U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

National Policy

**ORDER 8130.34A**

10/27/2010

**SUBJ:** Airworthiness Certification of Unmanned Aircraft Systems and Optionally Piloted Aircraft

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 and optionally piloted aircraft. The procedures in this order apply to Federal Aviation Administration (FAA) manufacturing aviation safety inspectors (ASI) and FAA airworthiness ASIs.

/s/
Frank P. Paskiewicz
Manager
Production and Airworthiness Division, AIR-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) and manned aircraft integrated with UAS technology. For the purposes of this directive, manned aircraft integrated with UAS technology are referred to as optionally piloted aircraft (OPA). 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 and OPA.

> **Note:** The use of the word "should" throughout this order refers to a recommended practice. The associated activity is not a requirement; therefore, a record of completeion is not required.

**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 (UA) operations.

**3. Where Can I Find This Order.** You can find this order on the internet at http://www.faa.gov/regulations_policies/orders_notices/.

**4. Explanation of Policy Changes.** This revision includes requirements for certificating optionally piloted aircraft, changes the safety checklist, and revises and adds definitions.

**5. Action Date.** FAA managing offices must implement the procedures contained in this order 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 to UAS and OPA.** 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 and OPA.

**b. Personnel Not Authorized to Issue Experimental Certificates to UAS and OPA.** Representatives of the Administrator or delegated organizations authorized under part 183 of Title 14 of the Code of Federal Regulations (14 CFR) are not permitted to issue experimental certificates to UAS and OPA.

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

**2. Responsibilities of FAA ASIs.** The procedural requirements for issuing airworthiness certificates 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 certificates and FAA airworthiness ASIs are responsible for issuing recurrent airworthiness certificates. As stated in paragraph 1 of this section, FAA manufacturing ASIs are responsible for issuing airworthiness certificates for UAS and OPA. During the certification process, airworthiness ASIs review and accept the UAS and OPA inspection and 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 UA registration and issuance of registration numbers are contained in 14 CFR part 47, Aircraft Registration. Requirements for OPA registration can be found in Order 8130.2. 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: After 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.** Nationality and registration marks displayed on 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 or OPA, 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 or OPA 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 or OPA programs must include this information appropriate to the UAS or OPA and the type of operation. Operators should see 14 CFR part 43, appendix D, 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 or OPA, 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 Original Airworthiness Certificates.** FAA Form 8130-7, Special Airworthiness Certificate, is the only airworthiness certificate that can be issued to a UAS or OPA. 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. Reissue of Airworthiness Certificates**.

**a.** If requested by an applicant, an experimental certificate may be reissued. The applicant must notify AIR-200 and provide information relative to the intent to request certification.

**b.** If the applicant does not plan to make changes to the UAS or OPA, the certification process may be abbreviated. The applicant is required to declare that the information in the safety checklist is accurate and has not changed. This declaration must be made in writing. Any modifications accomplished during the previous period of certification must have been reviewed by the FAA before incorporation. The applicant must provide a new program letter to AIR-200 for the period covering the certification. AIR-200 will verify that the requirements for changes have been satisfied. Any changes to the inspection and maintenance program will be coordinated with the geographically responsible FSDO.

**c.** If an applicant produces a duplicate UA or OPA with no changes from the original, reissue procedures described above may be used for certification.

**d.** AIR-200 will generate new operating limitations and coordinate with the manufacturing ASI.

**e.** The ASI will notify AIR-200 within 2 business days that the UA or OPA was successfully certificated.

**3. 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 or OPA registration number has been changed. In these cases, 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 or OPA, 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 or OPA 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 or OPA records and, if necessary, inspect the UAS or OPA to ensure that the applicant's request is justified and that the UAS or OPA 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 or OPA.

> **Note: Changes to any system, component, or software of a UAS or OPA may affect the operating limitations imposed by the experimental certificate. Applicants must consult with AIR-200 and the issuing office concerning changes to the UAS or OPA 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 or OPA records documenting the issuance of the amended certificate.

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

**4. 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 or OPA.

**b. Selling or Leasing in the United States.** When a UA or OPA owner or operator sells or leases a U.S.-owned UA or OPA to a purchaser in the United States, the registration may be transferred or the UA or OPA may be deregistered. In either case, the airworthiness certificate must be surrendered to the FAA issuing office by the current UA or OPA owner or operator.

**c. Selling or Leasing to Other Countries.** When a UA or OPA owner or operator sells or leases a U.S.-owned UA or OPA 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 or OPA owner or operator.

**5. 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.

**6. 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.

**7. 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 must 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 or OPA be operated as civil unless there is an appropriate and valid airworthiness certificate issued for that UAS or OPA. 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 proper completion of 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 to AIR-200 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 requested 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 within the boundaries of 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 may result in safely returning to a predefined lost-link waypoint, or any other procedure that is safe and predictable.

(3) Flight recovery. In the event the UA command and control link is unrecoverable, an independent means to safely terminate the flight must be provided.

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

**c. Safety Evaluation.** The FAA UAS team typically consists of personnel from AIR-200, AFS-407 (Unmanned Aircraft Program Office (UAPO)), AJR-36 (High Altitude Redesign (HAR) UAS Group), AFS-300 (Aircraft Maintenance Division), the geographically responsible MIDO/MISO or certificate management office/certificate management unit (CMO/CMU), FSDO, and ATO. The FAA UAS team 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 by the FAA.

(1) The applicant is expected to provide a detailed explanation of the information provided in the safety checklist. The applicant must provide a presentation consisting of detailed system descriptions using block diagrams and schematics, and explain how the system operates. The applicant is expected to discuss how the system is designed, constructed, and manufactured, including engineering processes, software development and control, electronic hardware development and control, configuration management, and quality assurance. The applicant must also be prepared to discuss the proposed flight test area in detail.

(2) The FAA must determine if the applicant's system is safe to operate in the National Airspace System (NAS) based on operational risk and safety considerations. The applicant will only get credit towards achieving this goal by providing the FAA with a complete understanding of the UAS or OPA. If the applicant's system is found to pose acceptable risk, AIR-200 will schedule a visit to the proposed flight test area within 30 to 60 days. The purpose of this visit will be to inspect the applicant's aircraft (and system of control), accept/approve the UAS or OPA inspection and maintenance program, review and issue operating limitations, and issue the experimental certificate. The applicant is expected to perform a test fight immediately after the certificate is issued to allow the FAA to validate the flight test area.

(3) The following items must be submitted by the applicant as supporting documentation required by the safety checklist. These items must be submitted before issuance of the requested airworthiness certificate:

(a) Proposed operating area. The proposed operating area must be plotted on an aeronautical chart with coordinates (latitude and longitude) that identify the area boundary. The distances of the boundary legs must be provided (for example, if the operating area is a rectangle, provide the length of the sides). The proposed altitudes of operation also must be included. Other types of charts and maps may be included in addition to the aeronautical charts.

(b) Operations manuals and checklists**.** All appropriate operating manuals, including limitations and checklists (normal, abnormal, and emergency procedures), must be provided.

(c) 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.

(d) Licenses and certificates**.** Applicants will be informed that the FAA will request evidence of FAA pilot's license 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 safety evaluation or the meeting referenced in paragraph 3d below.

(e) Frequency spectrum. Before conducting operations, the frequency spectrum used for operation and control of the UA or OPA must be approved by the Federal Communications Commission (FCC) or other appropriate government oversight agency. (This item may be included as an operating limitation.)

**d. Onsite Meeting and Schedule.** At the completion of the safety evaluation, an onsite meeting and inspection will be scheduled by AIR-200. This meeting is normally attended by the entire FAA team. However, scheduling the onsite meeting is dependent on several requirements that must be 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 by § 45.22(d);

(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 issuance 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 flight crews. These flight crews would normally be the manufacturer's employees necessary to be trained in experimental aircraft. Training must be accomplished by flight instructors certificated in accordance with 14 CFR part 61.

**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 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. Customer crew training must be accomplished by flight instructors certificated in accordance with 14 CFR part 61.

(1) The FAA ASI must ensure the applicant meets the provisions of § 21.195, Experimental certificates: Aircraft to be used for market surveys, sales demonstrations, and customer crew training. These provisions must be met before issuing the experimental certificate.

(2) In addition to meeting the requirements in § 21.193, an applicant under § 21.195 must:

(a) Establish an inspection and maintenance program for the continued airworthiness of the aircraft, and

(b) Show evidence that the aircraft has been flown for at least 50 hours, or for at least 5 hours if it is a type certificated aircraft which has been modified (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 may 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. See 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 3c. 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 3c(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 transmit and receiver link checks of the control station to 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 before 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 or Optionally Piloted 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 or Optionally Piloted 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. 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, AFS-407, the assigned MIDO/MISO and FSDO, AJR-36, and the nearest ATO office assigned geographic responsibility. The applicant must perform a test fight immediately after the certificate is issued to allow the FAA to validate the flight test area.

**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 demonstrated any hazardous operating characteristics or design features. The flight test area may or may not be expanded depending on the availability of an additional area that is remote and sparsely populated.

(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 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 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.

**a.** The ASI must review each imposed operating limitation with the applicant to ensure the applicant has a clear understanding of intent. 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.

**b.** Operating limitations can vary greatly from one UAS to the next based on system requirements and operating location. The ASI may impose any additional limitations deemed necessary in the interest of safety.

## Section 3. Certification and Operation of Optionally Piloted Aircraft.

**1. Manned Aircraft.** Current UAS technology development projects include modifying manned aircraft. Today's advanced technology in control systems and software permits modifications to traditional flight controls that enable command of the aircraft to be affected from outside the cockpit. Control can be affected through a data link or preprogrammed into the aircraft's autopilot/flight management system. Two methods are described below. If other methods of controls exist, the FAA will evaluate their effectiveness and conduct a system safety assessment.

**a.** For aircraft integrated with data link equipment and flown with a safety pilot onboard, remote control of the aircraft may be engaged or disengaged by the safety pilot. Once the system controls are engaged, the aircraft is controlled by a pilot operating the ground control station. Whether the system control is engaged or not, the pilot in command will always be the pilot sitting in the aircraft.

**b.** The second method of control is by modifying the flight management system to permit flight plan programming before takeoff. Once engaged, the flight management system initiates the takeoff sequence, flies selected way points, and lands the aircraft without pilot intervention. This method includes a data link which can change way-points in flight from commands sent by a control station external to the aircraft in the event of a change of plans or emergency.

**2. Safety Pilot.** Both of the above mentioned capabilities include an onboard safety pilot for the purpose of overriding the system in the case of malfunction or any other hazardous situation. Ultimately, plans may include further research and development and removal of the safety pilot from the aircraft. If the aircraft is operated without a safety pilot, it is considered a UA.

**3. Certification Process.** All traditional manned aircraft are eligible for consideration. When an applicant presents an OPA, the certification process used is similar to manned aircraft with the following exceptions.

**a.** The FAA UAS experimental certification team will conduct a safety evaluation based on the procedures established in chapter 3, section 1, of this order.

**b.** Operating limitations as described in Order 8130.2 will be issued by the manufacturing ASI. The Sample OPA Operating Limitations included in appendix B will be included, as necessary, in addition to those required by Order 8130.2.

# 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

| | |
|---|---|
| **Registered Owner Name:**<br>[Insert Owner Name] | **Aircraft Builder:**<br>[Insert Builder Name] |
| **Registered Owner Address:**<br>[Insert Address] | **Year Manufactured:**<br>[Insert Year] |
| **Aircraft Description:**<br>[Insert Description] | **Aircraft Serial Number:**<br>[Insert Serial Number] |
| **Aircraft Registration:**<br>[Insert Registration Number] | **Aircraft Model Designation:**<br>[Insert Model Designation] |
| | **Engine Model:**<br>[Insert Model Designation] |

**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.** Immediately after the certificate is issued, (applicant name) must forward an electronic 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 must be sent to the attention of (name), (title of ATO person), at e-mail (e-mail address), or via fax at (fax number). AIR-200 will be included on this transmission

**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, General Rulemaking Procedures.

**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 Vx _____, and Vy _____, 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 must 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, AFS-407. AFS-407 can be reached by telephone at 202-385-4322 and fax at 202-385-4651. Accidents must be reported to the National Transportation Safety Board (NTSB) per instructions contained on the NTSB website: www.ntsb.gov. Further flight operations must not be conducted until the incident is reviewed by AFS-407 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 second-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 second-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 a TSO approved Mode C or Mode S altitude encoding transponder during all flight operations. The transponder must be FAA TSO-C 74d or TSO-C112c approved. It must be identified by the applicable TSO marking. If the transponder is Mode S-capable, it must have an appropriately assigned International Civil Aviation Organization (ICAO) 24-bit address based on the UAS's assigned registration number.

(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 must be immediately notified of the lost link condition and the expected UA response.

**10. Inspection and Maintenance.**

**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 10d 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 10d 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. Inspection and Maintenance Records.** Inspections and maintenance of the UAS must be recorded in the UAS maintenance records. The following information must be recorded:

(1) 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.*

(2) 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.

(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.** (Applicant name) will immediately notify the Production and Airworthiness Division, AIR-200, and the (manufacturing inspection district office (MIDO) name), if there is any plan for requesting a Certificate of Waiver or Authorization (COA) for UAS operations during the time the experimental certificate is in effect. An entry in the aircraft logbook is required to document that the aircraft flight authority has been changed from the experimental certificate to COA. When COA operations are concluded and the aircraft resumes flying under the experimental certificate, a record entry will be made in the aircraft logbook by an appropriately rated person. This entry will document that the aircraft is in a condition for safe operation and appropriately configured.

**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.

**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.

/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 Operating Limitations for Optionally Piloted Aircraft

**1. Applicability.** The following limitations apply only to optionally piloted aircraft (OPA) and will be issued to supplement operating limitations issued under an experimental certificate as described in FAA Order 8130.2, Airworthiness Certification of Aircraft and Related Products. The aviation safety inspector (ASI) may include these limitations as an addendum to, or amend directly into, operating limitations issued under Order 8130.2. When an OPA is operated without a pilot onboard, operating limitations for UAS will be issued in accordance with the procedures described in this order.

**2. OPA Limitations.**

**a.** The aircraft will be operated with a pilot onboard at all times. UAS operations without a pilot onboard are not authorized except in restricted airspace and with the permission of the agency using that airspace. The pilot onboard is considered to be the pilot in command (PIC).

**b.** The PIC will hold, at a minimum, an FAA private pilot certificate. Additionally, the PIC will hold, at a minimum, a valid FAA Class 2 medical certificate and have it in his/her possession.

**c.** The PIC will have the ability to immediately override any installed system that can be operated remotely or by automation.

**d.** The system will not impede the pilot from overriding or otherwise controlling the aircraft using normal control input forces.

**e.** There may be no specific geographic limitation when the aircraft is being operated as a traditional aircraft unless otherwise specified in the operating limitations.

**f.** The identified flight test area is approved for the (applicant name) to conduct operations using the system:

(1) As described in section (annotate section/paragraph of operating limitations), the (list applicant or aircraft name or registration number) is restricted to the identified flight test area for an initial period of no less than 10 flight hours and a minimum of 5 takeoff and landings (may be modified, as required).

(2) After satisfying the initial limitation described above, there is no further geographic limitation.

**g.** Any changes or requests for additional flight test areas must be reviewed and approved by AFS-407, AIR-200, and the responsible manufacturing inspection district office (MIDO).

**h.** Control of the aircraft by any method other than the onboard pilot (that is, uplinks and uploaded commands to the aircraft) can only be initiated while the aircraft is in the flight test area specified in paragraph f above. Downlink of telemetry data is usually not restricted unless limited by the FCC or another agency.

**i.** The system may only be engaged or used while the aircraft is at or above XXXX feet above ground level (AGL). The system must be turned off or otherwise rendered inoperative below XXXX feet AGL.

**j.** The system may only be engaged or used during daylight hours only and in visual meteorological conditions (VMC) under visual flight rules (VFR). The system is not authorized for use under special VFR, in instrument meteorological conditions (IMC), or under instrument flight rules (IFR).

**k.** The system is not authorized for use during takeoff or landing.

**l.** Operations under *direct control* or *indirect control* will be authorized on a case-by-case basis as determined by the FAA team.

**m.** The system will not be operated over congested areas, heavily trafficked roads, or an open-air assembly of persons.

End of Limitations.

## Appendix C. Sample Program Letter for Unmanned Aircraft Systems or Optionally Piloted Aircraft for an Experimental Certificate

| | |
|---|---|
| **Registered Owner Name:**<br>[Enter Owner Name] | **Aircraft Builder:**<br>[Enter Builder Name] |
| **Registered Owner Address:**<br>[Enter Owner Address] | **Year Manufactured:**<br>[Enter Year] |
| **Aircraft Description:**<br>**[Enter** Description**]** | **Aircraft Serial Number:**<br>[Enter Serial Number] |
| **Aircraft Registration:**<br>[Enter Registration Number] | **Aircraft Model Designation:**<br>[Enter Model Designation] |
| | **Engine Model:**<br>[Enter Model Designation] |
| | **Propeller Model:**<br>[Enter Model Designation] |

**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 must provide enough detail for the FAA to understand the program's purpose and need for an experimental certificate for a UAS or OPA, 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 requested 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 D 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 D: Safety Checklist

**1. Introduction**. The safety checklist is designed to help the FAA evaluate those hazards that are unique to UAS or OPA in support of issuing an experimental certificate. Some safety items only require 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 safety checklist replaces any previous requirement for a hazard analysis. The FAA intends to update the safety checklist as we gain more experience. The current version of this document will be posted on the FAAWeb Site, www.faa.gov; search key word UAS.

**2. Aircraft Segment.**

**a. Airframe.**

(1) Structure. Describe in detail the physical characteristics of the UA. Include diagrams and schematics, as necessary.

(2) Composition. Describe the various materials and where they are used in the construction of the UA. Include details of the fabrication and construction processes and procedures.

(3) Describe the capability of the airframe structure to withstand expected flight loads and provide data/analysis to show that it is flutter-free throughout the flight envelope. Include any loads or stress analysis that demonstrates positive structural margins of safety during flight.

(4) Identify and describe any unique design characteristic(s) such as a hydraulic system, environmental control system, parachute, or brakes.

(5) Measurements.

(a) Wingspan.

(b) Fuselage length.

(c) Body diameter.

(6) Weight.

(a) Empty.

(b) Maximum gross takeoff weight.

**b. UA Performance Characteristics.** Describe the performance of the aircraft within the proposed flight envelope. Specifically, address the following items:

(1) Maximum altitude.

(2) Maximum endurance.

(3) Maximum range.

(4) Airspeed.

(a) Cruise.

(b) Maximum.

(5) Maximum rate of climb.

(6) Maximum rate of descent.

(7) Maximum bank angle.

(8) Turn rate limits.

(9) Identify any performance limitations due to environmental and meteorological conditions. Specifically, address the following items:

(a) Wind speed limitations.

i. Headwind.

ii. Crosswind.

iii. Gusts.

(b) Minimum visibility conditions.

(c) Lighting (for example, daytime flights only).

(d) Outside air temperature (OAT) limits.

(e) In-flight icing.

i. Does the proposed operating environment include operations in icing conditions?

ii. Does the system have an icing detection capability? If so, what indications, if any, does the system provide the UA pilot, and how does the system respond?

iii. Describe any icing protection capability of the UA. Include any test data that demonstrates the performance of the icing protection system.

**c. Propulsion System.**

(1) Describe the propulsion system and its ability to provide reliable and sufficient power to takeoff, climb, and maintain flight at expected mission altitudes.

(2) Fuel-powered propulsion systems.

(a) What type (make and model) of engine is used?

(b) What type and capacity of fuel is used?

(c) How is engine performance monitored? What status indicators and warning messages are provided to the pilot?

(d) Describe all potential failure modes and abnormal operating conditions.

(e) How does the system respond, and what safeguards are in place to mitigate the risk of engine power loss for each of the following?

i. Fuel starvation.

ii. Fuel contamination.

iii. Failed signal input from the control station.

iv. Engine controller failure.

(f) Does the engine have in-flight restart capabilities? If so, describe the manual and/or automatic features of this capability.

(3) 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. Fuel System.** Describe the fuel system and how it allows for adequate control of the fuel delivery to the engine, and provides for aircrew determination of fuel remaining. Provide a system level diagram showing the location of the system in the aircraft and the fuel flow path.

**e. Electrical System.**

(1) Describe the electrical system and how it distributes adequate power to meet the requirements of the receiving systems. Provide a system level diagram showing electrical power distribution throughout the aircraft. Specifically, address the following items:

(2) How is power generated onboard the aircraft (for example, generator, alternator, batteries)?

(a) If a limited life power source such as batteries is used, what is the useful life of the power source during normal and emergency conditions? How was this determined?

(b) How are electrical power status and power remaining information displayed to the pilot?

(3) Describe the source(s) of backup power in the event of loss of the primary power source.

(a) What systems are powered during backup power operation?

(b) Is there any automatic or manual load shedding?

(c) How much operational time does the backup power source provide? Include the assumptions used to make this determination.

(4) Describe the electrical distribution architecture including all busses, regulators, switches, and converters.

**f. Flight Control Surfaces and Actuators.**

(1) Describe the design and operation of the flight control surfaces and servos/actuators. Include a diagram showing the location of the control surfaces and servos/actuators.

(2) Describe any potential failure modes and corresponding mitigations.

(3) How does the system respond to a servo failure?

(4) What indications alert the pilot that a servo is stuck or malfunctioning?

**g. Payloads.** Describe the payload equipment that will fly onboard the aircraft. Describe all payload configurations that significantly change weight and balance, electrical loads, or flight dynamics.

(1) Internal.

(2) External.

**3. Control and Communications Segment.**

**a. Avionics.** Provide an overall system diagram of the avionics architecture. Include the location of all air data sensors, antennas, radios, and navigation equipment.

**b. Navigation.**

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

(2) How does the pilot respond to the following directions from Air Traffic Control, a visual observer, or other crew member?

(a) Change of aircraft heading.

(b) Change of aircraft altitude.

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

(4) How does the system identify and respond to a loss of the primary means of navigation? Is there a backup means of navigation? How does the system respond to a loss of the secondary means of navigation?

(5) Describe the procedures to test the altimeter system (see § 91.411).

**c. UA Controls.**

(1) Describe how the control surfaces respond to commands from the flight control computer.

(2) Describe how the pilot provides input to the control surfaces (for example, through an external box, waypoint, stick, and rudder pedals).

(3) Flight control computer.

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

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

**d. Autopilot.**

(1) How was the autopilot system developed? What industry or regulatory standards were used in the development process?

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

(3) 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.

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

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

(6) 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?

**e. Communications.**

(1) Provide a detailed communication system architecture diagram that includes functional flows and subsystem performance (that is, data rates and latencies).

(2) Describe the communications datalink(s) connecting the UA and the control station. Specifically address the following items:

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

(b) What type of signal processing and/or link security (that is, encryption) is employed?

(c) 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?

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

(e) Does the system employ redundant and/or independent communications links? If so, how dissimilar are they?

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

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

(3) What design characteristics or procedures are in place to prevent or mitigate the loss of the control datalink due to the following:

(a) RF 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 including precipitation?

**f. Lost Link and Flight Recovery.**

(1) Lost link.

(a) How is it determined that the UA is experiencing lost link and how is this displayed to the pilot?

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

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

(d) How is it determined that the lost link functionality of the system is operational?

(e) How does the UA navigate when in the lost link mode?

(f) What parameters are used to define the lost link or return home point? How is this point selected? How is this point entered? What happens when the UA reaches this point?

(g) Under what conditions is a return home mode both manually and automatically activated?

(h) What do the control station displays indicate during lost link? Is it clear that the data is stale or invalid?

(2) Flight recovery system (FRS).

(a) Describe the FRS or flight recovery capability of the UA.

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

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

(d) How do you know that the FRS is operational?

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

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

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

**g. Control Station.**

(1) Describe or diagram the control station configuration, including functional flows. Include screen captures of the control station displays.

(2) Does the pilot have a standardized screen set up at the initiation of each phase of flight?

(3) How accurately can the pilot determine the attitude and position of the UA?

(4) What commands are safeguarded from inadvertent activation and how is that achieved (for example, a two step process to command "kill engine")?

(5) What kind of inadvertent input could the pilot enter to cause an undesirable outcome (for example, accidentally hitting the "kill engine" command in flight)?

(6) Are any other programs running on the ground control computer?

(7) What are the possible conditions that would cause a control position lock-up?

(8) Are any of the primary flight controls based on the Windows operating system?

(9) 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)?

(10) Describe the means of providing primary and backup power to the ground control station.

(11) What procedures are in place should the control station lose primary and secondary power?

**4. Ground Support Equipment.** Describe all the support equipment that is used on the ground. Include any launch or recovery systems, ground data terminals, generators, and power supplies.

**5. Processes and Procedures.**

**a. Configuration Management.**

(1) What procedures are in place to manage change configuration? Is it documented?

(2) Describe the procedures used for controlling drawings, test procedures, engineering changes, etc.

(3) Describe the quality assurance system, methods and procedures used, and structure within the organization.

**b. 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) have been used in the development of software components for the aircraft and the ground control station, and what software lifecycle data is available for review?

(3) How will updates to system software (including COTS 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 that the correct software components are loaded onto the system?

(8) What software quality assurance processes are used in the development of the system software? Are there problematic reporting, tracking and design standards? If software is vendor provided, vendor control must be addressed.

(9) What procedures are in place to manage change configuration? How are these documented?

(10) What programming language(s) are used? C? C++?

(11) What standard(s) was software written to?

**c. Electronic Hardware Design and Testing.**

(1) Describe the standards and processes used to design, test, and modify electronic hardware system elements such as line replaceable units, circuit board assemblies, and COTS components.

(2) How are safety critical electrical hardware components handled compared to non-safety critical hardware components?

**6. 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) What functions and/or settings of the transponder can be changed 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 visually acquire and track the UA?

(e) What characteristics of the aircraft shape or structure increase its ability to be seen and tracked?

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

(2) Air traffic control 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 (that is, radios), including any equipment on the aircraft.

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

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

(3) Sense and avoid.

(a) Describe the method(s) in place for sense and avoid, and if applicable, identify the members of the flightcrew that 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.

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

i. Pilot.

ii. Observers.

(b) Describe any special training that 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 at a minimum:

i. Notices to Airmen (NOTAM).

ii. Filing the flight plan.

iii. Transponder codes.

(c) 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?

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

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

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

(g) Describe the procedures to ensure the engine isn't started in a manner that could cause injury to ground personnel.

(2) Take off/launch. Provide a description of system equipment required for this operation. Identify unique system performance and procedures.

(3) Flight.

(a) Identify the components of the system, including support equipment that is required for the UA to conduct safe flight operations. Information presented in response to this item shall 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.

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 they are 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.

(a) 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 shall address at a minimum:

i. The process by which the system is operated post-flight.

ii. The systems required to operate the system post-flight.

iii. Critical process points that are established.

(b) Describe the process for a post-flight inspection.

(c) Describe the process for incident/accident reporting.

**c. Operating Areas.**

(1) How do you ensure that 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. How close will operations be to any populated areas and major highways?

(2) Describe how you plan to meet test objectives under the proposed flight envelop 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 of 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, or emergency procedures?

**7. Organizational Considerations.**

**a. Pilot/Crew Qualifications/Training Reference**: 14 CFR part 61 – Certification: Pilots and Flight Instructors; part 63 – Flight Crew Members other than Pilots; part 65 – Airmen other than Flight Crew Members.

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

(d) 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 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—

i. Proper communications and phraseology?

ii. Proper visual scan techniques?

iii. Standard flight operations at non-towered 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 14 CFR part 43, appendix D).

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

End of Safety Checklist

## Appendix E. 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 of the Code of Federal Regulations 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 the 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 or OPA applicant. If there are any questions regarding this order, please contact a member of the Evaluations and Special Projects Branch, AIR-240, at 202-385-6346. More information on unmanned aircraft can be found on the FAA website at www.faa.gov/about/initiatives/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. Forms.** Examples of forms referenced in this order are found in FAA Order 8130.2, Airworthiness Certification of Aircraft and Related Products.

**5. 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.

**6. Suggestions for Improvement.** Please forward all comments on deficiencies, clarifications, or improvements regarding this order to:

Aircraft Certification Service
Administrative Services Branch, AIR-510
ATTN: Directives Management Officer
800 Independence Avenue, SW
Washington, DC 20591

FAA Form 1320-19, Directive Feedback Information, is located as appendix G to this order for your convenience. If you require an immediate interpretation, please contact AIR-200 at (202) 385-6346; however, you should also complete Form 1320-19 as a follow-up to the conversation.

**7. Records Management.** See FAA Orders 0000.1 **(**FAA Standard Subject Classification System) and 1350.15 (Records Organization, Transfer, and Destruction Standards), or your Records Management Officer/Directives Management Officer for guidance regarding retention or disposition.

## Appendix F. Definitions

**a. Airworthy.** An unmanned aircraft system (UAS) is airworthy if the aircraft and all of the other associated support equipment of the UAS are in condition for safe operation. Special emphasis must be placed on the integrity of the data link. If any element of the systems is not in condition for safe operation, then the UA would not be considered airworthy.

**b. Direct Control.** The capability of a remote pilot to manipulate the flight control surfaces of the aircraft in a direct fashion using, for example, a radio control box with joystick or a ground control station using conventional type aircraft controls (such as a yoke/stick, rudder pedals, power levers, and other ancillary controls). This infers a one-to-one correspondence between control input and flight control surface deflection.

**c. Certificate of Waiver or Authorization (COA):** The authority needed to operate a UAS in the National Airspace System (NAS) as a public aircraft. COAs are issued by the FAA Air Traffic Organization.

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

**e. Indirect Control.** The capability of a remote pilot to affect the trajectory of the aircraft through computer input to an onboard flight control system. An example of an indirect control would be the entry of a navigational fix or waypoint on a remote system that, in turn, uploads this information to an onboard autopilot. The autopilot then computes the flight control inputs to achieve a flight path to the uploaded waypoint. The onboard system controls the flight control surfaces.

**f. Optionally Piloted Aircraft (OPA)**. An aircraft that is integrated with UAS technology and still retains the capability of being flown by an onboard pilot using conventional control methods.

**g. Safety Evaluation.** A comprehensive review of an applicant's UAS or OPA and all associated elements defined in paragraph f and j of this appendix. The applicant is expected to provide any and all information necessary to allow the FAA to objectively determine if the UAS or OPA can be safely operated in the NAS. The form of this review is a presentation by the applicant to the FAA. The safety evaluation is a formal review of the information contained in the safety checklist and is performed at the discretion of the FAA.

**h. 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.

**i. Unmanned Aircraft (UA**). A device used or intended to be used for flight in the air that has no onboard pilot. This includes all classes of airplanes, helicopters, airships, and translational lift aircraft that have no onboard pilot. Unmanned aircraft include only those aircraft controllable in three dimensions and, therefore, exclude traditional balloons and unpowered gliders.

**j. Unmanned Aircraft System (UAS).** An unmanned aircraft and its associated elements related to safe operation, which may include control stations, data links, support equipment, payloads, flight termination systems, and launch/recovery equipment.

## Appendix G. FAA Form 1320-19, Directive Feedback Information

U.S. Department of Transportation
**Federal Aviation Administration**

### 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: FAA Order 8130.34A

To: Administrative Services Branch, AIR-510

*(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: _____

FAA Form 1320-19 (10-98)