U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
National Policy

ORDER 8130.34C

08/02/2013

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

This order establishes procedures for issuing special airworthiness certificates in the experimental category or special flight permits to unmanned aircraft systems (UAS), optionally piloted aircraft (OPA), and aircraft intended to be flown as either a UAS or an OPA, under the designation "OPA/UAS." The procedures in this order apply to Federal Aviation Administration (FAA) manufacturing aviation safety inspectors (ASI), to FAA airworthiness ASIs, and to private persons or organizations delegated authority to issue special flight permits for production flight testing new production aircraft.

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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 or special flight permits 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. Aircraft intended to be flown as either an optionally piloted aircraft (OPA) or UAS will be given the designation "OPA/UAS." The terms "UAS," "OPA," and "unmanned aircraft (UA)" are further defined in appendix F, Definitions, to this order.

> **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 completion 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 UAS, OPA, and OPA/UAS operations. The procedures contained in this order also apply to private persons or organizations delegated authority to issue special flight permits for production flight testing new production aircraft.

3. Where Can I Find This Order? You can find this order on the internet at http://www.faa.gov/regulations_policies/orders_notices/ or at http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgOrders.nsf/Frameset?OpenPage.

4. Explanation of Policy Changes. This revision—

a. Creates a new aircraft designation, "OPA/UAS," for aircraft intended to be flown as either an OPA or UAS.

b. Provides authorization for manufacturing ASIs experienced in UAS, OPA, or OPA/UAS airworthiness certification to conduct recurrent certification and continuing airworthiness activities.

c. Allows qualified manufacturing designated airworthiness representatives to issue special flight permits for production flight testing new production aircraft.

d. Clarifies reporting requirements for minor and major changes made to an aircraft or control station.

e. Establishes flight test requirements following major changes.

f. Clarifies procedural requirements of special airworthiness certification.

g. Adds guidance regarding the handling of sensitive information that is restricted from public or foreign disclosure.

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. Aircraft Registration.

a. Registration. The procedures for UA registration and issuance of registration numbers are contained in Title 14 of the Code of Federal Regulations (14 CFR) part 47, Aircraft Registration. Requirements for OPA registration can be found in FAA Order 8130.2, Airworthiness Certification of Aircraft and Related Products. Registration is not a function of airworthiness certification; however, U.S. registration is a prerequisite for issuance of an airworthiness certificate. The FAA must ensure that an aircraft presented for airworthiness certification is properly registered (Title 49, United States Code 44704(c), Type certificates, production certificates, airworthiness certificates, and design organization certificates; and 14 CFR 21.173, Eligibility).

b. Proof of Ownership. The applicant for registration of an aircraft must submit proof of ownership to the FAA Aircraft Registration Branch (AFS-750) that meets the requirements prescribed in part 47. Aeronautical Center Form 8050-2, Aircraft Bill of Sale, or its equivalent, may be used as proof of ownership. The first time the aircraft is registered, the manufacturer must also complete and submit Aeronautical Center 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 aircraft 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 place of a bill of sale.

2. Registration Numbers, Reservation of Registration Numbers, Special Registration Numbers, Temporary 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:

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) The owner must apply in writing to AFS-750 and describe the aircraft. Permission to place the special number on the aircraft will be given on Aeronautical Center 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 aircraft.

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

(4) The old Certificate of Aircraft Registration, Aeronautical Center Form 8050-3, and the duplicate Aeronautical Center Form 8050-64 must be available until the new Certificate of Aircraft Registration is received (refer to 14 CFR 47.15, Registration 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. Temporary Registration Numbers. Temporary registration numbers are issued by the FAA to manufacturers, distributors, and dealers. These persons are holders of Dealer's Aircraft Registration Certificates, Aeronautical Center Form 8050-6, for temporary display on aircraft during flight allowed under subpart C of part 47. The holder of a Dealer's Aircraft Registration Certificate may apply to AFS-750 for as many temporary registration numbers as are necessary for their business (§ 47.16, Temporary registration numbers).

Section 2. Airworthiness Certificates

1. Special Airworthiness Certificates.

a. Personnel Authorized to Issue Special Airworthiness Certificates to UASs, OPAs, and OPA/UASs. Consistent with applicable Aircraft Certification Service (AIR) policies and instructions, FAA manufacturing ASIs are authorized to issue experimental certificates and special flight permits covered in this order. For the purposes of this directive, FAA manufacturing ASIs are responsible for the issuance of both original and recurrent experimental certificates and special flight permits to UASs, OPAs, and OPA/UASs.

b. Representatives of the Administrator.

(1) Representatives of the Administrator or delegated organizations authorized under 14 CFR part 183 are not permitted to issue experimental certificates to UASs, OPAs, or OPA/UASs.

(2) A qualified manufacturing designated airworthiness representative (DAR-F) may be delegated authorization to issue special flight permits to a specific UAS, OPA, or OPA/UAS model solely for production flight testing of new production aircraft. The DAR-F must have attended the safety evaluation and the original or a recurrent experimental certification inspection for the model. In addition, the DAR-F must have—

(a) At least one year of company experience working the program for the specific UAS, OPA, or OPA/UAS model for which production flight testing is sought;

(b) Experience drafting the program letter, safety checklist, or other manual required for the airworthiness certification of the model;

(c) Experience working with the FAA certification team; and

(d) A thorough understanding of this order.

(3) The DAR-F's Certificate of Authority must specify the type and limitation of authority granted. Manufacturing ASIs will supervise and maintain surveillance over the certification activities accomplished by DAR-Fs to ensure that certification and approval complies with the applicable rules, policies and procedures.

(4) The procedural requirements and minimum qualifications for applying to become a DAR-F can be found in FAA Order 8100.8.

c. Electronic Signatures. The use of an electronic signature on an experimental certificate or a special flight permit 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. FAA Order 8130.2 states that FAA manufacturing ASIs are responsible for issuing original airworthiness certificates and FAA flight standards 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 to UASs, OPAs, and OPA/UASs. During the certification process, flight standards ASIs review and accept the UAS, OPA, or OPA/UAS 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) challenging. The same is true for § 91.9(b)(2) concerning the flight manual, marking, and placard requirements. 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. If the exemption does not state an alternate location, the airworthiness certificate and flight manual will be located at the ground control station or within immediate proximity to the PIC if the control station is mobile.

4. Issuance of Original Airworthiness Certificates.

a. FAA Form 8130-7, Special Airworthiness Certificate, may be issued to an aircraft that does not meet the airworthiness requirements for a standard airworthiness certificate. Within the special classification, the certificate may be issued to a UAS, OPA, or OPA/UAS in the following categories:

(1) Experimental. An aircraft used for the purpose(s) of research and development (R&D), crew training, and/or market survey as defined in § 21.191(a), (c), and (f), Experimental certificates.

(2) Special Flight Permit. FAA Form 8130-7 may be issued for production flight testing new production aircraft (§ 21.197, Special flight permits). Ownership of the aircraft must be held by the manufacturer during production flight testing.

b. AIR-200 will coordinate the issuance of original experimental certificates and special flight permits for new aircraft models. AIR-200 will generate the operating limitations and make them available for review and comment to ASIs and specialists from the UAS Integration Office (AFS-80), the geographically responsible manufacturing inspection district office (MIDO)/manufacturing inspection satellite office (MISO) or certificate management office (CMO)/certificate management unit (CMU), and the geographic FSDO.

5. Recurrent Airworthiness Certificates.

a. If requested by an applicant, an experimental certificate may be reissued. The applicant must notify the MIDO, MISO, CMO, or CMU that issued the current airworthiness certificate.

b. A manufacturing ASI from the certificate issuing office will lead recurrent airworthiness certifications if the ASI has the following experience with the particular model of aircraft:

(1) Attended the safety evaluation;

(2) Issued the original or a recurrent experimental certificate; or

(3) Assisted during the onsite activities of the original or a recurrent certification to include the inspection of the aircraft and control station.

c. In circumstances where a manufacturing ASI that meets the above criteria is no longer available to support a program, AIR-200 will coordinate recurrent airworthiness certifications and continuing airworthiness activities.

d. If the applicant does not propose any changes to their program, the applicant is required to declare, in writing, that the information in the safety checklist is accurate and reflects the configuration of the aircraft upon which the recurrent inspection will be conducted. 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 the certificate issuing office for the period covering the certification. The manufacturing ASI will verify no program changes have been made in the program letter. Before reissuing the experimental certificate, the manufacturing ASI must provide the program letter and revised operating limitations to AFS-80 for review.

e. The manufacturing ASI will coordinate any program change with AFS-80. In addition to program letter and safety checklist revisions, the FAA may require the applicant to present their proposal via presentation, teleconference, differences paper, or any other means. The manufacturing ASI will generate new operating limitations. The manufacturing ASI will coordinate the operating limitations, revised program letter, and revised safety checklist (if applicable) with AFS-80 and the geographic flight standards ASI. AFS-80 and the geographic flight standards ASI will have the opportunity to review and comment on these documents.

> **Note:** AFS-80 is comprised of three office branches: Airworthiness Systems Engineering, Flight Operations, and Air Traffic. All three office branches will be included in original and recurrent certification coordination.

f. Any changes to the inspection and maintenance program will be coordinated with the geographic flight standards ASI.

g. If an applicant manufactures a duplicate aircraft in the same configuration as a certificated model, the manufacturing ASI will lead the certification process. The abbreviated procedures described above in paragraph 5d may be followed.

h. The manufacturing ASI will notify AIR-200 within 2 business days that a UAS, OPA, or OPA/UAS was successfully certificated.

6. Continuing Airworthiness Activities. The manufacturing ASI will coordinate continuing airworthiness activities with the applicant. The manufacturing ASI will consult with AFS-80 on issues unique to UAS or OPA. This includes, but is not limited to, airspace; ATC procedures; lost link and flight termination procedures; flightcrew training and qualification; part 91, General Operating and Flight Rules, requirements; flight test plans; aircraft or control station changes; engineering analysis; safety and risk management assessments; and spectrum and control link guidance. Any changes to the inspection and maintenance program will be coordinated with the geographic flight standards ASI.

7. Replacement or Amendment of Airworthiness Certificates. Changes to the current airworthiness certificate require specific actions and the issuance of a new FAA 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 aircraft registration number has been changed. The manufacturing ASI must forward a copy of the replacement certificate and a copy of the registered owner's request for a replacement certificate or an Aeronautical Center Form 8050-64 to AFS-750. 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. The registered owner makes this request by submitting a signed statement containing the registration number (N-number), serial number, make, and model of the aircraft, 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 aircraft records, or from the remains of the certificate. If there is insufficient data on which to base issuance of the replacement certificate, the manufacturing 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 aircraft records and, if necessary, inspect the aircraft to ensure that the applicant's request is justified and that the aircraft is eligible for a special airworthiness certificate.

b. Amendment.

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

> **Note:** Changes to any system, component, software, airspace, or program objectives may affect the operating limitations. The manufacturing ASI must discuss changes with the applicant to understand how the proposed change could impact the operating limitations. For program changes, follow guidance in paragraph 5 of this section.

(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, to the issuing certification office (MIDO/MISO). An appropriate record entry, in accordance with this order, will be made in the aircraft records documenting the issuance of the amended certificate.

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

8. Surrendered Airworthiness Certificate.

a. Written Authorization. An aircraft owner or authorized representative may voluntarily surrender an airworthiness certificate by written authorization. The authorization and certificate must be forwarded to AFS-750 for retention in the permanent airworthiness files for that aircraft.

b. Selling or Leasing to Other Countries. When an aircraft owner or operator sells the U.S.-owned aircraft to a purchaser in another country, or registers a leased aircraft in another country, then the aircraft is removed from the U.S. registry and the airworthiness certificate is no longer effective. The owner or operator must surrender the airworthiness certificate to the FAA.

9. 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.

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

11. Records Retention. A copy of all certification documents are to be retained in the files of the issuing office as required by FAA Order 8130.2. FAA 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. Any U.S.-registered aircraft, other than public aircraft, that does not have a current standard airworthiness certificate or special airworthiness certificate cannot legally be operated until it has been issued an experimental certificate or special flight permit. The procedures in this chapter provide guidance material associated with airworthiness certification and the issuance of FAA Form 8130-7. 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.

2. Application for an Airworthiness Certificate. FAA 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 application for a U.S. airworthiness certificate must be made by the registered owner or an authorized agent who has a notarized letter of authorization from the registered owner. For an experimental airworthiness certificate, complete sections I, II, and III (blocks A, B (when applicable), C, and D). For a special flight permit to conduct production flight testing, complete sections I, II, and VI. The applicant must sign the application.

3. Flight Test Area and Operating Area.

a. All proposed flight test and operating areas outside of restricted airspace must be approved by the FAA. Flight test and operating areas will be coordinated with the air traffic component of AFS-80.

b. All flight-testing operations must be limited to the assigned flight test area until the aircraft is shown to be controllable throughout its normal range of speeds and maneuvers, and has not displayed any hazardous operating characteristics or design features. The FAA may also designate a minimum number of flight hours that must be completed before the aircraft can transition from the flight test area to the operating area. Typically, the flight test area is smaller, restricted in altitude, and in closer proximity to the operator when compared to the operating area. For some programs, the flight test area and the operating area may be the same. The flight test area and operating area must be over open water, or sparsely populated areas, having light air traffic. The FAA is required to evaluate each application to determine that the proposed flight area does not exceed that which is reasonably required to accomplish the program.

c. The proposed flight test and operating area must be plotted on an aeronautical chart, topographical map, or satellite image. The applicant must include latitude and longitude coordinates that identify the corners of the airspace boundary. The length of each side of the boundary must also be provided. If the area is circular, the applicant must provide the coordinates of the center point and the radius. The applicant must also provide the proposed operating altitude. The applicant must submit their proposed flight area to AIR-200 before completing their program letter and safety checklist. This will allow the FAA to assess the flight area and determine feasibility. A chart of the area will be included in the applicant's program letter and made a part of the operating limitations.

d. In the case of the first flight of 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 that a route of flight is selected that subjects the fewest persons and least property to possible hazards. This routing must be included in the operating limitations. In addition, upon leaving such an airport, the aircraft must be required to operate from an outlying airport until its controllability and safety are established, after which the aircraft may return to its base and use the established corridor for subsequent operations. The operating limitations will prescribe the conditions that allow the aircraft to return to its base. An acceptable approach/departure corridor exists when the corridor provides reasonable opportunity(s) to execute an off-airport emergency landing that will not jeopardize other persons or property.

e. In the case of an UA located at any airport surrounded by a densely populated area and lacking any acceptable approach/departure route of flight, the FAA will not issue a special airworthiness certificate. The applicant must be advised to relocate the aircraft to an airport suitable for flight testing. For an OPA of a previously certificated model, the FAA may permit a one-time flight at an airport that is surrounded by a densely populated area if the onboard pilot is manually flying the aircraft and the equipment used for remote control operations is disengaged. Remote control equipment is typically disengaged by removing the power source, pulling the appropriate circuit breaker(s), or by mechanical means.

4. Flight Test Plan(s). Applicants must develop a flight test plan(s) for their flight operations conducted in the flight test area. The plan should identify flight test objectives.

5. Program Letter.

a. The program letter outlines the program objectives and describes the purpose of the flight operation and the aircraft configuration. Minute details are not required, however, the program letter must be detailed enough to permit the FAA to prescribe the conditions and limitations necessary to ensure safe operation of the aircraft. The program letter must not contain information that is proprietary, confidential, company-sensitive, subject to International Traffic in Arms Regulations (ITAR, 22 CFR subchapter M), or otherwise restricted from public or foreign disclosure.

b. Appendix C, Program Letter for (Model Designation) Unmanned Aircraft System, Optionally Piloted Aircraft, or OPA/UAS (select one), to this order provides a program letter template that includes information required by § 21.193, Experimental certificates: general, or § 21.199, Issue of special flight permits, as applicable. The program letter must be submitted to AIR-200 for original certificate requests, and to the certificate issuing office for recurrent certificate requests. The program letter must be reviewed to ensure the requirements of § 21.193 or § 21.199 (as applicable) have been met.

> **Note:** Changes to any system, component, software, airspace, or program objective may require a new program letter. The manufacturing ASI must discuss changes with the applicant to understand how the proposed change could impact the program letter.

6. Safety Checklist.

a. For original airworthiness certificate requests, the applicant must provide a completed safety checklist to AIR-200. The applicant's safety checklist must mirror the template in appendix D, Safety Checklist, to this order and contain all requested information. The safety checklist reflects a baseline of the aircraft configuration at the time of certification.

b. The safety checklist must be updated with subsequent significant changes to the program objectives, aircraft, or control station. After the initial certification, if changes are made to the safety checklist, the applicant must submit the safety checklist to the certificate issuing office.

c. The safety checklist will be coordinated with AIR-200, AFS-80, the manufacturing ASI, and the geographical flight standards ASI.

7. Inspection and Maintenance Programs. Applicants must develop inspection and maintenance programs for the continued airworthiness of the aircraft, control station, data link equipment, payload, and support equipment. The inspection and maintenance manual(s) must be reviewed and accepted by the geographic FSDO ASI before the onsite inspection. Information on inspection and maintenance programs and how they relate to aircraft 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 programs must include this information appropriate to the type of aircraft and operation. Operators may reference 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, for the types of items that should be included.

b. Maintenance Elements. Maintenance elements describe what and how maintenance is to be performed. Examples include, but are not limited to, servicing schedules, inspection schedules, special inspections (for example, hard landing and foreign object damage), life limited item replacement schedules, and tests and inspections for the transponder and altimeter. For UASs, OPAs, and OPA/UASs, this will be how discrepancies are recorded and how logbook entries are made (for example, how often and what is included).

8. Safety Evaluation.

a. The FAA team typically consists of ASIs and specialists from AIR-200, AFS-80, the Aircraft Maintenance Division (AFS-300), the geographically responsible FSDO, and the geographically responsible MIDO/MISO or CMO/CMU. The FAA team will review the applicant's program letter and safety checklist. If the applicant's program is deemed feasible, the FAA will invite the applicant to participate in a safety evaluation at a location to be determined by the FAA.

b. The applicant is expected to present a detailed explanation of the information provided in the safety checklist. The applicant must provide a presentation consisting of detailed system descriptions 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 discuss the proposed flight area and the planned flight test procedures in detail.

c. The FAA will determine if the applicant's system is safe to operate in the National Airspace System (NAS) based on compliance with part 91, risk mitigation strategies, and safety features. The applicant must provide the FAA with a complete understanding of their program. If the applicant's program is found to pose acceptable risk, AIR-200 will schedule a site visit to the proposed flight test area within 30 to 60 days.

d. The following items must be submitted by the applicant as supporting documentation. These items must be submitted before the site visit is scheduled:

(1) Flight manual(s) and checklists. All appropriate operating manuals, including limitations and checklists (normal, abnormal, and emergency procedures), must be provided.

(2) Training program. Applicants must provide a training manual for crewmembers operating their system and involved in observer or chase operations (if applicable). Applicants must also provide documentation verifying that personnel have successfully completed all necessary training. Crewmember training requirements are listed in appendix A, paragraph 7 to this order.

(3) Licenses and certificates. The FAA will review and verify all crewmember qualifications before issuing the airworthiness certificate. Crewmember licenses and certificates must be made available at any time upon request of the FAA. Crewmembers in positions 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. Crewmember licensing and certification requirements are listed in appendix A to this order.

(4) Radio frequency (RF) spectrum. Before airworthiness certification, the RF spectrum used for operation and control of the UAS, OPA, or OPA/UAS must be approved by the Federal Communications Commission (FCC) or other appropriate government oversight agency. For the initial airworthiness certification, the applicant must provide FCC approval to AIR-200. The applicant will provide subsequent FCC approvals to the certificate issuing office. FCC approval will be checked during recurrent certifications and included as an operating limitation.

9. Opting Out of the Safety Evaluation. Civil aircraft operators that choose to not undergo a safety evaluation for their OPA or OPA/UAS must remove any onboard UAS-related equipment. The aircraft cannot be certificated or operated as an OPA or OPA/UAS.

10. Onsite Inspection. The onsite inspection for issuance of original airworthiness certificates will be scheduled by AIR-200. Recurrent inspections will be scheduled by the manufacturing ASI. The purpose will be to inspect the applicant's aircraft, control station, and support equipment. The FAA will verify the applicant has completed requirements contained in this order. The FAA will also verify compliance with the inspection and maintenance program, review the operating limitations with the applicant, and issue the experimental certificate or special flight permit. The applicant is expected to perform a test fight immediately after the experimental certificate or special flight permit is issued. The test flight will allow the FAA to validate the flight test area. This meeting is normally attended by the entire FAA team. In

addition to the inspection and maintenance program and the items listed above in paragraph 8, the following items must be submitted to the FAA before the onsite meeting is scheduled:

a. Exemptions, to include §§ 91.9(b) and 91.203(a) and (b), if required;

b. Alternate marking approval letter, if required by § 45.22(d), Exhibition, antique, and other aircraft: Special rules;

c. Registration through AFS-750 in accordance with part 47;

d. Current weight and balance report;

e. Flight test plan; and

f. All action items identified during the safety evaluation.

Section 2. Certification and Operation of UASs, OPAs, and OPA/UASs

1. OPA Certification. The process used is similar to manned aircraft, with the following exceptions:

a. The FAA team will conduct a safety evaluation based on the procedures established in section 1 of this chapter.

b. Operating limitations will be comprised of the limitations in appendix B, Sample Operating Limitations for Optionally Piloted Aircraft, to this order, as necessary, in addition to those required by FAA Order 8130.2, chapter 4.

2. OPA/UAS Certification. For the purpose of this order, aircraft that intend to fly as either an OPA or a UAS will be given the designation of OPA/UAS. OPA/UAS aircraft will be certificated using a combination of the procedures found in FAA Order 8130.2 and this order.

a. Interchangeability between an OPA and a UAS is achieved through a maintenance or operational procedure.

b. To ensure the conversion procedure is recorded, an operating limitation must prescribe that an aircraft maintenance record entry, signed by the person making the conversion, be made each time the aircraft is converted between OPA and UAS.

c. If conversion is accomplished by a maintenance procedure, the aircraft must be inspected by a maintenance provider certificated by the FAA, to determine airworthiness each time the aircraft is converted between OPA and UAS.

d. If converting the aircraft between OPA and UAS configurations using an operational procedure, the conversion must be documented in the aircraft maintenance records.

e. OPA/UAS must be certificated and flight tested as an OPA before UAS operations are conducted. The safety evaluation must include OPA and UAS configurations. If not, a subsequent safety evaluation must be conducted prior to UAS operations.

f. The operating limitations will be created from the UAS and OPA operating limitations provided in appendixes A and B to this order, in addition to the required limitations from FAA Order 8130.2, chapter 4. The FAA may impose other operating limitations as deemed necessary. The operating limitations will specify which limitations apply when the aircraft is operating as an OPA or as a UAS.

3. Experimental Certificates. UASs, OPAs, and OPA/UASs may be issued an experimental certificate for the following purposes:

a. Research and Development. Under § 21.191(a), the applicant may conduct research to determine whether an idea warrants further development. This includes testing new design concepts, new aircraft equipment, new equipment installations, new operating techniques, or new uses for aircraft.

b. Crew Training. Under § 21.191(c), the applicant may train their own flightcrews. These flightcrews 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, Certification: Pilots, Flight Instructors, and Ground Instructors.

c. Market Surveys. Under § 21.191(f), U.S. manufacturers may use the aircraft for purposes of conducting market surveys, sales demonstrations, and customer crew training only as provided in § 21.195, Experimental Certificates: Aircraft to be used for market surveys, sales demonstrations, and customer crew training. Customer crew training must be accomplished by flight instructors certificated in accordance with part 61. Before issuing the experimental certificate, the applicant must meet the provisions of §§ 21.193 and 21.195. The applicant must—

(1) Submit the provisions of § 21.193(d) in the program letter;

(2) Establish an inspection and maintenance program for the continued airworthiness of the aircraft; and

(3) 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. The FAA may reduce these operational requirements if the applicant provides adequate justification. This requirement must be specified in the operating limitations.

4. Special Flight Permits. A special flight permit may be issued for an aircraft that may not currently meet applicable airworthiness requirements but is capable of safe flight for the purpose of production flight testing new production aircraft.

5. FAA Form 8130-7, Special Airworthiness Certificate.

a. Purpose of FAA Form 8130-7. FAA Form 8130-7 (GPO pad only) is used for certification of UASs, OPAs, and OPA/UASs.

b. Effective Period.

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

(2) A special flight permit issued for production flight testing is effective for the period of time specified in the permit.

6. Operating Limitations. Operating limitations generally applicable to nonstandard aircraft are printed on the reverse side of FAA Form 8130-7. The additional operating limitations will be enumerated on a separate sheet, dated, signed, and attached to FAA Form 8130-7. Operating limitations must be designed to fit the specific situation and the specific objectives of the special airworthiness certificate under § 91.319. The first page of the operating limitations is prepared on FAA letterhead paper.

a. The ASI must review each imposed operating limitation with the applicant to ensure the applicant has a clear understanding of intent. Appendices A and B of this order provide sample operating limitations that must be prescribed for an experimental certificate or a special flight permit, as applicable.

b. Operating limitations can vary greatly from one aircraft to the next based on equipment requirements, performance characteristics, and operating location. As authorized by § 91.319, the FAA may recommend additional limitations deemed necessary in the interest of safety.

7. Inspection Activities. The following activities must be accomplished during or before the site visit:

a. Record Inspection. The FAA must do the following:

(1) Obtain from the applicant a properly executed FAA 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 14 CFR part 47 have been met.

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

(4) Review the maintenance records to determine that any required maintenance and inspections have been accomplished. Records must include a statement that the UAS has been inspected and found to be in condition for safe operation, as described in paragraph 7c(1)(a) below.

(5) Verify the applicant has provided copies of the maintenance and inspection program to the flight standards ASI.

(6) Following a sufficient review time, verify the flight standards ASI has reviewed and accepted the inspection and maintenance program.

> **Note:** The maintenance program must include all supporting systems and equipment, for example, control 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) and manufacturer service advisories.

(9) Establish that 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. Aircraft Inspection. At the time of certification, the aircraft, control station, data link equipment, and support equipment must be complete in every respect and reflect the configuration in the safety checklist. The applicant must make the aircraft and related support systems available for inspection to determine—

(1) The aircraft nationality and registration marks are in accordance with part 45 or alternate marking approval from AIR-200. The marks must be painted on the aircraft or affixed by any other means ensuring a similar degree of permanence (§ 45.21(c)(1), General). The nationality and registration marks may be affixed with readily removable material if the aircraft is intended for immediate delivery to a foreign purchaser or it is bearing a temporary registration number (§ 45.21(d)).

(2) The information on the identification plate is correct, matches the information on FAA Form 8130-6, and is in accordance with § 45.13, Identification data, as applicable.

> **Note:** Experimental certificate applicants must attach a fireproof identification plate to their aircraft that meets the requirements of § 45.11, Marking of Products. Applicants for a special flight permit do not have to attach a fireproof identification plate to their aircraft.

(3) The flight control system operates properly.

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

(5) 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.

(6) 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 aircraft.

c. Certificate Issuance.

(1) If the aircraft 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 aircraft meets the requirements for the certification requested, and have issued a special airworthiness certificate dated (MM/DD/YYYY). The operation of this aircraft 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.

(ASI signature)
Aviation Safety Inspector, (Office Code)

(b) Issue FAA Form 8130-7. The blocks on FAA Form 8130-7 must be completed using all applicable information obtained from the completed FAA Form 8130-6. When completing block A of FAA Form 8130-7, Category/Designation, include the words *Experimental (Unmanned Aircraft* or *Optionally Piloted Aircraft* or *OPA/UAS)* or *Special Flight Permit*, as appropriate. When completing block A, Purpose, include the words *Research & Development, Crew Training, or Market Survey*, as appropriate, for an experimental certificate, or *Production Flight Testing* for a special flight permit.

(c) On the FAA Form 8130-6, annotate, *Unmanned Aircraft* or *Optionally Piloted Aircraft* or *OPA/UAS* in section II, block B, immediately after the preprinted wording, *SPECIAL AIRWORTHINESS CERTIFICATE (Check appropriate items).* For OPA/UAS, blocks 1, 5, 6, 9, 9A, 9B, and 9c should be checked, as appropriate, in section II, block B4. Complete sections V and VIII of FAA Form 8130-6 according to the instructions contained in Chapter 8 of FAA Order 8130.2. Exception: for section VIII, block D, since the current weight and balance information will not be flown aboard an unmanned aircraft, annotate that the document is to be available at the ground control station or within immediate proximity to the PIC (as applicable).

(d) Examine, review, and route the certification file according to the instructions contained in Chapter 8 of FAA Order 8130.2. Do not send any documents to AFS-750 that are labeled as proprietary, confidential, company-sensitive, subject to ITAR, or contain any other label indicating the document is restricted from public or foreign disclosure.

(2) If the aircraft 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.

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

Appendix A. Sample Operating Limitations for Unmanned Aircraft Systems

(Name of MIDO)

(Issuing office address)

Operating Limitations for the *(Model Designation)* Unmanned Aircraft System: Experimental Certificate or Special Flight Permit *(select one)*

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

The following conditions and limitations apply to all unmanned aircraft system (UAS) flight operations for the (*model designation*) UAS while operating in the National Airspace System (NAS).

1. General Information.

a. Integrated System. For the purpose of this special airworthiness certificate, the (*model designation*) UAS operated by (*individual or company name*) is considered to be an integrated system. The system is comprised of the following:

(1) (*Model designation*).

(2) (*Serial number*).

(3) UAS control station(s), that is fixed, mobile, ground-based, or airborne (*select as appropriate*).

(4) Telemetry, launch, and recovery equipment.

(5) Communication and navigation equipment, including ground and/or airborne equipment, used for control of the (*model designation*).

(6) Equipment on the ground and in the air used for communication with the chase aircraft, crewmembers, 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 unmanned aircraft (UA) pilot-in-command (PIC) and (*applicant name*) must comply with all applicable 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, crew training, or production flight testing new production aircraft (*select purpose(s) for appropriate certification*) to accomplish the flight operation outlined in the (*model designation*) program letter for (*registration number*) dated (*include date*), which describes compliance with 14 CFR 21.193, Experimental certificates: general, or § 21.199, Issue of special flight permits, (*select one*). The program letter has been made available to the UA PIC.

(2) While operating under an experimental certificate, (*Company name*) must comply with applicable air traffic and general operating rules of part 91 and all additional limitations herein prescribed under the provisions of § 91.319, Aircraft having experimental certificates: Operating limitations.

(3) While conducting production flight test of new production aircraft, (*Company name*) must comply with applicable air traffic and general operating rules of part 91, and all procedures, requirements, and restrictions contained within this document.

d. UA Condition. The 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 to document that finding in the maintenance records. (*This limitation is not applicable for a special flight permit.*)

f. Operation Exceptions. While operating under an experimental certificate, no person may operate this UA to carry persons or property for compensation or hire (§ 91.319(a)(2)).

g. UA Markings.

(1) This UA must be marked with its U.S. nationality and registration marks in accordance with 14 CFR part 45, an alternative marking approval issued by the FAA Production and Airworthiness Division (AIR-200), or as prescribed by an exemption granted in accordance with 14 CFR part 11, General Rulemaking Procedures.

(2) This UA must display the word *Experimental* in accordance with § 45.23. (*As applicable*).

(3) This UA must have a fireproof identification plate marked in accordance with § 45.11. (*As applicable*).

h. Air Traffic Control Notification. Immediately after the certificate is issued, (*applicant name*) must forward an electronic copy of the (*model designation*) program letter, special airworthiness certificate, and operating limitations to the attention of: FAA Headquarters, Unmanned Aircraft Systems, Tactical Operation Section, at email: 9-AJR-36-UAS@faa.gov, or via fax at 202-385-4559. AIR-200 will be included on this transmission.

i. Change in Registrant Address. 14 CFR 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 Aeronautical Center 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 §§ 91.203 and 91.9, or as prescribed by an exemption granted in accordance with 14 CFR part 11, General Rulemaking Procedures. If the exemption does not state an alternate location, the airworthiness certificate and flight manual will be located at the ground control station or within immediate proximity to the PIC *(select as appropriate).*

2. Program Letter. The (*model designation*) program letter for (*registration number*), dated (*insert date*), was used as the basis for determining the operating limitations prescribed in this document. All operations must be conducted in accordance with the provisions of these operating limitations.

3. Flight Area.

a. Description of the Flight Area. This must include coordinates (latitude and longitude), altitude dimensions, and the home airfield for the UAS. (*Applicant must provide appropriate chart(s) of the initial flight test area and the operating area for insertion here*.)

b. Criteria for Remaining in the Flight Area. The PIC must ensure all UA flight operations remain within the lateral and vertical boundaries of the designated flight area. Furthermore, the PIC must take into account all factors that may affect the capability of the UA to remain within the airspace boundary. This includes, but is not limited to, wind, gross weight, and glide distances.

c. Flight Conditions. All flight operations must be conducted during daylight hours in visual meteorological conditions with cloud clearance and flight visibility not lower than the minimums as specified in § 91.155. Flight operation in instrument meteorological conditions (IMC) is not permitted. Operations under special visual flight rules (SVFR) are not authorized.

d. Incident and Accident Reporting. Any incident, accident, or any flight operation that transgresses the lateral or vertical boundaries of the flight test area or any restricted airspace must be reported to the UAS Integration Office (AFS-80) within 24 hours. AFS-80 can be reached by telephone at 202-385-4636 or by fax at 202-385-4559. Accidents that result in death or serious injury to any person, or accidents that cause substantial damage to a UA with a maximum gross takeoff weight of 300 pounds or more must be reported to the National Transportation Safety Board (NTSB) per instructions on their website: www.ntsb.gov. Further flight operations must not be conducted until the incident is reviewed by AFS-80 and authorization to resume operations is provided to (*applicant name*).

4. Initial Flight Test.

a. Requirements. Flight operations must be conducted within the visual line of sight of the pilot/observer. Initial flight testing will be completed upon accumulation of *(number)* flight hours, *(number)* takeoffs and landings *(select as appropriate)*, or when the aircraft is deemed controllable and safe for operation, whichever occurs later. Following satisfactory completion of initial flight testing, the operations manager or chief pilot must certify in the aircraft records that the aircraft has been shown to comply with § 91.319(b) with the following, or a similarly worded, statement:

> ***I certify that the prescribed flight test has 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.***

5. Aircraft Operations for the Purpose of Market Surveys, Sales Demonstrations, and Customer Crew Training. These operations cannot be performed until the flight hour requirements of § 21.195(d)(2) have been accomplished. An entry in the maintenance records is required as evidence of compliance.

6. UA Pilots and Observers.

a. PIC Roles and Responsibilities.

(1) The PIC must perform crew duties for only one UA at a time.

(2) All UA flight operations must have a designated PIC. The PIC has responsibility over each flight conducted and is accountable for the UA flight operation.

(3) The 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 PIC must avoid densely populated areas and congested airways in accordance with § 91.319.

b. UA PIC Certification and Ratings Requirements.

(1) The 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; with single- or multiengine class ratings, appropriate to the type of UA being operated.

(2) The 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 PIC must maintain currency in manned aircraft by accomplishing at least three takeoffs and three landings within the preceding 90 days while acting as the sole manipulator of the flight controls.

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

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

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

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

d. UA Supplemental Pilot Roles and Responsibilities.

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

(2) A supplemental 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 PIC will have operational override capability over any supplemental pilots, regardless of position, and must have immediate access to all controls.

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

e. UA Supplemental Pilot Certification.

(1) Supplemental pilots must have, at a minimum, successfully completed private pilot ground school. Additionally, supplemental pilots without a current FAA private pilot certificate must have successfully passed the private pilot, commercial pilot, or airline transport pilot knowledge test within the past 24 calendar months. If a supplemental pilot assumes the role of PIC, then they must be a certificated pilot and meet the requirements listed above in 6a through 6c.

(2) Supplemental pilots 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.

f. UA Supplemental Pilot Currency, Flight Review, and Training.

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

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

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

g. Observer Roles and Responsibilities. The role of the observer is to provide the PIC with instructions to maneuver the UA clear of any hazards and any potential collision with ground obstructions or air traffic. Additionally, the observer must assist the UA pilot in complying with the flight visibility and cloud clearance requirements. To satisfy these requirements—

(1) The observer must perform crew duties for only one UA at a time.

(2) Visual observers must not allow the aircraft to operate beyond the visual line-of-sight limit. Observers must be able to see the aircraft and the surrounding airspace throughout the entire flight. Observers must be able to determine the UA's altitude, flight path, and proximity to all aviation activities and other hazards (for example, terrain, weather, or structures) sufficiently to comply with §§ 91.111, 91.113, and 91.115, and prevent the UA from creating a collision hazard.

(3) 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.

(4) Observers must continually scan the airspace for other aircraft that pose a potential conflict.

(5) All flight operations conducted in the flight test area and operating 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 hold, at a minimum, an FAA private pilot certificate, 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, and be in possession of, a valid second-class (or higher) airman medical certificate issued under 14 CFR part 67, Medical Standards and Certification.

i. Observer Training.

(1) All observers must be thoroughly trained to accomplish observer roles and responsibilities. All observers must 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.

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

7. Equipage.

a. Radio Frequency Equipment. Before conducting operations, the radio frequency spectrum used for operation and control of the UA must be approved by the Federal Communications Commission (FCC) or other appropriate government oversight agency. The experimental radio license issued by the FCC must be renewed before the expiration date to continue flight operations under this experimental certificate.

b. Transponder.

(1) The UA must operate with a transponder that meets the performance and environmental requirements of any class of Technical Standard Order (TSO)-C74d or TSO-C112, to include altitude reporting, during all flight operations. If the transponder is Mode S capable, it must have an appropriately assigned International Civil Aviation Organization (ICAO) 24-bit address based on the UA's assigned registration number.

(2) While performing chase operations with the UA, chase aircraft transponders must be on standby unless otherwise directed by ATC.

c. 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.

d. Aircraft Lights. 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.

8. Air Traffic Control Provisions.

a. Notice to Airman. *(Applicant name)* must request a distance (D) NOTAM be issued for UA operations. Coordinate the NOTAM through the local base operations or (*Name*) Flight Service Station at 1-877-487-6867 not more than 72 hours in advance, but not less than 24 hours before the operation.

b. ATC Coordination.

(1) At least 2 hours before each UA flight, (*applicant name*) must contact the (*Name*) Air Traffic Control facility at (*phone number*), and advise the following:

(a) Location and description of the flight area (*latitude and longitude coordinates*).

(b) The Notice to Airman (NOTAM) number.

(c) The planned time for commencing and terminating UA operation(s).

(d) A point of contact name and phone number who will be attending the operation(s).

(2) After takeoff, upon initial contact with ATC, the PIC must indicate the experimental nature in accordance with § 91.319.

(3) Appropriate ATC frequencies must be monitored during flight operations.

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

10. Flight Prohibitions.

a. 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 (§ 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.

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

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

11. Flight Termination and Lost Link Procedures.

a. Flight Termination. 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. Comply with the following provisions:

(1) If lost link occurs within a restricted or warning area, or the lost link procedure takes the UA into a restricted or warning area, the aircraft will not exit the restricted or warning area until the link is re-established.

(2) The UA lost link mission will not transit or orbit over populated areas.

(3) Lost link programmed procedures will avoid unexpected turn-around and/or altitude changes and will provide sufficient time to communicate and coordinate with ATC.

(4) Lost link orbit points will not coincide with the centerline of published airways.

12. Inspection and Maintenance.

a. General Requirements. The UAS must not be operated unless it is inspected and maintained in accordance with the (*applicant's model name and name of procedures*), (*effective date*) or later accepted FAA revision. (*Applicant name*) must establish and maintain aircraft maintenance records.

b. Inspections. No person may operate this UAS unless it has had a condition inspection performed within the preceding 12 calendar months in accordance with 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.

c. Authorized Inspectors and Maintainers. Only certified maintenance providers or the manufacturer and their representatives may perform the inspections and maintenance required by these operating limitations. Certified maintenance providers include repair stations, holders of mechanic and repairman certificates, and persons working under the supervision of these mechanics and repairman. Representatives of a manufacturer must have written authorization from the manufacturer.

d. Inspection and Maintenance Records. Inspections and maintenance of the UAS must be recorded in the UAS maintenance records.

(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 determined 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.

13. UAS Changes.

a. Minor changes to the UAS, including minor software changes, must be documented as part of the normal maintenance procedures and must be available for inspection. A "minor change" is one that has no appreciable effect on the weight, balance, structural strength, reliability, operational characteristics, or other characteristics affecting the airworthiness of the UAS. Minor changes have negligible impacts to system safety.

b. Changes that do not meet the definition of a minor change are classified as "major changes." All major changes, including major software changes, performed under the special airworthiness certificate, Certificate of Waiver or Authorization (COA), or other authorizations that could potentially affect the safe operation of the system must be documented and provided to the certificate issuing office before operating under this certificate. The applicant must provide the necessary substantiating and descriptive data to allow the FAA to perform an assessment of the proposed major changes.

c. All requested information is to be provided to the certificate issuing office.

14. Aircraft Operations following Major Changes. Crew training, market survey, sales demonstrations, and customer crew training *(select, if applicable)* operations cannot be performed following major changes to the aircraft or control station. The aircraft must first be flight tested for *(number)* hours or by completing (number) takeoffs and full stop landings *(select, as appropriate).* Following the flight test, the operations manager or chief pilot must certify the aircraft as controllable, demonstrating no hazardous operating characteristics, and safe for operation. The successful completion of the flight test following a major change must be

recorded in the aircraft log by the operations manager or chief pilot with the following, or a similarly worded, statement:

I certify the prescribed flight test has 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.

15. Information Reporting. (*Company name*) will provide the following information to (*name and contact information*) on a monthly basis.

a. Number of flights conducted under this certificate.

b. Pilot duty time per flight.

c. Equipment malfunctions (hardware or software).

d. Deviations from ATC instructions.

e. Unintended entry into lost link flight mode that results in a course change.

16. Revisions and Other Provisions.

a. Experimental Certificates, Special Flight Permits, Program Letters, and Operating Limitations. The experimental certificate or special flight permit *(select one),* FAA-accepted (*model designation*) program letter, and operating limitations cannot be reissued, renewed, or revised without application being made to the (*Manufacturing Inspection District Office (MIDO) name*).

b. Certificates of Waiver or Authorization. (*Applicant name*) will immediately notify the (*MIDO name*), if there is any plan for requesting a 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 a 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 the FAA-accepted (*model designation*) inspection and maintenance program must be reviewed and accepted by the (*Flight Standards District Office (FSDO*) name.

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, crew training, or production flight testing new production aircraft (select as applicable).

This special airworthiness certificate is issued to (name and model designation), 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 will be issued, as required, to supplement operating limitations issued under an experimental certificate or special flight permit, as applicable, as described in chapter 4 of FAA Order 8130.2, Airworthiness Certification of Aircraft and Related Products.

2. Opting Out of the Safety Evaluation. Civil aircraft operators who choose not to undergo a safety evaluation for their OPA or OPA/UAS must remove any onboard UAS-related equipment. The aircraft cannot be certificated or operated as an OPA or OPA/UAS.

3. OPA Limitations.

a. The pilot in command is always onboard the OPA and must have the ability, using normal control input forces, to immediately override any installed system that can be operated remotely or by automation.

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. There may be no specific geographic limitation when the aircraft is to be flown entirely by an onboard pilot unless otherwise specified in the operating limitations.

d. The identified flight test area is approved for the (*model designation*) to conduct operations using the system with a pilot onboard:

(1) As described in (*list section or paragraph number of operating limitation*), the (*model designation*) 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 flight test limitation described above, there is no further geographic limitation.

e. *(Applicant)* must notify the certificate issuing office to request additional flight test areas or operating areas.

f. Engaging the system can only be accomplished while the aircraft is in the approved flight test or operating area. Downlink of telemetry data is usually not restricted unless limited by the FCC or another agency.

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

h. The system may only be engaged or used during daylight hours and in visual meteorological conditions (VMC) with minimum flight visibility no less than three statute miles below 10,000 feet mean sea level (MSL) and five statute miles at or above 10,000 feet MSL.

The system is not authorized for use under special visual flight rules (SVFR), or in instrument meteorological conditions (IMC). If the system is disabled or rendered inoperative, an OPA may be allowed to operate in IMC under instrument flight rules (IFR) provided that the PIC is IFR current, and the aircraft is suitably equipped for IFR flight in accordance with 14 CFR 91.205.

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

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

k. Major aircraft or control system changes must be flight tested before conducting crew training *(if applicable)* or market surveys, sales demonstrations, and customer crew training flights *(if applicable).* These flight tests must be conducted in the flight test area and require (*number*) takeoffs and landings over a period of (*number*) flight hours. The successful completion of the flight tests must be recorded in the aircraft log.

l. When converting the aircraft between OPA and UAS configurations using a maintenance procedure, the person making the conversion must make an aircraft maintenance record entry. The aircraft must be inspected by a maintenance provider certificated by the FAA to determine airworthiness each time the aircraft is converted. Airworthiness findings must be documented in the aircraft maintenance records.

m. When converting the aircraft between OPA and UAS configurations using an operational procedure, the conversion must be documented in the aircraft maintenance records.

End of Limitations.

Appendix C. Program Letter for the *(Model Designation)* Unmanned Aircraft System, Optionally Piloted Aircraft, or OPA/UAS *(select one)*

Experimental Certificate or Special Flight Permit *(select one)*

Registered Owner Name: [Enter Owner Name]	**Aircraft Builder:** [Enter Builder Name]
Registered Owner Address: [Enter Owner Address]	**Year Manufactured:** [Enter Year]
Aircraft Description: **[Enter** Description**]**	**Aircraft Serial Number:** [Enter Serial Number]
Aircraft Registration: [Enter Registration Number]	**Aircraft Model Designation:** [Enter Model Designation]
	Engine Model: [Enter Model Designation]
	Propeller Model: *(if applicable)* [Enter Model Designation]

Note: The program letter must not contain information that is proprietary, confidential, company-sensitive, subject to International Traffic in Arms Regulations (22 CFR subchapter M), or otherwise restricted from public or foreign disclosure.

1. Overview of Project. Provide a general explanation and overview of the project. The applicant must provide enough detail for the FAA to understand the program's purpose and need for an experimental certificate or special flight permit *(select one)*.

a. Definition of the Experimental Purpose *(if applicable)*. Provide the definition of the experimental purpose(s) under which the aircraft is to be operated. The definitions of research and development, crew training, and market survey can be found in 14 CFR 21.191, Experimental certificates.

b. Scope of the Experimental Program *(if applicable)*. Provide the estimated time or number of flights required for each experimental purpose sought (§ 21.193(d)(2), Experimental certificates: general).

c. Description of Production Flight Testing under a Special Flight Permit *(if applicable).* Provide the information required by § 21.199, Issue of special flight permits. Describe—

(1) The proposed itinerary;

(2) The crew required to operate the aircraft and associated equipment;

(3) The ways, if any, in which the aircraft does not comply with the applicable airworthiness requirements;

(4) Any restriction the applicant considers necessary for the safe operation of the aircraft and associated equipment; and

(5) Any other information considered necessary by the FAA for prescribing operating limitations.

d. Description of past flight history. Provide the aircraft's past flight history.

2. Definition of Flight Areas. Provide an aeronautical chart(s) or aerial photograph(s) of the operating area in which the experimental flights or production flight testing *(select one)* will be conducted. For experimental aircraft, indicate where initial flight testing will occur on an aeronautical chart or aerial photograph. Include the following:

a. Address of the home field or the location of the flight operation.

b. Latitude and longitude of the proposed flight area(s). If the perimeter of the proposed flight 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. If the proposed flight area is in the shape of a circle, provide the latitude and longitude of the center point and the radius.

c. Proposed upper and lower altitude limits.

d. Class of airspace to be used.

e. Flight rules and weather conditions, for example, visual flight rules (VFR) and visual meteorological conditions (VMC).

f. Whether the aircraft will perform any aerobatic maneuvers as defined by § 91.303.

3. Aircraft and Support Equipment Configuration. Discuss the aircraft's performance characteristics and include the following:

a. Three-view drawings or three-view dimensioned photographs of the aircraft.

b. Wing span.

c. Length of the aircraft.

d. Maximum gross takeoff weight.

e. Fuel capacity (if applicable).

f. Payload capacity.

g. Maximum altitude (not the proposed operating altitude).

h. Maximum endurance.

i. Maximum airspeed (not the proposed operating airspeed).

j. Description of ground support equipment (for example, power carts, air carts, or towing equipment).

k. Description of launch and recovery equipment (if applicable).

4. ATC Transponder and Altitude Reporting Equipment and Use (§ 91.215). Describe how the UAS complies with the transponder and altitude reporting equipment requirements of 91.215, if applicable.

5. Identification and Registration Marking (14 CFR part 45). Describe the location and size of the aircraft's nationality and registration marks. For experimental certification, discuss the *EXPERIMENTAL* markings and the fireproof plate location and markings.

6. Control Station System Configuration. Provide a description and a diagram or picture of the ground control station.

7. 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.

8. Flight Recovery and Lost Link Procedures. Describe/explain aircraft lost link and emergency recovery procedures. Describe/explain how the aircraft will remain within the boundaries of the proposed flight area. Provide an explanation of the flight termination system in the event the UA control link is unrecoverable.

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

a. Pilot Qualifications. Describe the qualifications of the company's pilots with regard to guidance in appendix A, Sample Operating Limitations for Unmanned Aircraft Systems, to this order. Discuss prior model aircraft or unmanned aircraft experience. Do not include the names of crewmembers.

b. Pilot Training. Describe the company's training program to qualify pilots. Describe company procedures and requirements for maintaining currency and conducting a flight review.

c. Supplemental Pilots. If used, describe the qualifications of the company's supplemental pilots with regard to guidance in paragraph 7 of appendix A to this order. Describe how supplemental pilots will be used. Describe the company's training program for supplemental pilots. Describe company procedures and requirements for maintaining currency and conducting a flight review for supplemental pilots.

d. Qualifications and Training of Observers. Describe the qualifications of the company's observers with regard to guidance in appendix A to this order. Acceptable observer training must include, at a minimum, 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*.

10. Inspection and Maintenance. Describe the inspection and maintenance program that will be used to maintain the aircraft and related systems, including control stations, data link equipment, and other support systems.

Appendix D: Safety Checklist

1. Introduction. The safety checklist is designed to help the FAA evaluate those hazards that are unique to UAS, OPA, or OPA/UAS in support of issuing a special airworthiness certificate. Some safety items only require brief responses and others may not be applicable to a specific program. Additional information and supporting documentation may be required during the evaluation process.

> **Note:** The applicant must identify all responses that contain information deemed proprietary, confidential, company-sensitive, subject to International Traffic in Arms Regulations (22 CFR subchapter M), or subject to any other classification that would restrict or prevent the information from public or foreign disclosure.

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) Turbulence restrictions.

(c) Minimum visibility conditions.

(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 the most critical propulsion related failure modes and their impact on system operation.

(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)?

(3) 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?

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

(5) 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.

(6) Provide a high-level description of the electrical distribution architecture. Include items such as regulators, switches, buses, and converter, as necessary.

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) 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?

(4) Describe the procedures to test the altimeter system (refer to § 91.411).

c. UA Flight 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 system.

(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 and provide the criteria that was used in selecting the system.

(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. Control Link.

(1) Provide a detailed control system architecture diagram that includes informational or data flows and subsystem performance. Include values for data rates and latencies, if known.

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

(a) What spectrum will be used for the control link 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 control links? If so, how dissimilar are they?

(f) For satellite links, estimate the 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 the sequence the UA will follow in the event control link is lost.

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

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

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

(g) 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?

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

(i) 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. 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 concurrently on the ground control computer? If so, what precautionary measures are used to ensure that flight-critical processing will not be adversely affected?

(7) What are the possible conditions that would cause a ground control station display or interface 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) Describe what software functions were developed by the applicant or the applicant's suppliers, and what functions are implemented by COTS 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) Describe how the software requirements are validated and how the software is verified.

(5) For aspects of software development that are allocated to suppliers, describe the process of supplier oversight.

(6) How is software load control implemented for the system to ensure that the correct software components are loaded onto the system?

(7) What software quality assurance processes are used in the development of the system software? How are suppliers a part of the process?

(8) Is there a system for reporting and tracking problems? How are suppliers integrated into the problem reporting system?

(9) What procedures are in place to manage configuration changes? How are they documented?

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

(11) What requirements standards, design standards, and coding standards are used in the software development process? What ensures that the standards are followed?

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 hardware components considered in the design, test, and modification processes described above relative 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 TSO approved Mode-C or Mode-S transponder? If yes, under what TSO and Class of equipment was the transponder approved?

(b) Is the UA equipped with a non-TSO Mode-C or Mode-S transponder? If yes, describe the method used to determine that the transponder meets the performance and environment requirements of any class of TSO-C74d (Mode C) or TSO-C112 (Mode S). Highlight any TSO deviations or non-TSO functions.

(c) What functions and/or settings of the transponder can be changed by the pilot?

(d) Describe the transponder test procedures (reference § 91.413).

(e) 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?

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

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

(h) For OPA, does the cockpit have instrument and cockpit lighting?

(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) For OPA, describe how the remote control equipment will be engaged and disengaged during ground and flight operations.

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

(f) 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 envelope and operating area. Include test plans, if possible.

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

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

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

f. Manuals.

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

(2) Does the manual have a section with all 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, flight instructors, and ground instructors; part 63 - Certification: flight crewmembers other than pilots; part 65 - Certification: airmen other than flight crewmembers.

(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 in detail and reference any procedures that show that the pilots are properly trained.

(d) Is there an established formal training curriculum for all pilots including PIC, supplemental, or chase pilots(s)?

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

(3) Observer.

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

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

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

(d) 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.

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

(f) 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.

(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 MIDOs and MISOs; to all FSDOs; 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 UAS could be given limited access to the NAS (refer to Title 14 CFR part 21, Certification Procedures for Products and Parts, 21.191, 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, is tasked with coordinating all aspects of issuing an experimental certificate or a special flight permit to a UAS, OPA, or OPA/UAS 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, FAA Form 1320-19, Directive Feedback Information, to this order for your convenience or you may use the automated system to submit your request via the directive feedback system (DFS) at http://avsdfs.avs.faa.gov/. If you require an immediate interpretation, please contact AIR-200 at (202) 385-6346; however, you should also complete FAA Form 1320-19 as a follow-up to the conversation.

7. Records Management. Refer to FAA Orders 0000.1, FAA Standard Subject Classification System; 1350.14, Records Management; and 1350.15, Records Organization, Transfer, and Destruction Standards; and FAA IR-04-01, Aircraft Certification Service Records Management Requirements Manual; or see your office Records Management Officer/Directives Management Officer for guidance regarding the retention or disposition of records.

Appendix F. Definitions

a. Airworthy. A UAS is airworthy if the aircraft and all of its associated elements are in condition for safe operation.

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 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 flight control computer. The flight control computer 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). A manned aircraft that can be flown by a remote pilot from a location not onboard the aircraft.

g. Safety Evaluation. A comprehensive review of an applicant's UAS, OPA, or OPA/UAS and all associated elements of the system. The applicant is expected to provide any and all information necessary to allow the FAA to objectively determine if the aircraft 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. The device can be any type of airplane, helicopter, airship, glider (powered or unpowered), powered-lift aircraft, or tethered aircraft without an onboard pilot. Unmanned free balloons and unmanned rockets discussed in 14 CFR part 101 are not considered UA.

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 8130.34C

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)