43 north, longitude 97 degrees 54 west).
- (i) In the States of Alabama, Florida, Georgia and South Carolina within a 200 kilo-meter (124 mile) radius of Warner Robins Air Force Base, Georgia (latitude 32°38 North, longitude 83°35 West).

In the State of Texas within a 200 kilometer (124 mile) radius of Goodfellow Air Force Base, Texas (latitude 31°25 North, longitude 100°24 10 west).

US13 For the specific purpose of transmitting hydrological and meteorological data in co-operation with agencies of the Federal Government, the following

frequencies may be authorized to non-Government fixed stations on the condition that harmful interference will not be caused to Government stations.

MHZ

169.425 169.450 169.475 169.500 169.525 170.225 170.250 170.275 170.300  
170.325 171.025 171.050 171.075 171.100 171.125 171.825 171.850 171.875  
171.900 171.925 406.125 406.175 409.675 409.725 412.625 412.675 412.725  
412.775

Licensees holding a valid authorization on June 11, 1962, to operate on the frequencies 169.575, 170.375 or 171.975 MHz may continue to be authorized for such operations on the condition that harmful interference will not be caused to Government stations.

US74 In the bands 25.55–25.67, 73.0–74.6, 406.1–410.0, 608–614, 1400–1427, 1660.5–1670.0, 2690–2700 and 4990–5000 MHz and in the bands 10.68–10.7, 15.35–15.4, 23.6–24.0, 31.3–31.5, 86–92, 105–116 and 217–231 GHz, the radio astronomy service shall be protected from extraband radiation only to the extent that such radiation exceeds the level which would be present if the offending station were operating in compliance with the technical standards or criteria applicable to the service in which it operates.

US87 The frequency 450 MHz, with maximum emission bandwidth of 500 kHz, may be used by Government and non-Government stations for space telecommand at specific locations, subject to such conditions as may be applied on a case-by-case basis.

US117 In the band 406.1–410 MHz, all new authorizations will be limited to a maximum 7 watts per kHz of necessary bandwidth; existing authorizations as of November 30, 1970 exceeding this power are permitted to continue in use.

New authorizations in this band stations, other than mobile stations, within the following areas are subject to prior coordination by the applicant through the Electro-magnetic Spectrum Management Unit, National Science Foundation, Washington, D.C. 20550, (202–357–9696):

Arecibo Observatory:

Rectangle between latitudes 17°30N. and 19°00N. and between longitudes 65°10 W. and 68°00W.

Owens Valley Radio Observatory:

Two contiguous rectangles, one between latitudes 36°N. and 37°N. and longitudes 117°40W. and 118°30W. and the second between latitudes 37°N. and 38°N. and longitudes 118°W. and 118°50W.

Sagamore Hill Radio Observatory:

Rectangle between latitudes 42°10N. and 43°00N. and longitudes 70°31W. and 71°31W.

Table Mountain Solar Observatory (NOAA), Boulder, Colorado (407–409 MHz only):

Rectangle between latitudes 39°30N. and 40°30N. and longitudes 104°30W. and 106°00W. or the Continental Divide whichever is farther east.

The non-Government use of this band is limited to the radio astronomy service and as provided by footnote US13.

US217 Pulse-ranging radiolocation systems may be authorized for Government and non-Government use in the 420–450 MHz band along the shorelines of Alaska and the contiguous 48 states. Spread spectrum radiolocation systems may be authorized in the 420–435 MHz portion of the band for operation within the contiguous 48 States and Alaska. Authorizations will be granted on a case-by-case basis; however, operations proposed to be located within the zones set forth in US228 should not expect to be accommodated. All stations operating in accordance with this provision will be secondary to stations operating in accordance with the Table of Frequency Allocations.

US228 Applicants for operation in the band 420 to 450 MHz under the provisions of US217 should not expect to be accommodated if their area of service is within the following geographic areas:

(a) Those portions of Texas and New Mexico bounded on the south by latitude 31°45' North, on the east by longitude 104°00' West, on the north by latitude 34°30' North, and on the West by longitude 107°30' West.

(b) In the State of Massachusetts within a 160 kilometers (100 miles) radius around the locations of Otis Air Force Base, Massachusetts (latitude 41°45' North, longitude 70°32' West).

(c) In the State of California within a 240 kilometer (150 mile) radius of Beale Air Force Base, California (latitude 39°08' North, longitude 121°26' West).

(d) In the State of Alaska, within a 160 kilometer (100 mile) radius of Clear, Alaska (latitude 64°17' North, longitude 149°10' West).

(e) In the State of North Dakota, within a 160 kilometer (100 mile) radius of Concrete, North Dakota (latitude 48°43' North, longitude 97°54' West).

(f) Those portions of Texas and New Mexico bounded on the south by latitude 31°45' North, on the east by longitude 104°100' West, on the north by latitude 34°30' North, and on the West by longitude 107°30' West.

(g) In the state of Alaska within a 160 kilometer (100 mile) radius of Clear, Alaska (latitude 64 degrees 17 north, longitude 149 degrees 10 west).

(h) In the state of North Dakota within a 160 kilometer (100 mile) radius of Concrete, North Dakota (latitude 48 degrees 43 north, longitude 97 degrees 54 west).

(i) In the States of Alabama, Florida, Georgia and South Carolina within a 200 kilometer (124 mile) radius of Warner Robins Air Force Base, Georgia (latitude 32°38 North, longitude 83°35 West).

(j) In the State of Texas within a 200 kilometer (124 mile) radius of Goodfellow Air Force Base, Texas (latitude 31°25 North, longitude 100°24 West).

US230 Non-government land mobile service is allocated on a primary basis in the bands 422.1875–425.4875 and 427.1875–429.9875 MHz within 50 statute miles of Detroit, MI, and Cleveland, OH, and in the bands 423.8125–425.4875 and 428.8125–429.9875 MHz within 50 statute miles of Buffalo, NY.

G2 In the bands 216–225, 420–450 (except as provided by US217), 890–902, 928–942, 1300–1400, 2310–2390, 2417–2450, 2700–2900, 5650–5925, and 9000–9200 MHz, the Government radiolocation is limited to the military services.

G5 In the bands 162.0125–173.2, 173.4–174, 406.1–410 and 410–420 MHz, the fixed and mobile services are all allocated on a primary basis to the Government non-military agencies.

G6 Military tactical fixed and mobile operations may be conducted nationally on a secondary basis: (1) To the meteorological aids service in the band 403–406 MHz; and (2) to the radio astronomy service in the band 406.1–410 MHz. Such fixed and mobile operations are subject to local coordination to ensure that harmful interference will not be caused to the services to which the bands are allocated.

G8 Low power Government radio control operations are permitted in the band 420–450 MHz.

NG135 In the 420–430 MHz band the amateur service is not allocated north of line A (def. § 2.1).