


U.S. Department
of Transportation

Federal Aviation
Administration

Central Region
Iowa, Kansas,
Missouri, Nebraska

901 Locust
Kansas City, Missouri 64106

DEC 10 2003

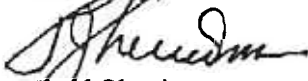
Mr. Terry J. Schmidt
The Boeing Company
P.O. Box 516 MC S064-2374
St. Louis, MO 63166-0516

Dear Mr. Schmidt:

Your request for an amendment to the Certificate of Authorization issued to the Boeing Company within Class "G" and Class "E" airspace was approved as written. After review of the document, the effective date of the modification has been changed to read "effective from December 1, 2003 to November 30, 2004." UAV operations are also authorized in Class "E" airspace.

If you have any questions or need further assistance, please contact Scott Guetzko, ACE-530B, at (816) 329-2532.

Sincerely,



Paul Sheridan
Acting Manager, Air Traffic Division

cc: ZKC
T75 TRACON
STL AFSS
STL FSDO
ACE-200



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530B

DEC -2 2003

Mr. Terry J. Schmidt
The Boeing Company
P.O. Box 516 MC S064-2374
St. Louis, MO 63166-0516

Dear Mr. Schmidt:

Your request for a Certificate of Authorization to conduct UAV operations within Class "G" Airspace is approved. The enclosed certificate outlines the standard and special provisions.

If you have any questions or need further assistance, please contact Scott Guetzko, ACE-530B, at (816) 329-2532.

Sincerely,

Original Signed By:
Paul J. Sheridan
Paul Sheridan
Acting Manager, Air Traffic Division

Enclosure

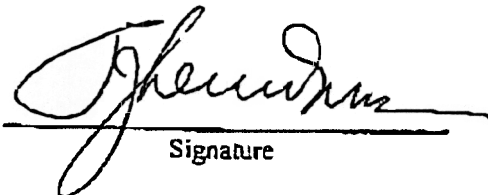
cc: ZKC
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ACE-200

ACE-530B:GGOLDEN:GN(H:WAIVERS/BOEINGCOAAPP.DOC):6/02/03 FILE IN

Amendment to FAA Form 7711-2**Issued to:**

The Boeing Company
P.O. Box 516 MC S064-2374
St. Louis, Missouri

DESCRIPTION: Within the lateral and vertical confines (at or below 1,200 feet AGL) of prescribed airspace referred to in this document as Area 1 (see attachment). Within the lateral and vertical confines (at or below 5,000 feet MSL) of the prescribed airspace referred to in this document as Area 1A (see attachment).


Signature

Paul Sheridan
Acting Manager, Air Traffic Division
ACE-500


Signature

 Marion Dittman
Manager, Flight Standards Division
ACE-200

12/1/03
Date

12/1/03
Date

No certificate may be issued unless a completed application form has been received (14 C.F.R. 91.101 and 105).

 US Department of Transportation Federal Aviation Administration APPLICATION FOR CERTIFICATE OF WAIVER OR AUTHORIZATION		Form Approved: O.M.B. No. 2120-0027 APPLICANTS - DO NOT USE THESE SPACES Region _____ Action ☐ Approved ☐ Disapproved - Explain under "Remarks" Signature of authorized FAA representative _____	
INSTRUCTIONS			
Submit this application in triplicate (3) to any FAA Flight Standards district office. Applicants requesting a Certificate of Waiver or Authorization for an aviation event must complete all the applicable items on this form and attach a properly marked 7.5 series Topographic Quadrangle Map(s), published by the U.S. Geological Survey (scale 1:24,000), of the proposed operating area. The map(s) must include scale depictions of the flightlines, showlines, race courses, and the location of the air event control point, Police dispatch, ambulance, and fire		fighting equipment. The applicant may also wish to submit photographs and scale diagrams as supplemental material to assist in the FAA's evaluation of a particular site. Application for a Certificate of Waiver or Authorization must be submitted 45 days prior to the requested date of the event. Applicants requesting a Certificate of Waiver or Authorization for activities other than an aviation event will complete items 1 through 8 only and the certification, item 15, on the reverse.	
1. Name of organization The Boeing Company		2. Name of responsible person Terry J. Schmidt	
3. Permanent mailing address P.O. Box 516 MC 5064-2374	House number and street or route number	City St. Louis	State and ZIP code MO 63166-0516
		Telephone No. 314-233-9815	
4. FAR section and number to be waived N/A			
5. Detailed description of proposed operation (Attach supplement if needed) Modification to approved UAV CoA dated 2 June 2003. See attachment, Boeing Ser 285-3010 dated 17 November 2003.			
6. Area of operation (Location, altitudes, etc.) See #5 above.			
7a. Beginning (Date and hour) TBD		b. Ending (Date and hour) TBD	
8. Aircraft make and model (a)	Pilot's Name (b)	Certificate number and rating (c)	Home address (Street, City, State) (d)
Bat UAV	TBD	TBD	Same as #3 above

FAA Form 7711-2 (8-00) Supersedes Previous Editions

ITEMS 9 THROUGH 14 TO BE FILLED OUT FOR AIR SHOW/AIR RACE WAIVER REQUESTS ONLY.				
9. The air event will be sponsored by:				
N/A				
10. Permanent mailing address	House number and street or route number	City	State and ZIP code	Telephone No.
11. Policing (Describe provisions to be made for policing the event.)				
Local authorities will be notified of UAV operations (Police/Sheriff/Fire)				
12. Emergency facilities (Mark all that will be available at time and place of air event.)				
☐ Physician ☐ Fire truck ☒ Other - Specify <u>CFR at Airport</u> ☐ Ambulance ☐ Crash wagon				
13. Air Traffic control (Describe method of controlling traffic, including provision for arrival and departure of scheduled aircraft.)				
ATC will be notified via VFR Flight Plan, NOTAM, and communications with the Range Safety Aircraft.				
14. Schedule of Events (Include arrival and departure of scheduled aircraft and other periods the airport may be open.)				
Hour (a)	Date (b)	Event (c)		
TBD	TBD	UAV operations within Class "G" and "E" Airspace.		
If sufficient space is not available, the entire schedule of events may be submitted on separate sheets in the order and manner indicated above.				
Please Read > The undersigned applicant accepts full responsibility for the strict observance of the terms of the Certificate of Waiver or Authorization, and understands that the authorization contained in such certificate will be strictly limited to the above described operation.				
15. Certification - I CERTIFY that the foregoing statements are true.				
Date	Signature of Applicant			
11/20/03	Terry J. Schmidt			
Remarks				
UAV Operators will be locally certified and the Mission Commander will hold the required Pilot Qualifications for operations within the Class of Airspace. Additional point of contact: Peter A. Drain (314) 234-1938				

FAA Form 7711-2 (5-80) Supersedes Previous Edition



Ser 285-3010
17 November 2003

From: The Boeing Company
To: Federal Aviation Administration

Subject: Request for Modification of Certificate of Authorization (CoA) Dated June 2, 2003 for operations of The Boeing Companies' Bat Unmanned Aerial Vehicle (UAV) from 2 June 2003 to 3 June 2004.

References: (a) FAA Order 7210.3, Facility Operation and Administration
(b) FAA Order 7610.4, Special Military Operations

1. Purpose. The Boeing Company is requesting the FAA to approve a modification to the granted Certificate of Authorization (CoA) for additional airspace and altitude in accordance with references (a) through (b) to demonstrate the manual and autonomous flight capabilities of the Bat Unmanned Aerial Vehicle (UAV) system operated by Boeing.

2. The following information is provided detailing the flight operations in accordance with reference (b).

A. Intended Flight Operations.

1. Airfield. The Boeing Company has been granted permission to perform these UAV operations from Mr. Frank Baldwin, the owner of Baldwin Private Airfield, located four miles south of Whiteside, Missouri at N39° 07', W91° 03'. The airfield is an uncontrolled airfield with one runway orientated 320-140, constructed of sod, and is at an elevation of 505 feet MSL. The secondary airfield will be the Troy Private Airfield, located four miles south of Baldwin, at N39° 03', W91° 02' with an elevation of 650 feet MSL. Troy Private Airfield is an uncontrolled airfield with one runway orientated 260-080, and constructed of sod.

2. Flight Operations. The current flight operations area (Area 1) is approximately a ten NM by eight NM rectangle with the corner boundaries located at N39° 13', W91° 10'; N39° 13', W91° 04'; N39° 11', W91° 01'; N39° 03', W91° 10'; N39° 02', W91° 01'. The additional airspace (Area 1A) overlays the majority of the current airspace (Area 1) and extends to the North and West, with the corner boundaries located at N39° 05', W91° 01', then North to N39° 30'.

W91° 01', then West to N39°30', W91° 30', then South to N39° 05', W91° 30', then East to connect at N39° 05', W91°01'. Flight operations in this area are requested up to and including 5000 feet MSL. We also request to maintain an existing portion of the current area (Area 1) which connects to the Southeast portion of the proposed area at N39° 05', W91° 01', then South to N39° 02', W91° 01', then West to N39° 03', W91° 10', then North to connect at N39° 05', W91° 10'. This area should only be utilized for operations to or from Troy Private Airfield, and all flights within this area will be conducted at or below 1200 feet AGL. Baldwin and Troy Private Airfields are located within the confines of the flight operations area. All UAV flight operations will be conducted in Class "E" and "G" Airspace in day Visual Meteorological Conditions (VMC), under Visual Flight Rules (VFR). The operations area is over remotely populated terrain with no obstructions to interfere with flight safety.

3. Site/Safety Survey. Prior to any flight operations, a comprehensive site/safety survey will be conducted utilizing the same procedures conducted for regular flight operations. This survey will include at a minimum assessing the airfield facilities, operating area obstructions, populated areas, minimum safe altitudes, minimum altitudes for the Range Safety Aircraft (IFF and Communications), and notification of local authorities of the proposed UAV operations. All flight operations will then be conducted in accordance with the findings of the site/safety survey, applying the principles of Operational Risk Management to ensure no unnecessary risks are taken.

4. Briefing. All personnel, including but not limited to the UAV Operators, Launch and Recovery Crews, Ground Observers, Range Safety Aircraft personnel, Search and Rescue, and Air Traffic Control (ATC)/Air Route Traffic Control Center (ARTCC) will be provided a detailed briefing for each flight/mission, and to ensure the appropriate FAA Facility is contacted to issue the required NOTAM.

5. Weather. All flight operations will be conducted in VMC under VFR, ensuring compliance with the guidelines outlined in the U. S. Airspace Classifications for visibility and cloud clearance. Additional consideration will be given for maximum sustained winds and gusts to ensure safe UAV operations. Boeing Flight Operations in conjunction with the local Flight Service Station will provide current weather and forecast updates as necessary to the field activity.

6. Takeoff and Landing. The Bat UAV will be launched from a platform by qualified Bat UAV operators at Baldwin Airfield utilizing a bungee driven rail system to propel the UAV to launch airspeed, where the UAV will then assume self propelled flight to attain the flight profile altitude. The Bat UAV will be landed at Baldwin Airfield by a qualified Bat UAV Operator from the Ground Control Station (GCS). The Bat UAV has the capability to be launched and

recovered either manually (via operator inputs from a control station) or autonomously (via preprogrammed flight profile internal to the UAV without manual inputs from a control station), with the autonomous mode being the primary mode of recovery.

7. Range Safety Aircraft. Boeing will provide a Range Safety Aircraft (Cessna 182 or similar) that will maintain the Responsible Accountable Authority (TBD) over all UAV operations regarding go-nogo criteria as well as flight termination authority. The Range Safety Aircraft will also ensure the operations area is clear of other aircraft, maintain visual contact with the Bat UAV to provide see and avoid capabilities, maintain instantaneous communications with ATC, the UAV GCS, and other aircraft, squawk the appropriate transponder codes (Boeing discrete Mode 3/C), and provide search and rescue operations if required. The Range Safety Aircraft will also maintain the capability to take manual control of the Bat UAV via a portable GCS in the aircraft by the qualified Bat UAV operator/observer to redirect the Bat UAVs flight path should an unsafe/safety of flight situation arise such as aircraft avoidance or preprogrammed route of flight failure. The airborne Bat UAV operator/observer will also have the ability to terminate the Bat UAV flight either by directing the primary GCS operator to command the Bat UAV to return for landing, or to manually terminate the flight by overriding the preprogrammed flight plan route. Additionally, there will be a ground vehicle in radio communications with the Range Safety Aircraft observing the Bat UAV to the maximum extent possible. The flight may also be terminated at any time by commanding the Bat UAV to return to land, either autonomously or manually.

8. Route of Flight. Once safely airborne, the Bat UAV will climb to a preplanned altitude (within Class "G" airspace, approximately 500 feet AGL)) and proceed to a predetermined waypoint to effect a rendezvous with the Range Safety Aircraft. Upon receiving clearance to proceed by the Range Safety Aircraft, the Bat UAV will be commanded to its autonomous flight mode and proceed on its preprogrammed route of flight closely observed by the Range Safety Aircraft. The flights are expected not to exceed 45 minutes in duration. Upon completion of the preprogrammed flight route, the BAT UAV will return to a predetermined waypoint and hold until clearance to land has been received. At this point, the Bat UAV will be commanded to land under autonomous control via preplanned flight path or manual control (if necessary) by the GCS as the secondary mode.

9. Lost Data Link. The Bat UAV has an autonomous and manual mode of operation. In autonomous mode, if the data link connection is lost, the vehicle will follow the preprogrammed route of flight to recovery. The Bat UAV operator/observer in the Range Safety Aircraft will be informed of the data link status and take appropriate action. If data link is lost, the airborne

operator/observer will monitor the Bat UAV and if the Bat UAV is following the mission plan the airborne operator/observer will allow the Bat UAV to continue, maintaining see and avoid criteria. If the Bat UAV is not following the preprogrammed route of flight, the airborne operator/observer will switch to manual mode utilizing the onboard control station overriding the preplanned flight route and command the Bat UAV to return for landing. At the predetermined hand-off point, the Bat UAV will have manual command passed from the airborne operator/observer to the primary GCS for initiating the landing sequence. This will be accomplished by securing the airborne signal to the Bat UAV. In the manual mode, if the data link is lost due to line of sight restrictions, the Bat UAV will revert to the autonomous mode and follow the predetermined route of flight to recovery. Once the aircraft is within GCS range, the GCS operator can switch to manual mode and land the aircraft if required.

B. Bat UAV Physical Characteristics.

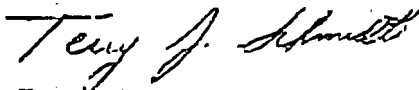
1. The Bat UAV is a self-contained autonomous Unmanned Air Vehicle system consisting of a transport vehicle, a Ground Control System, and several air vehicles that can be flown either singly or in combination. The air vehicle weighs thirteen pounds and has a wing span of five feet and a length of four feet. The propulsion system is a 0.60 cubic inch 2-stroke engine (OS 61 R/C type) with a 32 ounce fuel tank which utilizes a combination of methanol and oil mixture. The Bat UAV is predominately white with high visibility orange/red reflective markings on the wings and horizontal stabilator and a strobe light on the upper/lower fuselage.

C. Bat UAV Flight Performance Characteristics.

1. The Bat UAV has a top speed of 50 KIAS and a normal cruise speed of 25-35 KIAS, with a maximum altitude/service ceiling of 7500 feet MSL. The Bat UAV normal flight duration is approximately one hour with a range of approximately 35 NM. The air vehicle is GPS equipped to provide air vehicle position and flight routing. The Bat UAV and GCS utilize a 900 MHz command uplink and a 2.4 GHz downlink for the gimbaled mounted EO camera. The data links have a six nautical mile line of sight range. The Bat UAV has the capability to be independently programmed to fly a series of waypoints, position the camera to data link video data to the GCS, and during the flight the system has the capability to modify the flight path and camera position as long as the GCS is within line of sight to the Bat UAV. Also each air vehicle can be manually flown using a 72 MHz portable GCS out to 0.7 nautical miles.

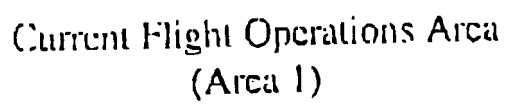
D. Method of Pilotage and proposed Method to Avoid Other Aircraft.

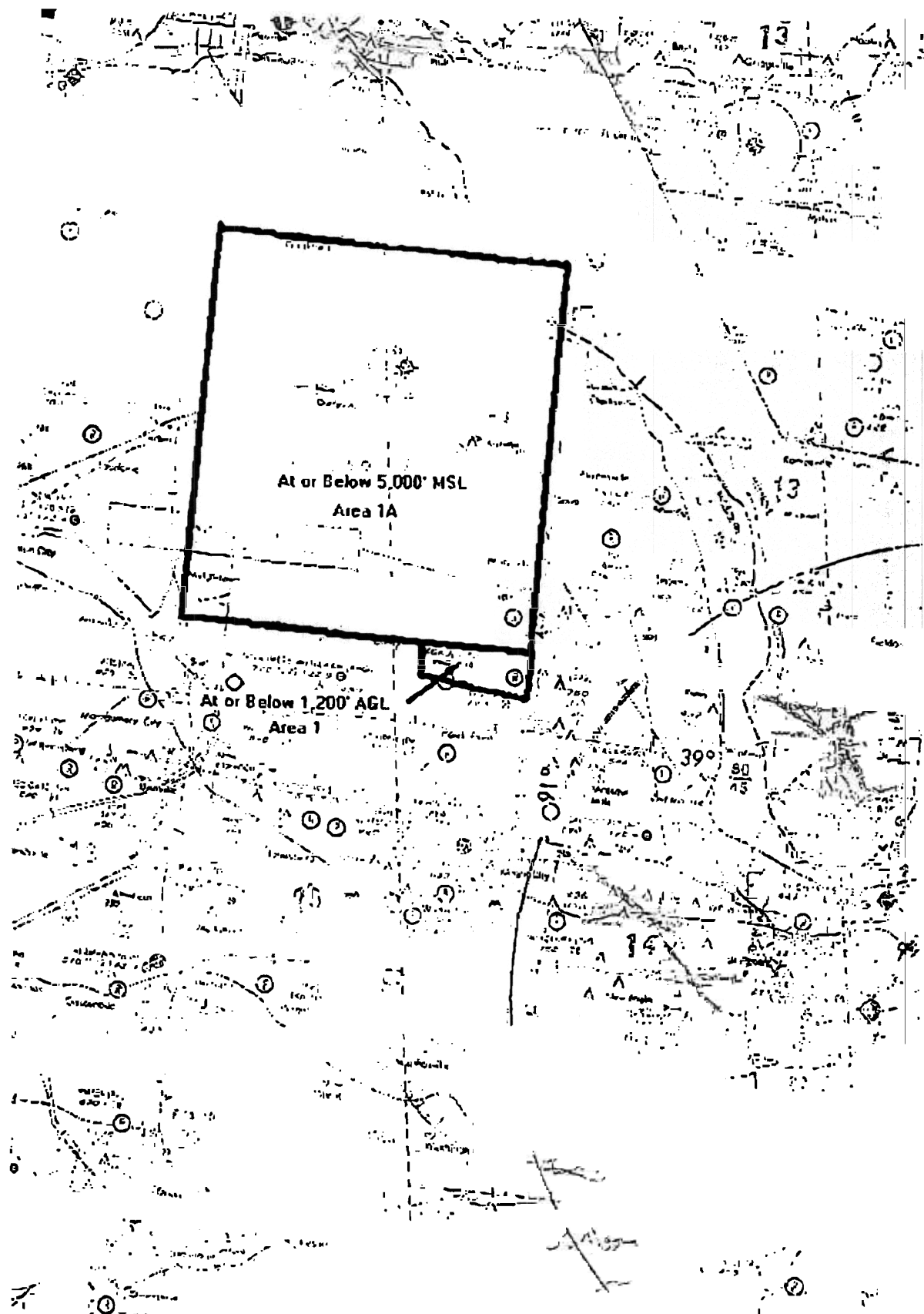
1. The primary method of pilotage for all flight operations will be autonomous control from takeoff through the flight planned route, to landing, with manual control as the back-up. Manual control will also be the back-up method of control should any unforeseen safety of flight circumstances arise. The primary method for avoidance of other aircraft and or flight hazards will be the Range Safety Aircraft, which will clear the area of operations/route of flight prior to the Bat UAV launch, join with the Bat UAV at a predetermined point, and perform flight following/see and avoid capabilities during the route of flight until hand off to the GCS for recovery. The secondary method to avoid other aircraft or flight hazards and see and avoid criteria will be through the Bat UAV onboard EO camera, which has a 45° field of view, -90° to +135° in azimuth, and 0° to -90° in elevation. All Bat UAV flights will be terminated if the Range Safety Aircraft is not capable of maintaining visual contact with the Bat UAV or determines the risk of continuing the flight is deemed unsafe.
3. The Boeing Company looks forward to working with The Federal Aviation Administration in refining the criteria for Unmanned Air Vehicles operations within civil airspace. As future technologies are unveiled, it will be imperative that we have established the operational requirements that will effectively allow the production UAVs the latitude to perform their tasks, both on the military side, as well as on the civil side.
4. Any further questions can be addressed to Mr. John Simmons at (314) 234-3271, or by e-mail at john.l.simmons-iii@boeing.com.


Terry J. Schmidt
Manager, Phantom Works EPIC

Enclosures:

Current and Proposed Flight Operations Areas
Bat UAV Command and Control Architecture





Cooperative Autonomous Multi-platform Mission Operations (CAMMO)

