
UK Research and Innovation
UK Civil Aviation Authority
Innovation Hub
Guide for Innovators:
On the Path to Certification
An Introduction to Initial Airworthiness

Introduction

This document provides guidance on regulations for innovators who intend to start the certification of their innovative aircraft

Advances in developing novel (e.g. electric) powertrains are driving the design and introduction of innovative aircraft, under concepts such as Advanced Air Mobility (CAP 2122). We are seeing innovators making rapid advances in the design of Electric Vertical and Take-Off (EVTOL) aircraft. Other innovators are making significant progress with replacing fuel powertrains in existing aircraft with battery or hydrogen powertrains.

This guide is for innovators who intend to plan or start the certification process for an aircraft. It explains which regulatory approvals are required, and the key stages of the certification process.

A separate guide has been released as CAP 2290 for innovators who want to conduct experimental flights to test their design and validate the performance of their aircraft, or showcase their innovation to the public, Government, and investors. This can be accessed through www.caa.co.uk/innovation.

These guides have been designed to assist innovators and those outside of the aviation sector in developing their knowledge of what *airworthiness* is and how it works in practice. They offer an introduction to some of the most commonly used terms and processes enabled under the UK's regulatory framework. We have provided a number of links to outline the certification landscape for existing aviation and emerging concepts; and develop the knowledge of innovators beyond this document.

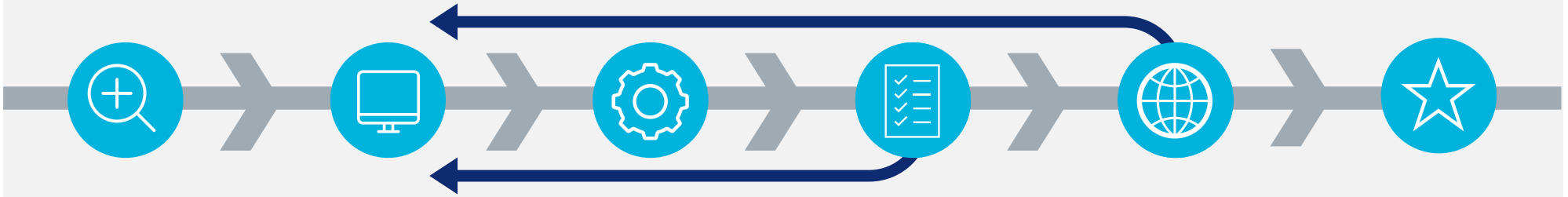
From the 31 December 2020, State of Design duties transferred from EASA to the CAA. As a result, we have responsibility for approving the design and production of all aircraft in the UK. International coordination still continues to play an important role in the CAA's approaches. We briefly describe mechanisms that enable validation of applicant certification activities in other countries within this guide too.

Airworthiness

The status of an aircraft, engine, propeller or part when it conforms to its approved design and is in a condition for safe operation.

ICAO, Annex 8

Design Process



Concept Development

Preliminary Design

Detailed Design

Prototype Testing (ground/ in-flight)

Certification Testing

Issue Approval (e.g. type certificate)

A simplified design approval process is shown in the flow chart above.

This applies to products, parts, and appliances.

The first step towards certification is to understand and apply the appropriate requirements for your design. If an aspect of your design is not covered by existing certification specifications, we will need to work with you to develop requirements. This is worth considering as part of your timescales.

You can make an application for a design approval on "The Type Design Approvals" section of our website. This can be done at any point up to certification testing, although early engagement with your regulator is recommended.

What is meant by "aeronautical products, parts and appliances"?

- **Products** include Aircraft, Engine, Propeller
- **Parts and appliances** include any equipment, mechanism, or system that is used or intended to be used in operating or controlling an aircraft in flight

Approvals Design & Production

Design and production of an aircraft, engine, propeller or Auxiliary Power Unit requires specific approvals from the CAA.

Applicants must gain a Design Organisation Approval

Design Organisation Approval (DOA) is required for an organisation to create an approved design. A DOA is covered under Part 21, Sub-part J of the UK Regulation (EU) No. 748/2012. The organisation must maintain this approval and provide appropriate support for the aircraft or other product type throughout its life.

To build for volume (scaled) production, applicants must gain a Production Organisation Approval

A Production Organisation Approval (POA) is needed to show conformity of products, parts and appliances with the applicable design data. A POA is required for an organisation to produce a certified product or part thereof.

In order to produce in accordance with the design data provided by the DOA holder, a formal arrangement is required between the DOA and POA. These could be two separate organisations.

More information on a DOA can be found here or on a POA here

Approvals are built on confidence

DOA privileges

Holders of DOAs gain approvals, balanced against detailed obligations. For example, a DOA may be able to classify and approve certain changes/repairs to a design. For mature Design Organisations, the scope of their approval may include flight testing, approval of flight conditions, and the ability to issue a Permit to Fly.

POA Privileges

Holders of POAs gain approvals in the same way as holders of a DOA.

POA rights may include approval for them to perform specific production activities. For example, they may allow them to confirm approved design data (supplied by the corresponding Design Organisation) to scale production. Mature Production Organisations could also have flight testing within the scope of their approval. This would enable production flight testing of newly produced aircraft.

Approvals Product Certification

If an organisation starts building a new product, they can apply to the CAA to start their certification process.

What does the certification process result in for the applicant?

- Type Certificate

This is the process of establishing that the generic type design meets applicable design and safety requirements. The 'Type' equates to a make or model of the aircraft. It is linked to the design, not one aircraft or other product. The result of the certification activities is the issue of a Type Certificate and associated Type Certificate Data Sheet (TCDS) and TCDS for Noise (TCDSN).

- Certificate of Airworthiness (CofA)

This is the process recognising that an individual aircraft meets its relevant Type Design. This is issued for a specific – and for each – aircraft.

How does the certification process work?

Whilst there are rigorous structures and requirements for certification, in practice the applicant and the regulator engage in the process on a two-way basis with 1:1 conversations enabling an iterative approach that is proportionate with the safety risks and requirements being addressed.

Under this approach, the process is steered from end-end by an agreed Certification Basis. We will look at this in more detail on the next page.

Key stages of the Approval Process

1. **Technical Familiarisation of the project**
   Once the applicant's eligibility has been confirmed, the applicant will present detailed information to familiarise the CAA team with the project.
2. **Agree the Certification Basis, Means of Compliance (MOC) and Level of Involvement (LOI)**
   The applicant will propose an initial certification programme, including the Certification Basis, Means of Compliance (MOC), CAA Level of Involvement (LOI) and timescales. The proposal will be reviewed, discussed and eventually agreed.
3. **Demonstration of compliance with airworthiness and environment requirements**
   The applicant will need to demonstrate that the product is compliant with the Certification Basis. The CAA will then determine compliance by reviewing the substantiation documentation and/or witnessing test activities.
4. **Issue design approval**
   The result of a successful certification project is the issue of the relevant design approval. In the case of a product, this would be a Type Certificate. For an aircraft, this would also include a Type Certificate Data Sheet (TCDS) and TCDS for Noise (TCDSN). The design organisation in this case would also be known as the Type Certificate Holder or TCH.

What if you want to make changes to existing products?

Given the evolving nature of aircraft or the product design cycle, applicants sometimes need or want to make changes to an existing product – for example to retrofit a certified aircraft with a different, greener propulsion system. Changes can be minor or major, and for safety reasons will be considered not only in isolation but against the whole product and its use.

Approvals Certification Basis

The establishment of the Certification Basis sets the direction for the programme of work to certify a new aircraft or other product.

A product will be assessed against design and safety criteria applicable to that product: these are referred to as Certification Specifications (CS). The applicable airworthiness and environmental specifications include:

- for classes of aircraft e.g. large aeroplanes, small rotorcraft (e.g. CS-25, CS-27)
- For environmental standards (e.g. CS-34, CS-36, CS-02)
- For operational suitability data
- For specific operations (Airborne Communications, Navigation and Surveillance (e.g. CS-ACNS), All-Weather Operations (e.g. CS-AWO)

What happens when something new comes along?

Given the rapid rate of change and technological evolution, it stands to reason that there is not always a CS to cover all aspects of a new aircraft or other product. In this instance, Special Conditions (SC) may be applicable.

What is a Special Condition?

Special Conditions can be thought of as a flexible tool within the airworthiness process to fill a gap when there is a new design received for which there is no existing CS. Creating a new Special Condition enables the regulator to work with industry when it receives a design that is new and unknown. Special Conditions may be included in an existing CS over time, or become a new CS.

How can innovation be reflected in the certification process?

Both Certification Specifications and Special Conditions have evolved to reflect aviation and aerospace manufacturing trends. With increased variety and complexity of designs, there may be a need for more variations across products and more extensive lists of specifications.

Special Conditions are particularly useful for designs incorporating the latest technologies. Such technologies may with time become a core feature of future AAM aircraft or Remotely Piloted Aircraft Systems, but at present their novelty means that they may not have existing specifications to work with.

What happens when new Special Conditions are created outside of the UK?

To avoid duplication and maximise harmonisation of standard approaches, all Special Conditions published by other authorities - like EASA - are reviewed within the CAA for a decision as to whether we should ignore, adopt or initiate a parallel ‘rule making task’ (i.e. action). A CAA Decision will be issued to inform the industry and public of new Special Conditions and Specifications.

Certification Specifications

Those recognised in the UK are published by the CAA. They are too numerous to list here but begin at CAP 2021A03 on this page.

International Landscape

Applicants outside of the UK will need to accept the CAA's processes to fly here. These processes will consider the track record of the aircraft, which may include activities in another country. There are mechanisms in place to support this.

Validation for Type Certificates

If an applicant already has a Type Certificate (i.e. a certified product) from another National Aviation Authority, they may be eligible for a validation in line with an existing 'Bilateral Aviation Safety Agreement' (BASA)

Ongoing International Engagement and it's Importance

There are many forms of International Agreements under aviation. For the UK these fall under Bilateral Aviation Safety Agreement (BASA), Memorandum of Understanding (MoU) or Working Arrangement (WA).

International Agreements of this nature will be either made on a State-State level or National Aviation Authority (NAA) level. Together with specific implementation procedures and accompanying documents, these establish technical cooperation between the relevant state regulators that supports certification, maintenance and export/import activities. It should be noted that these agreements do not cover experimental activities.

Whilst formal agreements can take a lot of time to establish, the processes underpinning them do evolve and new ones develop, so it is worth applicants being aware of this when planning their future business aims and operations.

Information on current arrangements and agreements the UK has in force can be found on the CAA website International cooperation | UK Civil Aviation Authority (caa.co.uk)

Further Information

CAA International provides training courses on Design and Certification and related subjects. More information can be found at www.caainternational.com/training

References

- Certification Specifications Link
- UK Basic Regulation Link
- Initial Airworthiness Regulation Link
- CAA Scheme of Charges Link

  Advanced Air Mobility: Taking A Use Case Approach (CAP 2122) Link
- UK CAA International Cooperation (including EU-UK and US-UK BASAs) Link

The Innovation Hub does not provide regulatory approvals or define CAA Policy. Approvals will be assessed independently by our regulatory teams and their decision about whether or not to grant an authorisation or approval will be subject to current regulatory requirements. Whilst the Innovation Hub endeavours to ensure the accuracy of its guidance and materials, the nature of innovation is one of forecasting, continuous development and change and you should seek independent advice on your specific circumstances.

Tell us what you think

We want to hear your views on this publication and the themes it explores under airworthiness in relation to new aircraft.

To submit feedback please contact innovation@caa.co.uk

Visit the CAA Innovation Hub online
for latest updates, guidance and challenges
caa.co.uk/innovation

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