

ScanEagle UAV Demo Flights Technical Description

The Boeing Company
Frequency Management Services

Submitted 04/03/06

by

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PURPOSE

The purpose of this application is to test various concepts for UAV (Unmanned Aerial Vehicle) systems for flight testing and support demonstrations of the UAV. It will not be used for production or manufacturing testing. The UAV operation is strictly for research, development, proof of concept and demonstrations.

REASON FOR APPLICATION

Boeing is requesting an Experimental License to provide flight demonstrations of the ScanEagle UAV system for potential customers and facilitate various tests at the following locations.

NUMBER OF SYSTEMS

Boeing plans to operate 4 UAV systems.

FAA Remote Operation Area (ROA) Authority

Boeing is working with the FAA to obtain an experimental airworthiness certificate to fly ScanEagle from the Waynesville Regional Airport and the Vandalia Airport. In the meantime, Boeing will operate the ScanEagle UAV in restricted airspace R-4501 at Ft. Leonard Wood. See the following figures. For operations in restricted airspace, no authorization from FAA is required. The following figures illustrate each location for flight operations.

LOCATIONS

The Boeing Company

Tract II (2) West

73-065 Simulator Building

6315 McDonnell Blvd

Berkeley (St Louis County), MO 63134-0000

38-45-14 LAT

90-21-00 LONG

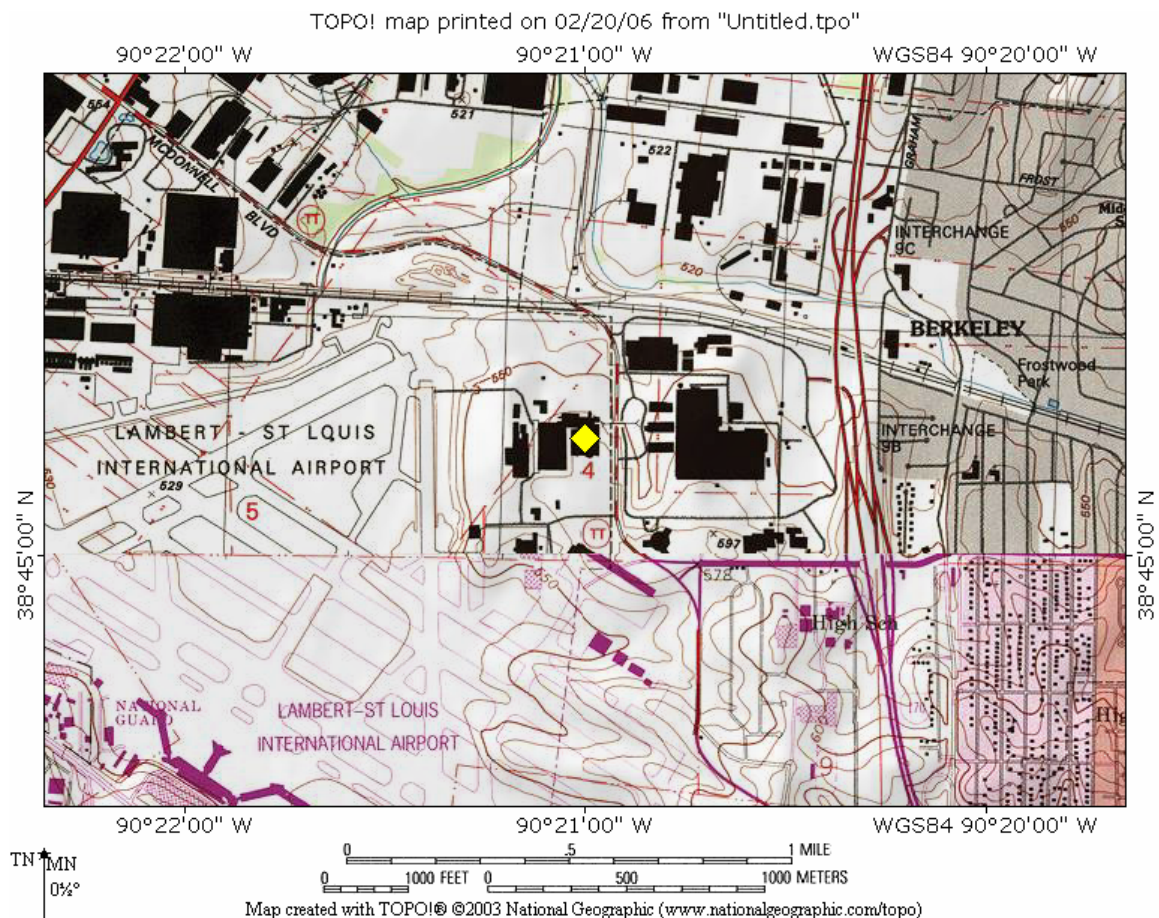
NAD83

Elevation 550 Feet / 167.64 meters

Radii of operation 0.6 miles / 1.0 kilometers **ground test operations only**

Ground test operational time typically 1 hour, with maximum of 6 hours

There are ground aircraft communications or navigation electronic systems at this location



73-075 Hanger Building, Flight Test Ramp Area

5621 J.S. McDonnell Blvd

Berkeley (St Louis County), MO 63145-9999

38-45-05 LAT

90-21-18 LONG

NAD83

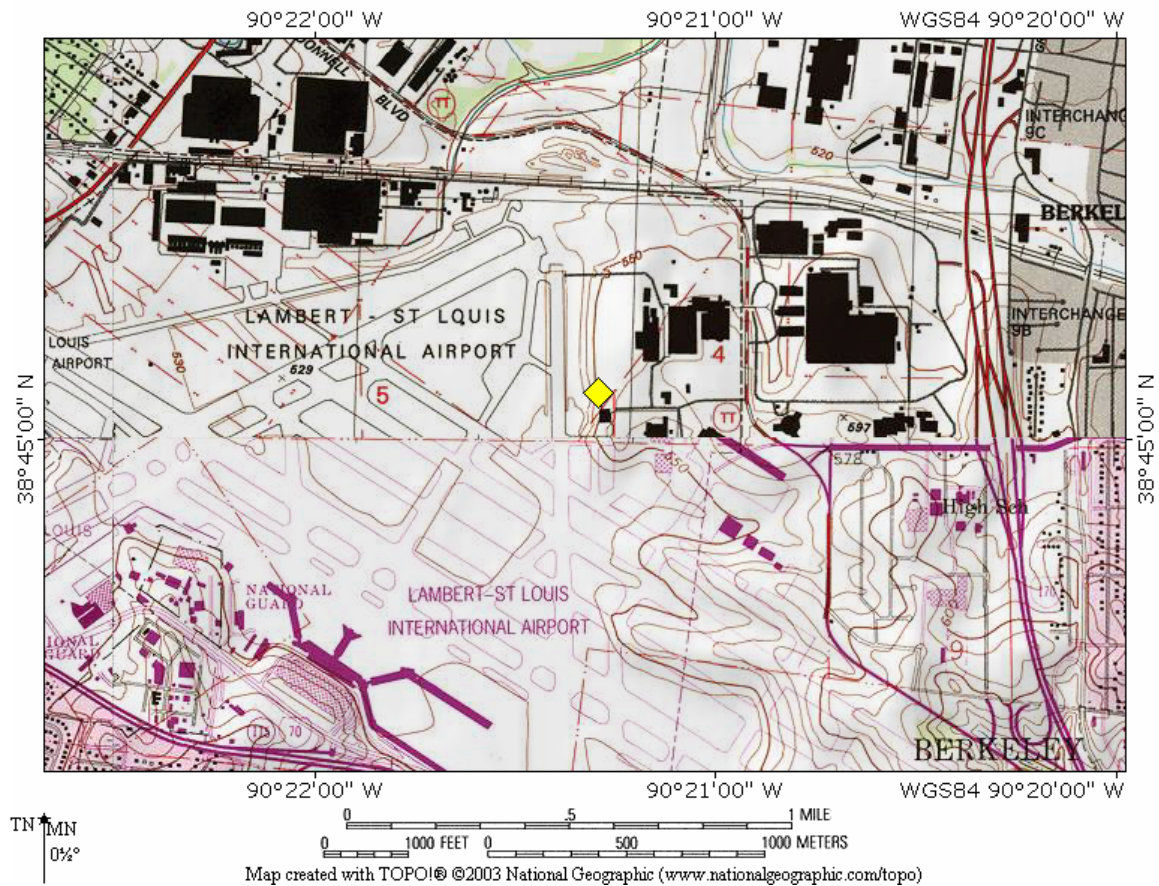
Elevation 546 Feet / 166.42 meters

Radii of operation 0.6 miles / 1.0 kilometers **ground test operations only**

Ground test operational time typically 1 hour, with maximum of 6 hours

There are ground aircraft communications or navigation electronic systems at this location

TOPO! map printed on 02/20/06 from "Untitled.tpo"



The Boeing Company

73-304 Office Building

325 JS McDonnell Blvd

Hazelwood (St Louis County), MO 63042-2513

38-46-05 LAT

90-22-17 LONG

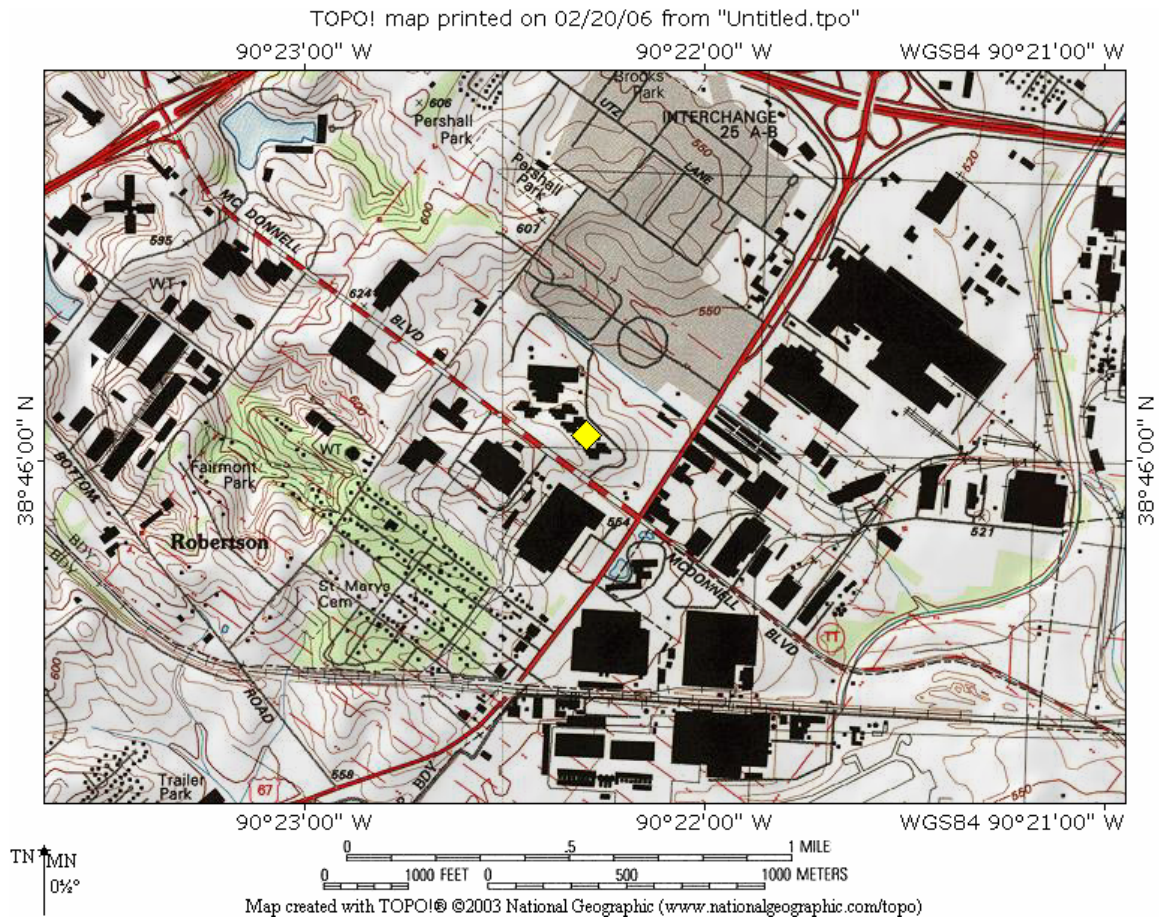
NAD83

Elevation 588 Feet / 179.22 meters

Radii of operation 0.6 miles / 1.0 kilometers **ground test operations only**

Ground test operational time typically 1 hour, with maximum of 6 hours

There are no ground aircraft communications or navigation electronic systems at this location



Vandalia Municipal Airport (KVLA)

Vandalia (Fayette County), IL 62471

38-59-29.8 LAT

89-09-58.3 LONG

NAD83

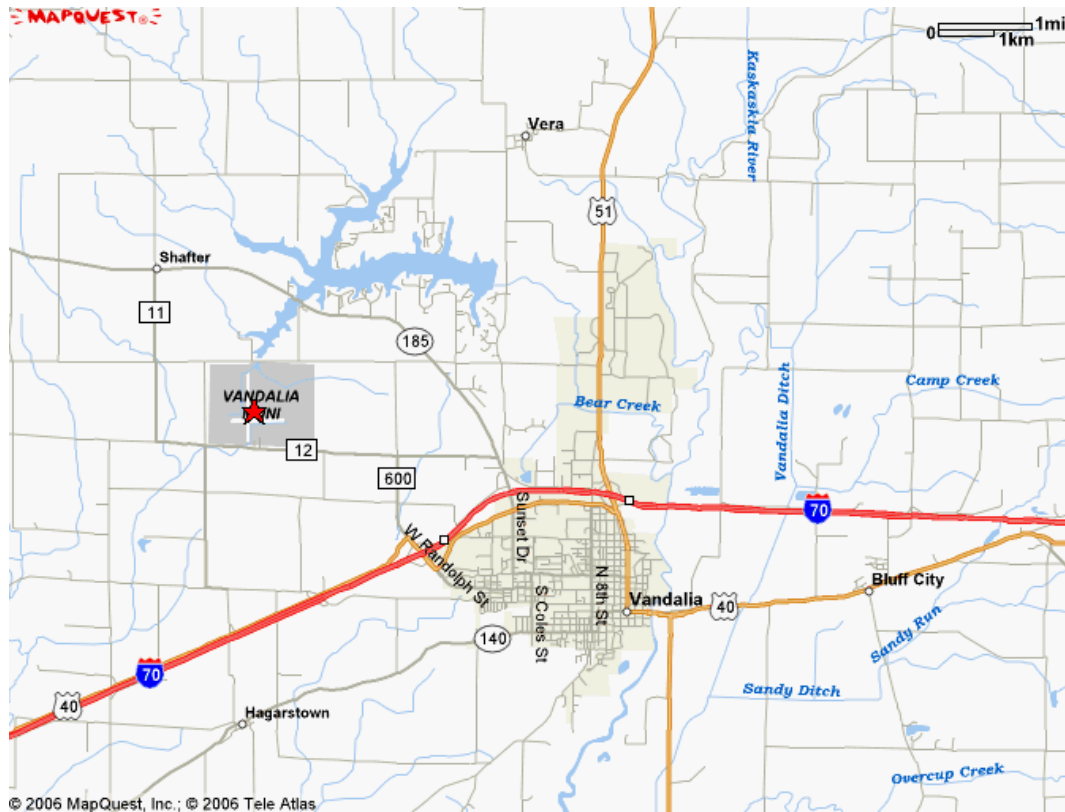
Elevation 537 feet / 163.7 m

See the following figures for radii and maximum altitude of operation

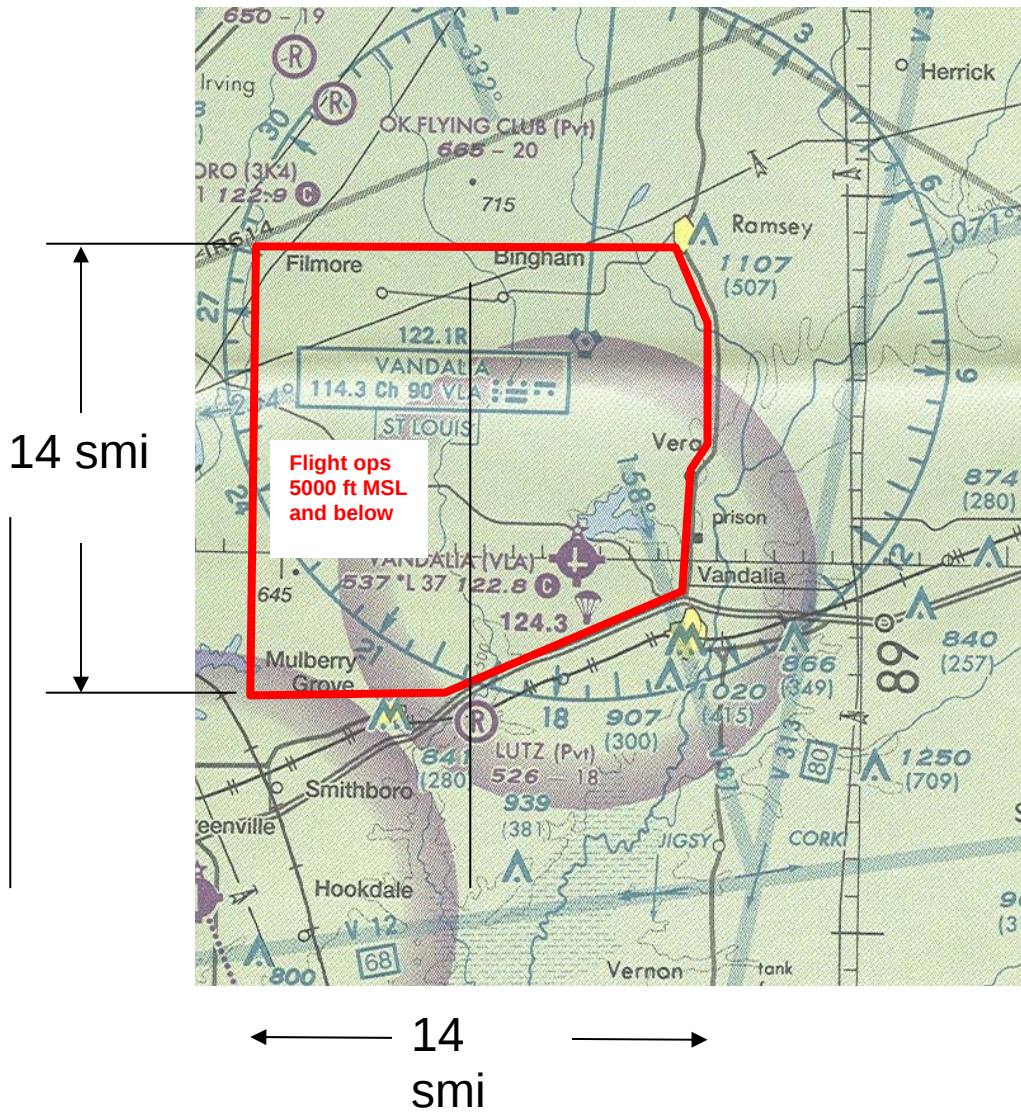
Flight time typically 1 hour, with maximum of 6 hours

Nearest city is 3 miles NW of Vandalia, IL

There are ground aircraft communications or navigation electronic systems at this location



Vandalia Airport



Waynesville Regional Airport at Forney Field (KTBN)

Ft. Leonard Wood (Pulaski County), MO

37-44-29.8 LAT

092-08-26.7 LONG

NAD83

Elevation is 1159 feet. / 353.3 meters

Inside the Clark National Forest

See the following figures for radii and maximum altitude of operation

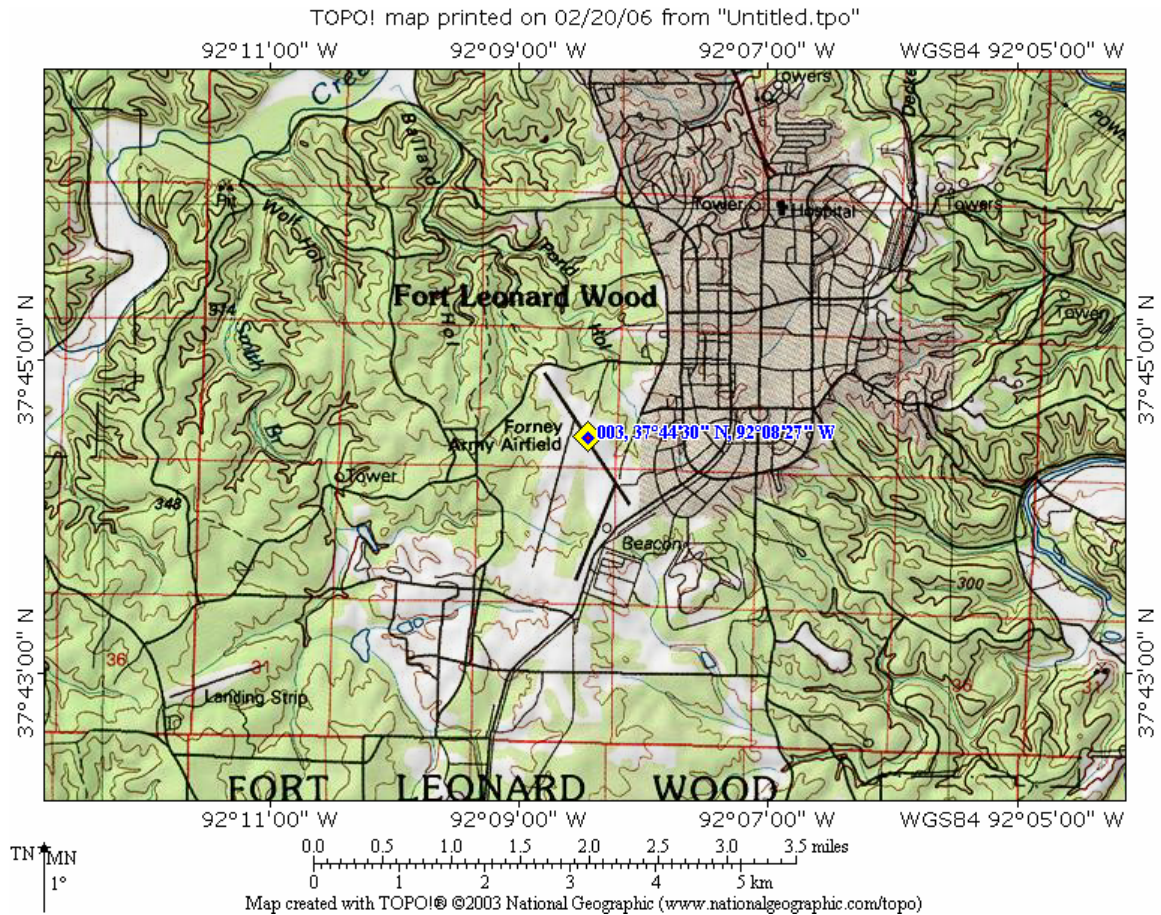
Operation in restricted airspace R-4501

Flight time typically 1 hour, with maximum of 6 hours

There are ground aircraft communications and navigation electronic systems at this location

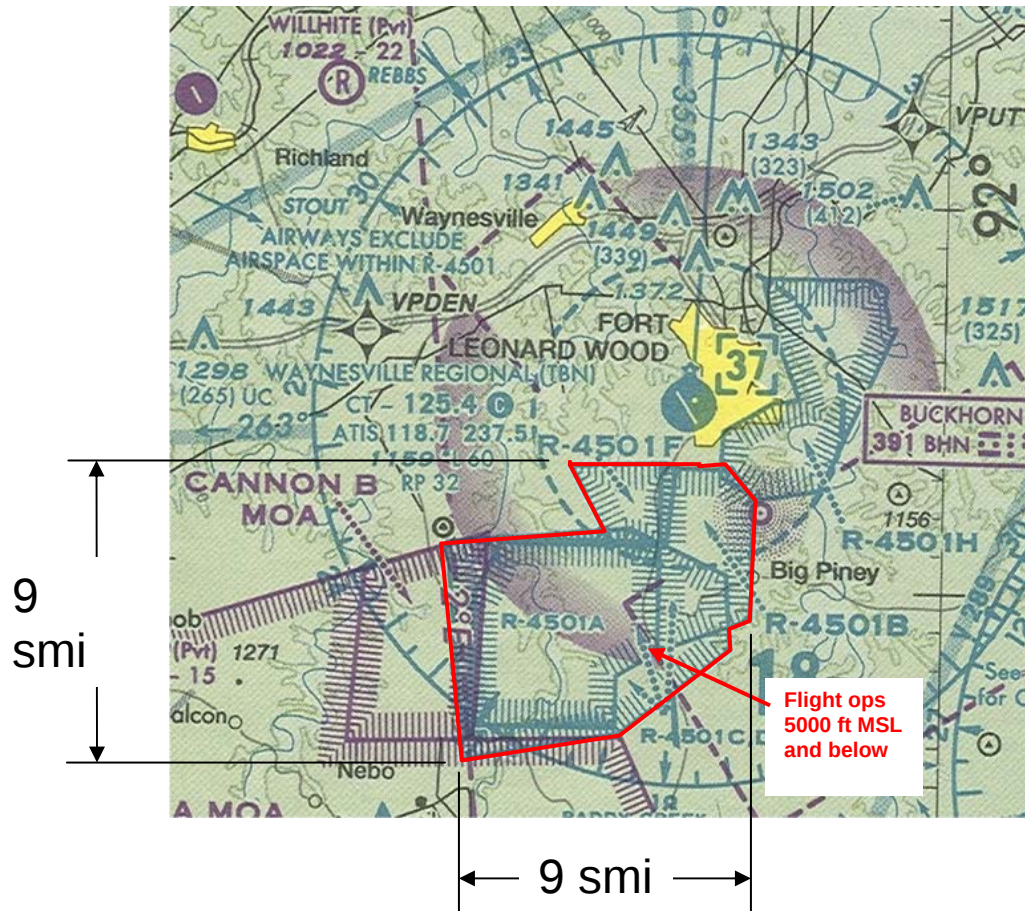
Local contact is Major Scott Porter

May be reached through Post Operator (573)596-0131

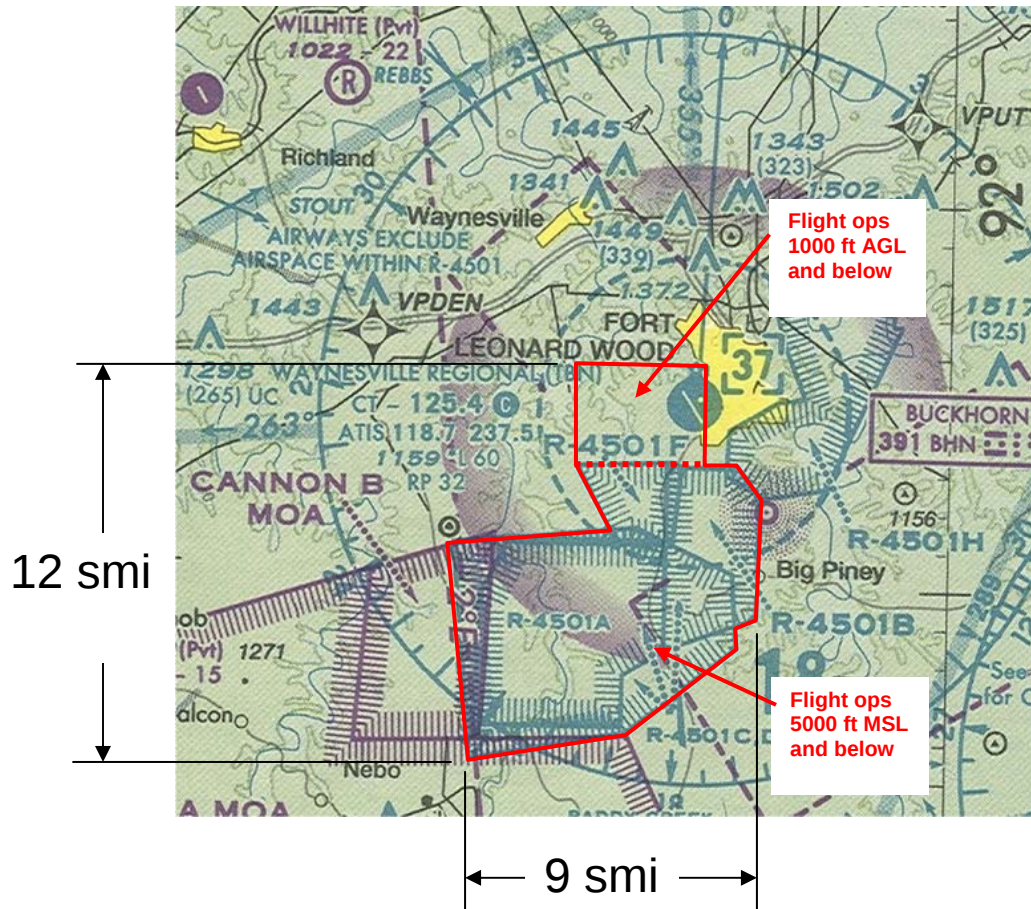


R-4501 Cannon Range

Airspace owner: Missouri Air National Guard



Waynesville Regional Airport



STOP BUZZER CONTACT INFORMATION (ALL LOCATIONS)

All Boeing Employees:

Tim Bischof:

314-232-3168 (Office)

314-306-1187 (Mobile)

Jeff Brundt:

314-232-3534 (Office)

314-941-9982 (Mobile)

SCHEDULE

Actual date and time of operation depends primarily on weather conditions and other scheduled flight activity at each location. The operational period is from May 1, 2006 May 1, 2008. Flight time is planned for 1 to 6 hours at a time. Actual day and time of flight depends on the weather. Only a few days each month will actually be needed.

MISC.

No proprietary or classified programs/contracts are connected with this project.

For photographs, video and other information about the basic system go to the following link:

<http://www.insitugroup.com/>

Frequencies, Emission and RF Power

MHz	Emission	RF Power	RF Unit	AFTRCC Coordination	ISM Band	FAA Coordination	Mode
219.025	1K00A1D	1 mW	ERP	Not required	No	Not required	Downlink
219.065	1K00A1D	1 mW	ERP	Not required	No	Not required	Downlink
219.105	1K00A1D	1 mW	ERP	Not required	No	Not required	Downlink
219.145	1K00A1D	1 mW	ERP	Not required	No	Not required	Downlink
902-928	20M0WXX	1 watt	ERP	Not required	Yes	Not required	Downlink
902-928	20M0WXX	2 watts	EIRP	Not required	Yes	Not required	Uplink
2434.0	20M0F3F	1 watt	EIRP	Not required	Yes	Not required	Downlink
2473.0	20M0F3F	1 watt	EIRP	Not required	Yes	Not required	Downlink



ScanEagle UAV



**Video
Downlink
2434.0 MHz
2473.0 MHz**

**Telemetry
Downlink
902-928 MHz
FHSS**

**Command
Telemetry
Uplink
902-928 MHz
FHSS**

**The Boeing Company
Frequency Management
Services
Chuck Zappala
03/28/06**

ScanEagle UAV Ground Station RF Equipment

Telemetry Uplink TX

Freewave FGRM-501X005

FCC Type ID: KNY21161341911919

<http://www.freewave.com/fgr900oem.html>

4 Units required.



Specifications:

Radio link:

Frequency Range	902-928 MHz
Method	Frequency hopping spread spectrum
Hopping Patterns	15 per band, 105 total, user selectable
Hopping Channels	50 to 112, user selectable
Hopping bands	7, user selectable
Range, Line-of-sight	60 miles
Occupied Bandwidth	230 KHz
Modulation	GFSK, 144 ~ 188 Kbps

Transmitter:

Output Power	100 mW to 1 Watt (+30 dBm)
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Receiver:

Sensitivity	-106 dBm for 10^{-6} BER -108 dBm for 10^{-4} BER
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Data Transmission:

Error Detection	32 bit CRC, retransmit on error
Data Encryption	Substitution, dynamic key
Link Throughput**	115.2 Kbps standard speed, 38.4 Kbps low speed

** Uncompressed , measured assuming 75% frequency availability

Video Downlink Video Receive Antenna

TekSharp 1.8m Dish #130111

10 dBi gain

www.plumdragon.com/teksharp

www.plumdragon.com/teksharp/hr_AO-40_products.htm



ScanEagle UAV Aircraft RF Equipment

Telemetry Uplink TX

Freewave FGRM-501X005

FCC Type ID: KNY21161341911919

<http://www.freewave.com/fgr900oem.html>

4 Units required.

SAME AS TELEMETRY UPLINK TX (SEE PREVIOUS)

Telemetry Downlink Antenna

Insitu Custom Antenna (winglet mounted)

Vertical made from brass tube and tuned for specific frequency

0 dBi gain (airborne), 1 watt ERP

www.insitugroup.com

No further information is available.

Video Downlink TX

GMS NT Series, Model number NTS2BU3N100X

FCC ID – **No label** - Filed as experimental device

2434.0 MHz 1 watt EIRP, 20M0F3F

2473.0 MHz 1 watt EIRP, 20M0F3F

www.gmsinc.com

http://www.gmsinc.com/GMSroot/product_specs/nt_datasheet.pdf

http://www.gmsinc.com/product_details.asp?prod_idno=108&prod_cat_idno=1



NT Transmitter mounted to 1 Watt PA and SME

The new NT series transmitters from GMS incorporate the latest microwave technology in a subminiature package. The new NT operates in L, S, or C-Bands with a nominal RF power output of 10 or 250mW. An integrated 1 watt amplifier is attached. Broadcast quality video (NTSC or PAL) with one audio subcarrier make this transmitter ideal for hidden camera and point-of-view applications where weight and size are critical factors. The new NT Series is a fully synthesized 16 channel (field programmable) transmitter. Two video transmitters are used in each UAV simultaneously providing frequency diversity to the ground based receiver.

Video Downlink Antenna

Insitu Custom Antenna (winglet mounted)

Vertical made from brass tube and tuned for a specific frequency

0 dBi gain (airborne), 1 Watt EIRP

www.insitugroup.com

The antenna is an integral part of the UAV. No further information is available.

UAV LOCATION BEACON SUB-SYSTEM

The purpose of this application is to license the 216-220 MHz micro-transmitter operating at 1 mW that is used to help locate the UAV by radio location especially on the ground after a flight. Our calculations show that this device exceeds the 200 micro-volts/meter, at three meters per Part 15. Boeing believes this transmitter requires a license as noted by its FCC Part 5 device Type ID registration and not a Part 15 device.

There are currently two full systems ready to use and the unique radio channels in this band have been established. Boeing anticipates placing two more systems into service. Each one requires a unique radio channel in this band. The two additional channels are included below.

Refer to WD2XPA, The Boeing Company.

Transmitter Information:

Full description and photograph located on:

http://www.texastimers.com/helpful_hints/walston/wal_trans.htm

MODA 2438 MVS-F transmitter, quantity 4 units

219.025 MHz, 1 mW ERP, Frequency Tolerance 0.004%, 1K00A1D

219.065 MHz, 1 mW ERP, Frequency Tolerance 0.004%, 1K00A1D

219.105 MHz, 1 mW ERP, Frequency Tolerance 0.004%, 1K00A1D

219.145 MHz, 1 mW ERP, Frequency Tolerance 0.004%, 1K00A1D

FCC Type ID: GZ38TA, CFR 47, Part 5 device

A short wire antenna is used.

Transmitter is turned on at take off and turned off after UAV recovery on the ground.