



# FAA

## Aviation Safety

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### Memorandum

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To: See distribution list

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Subject: FAA Approval of Unmanned Aircraft Systems (UAS) Special Class UA  
Projects and their Associated Elements

Memo No.: AIR600-21-AIR-600-PM01

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#### Purpose

This memo addresses the FAA's approach to type certification of low-risk unmanned aircraft (UA), which use durability and reliability testing in the special class airworthiness criteria, and describes the FAA's process for evaluation of integrated Unmanned Aircraft System (UAS). This memorandum provides policy guidance and instruction to Aircraft Certification Service and Flight Standards Service staff involved in the certification and operational approvals of these UAS.

#### Background

Under the certification regulations in 14 CFR part 21, the FAA issues a type certificate for an aircraft upon finding that the type design of the product meets the applicable airworthiness requirements. Section 21.41 defines the type certificate to include the type design, the operating limitations, the type certificate data sheet (TCDS), the applicable regulatory airworthiness standards, and any other conditions or limitations prescribed by the FAA.

A UAS is defined as a UA and its associated elements (AE), including communication links and the components that control the UA, that are required to operate the UAS safely and efficiently in the national airspace system.<sup>1</sup> The AE discussed in this memo are those elements that are not airborne or directly affixed to the aircraft.

The FAA recently determined that some UAS may be type certificated as special class aircraft under 14 CFR 21.17(b) and published a notice of this policy in the Federal Register (85 FR 58251, September 18, 2020). Under the provisions of 14 CFR 21.17(b), the airworthiness standards for special class aircraft are those standards in parts 23, 25, 27, 29, 31, 33, and 35 that the FAA finds to be appropriate and applicable to the specific type design, or other airworthiness criteria that provides an equivalent level of safety to those parts. The FAA defines the proposed airworthiness requirements for each project through the issue paper process, which is then used to develop a Federal Register notice requesting public comment.

The operation of any aircraft in the national airspace system must meet all applicable regulatory requirements in title 14 of the Code of Federal Regulations. In some instances, the FAA may provide relief from certain regulations. For example, Flight Standards may, through waivers or exemptions, provide relief from the requirements of an operating rule when a regulated entity cannot comply but meets the safety standard for relief.<sup>2</sup> The base operating rules for unmanned aircraft are provided in 14 CFR 107 (Small Unmanned Aircraft Systems) and 14 CFR 91 (General Operating and Flight Rules), and are augmented for specific operations for compensation or hire by part 135 or part 137, for example.

As the FAA has continued to work with the public and industry to create and refine standards for UAS, Aircraft Certification and Flight Standards have determined that a change to the type certification policy is necessary. Where appropriate, the FAA will issue a type certificate for the UA, and the FAA may approve use of the AE through operating limitations and operational approvals (i.e., waivers, exemptions, and/or operating certificates). This memo provides guidance to FAA offices on these approval and oversight processes for UAS. Additionally, it underpins a fundamental approach to working in a collaborative OneAVS environment where Flight Standards supports Aircraft Certification in the evaluation and issuance of the type certificate, while Aircraft Certification supports Flight Standards in the evaluation and issuance of the operational approval.

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<sup>1</sup> See 49 U.S.C. 44801(12).

<sup>2</sup> The FAA may grant an exemption from certain regulations if doing so would be in the public interest. See 49 U.S.C. 44701(f). In implementing this authority, the FAA must find that the requested relief would not adversely affect safety or that the exemption would provide a level of safety at least equal to that provided by the rule from which the petitioner seeks relief, and benefit the public as a whole.

### **The UA Type Certification (TC) Process**

In November 2020, the FAA requested public comments on proposed airworthiness criteria for several UAS type certification projects. Public comments on these notices ranged from suggestions for revising the specific airworthiness requirements to requests for clarification on operational issues. In addition, in processing TC applications that include the AE in the type design approval, several issues have arisen. Some AE, such as a launch-and-recovery system or fleet-management software, are frequently used with more than one UA. Including these components within the type design of the UA raises challenges for the certificate of airworthiness for each individual UA and continued conformance to the type design. Post-TC changes to these AE could pose extensive aircraft recordkeeping and configuration management challenges, such as keeping track of which specific AE are associated with specific UA and recording an alteration of an AE in the maintenance records of many UA.

As an additional consideration, current part 91 regulations were not originally drafted to accommodate UAS operations. The FAA enables compliance with part 91 regulations for UAS operations by providing regulatory relief through the exemption or waiver process. During this evaluation, the FAA may observe the operational suitability of the UAS in order to develop appropriate conditions and limitations that ensure the safety of the operation. These conditions and limitations could contain specifications for services and systems that are not covered by the airworthiness criteria in the TC for the UA but that are necessary to ensure the safety of the proposed operation in consideration of the regulatory relief granted.

### **Policy Clarification**

Under this policy, ACOs should apply the regulations for type design approval, production approval, conformity, certificates of airworthiness, and maintenance to only the unmanned aircraft, and not to the associated elements. However, because safe UAS operations depend and rely on both the UA and the AE, the FAA will consider the AE in assessing whether the UA meets the criteria that comprise the certification basis. While the AE items themselves will be outside the scope of the UA type design, the TC applicant must provide sufficient specifications for any aspect of the AE that could affect airworthiness, including a complete and unambiguous definition of the elements and their interface with the UA, so that their availability or use is readily apparent. ACOs may approve the use of AE with certain specifications as an operating limitation and include them in the TCDS and flight manual. Operating limitations outlining acceptable fuels for conventional aircraft is an example of this concept from the traditional aviation framework.

In developing the special class airworthiness criteria for a UA project, Aircraft Certification will include a requirement that the applicant submit the specifications and interface conditions of the AE that could affect UA airworthiness, for the FAA to use in establishing operating limitations. For AE that are used to show compliance with the airworthiness criteria and relevant to the

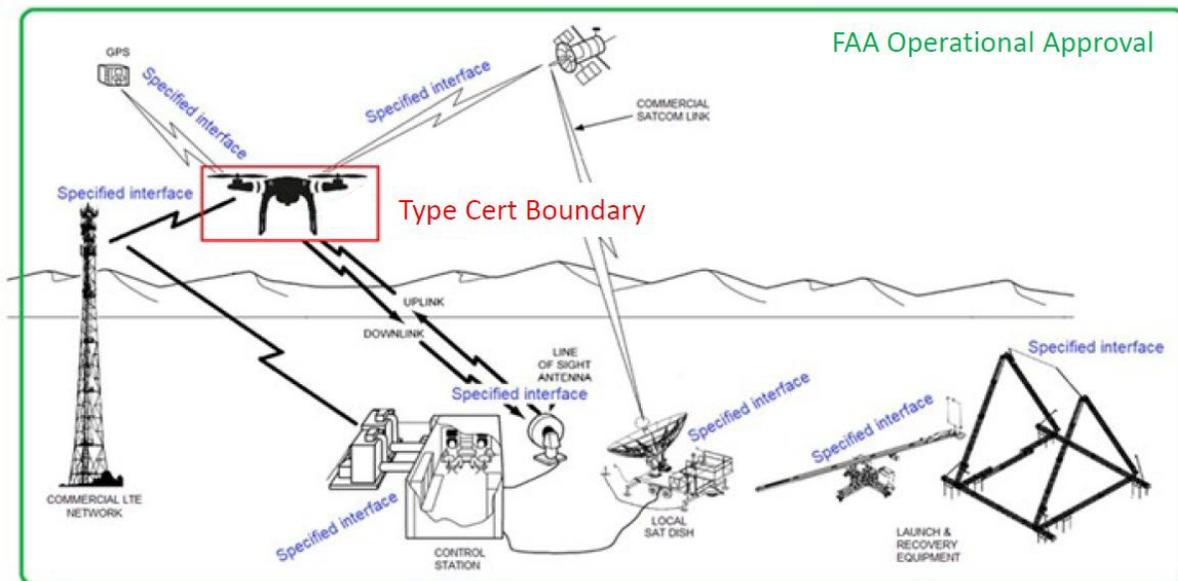
operator's safe operation of the UA, applicants will either specify the AE or detail minimum specifications for that AE. Approval for the use of that AE or AE specifications as an operating limitation will ensure compliance of the UA with the criteria in the certification basis. The FAA will determine that the AE specifications adequately define the features of the AE and are correct, complete, consistent across AE specifications, and verifiable. This is further detailed in Appendix A.

The AE specifications included as operating limitations in the type certificate and the flight manual would likely be similar for all type-certificated UA and consistent between operating parts, as indicated by the examples in Appendix B. As discussed later in this memo, because part 107 applies to small UA engaged in lower risk operations, at this time, the FAA does not expect that additional specifications would be necessary for those part 107 operations. For operations outside of part 107 (e.g., parts 91, 135, or 137), which are more complex, the FAA may provide relief from regulations with conditions and limitations that identify additional specifications to mitigate a possible adverse safety impact.

Flight Standards will generate conditions and limitations for inclusion in the operational approval (i.e., waiver or exemption), specific to the AE that are necessary for the safe operation of the UAS. In generating those conditions and limitations, Flight Standards will consider the regulatory relief necessary for the intended UAS operations, such as § 91.119, as well as the limitations of the TC and any other additional regulatory relief the operator seeks that increases the complexity of the operation, such as § 91.113. When seeking an operational approval, operators must address the AE specifications in the operating limitations of the flight manual and any other system specifications necessary for the safe of the operation, and may use data, test results, or other compliance evidence provided by the TC holder and demonstrated in conjunction with the TC to support the operational approval request. The FAA will evaluate whether any additional conditions and limitations are necessary for safety, commensurate with the complexity of the operation.

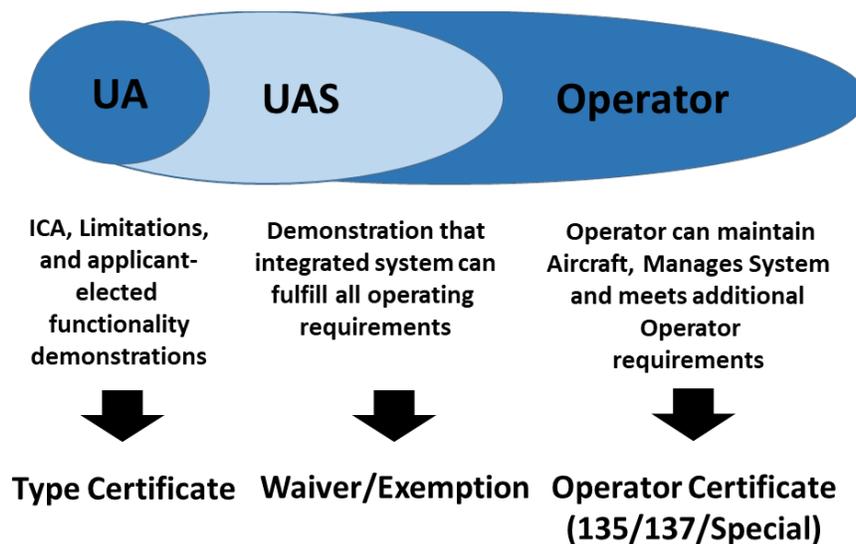
Figures 1 and 2 below illustrate notional UAS boundaries and the different approvals related to this policy memo.

**Figure 1. UAS Approval Boundary**



**Figure 1:** The red box illustrates that FAA will issue the TC on the UA plus AE specifications necessary to meet airworthiness criteria. The green box illustrates the remaining UAS AE, which will be addressed in the FAA approval to operate. Appendix C: UA/AE Approval Process Flow Chart further illustrates the approval process outlined in this memo.

**Figure 2. Path to Operations Using Type Certificated UA**



**Figure 2:** Figure 2 illustrates that the type certification boundary includes only the UA and its AE specifications. The TC includes the UA's approved type design and the AE specifications which have the ability to affect the airworthiness of the UA.

In addition, applicants may specify other AE that comprise the UAS and demonstrate performance or functionality during TC demonstration flights. While this evaluation is only a component of the TC approval, to the extent that the AE contains aircraft-critical features whose performance or functionality must be demonstrated during flight testing, the demonstration as a whole could also be used by the applicant to inform subsequent operational approvals by the FAA of use of the integrated UAS. AIR will support AFS in the evaluation and issuance of the operational approval, just as AFS will support AIR in the evaluation and issuance of the TC. Example specifications are further detailed in Appendix B.

### **Continued Operational Safety**

FAA regulations require certain continued operational safety responsibilities for the TC holder, persons maintaining or modifying the aircraft, and the operator.

Responsibilities for continued operational safety apply to the product for which the FAA has issued a design approval or airworthiness approval, as provided in 14 CFR part 21. This approval includes the UA and the AE or AE specifications that are included on the TCDS and flight manual as operating limitations. For example, TC holders will be responsible for notifying the FAA of those certain failures, malfunctions, and defects in a UA under 14 CFR 21.3 and developing design changes to address unsafe conditions in a UA under 14 CFR 21.99. Production certificate holders will be responsible for incorporating corrective actions in production under 14 CFR 21.137. Proposed changes to an AE specification will be subject to Subpart D of 14 CFR part 21.

Aircraft owners and operators will be responsible under 14 CFR 39.7 for ensuring compliance with applicable airworthiness directives (ADs) before operating a UA. The FAA will determine whether an AD is necessary to correct any unsafe conditions that may exist in a UA. If the FAA determines that the AE specification causes an unsafe condition in a UA, and the unsafe condition may exist or develop on other UA of the same type design, the FAA may issue an AD requiring operators to revise the operating limitations in the UA flight manual.

The operator is responsible for continued compliance with the operating rules and any conditions and limitations of a waiver or exemption. Appendix B details examples of UAS-related reporting and safety management the FAA would consider including in the conditions and limitations of waivers or exemptions to ensure the regulatory relief continues to meet the established safety standard. The FAA may rescind the operator's exemption or waiver if at any point the FAA finds

the operator cannot continue to conduct operations safely or without an adverse effect on safety. Rescission of the exemption or waiver would be the FAA's primary tool for compliance and enforcement with AE specifications.

### **Operations under 14 CFR part 107 (§ 107.140)**

In accordance with 14 CFR part 107, the FAA allows for operation of a small UA over human beings within line of sight of the remote pilot, provided the operation is conducted in accordance with approved operating limitations and the aircraft is maintained in accordance with approved maintenance instructions. *See* 14 CFR 107.140. The rule does not require the aircraft have a type certificate – instead, the rule allows use of certificates of airworthiness provided they do not include operating limitations prohibiting operations over people.

The FAA is developing criteria to consider in determining appropriate operating limitations for aircraft with a Certificate of Airworthiness to be operated in accordance with the requirements of § 107.140. In order to ensure the low-risk operations envisioned in 14 CFR part 107, UA which gain authority to be operated over people through this process may be limited to those for which the only associated elements are a GCS with a direct radio link to the aircraft. Any additional AE specifications would be included in the operating limitations of the flight manual. For example, operators of part 107 aircraft would need to ensure that the GCS comply with any limitations placed on the airworthiness certificate of the UA.

The appendices of this memo provide additional information regarding this policy memo. This memo, and the guidance contained within will be updated as necessary to reflect the refinement of this new approach as it is applied to the UA TC approval process.

If you have any questions or concerns, please contact Brian Cable, Systems Policy Branch Manager, at (202) 267-1579 or Chris Parfitt, Avionics Maintenance Branch Manager, at (202) 267-1708.

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## **Appendix A: TC Process Guidelines**

1. The ACO will include Aircraft Evaluation Division (AFS-100) in the FAA's review and acceptance of the applicant's concept of operations (CONOPS).<sup>3</sup>
2. The ACO will document the airworthiness criteria referenced in this appendix in a Certification Basis (G-1) issue paper or Certification Position Paper, as applicable.
3. The special class airworthiness criteria will include requirements addressing the following:
  - (a) The applicant will submit the specifications and interface conditions of the AE that could affect UA airworthiness.
  - (b) The applicant may capture the AE specifications in an interface control drawing, requirements document, or other reference, titled so that it is clearly designated as AE interfaces to the UA.
  - (c) The applicant may identify specific elements or minimum specifications for the elements. If minimum specifications are used, they must describe the critical requirements of the AE, including necessary performance, compatibility, function, reliability, interface, and environmental requirements.
  - (d) The applicant will identify and define all AE that are necessary for the UA to meet the airworthiness requirements.
  - (e) The applicant will show the FAA that the AE specifications are adequate to assure UA airworthiness in conjunction with the rest of the proposed design.
  - (f) If minimum specifications are used to identify the AE, the applicant will show that the specifications are correct, complete, consistent, and verifiable using established systems engineering methods and industry standards.
  - (g) The applicant will develop ICA for the UA. In addition, the criteria will ensure that any implications from the AE on the airworthiness of the UA will be addressed in the ICA.
4. AIR and AFS will evaluate the applicant's showing to determine whether the AE specifications are sufficient to meet compliance with the airworthiness criteria. The applicant's showing may include system descriptions, test data, analysis, and other substantiation.
5. The ACO will route the UA TC applicant's documentation to other affected FAA program offices for review, including AFS-100, who will coordinate with other Flight Standards groups as necessary. Upon resolution of issues and concurrence from all reviewers, the AE specifications will be approved by the FAA. The ACO may then notify the UA TC applicant that the AE specifications have been approved.
6. The ACO will support FS with relevant information regarding the UA and the AE specifications.
7. The ACO will use the approved AE specifications to establish operating limitations on the UA TCDS and flight manual.

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<sup>3</sup> This step will not be required for existing project where the FAA has already accepted an applicant's CONOPS.

## **Appendix B: AE Specifications in Operating Limitations and Operational Approvals**

1. For any AE specifications that impact the airworthiness of the UA, the operator must comply with approved operating limitations that are established through the TCDS and the Flight Manual as required by § 91.9 (see Appendix A paragraph 7). The operator must also comply with airworthiness limitations of the ICA as required by part 43 (see Appendix A paragraph 3(g)).
2. The FAA may establish additional specifications that are pertinent to the operation of a particular UAS in the operational approval (e.g., exemption or waiver) conditions and limitations, commensurate with the proposed concept of operations and the operating rules from which the FAA is granting relief, such as beyond visual line-of-sight operations or operations which leverage an operating certificate. Certain AE specifications will likely be similar for type certificated UA covered by this memorandum. Examples are included below:
  - a. *Ex: A requirement that the operator documents and maintains the configuration of the integrated system (such as identifying the UA and associated elements, including communication links and the components that control the unmanned aircraft) that is necessary for each operation to be conducted safely.*
    - i. The configuration of the integrated system may include additional AE that may exceed the TC but that the FAA would require to meet specific design or qualification specifications to ensure an operation can be conducted safely. Additional specifications for AE that exceed the TC and are not included as operating limitations would be established through operational approval conditions and limitations. These additional specifications may include commercial parts that are manufactured without an FAA production approval or services provided by a third-party company (such as for communication links).
  - b. *Ex: For any AE specifications not approved as a part of the TC, a requirement that the operator have document(s) in their possession displaying the AE specifications necessary to establish the continued airworthiness and safe operation in the NAS of the UA, and that the operator will provide the document to a representative of the Administrator upon request.*
3. Flight Standards may find that additional AE specifications are necessary to ensure use of the AE does not adversely affect safety or can otherwise meet the requisite standard for the operational approval. Examples of generic AE specifications that might be included as exemption or waiver conditions and limitations are below:
  - a. *Ex: A requirement that any UAS that has undergone maintenance or alterations that affect the UAS operation or flight characteristics (e.g. replacement of a flight critical component) must undergo a functional test flight prior to conducting further operations.*

- b. *Ex: A requirement that the operator documents and maintains a method to assure that each associated element of the UAS continues meet all AE specifications during all flight operations.*
- i. The exact structure of this requirement may vary depending on the type of AE and previous demonstration of that AE, as well as on the complexity of the operation. The operator may provide data to the FAA obtained from flights during TC flight testing to support evaluation of system AE; however, the FAA may require additional assurance when issuing an operational approval to ensure the applicant can comply with specifications that are outside the scope of the TC.
- A. When using associated elements that are provided by the TC holder, this assurance may take the form of maintenance procedures.
- B. When using associated elements that are equipment, this assurance may take the form of additional qualification criteria to ensure that the equipment meets specifications (e.g., an IOS device with specific processing power, storage capacity and operating system evaluation criteria). Some of these items may initially be included on a less granular level as an operating limitation on the TC and the flight manual, but additional qualification criteria may be necessary for more complex operations.
- C. When using associated elements that are services provided by a third party (such as a communications link), this assurance may include qualification and in-service monitoring criteria to detect out-of-compliance performance and initiate corrective action (such as avoiding new operations into areas of known coverage gaps until such time as the communication service provider verifies that the gap is eliminated).
- c. *Ex: A requirement that the operator has an error reporting, evaluation and mitigation program in order to maintain compliance with operating rules and conditions and limitations. The operator must evaluate any failures, anomalies, or other in-service problems to ensure that they do not represent a system deficiency that will result in a subsequent noncompliance with regulations or conditions and limitations. If a failure, anomaly or in-service problem may result in subsequent noncompliance, the operator would be required to correct the issue to prevent that noncompliance and would be required to report the issue and correction to the FAA.*
4. Led by relevant Divisions in the Office of Safety Standards in the Flight Standards Service, the FAA will review the operator's concept of operations, including the UAS and management of AE to determine whether to issue an operational approval. Review of the operator's request for relief and supporting data, such as integrated UAS configuration and compliance method and assurance will be completed jointly by Flight Standards Safety Assurance office, the relevant Divisions in the Office of Safety Standards, and the Certificate Management ACO with responsibility for the UA's type certificate. The specificity of the

conditions and limitations imposed must be commensurate with any potential safety risk if the AE does not meet its specifications or if specifications are not adequately defined.

5. The operator may be required to demonstrate use of the integrated system as part of the decision to grant the operational approval, or, if applicable, an operating certificate. If the TC applicant is also the operator, certification flight tests may be conducted concurrently with any necessary operational demonstrations. Any overlapping data may be used in both efforts.
6. Continuing oversight of an operator's compliance to the operating limitations and conditions and limitations is the responsibility of the assigned Safety Assurance Office and must be incorporated into certificate management for any operations conducted under an operating certificate. Rescission of an operator's exemption would be the primary tool for the FAA to ensure operator compliance at this time.

**Appendix C: UA/AE Approval Process Flow Chart**

