



U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

**ORDER
8130.34**

National Policy

3/27/2008

SUBJ: Airworthiness Certification of Unmanned Aircraft Systems

This order establishes procedures for issuing a special airworthiness certificate in the experimental category for the purposes of research and development, market survey, or crew training to unmanned aircraft systems. The procedures in this order apply to Federal Aviation Administration (FAA) manufacturing aviation safety inspectors (ASI) and to FAA airworthiness ASIs.

/S/

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Distribution: A-W (IR/FS/VN) -3; A-X (CD/FS) -3; A-FFS-0 (LTD) **Initiated By:** AIR-200
A-FAC-0 (ALL); AMA-220 (50 copies); AMA-250 (10 copies)
AFS-600 (3 copies); (ALL); AEU-100/200

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Chapter 1. Introduction

1. Purpose of This Order. This order establishes procedures for issuing special airworthiness certificates in the experimental category for the purposes of research and development, market survey, or crew training to unmanned aircraft systems (UAS). The procedures contained in this order apply to Federal Aviation Administration (FAA) manufacturing aviation safety inspectors (ASI) and to FAA airworthiness ASIs. Currently, Representatives of the Administrator or delegated organizations are not authorized to issue special airworthiness certificates in the experimental category to UAS.

2. Audience. All manufacturing inspection offices, aircraft certification office personnel, directorate managers, flight standards division managers, flight standards district offices (FSDO), and Air Traffic Organization (ATO) personnel involved in unmanned aircraft operations.

3. Where Can I Find This Order. You can find this order on the Regulatory and Guidance Library at <http://rgl.faa.gov/>. Copies may be obtained from a member of AIR-200 at the phone number listed in paragraph 2 of appendix D to this order.

4. Action Date. FAA managing offices must implement the practices contained in this order related to issuing experimental certificates to UAS no later than 30 days from the date of issuance.

Chapter 2. Policies and Procedures

Section 1. Aircraft Registration

1. Experimental Certificates.

a. Personnel authorized to issue experimental certificates. Consistent with applicable Aircraft Certification Service (AIR) policies and instructions, FAA manufacturing ASIs are authorized to issue experimental airworthiness certificates. For the purposes of this directive, FAA manufacturing ASIs are responsible for the issuance of both original and recurrent airworthiness certificates and approvals for UAS.

b. Personnel not authorized to issue experimental certificates. Representatives of the Administrator or delegated organizations authorized under part 183 of Title 14, Code of Federal Regulations (14 CFR) are not permitted to issue experimental certificates for UAS.

c. Electronic signatures. The use of electronic signatures on experimental certificates is not permitted.

2. Responsibilities of FAA ASIs. The procedural requirements for issuing original and recurrent (that is, subsequent) airworthiness certifications in this order differ from those in FAA Order 8130.2, Airworthiness Certification of Aircraft and Related Products. Order 8130.2 states that FAA manufacturing ASIs are responsible for issuing original airworthiness certifications and FAA airworthiness ASIs are responsible for issuing recurrent airworthiness certifications. As stated in paragraph 1 of this section, FAA manufacturing ASIs are responsible for issuing *both* original and recurrent airworthiness certification for UAS. During the UAS certification process, airworthiness ASIs review and accept the UAS maintenance program.

3. Possession and Display of a Certificate of Aircraft Registration, an Airworthiness Certificate, and an Aircraft Flight Manual. The unique aspects of UAS design and configuration make compliance with 14 CFR § 91.203(a) and (b), Civil aircraft: Certifications required, unnecessary. The same is true for § 91.9(b)(2), Civil aircraft flight manual, marking, and placard requirements. The purpose of carrying and displaying these documents is for the benefit of the pilot, crew, passengers, and FAA. Because the aircraft is unmanned, the applicant must petition the FAA for relief from compliance with this requirement in accordance with 14 CFR part 11, General Rulemaking Procedures. If an exemption is granted, the aircraft registration, airworthiness certificate, and aircraft flight manual must be maintained at the location defined in the exemption.

4. Aircraft Registration.

a. Registration. The procedures for unmanned aircraft (UA) registration and issuance of registration numbers are contained in 14 CFR part 47, Aircraft Registration. The registration of UA is not a function of airworthiness certification; however, U.S. registration is a prerequisite for issuance of an experimental airworthiness certificate. The FAA must ensure that any UAS presented for airworthiness certification is properly registered (49 U.S.C. § 44704(c) and 14 CFR § 21.173).

b. Proof of ownership. The applicant for registration of a UA must submit proof of ownership to the FAA Aircraft Registration Branch (AFS-750) that meets the requirements prescribed in part 47. Aeronautical Center (AC) Form 8050-2, Aircraft Bill of Sale, or its equivalent, may be used as proof of ownership. The first time the UA is registered, the manufacturer must also complete and submit AC Form 8050-88, Affidavit of Ownership for Experimental Aircraft Including Amateur-Built Aircraft and Other Non-Type Certificated Aircraft. If the applicant did not purchase the UA from the last registered owner, the applicant must submit a complete chain of ownership from the last registered owner to the applicant. The purchaser under a contract of conditional sale is considered the owner for the purpose of registration. The contract of conditional sale may be submitted as proof of ownership in lieu of a bill of sale.

5. Registration Numbers, Reservation of Registration Numbers, Special Registration Numbers, and Size of Registration Numbers.

a. Registration numbers. All U.S. civil aircraft registration numbers are prefixed by an *N*. The registration number, apart from the *N* prefix, is made up of one to five symbols, the last two of which may be alphabetical. This alphabetical suffix must be preceded by at least one numerical symbol. The lowest possible number is N1. A zero never precedes the first number. For example:

N1 through N99999, all symbols are numeric.

N1A through N9999Z, single alphabetical suffix.

N1AA through N999ZZ, double alphabetical suffix.

Note: To avoid confusion with the numbers zero and one, the letters *O* and *I* are never used as alphabetical suffixes.

b. Reservation of registration numbers.

(1) A person may reserve a registration number of his or her choice, if available, for 1 year by sending a written request and the appropriate fee for each number to be reserved to the following address:

FAA Aircraft Registration Branch, AFS-750
Mike Monroney Aeronautical Center
P.O. Box 25504
Oklahoma City, OK 73125-0504

(2) The applicant should list five numbers in case the first choice is not available. Reservations may be renewed from year to year by paying the appropriate fee before the end of the renewal period. If the renewal payment is not received before the end of the 1-year period, reservation of the special registration number will expire.

Note: Once AFS-750 has been notified that the numbers have been permanently affixed to the aircraft and the airworthiness certificate has been issued, no subsequent fees will apply.

c. Special registration numbers. The following procedures apply:

(1) If a special registration number is desired for the UA, the owner must apply, in writing, to AFS-750, describing the UA for a special registration number. Permission to place the special number on the UA will be given on AC Form 8050-64, Assignment of Special Registration Numbers.

(2) The owner must complete, sign, and return the original form to AFS-750 within 5 days after the special registration number is affixed to the UA.

(3) The duplicate of Form 8050-64 and the present experimental certificate must be presented to the FAA ASI, who will issue a replacement experimental certificate showing the new registration number.

(4) The old certificate of aircraft registration and the duplicate Form 8050-64 must be available until the new certificate of aircraft registration is received (see § 47.15(f), Identification number).

(5) Any changes in the current assignment of nationality and registration numbers will be processed as a request for assignment of special registration numbers.

d. Size of registration numbers. All nationality and registration marks displayed on all aircraft must be in accordance with 14 CFR part 45, Identification and Registration Marking, except as provided in § 45.22(d), Exhibition, antique, and other aircraft: Special rules.

6. Inspection and Maintenance Programs. Applicants are required to develop an inspection and maintenance program for the continued airworthiness of the UAS, in accordance with § 21.195(d)(1), Experimental certificates: Aircraft to be used for market surveys, sales demonstrations, and customer crew training. Information on inspection and maintenance programs and how they relate to UAS follows:

a. Inspection elements. Inspection elements include the items to be inspected, the inspection interval, and instructions for completion of the inspection (for example, visual, eddy current, and operational). All UAS programs must include this information appropriate to the UAS and the type of operation. Operators should refer to appendix D to 14 CFR part 43, Scope and Detail of Items (as Applicable to the Particular Aircraft) To Be Included in Annual and 100-Hour Inspections, as a general guideline for the types of items that should be included.

b. Maintenance elements. Maintenance elements describe what and how maintenance is to be performed. For most UAS, this will simply be how discrepancies are recorded and how logbook entries are made (for example, how often, what is included). The specifics of what is required for the operator's maintenance program are defined in the operating limitations.

Section 2. Airworthiness Certificates

1. Issuance of Airworthiness Certificates. FAA Form 8130-7, Special Airworthiness Certificate, is the only airworthiness certificate that can be issued to a UAS. Form 8130-7 will be referred to as being a special classification within this order. Within the special classification, an experimental certificate may be issued to a UAS in the following categories (see § 21.191, Experimental certificates):

- a. Research and development (R&D), § 21.191(a).
- b. Crew training, § 21.191(c).
- c. Market survey, § 21.191(f).

2. Replacement or Amendment of Airworthiness Certificates. Changes to the current airworthiness certificate require specific actions and the issuance of a new Form 8130-7. Each form will be completed in accordance with this order.

a. Replacement.

(1) The FAA may issue a replacement airworthiness certificate when a certificate is declared lost, has been mutilated, or is no longer legible. The replacement airworthiness certificate must carry the original issue date of the certificate being replaced, preceded by a capital *R* in the Date block of the certificate. Replacement certificates also will be issued when the UA registration number has been changed. In this case, a new application for airworthiness certification is not required.

(2) A request for a replacement certificate is made to the issuing certification office (Manufacturing Inspection District Office (MIDO)/Manufacturing Inspection Satellite Office (MISO)). The registered owner makes this request by submitting a signed statement containing the registration number (N-number), serial number, make, and model of the UA, and a reason the replacement certificate is needed. Replacement of airworthiness certificates must not be accomplished by verbal agreement.

(3) A replacement airworthiness certificate may be issued without supporting documentation from AFS-750 if the date of issuance and the airworthiness classification and/or category of the lost or mutilated certificate can be positively established from the UAS records, or from the remains of the certificate. If there is insufficient data on which to base issuance of the replacement certificate, the FAA ASI will request copies of the appropriate data (such as the application form or previously issued airworthiness certificate) from AFS-750.

(4) Before issuing a replacement certificate, the FAA must review the UAS records and, if necessary, inspect the UAS to ensure that the applicant's request is justified and that the UAS is eligible for a special airworthiness certificate.

(5) A copy of the replacement certificate must be forwarded to AFS-750.

b. Amendment.

(1) A special airworthiness certificate may be amended when there is a change in the operating limitations for a UAS.

Note: Changes to any component of a UAS may affect the operating limitations imposed by the experimental certificate issued to the UAS. Applicants must consult with AIR-200 and the issuing office concerning changes to the UAS that may impact any operating limitation imposed.

(2) When a certificate is amended, the issuance date will be the current date, and the capital letter A will be typed in front of the date.

(3) Any amendment of an airworthiness certificate will require submission of FAA Form 8130-6, Application for Airworthiness Certificate. An appropriate record entry, in accordance with this order, will be made in the UAS records documenting the issuance of the amended certificate.

(4) A copy of the amended certificate must be forwarded to AFS-750.

3. Surrendered Airworthiness Certificate.

a. Written authorization. An aircraft owner or authorized representative who voluntarily surrenders an airworthiness certificate by written authorization must state why the certificate is being surrendered. The authorization and certificate must be forwarded to AFS-750 for retention in the permanent airworthiness files for the UA.

b. Selling or leasing to other countries. When a UA owner or operator sells or leases a U.S.-owned UA to a purchaser in another country for operations and registration, the aircraft is deregistered and the airworthiness certificate is no longer effective. Therefore, the airworthiness certificate must be surrendered to the FAA by the UA owner or operator.

4. Safeguarding FAA Airworthiness Certificates. Airworthiness certificates are official forms and must be safeguarded by those FAA ASIs who are charged with their issuance. Airworthiness certificates may not be produced in a computerized electronic format. Every measure must be taken to ensure these certificates are not obtained by unauthorized persons. At no time may a blank certificate be given to any unauthorized individual. Blank airworthiness certificates must be secured in a locked container when left unattended.

5. Recording of Inspections. FAA Form 8100-1, Conformity Inspection Record, is used to document airworthiness certification. Form 8100-1 must be prepared in accordance with the instructions shown on the back of the form.

6. Records Retention. A copy of all certification documents are to be retained in the project files of the issuing ASI as required by Order 8130.2. Form 8100-1 should be retained in accordance with FAA Order 1350.15, Records Organization, Transfer, and Destruction Standards, and any other National Archives and Records Administration (NARA)-approved document requirements.

Chapter 3. Special Airworthiness Certification

Section 1. Procedural Requirements

1. General. The procedures in this chapter provide guidance material associated with airworthiness certification and the issuance of Form 8130-7. Subpart H of part 21, Airworthiness Certificates, prescribes the procedural requirements for airworthiness certification for experimental aircraft.

2. Application for an Airworthiness Certificate. Form 8130-6 is required whenever a special airworthiness certificate is issued or amended. This includes changes to operating limitations that may have been prescribed. The applicant must complete the appropriate sections and sign the application. A sample program letter, unique to UAS, has been prepared as appendix B to this order. The applicant's program letter must be submitted to the FAA with any other document(s) required for the requested certification. The program letter is based on the requirements of § 21.193(d), Experimental certificates: General.

3. Certification Procedures. In no case may any UAS be operated as civil unless there is an appropriate and valid airworthiness certificate issued for that UAS. The following procedures describe the details for issuance of Form 8130-7, consistent with any other specific procedures that may be prescribed in other paragraphs. The FAA must conduct a safety evaluation and inspections necessary to verify the certification procedures listed below, including any other inspections deemed appropriate for that certification.

a. Program letter. The applicant must provide a completed program letter that includes the information contained in the sample program letter template provided in appendix B to this order. The sample template identifies the aircraft, the purpose of the certificate, the area over which the operations are to be conducted, the duration of the program, and other required information. The template must also contain information on the following specific areas:

(1) Containment. The FAA is particularly concerned with the ability of the aircraft to be contained in the proposed flight area. The applicant's ability to provide information that satisfies this requirement will help determine and define the operational area.

(2) Lost link. The applicant must provide a detailed process in the safety checklist describing the sequence the UA will follow in the event command and control is lost. This process will result in safely returning the UA to home base, or conclusion of the flight.

(3) Flight conclusion. In the event UA command and control is lost, an independent means to safely conclude the flight must be provided.

b. Safety checklist. The applicant must provide a completed safety checklist that includes the information contained in the sample template provided in appendix C to this order. The safety checklist assists the applicant in providing all the required information that must be provided during the UAS safety evaluation. This document is maintained on the FAA UAS Web site at www.faa.gov/uas or may be obtained from AIR-200.

c. Required items. The following items must be submitted by the applicant and accepted by the flight standards representative of the Unmanned Aircraft Program Office, AIR-160. These items must be submitted before issuance of the requested airworthiness certificate:

(1) Proposed operating area depicted on aeronautical chart. The proposed operating area must be plotted on an aeronautical chart with the coordinates that identify the area boundary. The proposed altitudes of operation also must be included. Other types of charts and maps may be included in addition to the aeronautical charts.

(2) Operations manuals and checklists. All appropriate operating manuals, including limitations and checklists (normal, abnormal, and emergency procedures), must be included.

(3) Training program. Applicants must provide an appropriate training curriculum for pilots, observers, chase operations, and ground personnel. Applicants must also provide documentation verifying that personnel have successfully completed all necessary training.

(4) Certificates. Applicants will be informed that the FAA will request evidence of FAA pilot and/or medical certificates. Personnel not requiring a certificate, but required to have successfully completed an FAA-accepted pilot ground school, must ensure the written examination results are available to the FAA. These documents must be made available at any time upon request of the FAA, and will be verified during the onsite meeting referenced in paragraph 3(d) below.

d. Safety evaluation. An FAA team, typically consisting of personnel from AIR-160, AIR-200, AFS-300, AFS-430, the local MIDO/MISO or certificate management office/certificate management unit (CMO/CMU), the FSDO, and ATO will conduct a review of the information in the applicant's program letter and safety checklist. The review may take place at the applicant's facility, the MIDO/MISO, FAA Headquarters, or a location to be determined.

e. Onsite meeting and schedule. At the completion of the safety evaluation, an onsite meeting and inspection will be scheduled by AIR-200. However, scheduling the onsite meeting is dependent on several requirements being completed at least 30 days before the onsite meeting date. If this is not possible, the meeting will be postponed. Completion of the following items is necessary before the meeting:

- (1) Exemption to §§ 91.9(b) and 91.203 (a) and (b), if required;
- (2) Alternate marking approval letter, if required;
- (3) Registration through the FAA Aircraft Registration Branch (AFS-750) in accordance with part 47; and
- (4) All open action items identified during the safety evaluation.

Section 2. Certification and Operation of Unmanned Aircraft Systems

1. Experimental Certificates. The procedures in this section apply to the issue of experimental airworthiness certificates under the provisions of § 21.191(a), (c), and (f), Experimental certificates: Research and development, crew training, and market surveys. These are described below.

a. Research and development. Under § 21.191(a), UAS are eligible for an experimental certificate for the purpose of research and development. The applicant may conduct research to determine whether an idea warrants further development. This includes testing new design concepts, aircraft equipment installations, operating techniques, or new uses for aircraft. In addition, the operation of a chase plane or other aircraft not otherwise eligible for a standard or an experimental certificate (but necessary for use in direct connection with the R&D project) is considered to be within the scope of this purpose.

b. Crew training. Under § 21.191(c), UAS are eligible for an experimental certificate for the purpose of training the applicant's flightcrews. These flightcrews would normally be the manufacturer's employees necessary to be trained in the United States.

c. Market surveys. Under § 21.191(f), U.S. manufacturers of UAS may apply for an experimental certificate for the purpose of market surveys, sales demonstrations, and customer crew training. The FAA ASI must ensure the provisions of § 21.195, Experimental certificates: Aircraft to be used for market surveys, sales demonstrations, and customer crew training, are met before issuing the experimental certificate. The applicant must ensure the provisions of § 21.193(d)(2) and (d)(3) are met by providing the FAA ASI with the estimated time or number of flights required for the market survey operation, as well as the area or itinerary over which the operations are to be conducted.

Note: The UAS manufacturer must accumulate at least 50 flight hours before it may conduct market surveys, sales demonstrations, or customer crew training. (See § 21.195(d)(2).) Flight hours flown under its experimental airworthiness certificate (R&D, manufacturer's crew training, or market survey) or an FAA Certificate of Waiver or Authorization will be considered to meet this rule. This requirement must be specified in the operating limitations.

2. FAA Form 8130-7, Special Airworthiness Certificate, and Attachments.

a. Purpose of Form 8130-7. Form 8130-7 (GPO pad only) is used for certification of all UAS.

b. Effective period. An experimental certificate for R&D, crew training, or market surveys is effective for 1 year or less after the date of issuance.

c. Operating limitations. Operating limitations generally applicable to nonstandard aircraft are printed on the reverse side of the form. The FAA also may prescribe additional operating limitations deemed necessary for the special purpose involved as authorized by § 91.319(i),

Aircraft having experimental certificates: Operating limitations. The additional limitations will be enumerated on a separate sheet, dated, signed, and attached to Form 8130-7. Refer to paragraph 5 of this section for information regarding additional operating limitations. The first page of the operating limitations is prepared on FAA letterhead paper.

3. Onsite Activities. After the safety evaluation is completed, as described in section 1, paragraph 3(d) of this chapter, an onsite meeting and inspection will be scheduled. Onsite activities consist of the following:

a. Record inspection. The FAA ASI must do the following:

(1) Obtain from the applicant a properly executed Form 8130-6 and any other documents required for the certification.

(2) Review the documentation provided by the applicant to determine that the registration requirements of part 47 have been met.

(3) Check with AFS-750 to determine if a denial letter exists for the particular UA. This may assist the ASI in determining UA eligibility.

(4) Review the maintenance records to determine that any required maintenance and inspections have been accomplished. Records must include a statement that UAS has been inspected and found to be in condition for safe operation, as described in paragraph 3(c)(1)(a), below.

(5) Provide copies of the applicable maintenance and inspection program to the Flight Standards Airworthiness ASI who will participate in the review process.

(6) Following a sufficient review time, ensure the Flight Standards Airworthiness ASI has reviewed and accepted the applicable inspection and maintenance program as described in the applicant's program letter.

Note: The maintenance program must include all supporting systems and equipment, for example, ground stations, launch and recovery systems, and backup generators.

(7) Review the applicant's weight and balance data for accuracy and currency for the aircraft submitted.

(8) Ensure the applicant has complied with all relevant airworthiness directives (ADs).

(9) Establish all required documentation and records have been provided for the UAS.

(10) Determine that the system configuration has been established and corresponds to the reviewed documentation.

b. UAS inspection. The applicant must arrange with the FAA to make the aircraft and related support systems available for inspection to determine the following:

(1) The aircraft nationality and registration marks are in accordance with part 45 or alternate marking approval from AIR-200.

Note: The UA is not required to be identified as described in § 45.11(a), Aircraft and aircraft engines, as related to fireproof identification plates, but it must be marked with a unique identifying number.

(2) The flight control system operates properly.

(3) The engine(s), propeller(s), and associated instruments operate in accordance with the manufacturer's instructions.

(4) The pitot-static and transponder inspections have been certified in accordance with §§ 91.411, Altimeter system and altitude reporting equipment tests and inspections, and 91.413, ATC transponder tests and inspections. In addition, associated instruments must operate properly, if applicable.

(5) All elements of the control station operate properly as demonstrated by normal preflight operational checks of the UA.

c. Certificate issuance.

(1) If the UAS meets the requirements for the certification requested, the FAA must—

(a) Make an entry in the maintenance records. The following or a similarly worded statement must be entered:

I find this Unmanned Aircraft meets the requirements for the certification requested, and have issued a special airworthiness certificate dated (MMM/DD/YYYY). The operation of this Unmanned Aircraft System is contingent upon (applicant's name) compliance with (title of the submitted program letter and documentation) and the operating limitations of this airworthiness certificate. A new condition inspection is required prior to issuance of another special airworthiness certificate.

Signed:

Aviation Safety Inspector, (Office Code)

(b) Issue Form 8130-7. When completing block A of Form 8130-7, Category Designation, the FAA ASI will include the words *Experimental (Unmanned Aircraft)* under the Purpose section of block A. The FAA ASI will write any of the following, as appropriate: *Research & Development, Crew Training, or Market Survey.*

(c) Complete sections V and VIII of Form 8130-6 according to the instructions contained in chapter 8 of Order 8130.2. The ASI will make an annotation in section II, block B identifying the aircraft as unmanned. The words *Unmanned Aircraft* will be entered in the block immediately after the preprinted wording until such time that Form 8130-6 is revised.

(d) Examine, review, and route the certification file according to the instructions contained in chapter 8 of Order 8130.2.

(2) If the UAS does not meet the requirements for the certification requested, and the airworthiness certificate is denied, the FAA must—

(a) Write a letter to the applicant stating the reason(s) for denying the airworthiness certificate, and

(b) Attach a copy of the denial letter to Form 8130-6 and forward it to AFS-750 to be made part of the aircraft record.

4. Flight Test Areas.

a. Compliance. The assigned test area is prescribed in accordance with § 91.305, Flight test areas. Upon request, the FAA will assist applicants in selecting areas that comply with § 91.305. The FAA must evaluate each application to ensure the flight test area does not exceed that which is reasonably required to accomplish the program. Actions pertaining to flight test areas must be coordinated through AIR-200, the assigned MIDO/MISO, the assigned FSDO, and the nearest ATO office.

b. Assigned flight test area requirements. All UAS flight testing operations must be limited to the assigned flight test area. This is required until the aircraft is shown to be controllable throughout its normal range of speeds and execution of all maneuvers. In addition, the aircraft must not have displayed any hazardous operating characteristics or design features.

(1) The FAA typically will assign a flight test area that has a defined perimeter. The shape of the perimeter can resemble a square, rectangle, or circle, or it could be multisided. The applicant will be expected to provide latitude and longitude coordinates for the flight test area.

(2) In the case of flight testing an aircraft from an airport surrounded by a densely populated area (but with at least one acceptable approach/departure route of flight), the FAA must ensure a route of flight is selected that subjects the fewest persons and least amount of property to possible hazards. The description of the area selected by the applicant and agreed to by the FAA must be made a part of the operating limitations.

(3) In the case of an aircraft located at any airport surrounded by a densely populated area and lacking any acceptable approach/departure route of flight, the FAA must deny the airworthiness certificate; the FAA must write a letter to the applicant stating the reason(s) for denying the proposed flight test area. The applicant must be advised to relocate the aircraft to an airport suitable for flight testing.

Note: An acceptable approach/departure route of flight may be considered to exist when the route of flight provides a reasonable opportunity to execute an off-airport emergency landing that will not jeopardize other persons or property.

5. Operating Limitations. Operating limitations must be designed to fit the specific situation and the specific objectives of the special airworthiness certificate under § 91.319. The ASI may impose any additional limitations deemed necessary in the interest of safety. The ASI must review each imposed operating limitation with the applicant to ensure the applicant understands the operating limitations. Appendix A to this order provides sample operating limitations that must be prescribed for an experimental certificate, as applicable. Operating limitations must be coordinated either by or through AIR-200.

**Appendix A. Sample Operating Limitations
Experimental: Research and Development, Market Survey,
and/or Crew Training**



800 Independence Ave, S.W.
Washington, D.C. 20591

**Operating Limitations
Experimental: Research and Development, Market Survey,
and/or Crew Training**

<p>Registered Owner Name: [Insert Owner Name]</p> <p>Registered Owner Address: [Insert Address]</p> <p>Aircraft Description: [Insert Description]</p> <p>Aircraft Registration: [Insert Registration Number]</p>	<p>Aircraft Builder: [Insert Builder Name]</p> <p>Year Manufactured: [Insert Year]</p> <p>Aircraft Serial Number: [Insert Serial Number]</p> <p>Aircraft Model Designation: [Insert Model Designation]</p> <p>Engine Model: [Insert Model Designation]</p>
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The following conditions and limitations apply to all unmanned aircraft system (UAS) flight operations for the (name and model of UAS) while operating in the National Airspace System (NAS).

1. General Information.

a. Integrated system. For the purposes of this special airworthiness certificate and operating limitations, the (name and model of UAS) operated by (individual or company name) is considered to be an integrated system. The system is composed of the following:

- (1) Name and model of the aircraft.

- (2) Serial number.
- (3) UAS control station(s), that is, fixed, mobile, ground-based, or airborne.
- (4) Telemetry, launch, and recovery equipment.
- (5) Communications and navigation equipment, including ground and/or air equipment used for command and control of the (name and model of UAS).
- (6) Equipment on the ground and in the air used for communication with the chase aircraft, other members of the flightcrew, observers, air traffic control (ATC), and other users of the NAS.

b. Compliance with 14 CFR part 61 (Certification: Pilots, Flight Instructors, and Ground Instructors) and part 91 (General Operating and Flight Rules). Unless otherwise specified in this document, the UA pilot-in-command (PIC) and (applicant name) must comply with all applicable sections and parts of 14 CFR including, but not limited to, parts 61 and 91.

c. Operational requirements.

- (1) No person may operate this UAS for other than the purpose of research and development, market survey, and/or crew training, to accomplish the flight operation outlined in (applicant's name) program letter dated (include date), which describes compliance with § 21.193(d), Experimental certificates: General, and has been made available to the UA PIC.
- (2) This UAS must be operated in accordance with applicable air traffic and general operating rules of part 91 and all additional limitations herein prescribed under the provisions of § 91.319(i), Aircraft having experimental certificates: Operating limitations.
- (3) (Applicant name) must accumulate at least 50 flight hours under its experimental airworthiness certificate before customer crew training is permitted, in accordance with § 21.195(d), Experimental certificates: Aircraft to be used for market surveys, sales demonstrations, and customer crew training.

d. UA condition. The UA PIC must determine that the UA is in a condition for safe operation, and in a configuration appropriate for the purpose of the intended flight.

e. Multiple-purpose operations. When changing between operating purposes of a multiple purpose certificate, the operator must determine that the aircraft is in a condition for safe operation and appropriate for the purpose intended. A record entry will be made by an appropriately rated person (that is, an individual authorized by the applicant and acceptable to the FAA) to document that finding in the maintenance records.

f. Operation exceptions. No person may operate this UA to carry property for compensation or hire (§ 91.319(a)(2)).

g. UA markings.

(1) This UA must be marked with its U.S. registration number in accordance with part 45 or alternative marking approval issued by the FAA Production and Airworthiness Division (AIR-200).

(2) This UA must display the word *Experimental* in accordance with § 45.23(b), Display of marks, unless otherwise granted an exemption from this requirement.

h. Required documentation. Before conducting the initial flight of the (name and model of UAS), (applicant name) must forward a copy of the (name and model of UAS) program letter, special airworthiness certificate, and operating limitations to the (title of the appropriate FAA Air Traffic Organization (ATO) facility(ies)). The documents should be sent to the attention of (name), (title of ATO person), at e-mail (e-mail address), or via fax at (fax number).

i. Change in registrant address. Section 47.45, Change of address, requires that the FAA Aircraft Registry be notified within 30 days of any change in the aircraft registrant's address. Such notification is to be made by providing AC Form 8050-1, Aircraft Registration Application, to the FAA Aircraft Registration Branch (AFS-750) in Oklahoma City, Oklahoma.

j. Certificate display and manual availability. The airworthiness and registration certificates must be displayed, and the aircraft flight manual must be available to the pilot, as prescribed by the applicable sections of 14 CFR, or as prescribed by an exemption granted in accordance with 14 CFR part 11, Investigative and Enforcement Procedures, to (individual company name).

2. Program Letter. The (name and model of UAS) program letter, dated (insert date), will be used as a basis for determining the operating limitations prescribed in this document. All flight operations must be conducted in accordance with the provisions of this document.

3. Initial Flight Testing.

a. Requirements. Flight operations must be conducted within visual line of sight of the pilot/observer. Initial flight testing must be completed upon accumulation of (TBD) flight hours. Following satisfactory completion of initial flight testing, the operations manager or chief pilot must certify in the records that the aircraft has been shown to comply with § 91.319(b). Compliance with § 91.319(b) must be recorded in the aircraft records with the following, or a similarly worded, statement:

I certify that the prescribed flight test hours have been completed and the aircraft is controllable throughout its normal range of speeds and throughout all maneuvers to be executed, has no hazardous operating characteristics or design features, and is safe for operation. The following aircraft operating data has been demonstrated during the flight testing: speeds V_x _____, and V_y _____, and the weight _____ and CG location _____ at which they were obtained.

b. Aircraft operations for the purpose of market surveys, sales demonstrations, and customer crew training. These operations cannot be performed until 50 flight hours have been accomplished. An entry in the maintenance records is required as evidence of compliance.

4. Authorized Flight Operations Area.

a. Description of the authorized flight operations area. This should include latitude and longitude and altitude dimensions, a map of the proposed flight operations area, and the base of operations for the UAS. (Applicant must provide appropriate graphics for insertion here.)

b. Flight test area. The flight operations area authorized for the UA will be referred to as the flight test area, and is depicted graphically below.

c. Authorized flight times and conditions. All flight operations must be conducted during daylight hours under visual flight rules (VFR).

d. Criteria for remaining in the flight test area. The UAS PIC must ensure all UA flight operations remain within the lateral and vertical boundaries of the flight test area. Furthermore, the UAS PIC must take into account all factors that may affect the capability of the UA to remain within the flight test area. This includes, but is not limited to, considerations for wind, gross weight, and glide distances.

e. Incident/accident reporting. Any incident/accident and any flight operation that transgresses the lateral or vertical boundaries of the flight test area or any restricted airspace must be reported to the FAA within 24 hours. This information must be reported to the Unmanned Aircraft Program Office, AIR-160. AIR-160 can be reached by telephone at 202-385-4636 and fax at 202-385-4651. Accidents must be reported to the National Transportation Safety Board (NTSB) per instructions contained on the NTSB Web site: www.nts.gov. Further flight operations must not be conducted until the incident is reviewed by AIR-160 and authorization to resume operations is provided to (applicant name).

5. UA Pilots and Observers.

a. UA PIC roles and responsibilities.

- (1) The UA PIC must perform crew duties for only one UA at a time.
- (2) All flight operations must have a designated UA PIC. The UA PIC has responsibility over each flight conducted and is accountable for the UA flight operation.
- (3) The UA PIC is responsible for the safety of the UA as well as persons and property along the UA flight path. This includes, but is not limited to, collision avoidance and the safety of persons and property in the air and on the ground.
- (4) The UA PIC must avoid densely populated areas (§ 91.319) and exercise increased vigilance when operating within or in the vicinity of published airway boundaries.

b. UA PIC certification and ratings requirements.

(1) The UA PIC must hold and be in possession of, at a minimum, an FAA private pilot certificate, with either an airplane, rotorcraft, or powered-lift category; and single- or multiengine class ratings, or the military equivalent, appropriate to the type of UA being operated.

(2) The UA PIC must have and be in possession of a valid third-class (or higher) airman medical certificate issued under 14 CFR part 67, Medical Standards and Certification.

c. UA PIC currency, flight review, and training.

(1) The UA PIC must maintain currency in manned aircraft in accordance with § 61.57, Recent flight experience: Pilot in command.

(2) The UA PIC must have a flight review in manned aircraft every 24 calendar months in accordance with § 61.56, Flight review.

(3) The UA PIC must maintain currency in unmanned aircraft in accordance with (applicant name) company procedures.

(4) The UA PIC must have a flight review in unmanned aircraft every 24 calendar months in accordance with (company name) procedures.

(5) All UA PICs must have successfully completed applicable (applicant name) training for the UAS.

d. Supplemental UA pilot roles and responsibilities.

(1) Any additional UA pilot(s) assigned to a crew station during UA flight operations will be considered a supplemental UA pilot.

(2) A supplemental UA pilot assists the PIC in the operation of the UA and may do so at the same or a different control station as the PIC. The UA PIC will have operational override capability over any supplemental UA pilots, regardless of position.

(3) A supplemental UA pilot must perform crew duties for only one UA at a time.

e. Supplemental UA pilot certification. The supplemental UA PIC need not be a certificated pilot, but must have successfully completed a recognized private pilot ground school program.

f. Supplemental UA pilot currency, flight review, and training.

(1) All UA pilots must maintain currency in unmanned aircraft in accordance with (applicant name) company procedures.

(2) All UA pilots must have a flight review in unmanned aircraft every 24 calendar months in accordance with (company name) procedures.

(3) All UA pilots must have successfully completed applicable (applicant name) training for the UAS.

g. Observer roles and responsibilities. The task of the observer is to provide the UA PIC(s) with instructions to maneuver the UA clear of any potential collision with other traffic. To satisfy these requirements—

- (1) The observer must perform crew duties for only one UA at a time.
- (2) At no time will the observer permit the UA to operate beyond the line-of-sight necessary to ensure maneuvering information can be reliably determined.
- (3) At no time will the observer conduct his/her duties more than (TBD) laterally or (TBD) vertically from the UA.
- (4) An observer must maintain continuous visual contact with the UA to discern UA attitude and trajectory in relation to conflicting traffic.
- (5) An observer may be positioned in a chase aircraft. When a chase aircraft is used, it must maintain a reasonable proximity, and must position itself relative to the UA to reduce the hazard of collision in accordance with § 91.111, Operating near other aircraft. When the observer is located in a chase aircraft, the observer's duties must be dedicated to the task of observation only. Concurrent duty as pilot of the chase aircraft is not authorized.
- (6) Observers must continually scan the airspace for other aircraft that pose a potential conflict.
- (7) All flight operations conducted in the flight test area must have an observer to perform traffic avoidance and visual observation to fulfill the see-and-avoid requirement of § 91.113, Right-of-way rules: Except water operations.

h. Observer certification.

- (1) All observers must either hold, at a minimum, an FAA private pilot license or military equivalent, or must have successfully completed specific observer training acceptable to the FAA. An observer does not require currency as a pilot.
- (2) All observers must have in their possession a valid third-class (or higher) airman medical certificate issued under part 67.

i. Observer training.

- (1) All observers must be thoroughly trained, be familiar with, and possess operational experience with the equipment being used. Such training is necessary for observation and detection of other aircraft for collision avoidance purposes as outlined in (applicant name) program letter.

(2) All observers must have successfully completed applicable (applicant name) training for the UAS.

6. Equipage.

a. The UAS must be equipped with an operable transponder with Mode C or Mode S, and two-way communications equipment allowing communications between the UA pilot, chase aircraft, observers, all UAS control stations, and ATC.

b. The UA and chase aircraft must be equipped with operable navigation, position, and/or strobe/anti-collision lights. Strobe/anti-collision lights must be illuminated during all operations.

7. Communications.

a. Before UA flights.

(1) Before conducting operations, the frequency spectrum used for operation and control of the UA must be approved by the Federal Communications Commission or other appropriate government oversight agency.

(2) At least 2 hours before each UA flight, (applicant name) must contact the (FAA name) Air Route Traffic Control Center (ARTCC) (identify specific ARTCC), Milsap Low Sector at (phone number), to obtain a transponder code (if so equipped). Upon initial contact with ATC, the UA PIC must indicate the experimental nature in accordance with § 91.319.

b. During UA flights.

(1) Appropriate air traffic frequencies must be monitored during flight operations.

(2) All UA positions must maintain two-way communications with each other during all operations. If unable to maintain two-way communication, the UA PIC will expeditiously return the UA to its base of operations while remaining within the flight test area and conclude the flight operation.

8. Flight Conditions.

a. Daylight operations. All flight operations must be conducted during daylight hours in visual meteorological conditions (VMC), including cloud clearance minimums as specified in § 91.155, Basic VFR weather minimums. Flight operation in instrument meteorological conditions (IMC) is not permitted.

b. Prohibitions.

(1) The UA is prohibited from aerobatic flight, that is, an intentional maneuver involving an abrupt change in the UA's attitude, an abnormal acceleration, or other flight action not necessary for normal flight. (See § 91.303, Aerobatic flight.) If aerobatic flight is anticipated, it must be thoroughly discussed during the system review and be appropriately described in the operating limitations.

(2) Flight operations must not involve carrying hazardous material or the dropping of any objects or external stores.

(3) Each UA must be operated by only one control station at a time. A control station may not be used to operate multiple UAs.

c. Transponder requirements.

(1) The UA must operate an approved operational Mode C or Mode S altitude encoding transponder during all flight operations.

(2) Chase aircraft transponders must be on standby while performing chase operations flight with the UA.

d. Transponder failure.

(1) In the event of transponder failure on either the UA or the chase aircraft, the UA must conclude all flight operations and expeditiously return to its base of operations within the prescribed limitations of this authorization.

(2) In the event of UA transponder failure, a chase aircraft will operate its transponder in Mode C.

e. Notice to airman. (Applicant name) must request the issuance of a Notice to Airman (NOTAM) through the (FAA name) Automated Flight Service Station at least 24 hours before flight operation.

9. Flight Termination and Lost Link Procedures.

a. Flight termination. In accordance with (applicant name) program letter, dated (date), flight termination must be initiated at any point that safe operation of the UA cannot be maintained or if hazard to persons or property is imminent.

b. Lost link procedures. In the event of lost link, the UA must provide a means of automatic recovery that ensures airborne operations are predictable and that the UA remains within the flight test area. The chase aircraft or observer, all other UAS control stations, and the appropriate ATC facility will be immediately notified of the lost link condition and the expected UA response.

10. Maintenance and Inspection.

a. General requirements. The UAS must not be operated unless it is inspected and maintained in accordance with the (applicant name and name of procedures), (State applicable sections and effective date) or later accepted FAA revision. (Applicant name) must establish and maintain aircraft maintenance records (see paragraph 10(d) below).

b. Inspections. No person may operate this UAS within the preceding 12 calendar months unless it has had a condition inspection performed according to the FAA-accepted (applicant name) Inspection and Maintenance Program. The UAS must also have been found to be in a condition for safe operation. This inspection will be recorded in the UAS maintenance records as described in paragraph 10(d) below.

c. Authorized inspectors. Only those individuals trained and authorized by (applicant name) and acceptable to the FAA may perform the inspections and maintenance required by these operating limitations.

d. Maintenance and inspection records. Maintenance and inspections of the UAS must be recorded in the UAS maintenance records. The following information must be recorded:

(1) Maintenance record entries must include a description of the work performed, the date of completion for the work, the UAS's total time-in-service, and the name and signature of the person performing the work.

(2) Inspection entries must contain the following, or a similarly worded, statement: *I certify that this UAS was inspected on (date), in accordance with the scope and detail of the (applicant name) Inspection and Maintenance Program, and was found to be in a condition for safe operation.*

(3) UAS instruments and equipment required to be installed must be inspected and maintained in accordance with the requirements of the (applicant name) Inspection and Maintenance Program. Any maintenance or inspection of this equipment must be recorded in the UAS maintenance records.

(4) No person may operate this UAS unless the altimeter system and transponder have been tested within the preceding 24 calendar months in accordance with § 91.411, Altimeter system and altitude reporting equipment tests and inspections, and § 91.413, ATC transponder tests and inspections. These inspections will be recorded in the UAS maintenance records.

11. Information Reporting. (Insert company name) will provide the following information to (insert name and contact information) on a monthly basis. (Contact name and information must be provided at the time the certificate is issued.)

- a. Number of flights conducted under this certificate.
- b. Pilot duty time per flight.
- c. Unusual equipment malfunctions (hardware or software).

- d. Deviations from ATC instructions.
- e. Unintended entry into lost link flight mode that results in a course change.

12. Revisions and Other Provisions.

a. Experimental certificates, program letters, and operating limitations. The experimental certificate, FAA-accepted (applicant name) program letter, and operating limitations cannot be reissued, renewed, or revised without application being made to the (manufacturing inspection district office (MIDO) name), in coordination with AIR-200. AIR-200 will be responsible for FAA Headquarters internal coordination with the Aircraft Certification Service, Flight Standards Service, Air Traffic Organization, Office of the Chief Council, and Office of Rulemaking.

b. Certificates of waiver or authorization. No Certificate of Waiver or Authorization (COA) may be issued in association with this experimental certificate unless coordinated with the (insert MIDO name) and AIR-200.

c. Amendments and cancellations. The provisions and limitations annotated in this operational approval may be amended or cancelled at any time as deemed necessary by the FAA.

d. Reviews of revisions. All revisions to (applicant name) FAA-accepted Inspection and Maintenance Program must be reviewed and accepted by the (Flight Standards District Office (FSDO) name). The (FSDO name) can be reached at telephone number (phone number).

13. UAS Modifications.

a. Software and system changes. All software and system changes will be documented as part of the normal maintenance procedures and will be available for inspection. All software and system changes must be inspected and approved per (applicant name) maintenance program dated (insert date). All software changes to the aircraft and control station are categorized as major changes, and must be provided in summary form at the time they are incorporated.

b. Major modifications. All major modifications, whether performed under the experimental certificate, COA, or other authorizations, that could potentially affect the safe operation of the system, must be documented and provided to the FAA before operating the aircraft under this certificate. Major modifications incorporated under COA or other authorization need to be provided only if the aircraft is flown under these authorizations during the effective period of the experimental certificate.

c. Submission of modifications. All information requested must be provided to AIR-200.

End of Limitations

3/27/2008

8130.34
Appendix A

/s/

(Name)

Date:

Aviation Safety Inspector

(Name of MIDO)

(Issuing office address)

(City, State Zip Code)

I certify that I have read and understand the operating limitations and conditions that are a part of the special airworthiness certificate, FAA Form 8130-7, issued on (date), for the purposes of [research and development, market survey, and/or crew training, (enter as applicable)].

This special airworthiness certificate is issued for (name and model of UAS), serial number (xxx), registration number (xxx).

Applicant (signature)

Date:

Name (Printed): _____

Title: _____

Company: _____

Appendix B. Sample Program Letter for Unmanned Aircraft Systems for an Experimental Certificate

<p>Registered Owner Name: [Enter Owner Name]</p> <p>Registered Owner Address: [Enter Owner Address]</p> <p>Aircraft Description: [Enter Description]</p> <p>Aircraft Registration: [Enter Registration Number]</p>	<p>Aircraft Builder: [Enter Builder Name]</p> <p>Year Manufactured: [Enter Year]</p> <p>Aircraft Serial Number: [Enter Serial Number]</p> <p>Aircraft Model Designation: [Enter Model Designation]</p> <p>Engine Model:: [Enter Model Designation]</p> <p>Propeller Model: [Enter Model Designation]</p>
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1. Overview of Project. The applicant must provide a general explanation and overview of the project, indicating any past flight history or experience for consideration. The applicant should provide enough detail for the FAA to understand the program's purpose and need for an experimental certificate for a UAS, including the following:

a. Definition of the experimental purpose. Provide a definition of the experimental purpose(s) under which the aircraft is to be operated (14 CFR § 21.191, Experimental certificates).

b. Description of the purpose/scope of the experimental program. Provide a description of the purpose/scope of the experimental program for each experimental purpose sought (§ 21.193(b) and (d), Experimental certificates: General).

2. Definition of Flight Areas. Provide a definition of the area(s) in which the experimental flights will be conducted, including the following:

a. The areas over which the flights are to be conducted and the address of base operation (§ 21.193(d)(3)).

b. The proposed flight test area using latitude and longitude on an aeronautical chart or aerial photograph. For example, if the perimeter of the proposed flight test area is in the shape of a rectangle, the latitude and longitude of the corners must be stated. The distance of each leg of the perimeter must be stated.

c. Airspeed, altitude, number of flight hours, number of flights, and program duration for each test flight area.

d. Class of airspace to be used.

e. Whether minimum fuel requirements of 14 CFR § 91.151, Fuel requirements for flight in VFR conditions, will be met.

f. Whether flight testing will include payload testing, if the operation is for flight testing.

g. Considerations that need to be taken into account regarding payloads.

h. Whether the aircraft will perform any aerobatic maneuvers.

i. Flight conditions, for example, VFR and visual meteorological conditions (VMC).

3. Aircraft Configuration. Attach three-view drawings or three-view dimensioned photographs of the aircraft (see § 21.193(b)(4)). Describe UAS configuration, including the control station. Include a description of aircraft/system performance characteristics including the following:

a. Wing span.

b. Length.

c. Powerplant.

d. Maximum gross takeoff weight.

e. Fuel capacity.

f. Payload capacity.

g. Maximum altitude.

h. Endurance.

i. Maximum airspeed.

j. Control/data frequencies.

k. Guidance and navigation control.

4. Inspection and Maintenance (part 91, (General Operating and Flight Rules) subpart E, (Maintenance, Preventive Maintenance, and Alterations).

a. Description of the program. Describe the inspection and maintenance program that will be used to maintain the aircraft and related systems, including ground stations and/or other support systems.

b. Required documentation. Provide a copy of the flight manual, if applicable; current weight and balance report; and equipment list.

5. Pilot Qualification (14 CFR §§ 61.3, Requirement for certificates, ratings, and authorizations, and 61.5, Certificates and ratings issued under this part).

a. Pilot qualifications. Describe the qualifications for each pilot.

b. Pilot certifications. Pilots must be qualified/certificated in the appropriate category of aircraft, that is, rotorcraft, powered lift, and airplane.

c. Pilot training. Describe the internal training program to qualify pilots.

d. Qualifications and training of observers. Describe the qualifications and training of observers. Observer training is required for observers to communicate to the pilot any instructions required to remain clear of conflicting traffic. Acceptable observer training as a minimum must include, but is not limited to, knowledge about the following—

(1) The rules and responsibilities described in §§ 91.111 (Operating near other aircraft), 91.113 (Right-of-way rules: Except water operations), and 91.155 (Basic VFR weather minimums);

(2) Air traffic and radio communications, including the use of approved ATC/pilot phraseology; and

(3) Appropriate sections of the *Aeronautical Information Manual*.

6. Aircraft Registration and Identification Marking (14 CFR part 45). All UAS are required to be registered and identified with the registration number. Aircraft must be marked in accordance with part 45 or alternative marking approval issued by AIR-200.

7. ATC Transponder and Altitude Reporting System Equipment and Use (§ 91.215, ATC transponder and altitude reporting equipment and use). Describe the aircraft altitude reporting system.

8. Method for See-and-Avoid (§ 91.113). Describe in what manner, or by what means, the requirement to see-and-avoid other aircraft will be met. Describe the expected performance of the chase plane.

9. Safety Risk Management. Provide a safety checklist that identifies and analyzes the hazards of UAS operations described in the program letter. (See a sample safety checklist in appendix C to this order.) Additional information is available by contacting the FAA Aviation Safety Inspector.

10. System Configuration. Provide a description of the aircraft system configuration and all onboard and ground-based equipment.

11. System Safety — Flight Termination and Lost Link. Describe/explain the expectation of aircraft flight if fuel is starved. Describe/explain aircraft lost link and emergency recovery procedures. Provide an explanation of the flight termination system in detail.

12. Command and Control. Provide a description of the system and/or procedures for command and control of the UAS.

13. Control Stations. Provide a description of the ground/airborne stations used to control the UAS.

14. Control Frequencies. Provide a description/listing of the frequencies used to control the UAS.

Appendix C. Sample Safety Checklist

1. General Information. The safety checklist is designed to help the FAA evaluate those hazards unique to unmanned aircraft in support of issuing an experimental airworthiness certificate. Some safety items require only brief responses and others may not be applicable to a specific program. Additional questions and supporting documentation will be required during the evaluation process. The FAA intends to update the safety checklist as necessary. The safety checklist can be found on the FAA Web site at www.faa.gov/uas.

2. Airborne Segment.

a. UA structure. Describe in detail the physical characteristics of the UA. At a minimum, address the following items/questions:

(1) Composition. Describe the various materials and where they are used in the construction of the UA.

(2) Measurements.

(a) Wingspan.

(b) Fuselage length.

(c) Body diameter.

(3) Weight.

(a) Empty.

(b) Maximum gross takeoff weight.

(4) System unique design characteristics (for example, hydraulic system, parachute, and brakes).

(5) If applicable, details on any loads or stress analysis that demonstrates positive structural margins of safety during flight.

b. UAS performance characteristics.

(1) Maximum altitude.

(2) Maximum endurance.

(3) Maximum range.

(4) Airspeed.

(a) Cruise.

- (b) Maximum.
- (5) Rate of climb.
- (6) Rate of descent.
- (7) Performance limitations due to environmental and meteorological conditions.
 - (a) Wind.
 - i. Constant wind shear.
 - ii. Gusts.
 - (b) Visibility.
 - (c) Lighting.
 - (e) Icing.
 - i. What indications, if any, does the system provide the UA pilot concerning the existence of icing conditions?
 - ii. Does the UA intend to operate in known icing conditions?
 - iii. Describe any icing protection capability of the UA.
- c. Propulsion system.
 - (1) Fuel-powered propulsion systems.
 - (a) Type (make and model) of engine being used.
 - (b) Type and capacity of fuel if applicable.
 - (c) Description of failure modes and abnormal conditions. How does the system respond, and what safeguards are in place to lower risk of loss of engine power for each of the following?
 - i. Fuel starvation.
 - ii. Fuel contamination.
 - iii. Failed signal input from the control station.
 - (d) Can the pilot restart the engine in flight?

(2) Electric-powered propulsion systems.

(a) What type of motor is used?

(b) What is the power output of the motor?

(c) What current draw range does the motor have?

(d) Does the system have a separate electrical source? If not, how is UA power managed?

d. Avionics. Provide an overall system diagram of the avionics architecture, including detailed descriptions of the following:

(1) UA architecture, including functional flow and subsystem performance.

(2) Control station architecture, including functional flow and subsystem performance.

(3) Communication system architecture, including functional flow and subsystem performance.

e. Navigation.

(1) How does the UA determine where it is? How does it navigate to its intended destination?

(2) How does the UA respond to the following directions from ATC?

(a) Change of heading.

(b) Change of altitude.

(3) What are the causes and effects of loss of heading or altitude?

(4) Describe the procedures to test the altimeter system (14 CFR § 91.411, Altimeter system and altitude reporting equipment tests and inspections).

f. Payloads.

(1) Describe the payload equipment that will fly onboard the aircraft.

(2) Describe all payload configurations that significantly change weight and balance, electrical loads, or flight dynamics.

(a) Internal.

(b) External.

3. Command, Control, Communications Segment.

a. Control station.

- (1) Describe or diagram the control station configuration.
- (2) How is the control station powered?
- (3) What procedures are in place should the control station lose primary and secondary power?
- (4) Does the pilot have a standardized screen set up at the initiation of each phase of flight?
- (5) Are any other programs running on the ground control computer?
- (6) What are the possible conditions that would cause a control position lock-up? Are any of the primary flight controls based on the Microsoft® Windows® operating system?
- (7) What alarms or warnings does the system provide to the pilot (for example, low fuel or battery, failure of critical systems, departure from operational boundary)?
- (8) How accurately can the pilot determine the attitude and position of the UA?
- (9) What kind of inadvertent input could the pilot enter to cause an undesirable outcome (for example, accidentally engaging the kill engine command in flight)?

b. UA controls.

- (1) Control surfaces. This section is intended to provide an understanding of the control surfaces and should include the following at a minimum:
 - (a) A diagram showing the location of the servos and control surfaces, and power to the servos.
 - (b) A description of failure modes and conditions.
 - i. Describe the failure modes and mitigations.
 - ii. How does the system respond to a servo failure?
 - iii. What indications alert the pilot that a servo is stuck?
 - (c) A description of how the control surfaces respond to commands from the flight control computer. Describe how the pilot provides input to the control surfaces (for example, through an external box, waypoint, stick and rudder pedals).
 - (d) A description of the procedures in place to prevent failures due to weather or icing?

(2) Flight control computer.

(a) Does the flight control computer interface with auxiliary controls that might cause unintended action?

(b) Describe the systems the flight control computer interfaces with to determine flight status and to issue appropriate commands.

c. Autopilot.

(1) Is the autopilot a commercial off-the-shelf product? If so, name the type/manufacturer.

(2) Describe the procedures you use to install the autopilot. How is correct installation verified? Reference any documents or procedures provided by the manufacturer and/or developed by your company.

(3) Does the autopilot employ input parameters to keep the aircraft within structural limits? If so, provide a table of these limits. How were these limits validated?

(4) Where do the autopilot commands reside once they are input by the pilot?

(5) What type of software-in-the-loop (SIL) and hardware-in-the-loop (HIL) simulations have been performed? What was the outcome of the simulations?

d. Communications.

(1) How do you limit the likelihood of unplanned loss of communication between the pilot and the UA due to—

(a) Radio frequency or other interference?

(b) Flight beyond communications range?

(c) Antenna masking during turns and pitch angles?

(d) Loss of control station functionality?

(e) Loss of UA functionality?

(f) Atmospheric attenuation?

(g) Loss of link?

(h) Loss of visual contact with the UA?

(2) What are the potential sources of radio frequency interference within the proposed operating area and how are they monitored, managed, and/or mitigated?

(3) What spectrum will be used for the communications? How has the use of this spectrum been coordinated? If not required, under what regulation is the use of the frequency authorized?

(4) What type of signal processing and/or link security is employed?

(5) For satellite links, estimate the system communications latencies associated with using the satellite link for aircraft control and for ATC communications.

(6) What is the data link margin in terms of the overall link budget at the maximum anticipated distance from the control station? How was it determined?

(7) Does the system employ redundant communications links? If so, how dissimilar are they?

(8) Is there a radio signal strength and/or health indicator or similar display to the pilot? How are the signal strength and health value determined, and what are the threshold values that represent a critically degraded signal?

(9) Is there an intercommunication system that allows for communication between the pilots(s), ground support personnel, and observers?

(10) What procedures have been established in the event of intercom failure?

e. Emergencies and flight recovery

(1) Describe the emergency recovery systems, if any.

(2) How do you know the emergency recovery system is operational?

(3) Under what conditions is the return home mode both manually and automatically activated?

(4) What is the return home point? How is this point selected? How is this point entered?

(5) How does the UA navigate when in the return home mode?

(6) Describe the flight recovery systems (FRS), if any?

(7) Under what conditions is an FRS manually and automatically activated?

(8) What happens to the aircraft when the FRS is activated? For example, does the engine run temporarily? Does the UA glide or become unstable?

(9) How do you know the FRS is operational?

(10) Provide a fault tree diagram, starting with the initial condition of normal flight, that shows the conditions that will trigger the FRS.

(11) If activated, can the FRS be turned off/shut down if no longer needed?

(12) If FRS fails, is there a backup or secondary FRS to ensure no additional hazards are introduced to the operational area?

(13) Describe how the aircraft will react during takeoff, climb, cruise, descent, and landing in the event of a lost link.

(14) Describe the operational procedures in the event of a lost link.

f. Ground support equipment. Describe all the support equipment used on the ground. Include any launch or recovery systems, ground data terminals, generators, and power supplies.

4. Operations.

a. National Airspace System (NAS) integration and interaction.

(1) Surveillance and aircraft visibility.

(a) Is the UA equipped with an operable Mode-C or Mode-S transponder?

(b) Can the transponder be operated by the pilot?

(c) Describe the transponder test procedures.

(d) Does the UA have a high visibility paint scheme that enables other pilots to see and avoid the UA and enables the observer(s) to obtain and track the UA?

(e) Does the UA have anticollision lights? What are the procedures if the lights are inoperative?

(f) Does the UA have position lights? What are the procedures if the lights are inoperative?

(2) ATC and crewmember communications.

(a) How does the pilot communicate with ATC?

(b) How does the pilot communicate with other users of the airspace?

(c) Describe the communications equipment, including any equipment on the aircraft.

(d) How does the flightcrew communicate with each other?

(3) Sense-and-avoid.

(a) Describe the method(s) in place for sense-and-avoid, and if applicable, identify the members of the flightcrew who hold this responsibility.

- (b) What are the minimum traffic detection capabilities in azimuth and elevation?
- (c) Describe the procedures that will be implemented should an aircraft enter the operating area.

(4) Chase aircraft operations.

- (a) Describe the roles and responsibilities of the chase aircraft crew, including pilot and observers.

Note: Chase aircraft pilots must not concurrently perform either observer or UA pilot duties while operating the chase aircraft.

- (b) Describe any special training the chase aircraft crew will receive.

b. Flight phases.

(1) Preflight/taxi operations.

- (a) Describe the entire flight planning process, including how weather briefings and updates are obtained.

- (b) Describe your coordination procedures with ATC before takeoff by addressing the following at a minimum:

- i. Notice to Airman (NOTAM),
- ii. Filing the flight plan, and
- iii. Obtaining transponder codes.

- (c) How do you ensure the area is clear for taxi?

- (d) Are there safeguards to preclude inadvertent engine starts that could cause injury to ground personnel?

- (e) Describe UAS preflight activities and the system and support equipment required by addressing at a minimum:

- i. The process by which the system is prepared for flight.
- ii. The systems required to prepare the system for flight.

- iii. What critical process points are established, such as system configuration files needed to establish flight controls calibration?

- (f) Describe how mapping updates are performed on the control station.

- (g) Describe the flightline/operations safety program, if any.

(2) Takeoff/launch. Provide a description of system equipment for required takeoff/launch. Identify unique system performance and procedures.

(3) Flight.

(a) Identify the components of the system, including support equipment required for the UA to conduct safe flight operations. Information presented in response to this item should address at a minimum—

- i. The process by which the system is operated during flight,
- ii. The systems required to operate the system during flight, and
- iii. Critical process points that are established.

(b) Describe the method for switching between pilot-controlled (manual) and autonomous flight modes. At what points during the flight will this happen?

(c) What indication does the pilot have that he/she is in control of the aircraft?

(d) How are changes made to the flight plan during flight?

(e) Describe the procedures in the event of lost communication with ATC (if applicable).

(4) Landing/recovery. Provide a description of system equipment required for this operation. Identify unique system performance and procedures.

(5) Post-flight. This subsection intends to identify the parts of the system, including support equipment required for the UAS to conduct safe operations. Information presented in response to this item should address at a minimum—

- (a) The process by which the system is operated post-flight,
- (b) The systems required to operate the system post-flight,
- (c) Critical process points that are established,
- (d) The process for a post flight inspection, and
- (e) The process for incident/accident reporting.

c. Operating areas.

(1) How do you ensure there is no unusual ground activity under the flight operations area? For example, are there any weekend events scheduled? Are there housing areas or public gathering places?

(2) Identify any military or civilian routes through the proposed operational area.

(3) Identify the proposed operating area on an aeronautical chart. The proposed area needs to define lateral boundaries and requested altitudes.

d. Flight envelope and test plans.

(1) Describe the conditions under which flight envelopes will be tested. What is the proximity of flight operations to populated areas, major highways, etc.?

(2) Describe how you plan to meet test objectives under the proposed flight envelope and operating area. Include test plans, if possible.

e. Operating history. Describe the operational history of the UAS. Include details of the following items:

(1) Total number of flights and flight hours on the UA.

(2) Any system failures, incidents, accidents, or emergencies, and the resultant system modifications or corrective actions.

f. Manuals.

(1) Is there an operating manual for the aircraft?

(2) Does the manual have a section with all the aircraft limitations in one location?

(3) Does the operating manual have bolded or underlined procedures for emergencies for memory item steps?

(4) Is there an operational checklist for all phases of the operation?

(5) Are there separate checklist items for normal, abnormal, and emergency procedures?

5. Organizational Considerations.

a. Pilot/crew qualifications/training reference. This section is based on 14 CFR part 61, (Certification: Pilots, Flight Instructors, and Ground Instructors), part 63 (Certification: Flight Crewmembers other than Pilots), and part 65 (Certification: Airmen other than Flight Crewmembers). The following information should be included:

(1) Crew. Is there a crew resource management training program? If so, describe the program.

(2) Pilot.

(a) Do the pilots have a current pilot certificate? If so, what type of pilot certificate?

(b) Do the pilots have a current medical certificate? If so, what class of medical certificate?

(c) Describe all physical limitations that might prevent the pilot from getting a current pilot or medical certificate.

(d) Describe in detail and reference any procedures that show the pilots are properly trained. Is there an established formal training curriculum for all pilots including PIC, supplemental, or chase pilots(s)?

(e) Is the pilot type-rated for the aircraft being flown?

(3) Observer.

(a) Do the observers have a current pilot certificate? If so, what type of pilot certificate?

(b) Do the observers have a current medical certificate? If so, what class of medical certificate?

(c) Describe all physical limitations that might prevent the observer from getting a current medical certificate.

(d) Does the observer understand the applicable aviation regulations, such as see-and-avoid, clear-of-clouds, and right-of-way rules?

(e) Is the observer a current pilot or does he/she have a training curriculum? Is there an established formal training curriculum for all observers? If so, please provide it during the site visit.

(f) Describe in detail how the observer is properly trained to be an effective member of the flight team.

(g) Does the observer understand the following?

i. Proper communications and phraseology.

ii. Proper visual scan techniques.

iii. Standard flight operations at nontowered airports.

iv. Containment areas and how to determine whether the UA is operating within that area.

b. Maintenance.

(1) Provide an inspection and maintenance program (see appendix D to part 43).

(2) Provide information on unique system maintenance activities, such as maintenance of a pneumatic launcher system.

c. Configuration management.

- (1) What procedures are in place to manage change configuration? Are they documented?
- (2) Describe the procedures used for controlling drawings, test procedures, and engineering changes.
- (3) Describe the quality assurance system, including methods and procedures used and structure within the organization.

d. Software management.

- (1) In high level terms, how much of the software was designed by the applicant? Identify which areas of the system contain vendor software.
- (2) What software development process(es) has/have been used in the development of software components for the aircraft and the control station, and what software lifecycle data is available for review?
- (3) How will updates to system software (including commercial off-the-shelf software) be implemented?
- (4) Provide a description of the software requirements and the functional allocation between hardware and software.
- (5) How is software verified, validated, and tested for the system?
- (6) How is vendor software development overseen?
- (7) How is software load control implemented for the system to ensure the correct software components are loaded onto the system?
- (8) What software quality assurance processes are used in the development of the system software? If software is vendor-provided, vendor control must be addressed.
- (9) What procedures are in place to manage change configuration? How are these documented?

End of Safety Checklist.

Appendix D. Administrative Information

1. Distribution. This order is distributed to the Washington headquarters branch levels of the Aircraft Certification Service, Flight Standards Service, and the Regulatory Support Division; to the Aviation System Standards office; to the branch level in the Aircraft Certification Service directorates and regional Flight Standards Service divisions; to all Aircraft Certification Offices; to all Manufacturing Inspection District Offices (MIDO) and Manufacturing Inspection Satellite Offices (MISO); to all Flight Standards District Offices (FSDO); to the Aircraft Certification Branch and Flight Standards Branch at the FAA Academy; to the International Policy Branch (Brussels, Belgium), Flight Standards staff; and to all international field offices.

2. Background. In 2005, the Associate Administrator for Aviation Safety determined that Unmanned Aircraft Systems (UAS) could be given limited access to the National Airspace System (NAS) (see Title 14 Code of Federal Regulations (CFR) part 21, (Certification Procedures for Products and Parts), §§ 21.191(a), (c), and (f) (Experimental certificates)). The Director of the Aircraft Certification Service, with concurrence from the Director of, Flight Standards Service, stipulated that this process be managed by the office of primary responsibility for § 21.195, (Experimental certificates: Aircraft to be used for market surveys, sales demonstrations, and customer crew training. The Aircraft Certification Service, Production and Airworthiness Division, AIR-200, leads the UAS experimental certification process and is tasked with coordinating all aspects of issuing an experimental certificate to a UAS applicant. If there are any questions regarding this order, please contact a member of the Airworthiness Certification Branch, AIR-230, at 202-267-8361. More information on unmanned aircraft can be found on the FAA Web site at www.faa.gov/uas.

3. Authority to Change This Order. The issuance, revision, or cancellation of the material in this order is the responsibility of AIR-200. AIR-200 will institute all changes to carry out the agency's responsibility to provide for original and recurrent airworthiness certifications and related approvals.

4. Definitions.

a. Airworthy. For the UAS to be considered airworthy, both the aircraft and all of the other associated support equipment of the UAS must be in a condition for safe operation. If any element of the systems is not in a condition for safe operation, then the UA would not be considered airworthy.

b. Exemption. Relief from the requirements of a current regulation as provided for in 14 CFR part 11, General Rulemaking Procedures.

c. Support equipment. All associated equipment, whether ground based or airborne, used to enable safe operation of the unmanned aircraft. This includes all elements of the control station, data links, telemetry, navigation, communications equipment, as well as equipment that may be used to launch and recover the aircraft.

d. Unmanned Aircraft (UA). An aircraft controlled either autonomously or by a control station located on the ground or in a manned aircraft. An unmanned aircraft is not operated by an on-board pilot.

e. Unmanned Aircraft System (UAS). An unmanned aircraft and all of the associated support equipment (defined above) necessary to operate the unmanned aircraft in the NAS. The experimental airworthiness certificate is issued for the entire system, not just the flying portion of the system.

5. Forms. Examples of forms referenced in this order are found in Order 8130.2.

6. Deviations. Adherence to the procedures in this order is necessary for uniform administration of this directive material. Any deviations from this guidance material must be coordinated and approved by AIR-200. If a deviation becomes necessary, the FAA employee involved should ensure the deviations are substantiated, documented, and concurred with by the appropriate supervisor. The deviation must be submitted to AIR-200 for review and approval. Title 28, United States Code § 2679, defines the limits of federal protection for FAA employees.

7. Suggestions for Improvement. Any deficiencies found, clarifications needed, or improvements suggested regarding the content of this order should be forwarded (written or electronically) to the Aircraft Certification Service, Planning and Financial Resources Management Branch, AIR-530, Attention: Directives Management Officer. This feedback should be provided on FAA Form 1320-19, Directive Feedback Information, which is located as appendix E to this order. A copy may be forwarded to the Production and Airworthiness Division, AIR-200, Attention: Comments to Order 8130.34. If an interpretation is urgently needed, contact the Aircraft Engineering Division, AIR-100 or, AIR-200. For flight standards concerns, contact the Continuous Airworthiness Maintenance Division, AFS-300. Always use Form 1320-19 to follow up each verbal conversation.

8. Records Management. Refer to Orders 0000.1 and 1350.15 (Records Organization, Transfer, and Destruction Standards, or your Records Management Officer/Directives Management Officer for guidance regarding retention or disposition.

Appendix E. FAA Form 1320-19, Directive Feedback Information



Directive Feedback Information

Please submit any written comments or recommendations for improving this directive, or suggest new items or subjects to be added to it. Also, if you find an error, please tell us about it.

Subject: Order 8130.34

To: Directive Management Officer, AIR-530

(Please check all appropriate line items)

An error (procedural or typographical) has been noted in paragraph _____ on page _____.

Recommend paragraph _____ on page _____ be changed as follows:
(attach separate sheet if necessary)

In a future change to this directive, please include coverage on the following subject:
(briefly describe what you want added)

Other comments:

I would like to discuss the above. Please contact me.

Submitted by: _____ Date: _____

FTS Telephone Number: _____ Routing Symbol: _____