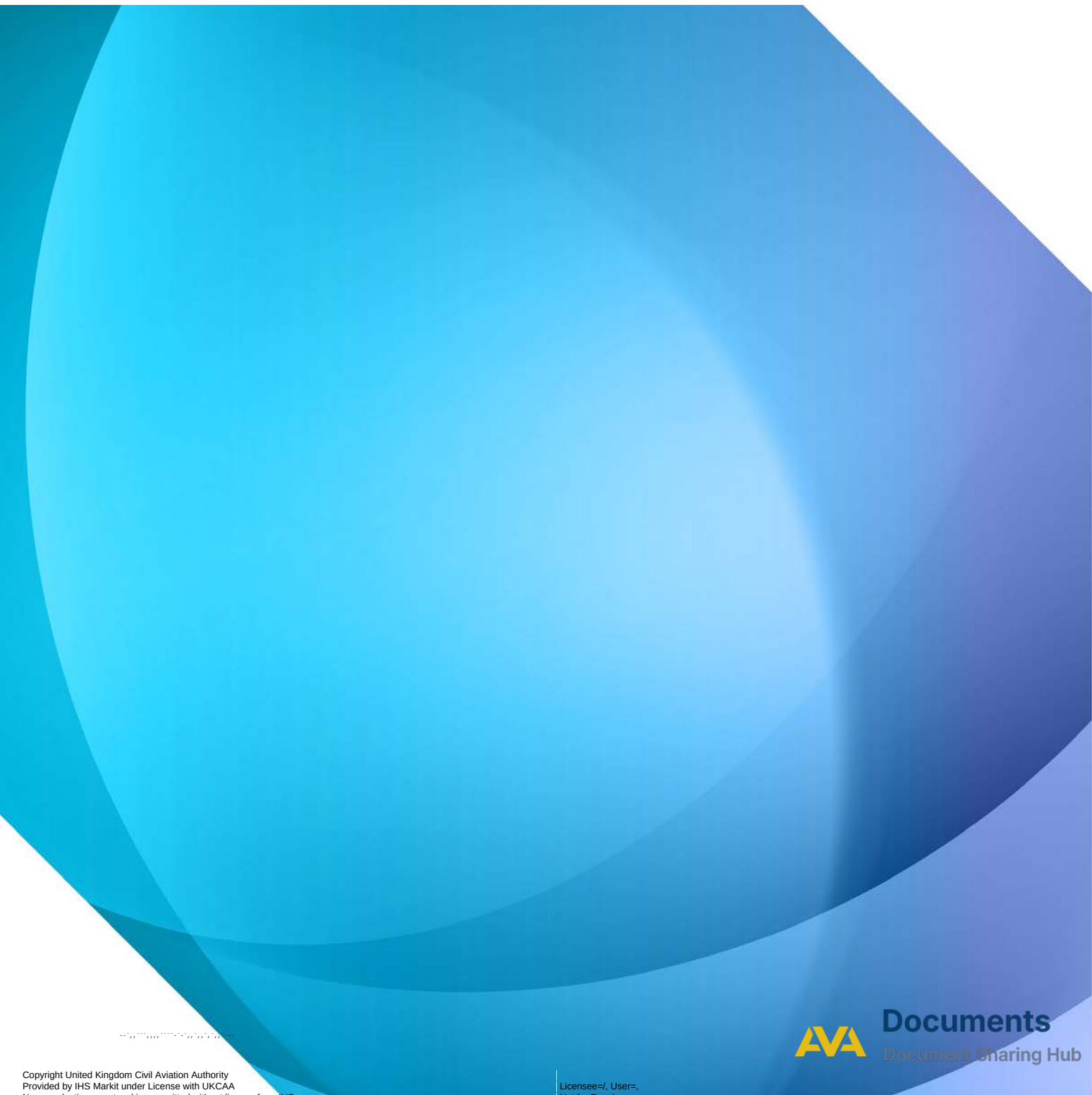


Ex-Military Aircraft

Design, restoration and continuing airworthiness approval

CAP 1640



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Foreword

This publication provides guidance for those who are seeking to obtain a Permit to Fly for an ex-military aircraft, or who wish to restore, maintain and operate such an aircraft issued with a Permit to Fly. It is applicable to an aircraft that may not have been designed and manufactured to specified civil standards as is generally the case of ex-military aircraft; and is ineligible for the issue of a Certificate of Airworthiness.

The Convention on International Civil Aviation signed in Chicago on 7 December 1944 requires aircraft registered in Contracting States to be provided with a Certificate of Airworthiness for international flight. The United Kingdom, which is a Contracting State to the International Civil Aviation Organisation (ICAO), has undertaken to implement national regulations that are, wherever possible, compliant with the ICAO standards. The Civil Aviation Authority (CAA), which acts on behalf of the British Government by virtue of the powers delegated to it under the Civil Aviation Act, develops and administers the UK regulations.

The primary national regulations relating to the airworthiness of aircraft are contained in the Air Navigation Order 2016 (ANO) Part III where it is stated that all aircraft operating in UK airspace shall have a valid Certificate of Airworthiness, but that if a British registered aircraft is unable to satisfy the requirements for the issue of a Certificate of Airworthiness, it may, instead, be issued with a United Kingdom Permit to Fly.

The Permit to Fly contains additional operational restrictions on the use of the aircraft and does not satisfy the requirements for international flight. Due to this limitation, British registered aircraft with a UK Permit to Fly require permission to fly within the airspace of another country. Similarly, foreign registered aircraft operating on airworthiness documents which are not ICAO compliant will also require the permission of the CAA to fly within UK airspace. Guidance on the principles that should be applied in the case of any application for a Permit to Fly is contained in the British Civil Airworthiness Requirements (BCARs). In particular, BCAR Section A Chapter A3-7 deals with design and construction standards and Chapters A8-23, 24 and 25 are concerned with the maintenance and continuing airworthiness management of ex-military aircraft.

The European Aviation Safety Agency (EASA) became operational on the 28th September 2003 and has assumed many of the functions previously undertaken by the National Aviation Authorities (NAAs) of the EU Member Nations. Many of the aircraft which fly on a UK Permit to Fly are excluded from regulation by EASA, by Annex II to EU Regulation (EC) No. 216/2008, which is the legislation enabling the formation of EASA. Such excluded aircraft remain subject to national requirements. In essence, this means that any such aircraft which has been flying on a Permit to Fly will continue to require a Permit to Fly issued by the CAA under the ANO.

The EASA Basic Regulation may be found at: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02008R0216-20130129>

Glossary

AAN	Airworthiness Approval Note
AD	Airworthiness Directive
AAIB	Air Accident Investigation Branch
ANO	Air Navigation Order
AP	Aviation Publication
ARB	Airworthiness Requirements Board
ASI	Air Speed Indicator
AVGAS	Aviation Gasoline
BCAR	British Civil Airworthiness Requirements
CAA	The Civil Aviation Authority
CAAIP	Civil Aircraft Airworthiness Information and Procedures
CAMO	Continuing Airworthiness Maintenance Organisation
CAP	Civil Aviation Publication
CARS	Civil Aviation Regulations (Canada)
CASA	Australian Civil Aviation and Safety Authority
CASR	Civil Aviation Safety Regulations (Australia)
CG	Centre of Gravity
CofA	Certificate of Airworthiness
CofV	Certificate of Validity
DAP	CAA Directorate of Airspace Policy
DLS	CAA Design Liaison Surveyor
DOA	Design Organisation Approval
EASA	European Aviation Safety Agency
EFIS	Electronic Flight Instrument System
FAA	United States Federal Aviation Administration
FADEC	Full Authority Digital Engine Control
FAR	Federal Aviation Regulation

FBW	Fly By Wire
FI	Fatigue Index
FM	Flight Manual
FRC	Flight Reference Cards
GAU	General Aviation Unit
GR	Generic Requirement
HP	Horse Power
HUD	Head Up Display
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
IMC	Instrument Meteorological Conditions
LAA	Light Aircraft Association
LAMS	Light Aircraft Maintenance Schedule
LTC	Limited Type Certificate (US)
MAA	Military Aviation Authority (UK)
MDC	Mini-Detonation Cord
MOD	UK Ministry of Defence
MPD	Mandatory Permit Directive
MSN	Manufacturer's Serial Number
MTMA	Maximum Take-Off Mass Authorised
MTWA	Maximum Take-Off Weight Authorised
NAA	National Aviation Authority
NATO	North Atlantic Treaty Organisation
NDI	Non-Destructive Inspection
NDT	Non-Destructive Test
NZCAA	New Zealand Civil Aviation Authority
OEM	Original Equipment Manufacturer
OCM	Organisational Control Manual
PFRC	Permit Flight Release Certificate

PMA	Parts Manufacturing Authorisation
PMR	Permit Maintenance Release
POH	Pilot's Operating Handbook
PtoF	Permit to Fly
RAF	Royal Air Force
RO	CAA Regional Office
SB	Service Bulletin
SoD	State of Design
SoR	State of Registry
SSAC	Safety Standards Acknowledgement and Consent
STI	Special Technical Instruction
TCA	Transport Canada – Air
TC	Type Certificate
TCDS	Type Certificate Data Sheet
TCH	Type Certificate Holder
TP	Test Pilot
TRA	Type Responsibility Agreement
USAF	United States Air Force
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions

Chapter 1 Introduction

- 1.1 The CAA is keen to continue to support the scale of restoration of ex-military aircraft that has developed over the last fifty years or more. However, such restoration must be managed throughout the life of the project in an appropriate manner that ensures that results in an airworthy product, that is properly defined, and compliant with the relevant requirements.
- 1.2 The restoration of ex-military aircraft varies considerably from the transition of a just out of service aircraft into the civil environment to a more substantial recovery of a severely damaged World War II aircraft, complete with bullet holes, fire damage and corrosion. Accordingly, the aircraft will have different demands to ensure that airworthiness is achieved to allow a Permit to Fly to be issued. As such, each ex-military aircraft is regarded as being unique. Whilst a number of the type may have qualified for a Permit to Fly, the circumstances surrounding the nature of the individual aircraft's history requires separate consideration. Each aircraft therefore has its own Airworthiness Approval Note (AAN) covering the history, any work done on transition to the civil system and the conditions associated with the issue of the Permit.
- 1.3 This CAP has arisen from a review of relevant material, both in the UK and overseas, in the wide context of the approval of Permit to Fly aircraft and, in particular those of military origin that have not previously been type certificated. This is a summation of the methods by which CAA will approve such aircraft and brings together all available information regarding restoration, maintenance and operation of ex-military aircraft. It is intended that the CAP will be a dynamic document that can be updated on a regular basis to take account of latest practices and information available.
- 1.4 This CAP takes into account, where possible, how other similar civil aviation authorities with such fleets go about their approval processes, in order to arrive at a coherent, transparent guidance document that facilitates the approval of ex-military aircraft. It is therefore intended that this CAP will give clear guidance both to applicants and CAA Surveyors as to the expectations from submission to approval. It aims to make clear the roles and responsibilities placed on the design, maintenance and continuing airworthiness management organisations and of the expectations of CAA Surveyors. This should allow the most expedient route to approval whilst maintaining appropriate levels of CAA oversight.
- 1.5 Additionally, this CAP contains guidance on standards parts, standard modifications and flight test approvals.

Purpose and scope

- 1.6 Within the United Kingdom, the operation of aircraft and the conduct of associated aviation activities are governed by the various legislative requirements contained in the United Kingdom Air Navigation Order 2016 (ANO). This requires that, except when operating in accordance with the provisions contained in Articles 24(3), 33(2), 40, 41 and Schedule 4 of the ANO, an aircraft must be registered and have a valid Certificate of Airworthiness issued by the State of Registry. The CAA is responsible for the airworthiness of aircraft that are on the British register and requires compliance with the standards and detailed requirements contained in the British Civil Airworthiness Requirements (BCARs) together with European (EASA) and other International (ICAO) Regulations as appropriate.
- 1.7 An aircraft will normally be issued with a Certificate of Airworthiness by its 'State of Registry', and this document attests to that National Aviation Authority being satisfied with the design and workmanship and the materials used in the construction of the aircraft. After a 'State of Design' has investigated all aspects of an aircraft's design, construction and flight characteristics, it will issue a 'type certificate', and it is compliance with this document that forms the basis on which individual Certificates of Airworthiness will subsequently be issued.
- 1.8 There are many aircraft, including aircraft of military design and service, which are not able to qualify for the issue of a Certificate of Airworthiness. In such cases, the CAA may issue a Permit to Fly which confirms that an aircraft is safe to fly, considering its overall design, construction and maintenance, but not to the extent provided for by the level of assurance that an aircraft with a Type Certificate and Certificate of Airworthiness could achieve. Due to this reduced level of airworthiness assurance, to ensure that an acceptable level of safety is maintained, additional limitations and conditions may be placed upon the operation of these aircraft.
- 1.9 An individual aircraft of military design and service may qualify for the initial issue of a Permit to Fly if the following are addressed to the satisfaction of the CAA:
- 1.10 The aircraft conforms to a design that was accepted by the recognised national authority of the state of design to fly within defined limitations.
- 1.11 The aircraft type has/had accumulated sufficient evidence of safe operation to demonstrate that such aircraft are safe to fly subject to whatever conditions may be appropriate.
- 1.12 An assessment of the aircraft demonstrates that any features with potentially unsafe failure modes are sufficiently reliable.
- 1.13 Manuals and procedures approved for the aircraft's military service are available.

- 1.14 A Through-Life-Total-Support approach is implemented. A through-Life-Total-Support approach will require the applicant to consider the implications posed by the differences in the operation and maintenance environment of the proposed PtoF operation compared to that of the original national (military or aviation) authority authorised operation, and demonstrate that the civil implementation achieves an equivalent level of safety, that is acceptable to the CAA.
- 1.15 The applicant demonstrates that the aircraft complies with the requirements of the relevant aircraft classification of BCAR A8-25 Supplement 2 that are broadly defined as Simple, Intermediate or Complex, and demonstrates that all of the objectives required by its classification are satisfied.
- 1.16 Notwithstanding the content of the ANO and BCAR A3-7, the aircraft of military design and service may continue to qualify for the Permit to Fly if all of the above conditions remain valid and the subsequent civil-registry service safety record has continued to demonstrate that the aircraft is safe to fly, subject to the original or amended limitations.

Issue and revalidation of a permit to Fly

- 1.17 Although a Permit to Fly is often thought of as embodying a lesser standard of airworthiness than a Certificate of Airworthiness, a Permit to Fly will only be issued on the basis that the aircraft to which it relates is airworthy. Under the provisions of the ANO, ex-military aircraft, which are eligible for the issue of a Certificate of Airworthiness, or are the subject of 'type certification' in another state, will not be eligible for the issue of a Permit to Fly. This means that a Permit to Fly will normally only be issued to ex-military aircraft which are not eligible to hold Certificates of Airworthiness because they have either never been type certificated or the type certificate holder has withdrawn its support for the aircraft type.
- 1.18 A Permit to Fly will only be issued after the CAA has investigated the aircraft. This investigation will cover those elements necessary to make sure that the aircraft is fit to fly and has no adverse operating or handling characteristics. When issued, the Permit to Fly will be non-expiring and will be revalidated by a Certificate of Validity, which will be conditional upon the completion of the periodic maintenance, inspections and checks. The actual process of Permit issue and revalidation varies according to aircraft type, the conditions under which the individual aircraft operate and the privileges of the associated approved organisation.

Permits to Fly and approved organisations

- 1.19 Before a Permit to Fly can be issued, the build standard, history and the intended operational use of the aircraft will be investigated. This process remains consistent irrespective of the basis upon which the application for a Permit to Fly is to be made.

- 1.20 The CAA has developed a number of different processes to deal with the specific needs of the industry, which reflect the varying nature of operations and the classifications of the various types of aircraft that may be eligible for a Permit to Fly.
- 1.21 Depending on the class and weight of an aircraft, the CAA may require the ex-military aircraft to be maintained and supported by organisations that have been approved according to BCAR Section A, Chapter A8-23, 24 and/or 25 as appropriate. In the main this is for those fixed wing aircraft above 2,730 kg and helicopters, or where the CAA believes this will assist or progress the application. However, these BCAR A approvals are equally relevant to other ex-military aircraft if applicable.
- 1.22 The initial Permit to Fly and Certificate of Validity will be issued by the CAA following the submission of design reports by the organisations approved under BCAR A8-25 and after a survey conducted by the CAA. Full Permit issue will follow flight tests taken place under a Permit to Test issued against a Working Draft of the AAN – see Appendix 1. Subsequent Certificates of Validity will be issued following recommendations for revalidation by the relevant BCAR A8-25 approved organisation. Aircraft which are not maintained under the control of an approved organisation will be investigated and surveyed directly by the CAA for the purpose of issuing a Permit to Fly, and the associated Certificates of Validity will be issued or re-issued subject to periodic and satisfactory inspection by the CAA.
- 1.23 There is also scope to cater for organisation approval privileges that will allow revalidation of a Permit to Fly without the CAA's direct involvement. This follows the CAA's drive to put such activity within the capability of approved organisations, allowing the CAA to concentrate its resources on the oversight of the organisations and the proportionate risk.

BCAR A8-23, A8-24 and A8-25 Approvals

- 1.24 The current requirements for the airworthiness support of ex-military aircraft are generally contained in BCAR A8-23, A8-24 and 25. These approvals replace the previous two main sub-elements of BCAR A8-20, E4 and M5 with those being subsumed and built upon. The requirements initially applied to aircraft above 2730 kg MTOW but, in order to provide greater flexibility for companies to manage their aircraft below that weight limit, the requirement was amended to cover any weight aircraft. The requirements, which approve organisations to carry out certain functions, have worked well since they were introduced and the approvals have contributed to the manner in which aircraft are initially issued with Permit to Fly and thereafter maintained to airworthy standards.

- 1.25 When BCAR A8-20 was introduced, the CAA included provision for the organisation to assist in defining the aircraft configuration. This organisation would review the build standard of the aircraft in relation to the original military standard and record the differences from that standard. The organisation catalogued the conformity of this build standard, the modification standard and the maintenance history, and the operational history of the type in order to provide a report from which the CAA could draft the Airworthiness Approval Note (AAN) that would support Permit to Fly issue.
- 1.26 In general, this worked well but there appeared to have been some confusion as to what the E4 element of the approval represented. This is now clarified by the transfer of the E4 element to BCAR A8-25 Supplement 2. This allows the organisation to compile a substantiation report on the aircraft, its history, build standard, modifications, equipment fit to help the CAA draft the AAN that will eventually clear the aircraft for Permit issue. This is not a design approval and confers no privileges in respect of the approval of modifications or changes at any level. Therefore, there is no need for specific design expertise to support a Supplement 2 as the path available for design approval is contained within BCAR A8-21. There are a number of existing BCAR A8-21 companies that currently work on ex-military aircraft. The issue is therefore not with the availability of design capability but that such companies have not been used previously by A8-25 organisations.
- 1.27 The move towards a system where all non-expiring Permits could be revalidated through an approved organisation utilises the A8-25 approval to support the process to advantage. This approval has been developed into a CAMO arrangement such that there is a situation that better supports continuing airworthiness management processes. This is as important for Permit aircraft as it is for those with a CofA. By changing the design report element, it provides greater clarity of function, introduces provision to give industry a CAMO style capability and allows CAA to reduce its direct involvement in processes that can be adequately managed by approved organisations with appropriate CAA oversight.
- 1.28 The other aspect is the A8-23 and A8-24 approval. These provide catch all approvals covering a variety of different processes under their umbrellas. These include the normal activities associated with maintenance but more importantly for this sector it permits considerable (in some cases total) restoration of unairworthy projects. However, it ought to be recognised that there is a considerable difference between routine support and a total rebuild.

- 1.29 These approvals provide for maintenance of the aircraft and the scope of approval will normally relate to specific aircraft types. The previous A8-20 M5 approval did not provide any commercial manufacturing capability and the parts could not be sold onto third parties therefore the manufacture of parts or components to support ex-military restorations for other organisations required a further approval, such as that currently available under BCAR A8-2 or A8-21. It is noted that the provisions of A8-21 were not written with Permit to Fly aircraft in mind and therefore the requirements may be seen as being over-burdensome when applied to ex-military aircraft support organisations.
- 1.30 A8-23 and A8-24 allow maintenance, overhaul, repair and restoration but introduce limited scope such that fabrication can take place. The need to exercise sub-contract control over external support arrangements with unapproved organisations is strengthened and an additional rating under A8-23/24 has been developed to cover the fabrication activity, thereby negating the need to hold separate A2 approvals in all cases. This is further explained in Chapter 4 and Appendix 5.
- 1.31 There is no reason why BCAR A8-23/24 cannot be used for the purposes of performing maintenance on engines, propellers or equipment for ex-military aircraft. It is relatively straightforward to build in a capability to cover these ancillary tasks to allow these to be covered separately from a complete aircraft approval. This provides for a greater degree of flexibility.
- 1.32 For ex-military aircraft revalidation shall be recommended by an appropriately approved organisation, e.g. to BCAR A8-25. The revalidation process will, normally, involve maintenance inspections and test flying to ensure that the aircraft is still able to meet the requirements of the Permit.
- 1.33 Once expired, the Certificate of Validity must be renewed before further flying is carried out. However, where necessary a Permit to Fly for test purposes may be issued, or the aircraft may be flown on 'A' or 'B' conditions under the control of an organisation suitably approved by the CAA for that purpose.

Limitations of use of a Permit to Fly aircraft

- 1.34 In recognition of the lack of compliance with some of the standards of airworthiness, the issue and continued validity of a Permit to Fly will reflect the limitations under which an aircraft is permitted to operate, and will normally be more restrictive than the operating conditions permitted in the case of a comparable aircraft operating on a Certificate of Airworthiness. Examples of limitations are as follows:
- An aircraft flying in accordance with a permit to fly may only be flown by day and in accordance with the Visual Meteorological Conditions unless the prior permission of the CAA has been obtained.
 - Limitations may be placed upon the numbers of persons permitted to be carried in the aircraft, either in general, or in specific operational circumstances.

- c. Aircraft will be required to be placarded showing operating limitations and conditions.
- d. Aircraft will normally be restricted to flights within UK airspace unless the prior agreement of the country in which the flights are to be made is obtained.
- e. Aircraft will not normally be permitted to fly over congested areas.

Eligibility of Ex-military aircraft

- 1.35 If an aircraft is of military origin and is not eligible for a Certificate of Airworthiness, the CAA may consider an application for a Permit to Fly. Aeroplanes of greater than 2,730 kg MTWA, and rotorcraft of any weight, will be required to be supported by a maintenance organisation approved under BCAR Section A, Chapter A8-23 or A8-25. Aeroplanes of 2,730 kg MTWA or below will not normally require the involvement of a BCAR A8-23/24 maintenance organisation.
- 1.36 Ex-military aircraft have often been designed to requirements that differ substantially from those of civil aircraft. Consequently, the design review of an ex-military aircraft will consider associated issues such as the operational role of the aircraft and the accident record. If, on the basis of this evidence, the CAA is satisfied that the aircraft is fit to fly, it may be granted a Permit to Fly.
- 1.37 Ex-military aircraft will be classified as 'simple' (e.g. Auster AOP-9, Harvard, Hurricane or P-51), 'intermediate' (e.g. Grumman F7F, de Havilland Vampire or Westland Wasp) or 'complex' (e.g. Buccaneer and Vulcan) according to the definitions shown in BCAR Section A, Chapter A8-25 Supplement 2. These classifications reflect the differences in technology, operational equipment and the flying and handling characteristics of the aircraft concerned. The more complex an aircraft is, the greater the level of organisational and operational support that will be required and, unless the CAA agrees alternative provision through a suitably competent design organisation, the continued involvement of the manufacturer will be required. Further guidance on how the CAA determines complexity is given in Chapter 3.
- 1.38 The CAA will issue Permits to Fly for ex-military aircraft after consideration of the recommendations and inspection reports submitted by the relevant BCAR A8-25 organisations, and will liaise with the BCAR A8-25 organisations concerning the detail, form and content of the inspections to be undertaken for this purpose.
- 1.39 In the case of ex-military aeroplanes of 2,730 kg MTWA or below, the CAA may interface directly with the applicant. The applicant will be expected to provide the CAA with sufficient information for development of an Airworthiness Approval Note

(AAN) to record the basis upon which a Permit to Fly can be issued. Note that the information required will be similar to that outline under Paragraph 5.2 above. The CAA may then, following the conduct of a satisfactory survey and investigation, and a satisfactory test-flight, issue a Permit to Fly.

Ineligible aircraft

- 1.40 Aircraft which are eligible for the grant of a Certificate of Airworthiness will be required to comply with the appropriate internationally recognised standards and will not normally be considered for the issue of the United Kingdom Permit to Fly. This includes all series built aircraft that have been built for civil use. It should be noted that an acceptance by another National Authority of an aircraft, without a Certificate of Airworthiness, to fly on a permit does not constitute a right for that aircraft to qualify for a UK Permit to Fly.
- 1.41 Aircraft may also be ineligible for other reasons, such as an unacceptable safety record.

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Chapter 2 Qualifying for the Initial Issue of a Permit to Fly

General

- 2.1 The process associated with the issue of a Permit to Fly follows the same basic steps irrespective of the aircraft type, whether it is dealt with directly by the CAA, or by an approved organisation. The details are contained in BCAR Section A, Chapter A3-7 (or in BCAR Section B, Chapter B3-7 for foreign products) and include the following requirements:
- The aircraft must be UK registered.
 - An application for a Permit to Fly must be made
 - The need for an application of an AAN and a Special Survey along with a Permit to Fly application
 - The aircraft design standard must be reviewed and documented.
 - The standard of maintenance must achieve an airworthy condition to ensure that the aircraft is fit to fly.
 - The aircraft must be inspected at various stages during its restoration.
 - The need for the owner/Maintenance Organisation to generate a visit programme for both Airworthiness Surveyor and Design Surveyor as appropriate
 - The need for comprehensive records of the project on an ongoing basis
 - The method by which the organisation has assured itself of how it has sourced all of the available data to carry out a restoration project and how it handles the parts, particularly if the owner provides parts
 - The aircraft must be test-flown to an agreed schedule.
 - The aircraft build standard, modification records, maintenance record and operating history shall be available.
- 2.2 A Permit to Fly will not be issued to an aircraft which has formerly been issued with a Certificate of Airworthiness by an ICAO contracting state, unless it is no longer possible to fulfil the requirements for the issue of a Certificate of Airworthiness.
- 2.3 Guidance on when a former CofA aircraft may be eligible for a Permit to Fly is given at: <http://www.caa.co.uk/General-aviation/Aircraft-ownership-and-maintenance/Types-of-aircraft/Orphan-Aircraft/>

Major Restoration Projects

- 2.4 The recovery of a severely corroded airframe, or part of one, can often act as the initiation point for restoration of an aircraft that requires rebuild virtually from first principles. This is therefore taken as the worst-case scenario. It is recognised that the restoration will often be performed within a BCAR A8-21, A8-23, A8-24 and/or A8-25 approved organisation. This means that the organisation will have demonstrated an overall competence in ex-military aircraft maintenance that will allow the CAA to take a degree of confidence that the project will be managed appropriately.
- 2.5 In many cases, the availability of replacement parts is severely restricted, particularly with regard to structural components. The solution often therefore requires manufacture of replacement parts to drawings that may be available, or by reverse engineering. This introduces issues of material substitution, as many of the original specification materials may no longer be available. It is important therefore that the restoration is project managed around a defined progressive programme of decisions and activities. To this end, the work can be substantiated and the decisions on alternative manufacture or materials can be seen and demonstrated.
- 2.6 Where necessary, if the approval is not held in house, the support of an appropriately approved BCAR A8-21 design organisation will be needed to substantiate the decisions. This is important, as material substitutions will often require careful consideration with regards to all aspects of the intended use of the material (see also the discussion paper on material substitution). The cataloguing of changes is also required to allow a proper aircraft design standard to be determined for Permit issue. This means that the work has to result in a progressive picture of what is being done, why and how it is substantiated as the project proceeds.
- 2.7 It is most practical to develop communication pathways with the CAA during such extensive rebuilds to ensure that agreement on the actions being taken is given. Too often, the CAA is presented a fait accompli with aircraft where the substantiation for the changes performed is not available, leading to repetition of the work and disputes. Keeping the CAA informed periodically, or consulting on key decisions will help ensure that there is no ambiguity over the project's status. The lack of CAA involvement at the appropriate time could also lead to the aircraft having to be dismantled to some extent to allow structural surveys of modifications or repairs to be reviewed.
- 2.8 It is inevitable that with ground up restorations, parts and sub-assemblies will be bought in from sub-contract organisations. It is crucial that the organisation demonstrates its oversight of these sub-contractors and its rigour in this can be demonstrated to the CAA. This will ensure that the organisation is certain of acceptability of the items it receives and that they can be accepted by CAA for use on the restored aircraft.

Aircraft Identity and Provenance

- 2.9 Inspection of project: There is no set threshold minimum for the amount of original material needed for the aircraft to be considered genuine, but there must be something recognisable and tangible as the start material. To ascertain whether or not sufficient material exists, the aircraft will need to be inspected. It should be anticipated that as a minimum, primary structure is available – generally, although not exclusively, from the fuselage – to establish a viable start point.
- 2.10 The applicant should arrange as early as possible in the restoration process for the CAA Design Surveyor and Airworthiness Surveyor to view the project. This will allow CAA assurance that there is a sufficiently viable amount of material for the restoration to be treated as original rather than a replica, even if subsequently further parts are replaced or fitted in order to make the aircraft airworthy. If it is deemed that there is insufficient material for the aircraft to be treated as original then it will have to be declared as a replica.
- 2.11 Data plates: Most, although not all, aircraft have a data plate fitted that records certain manufacturers information including the Manufacturers Serial Number (MSN). This data plate information should be used to determine the provenance of the aircraft being restored. The existence of the data plate can be an important part of establishment of the correct identity of the aircraft. Where the data plate is no longer in existence reliance may be placed on the evidence of historians and published information to gain confidence in the identity of the airframe.
- 2.12 Conversely, some early types originating before the Second World War (such as early Hawker biplanes) did not have data plates. In such cases assessment of the remains is usually sufficient to gain satisfaction that the aircraft is genuine. Additionally, where the original data plate is not available it is permissible for the aircraft restoration company to manufacture a replacement data plate. This data plate should include the aircraft serial number and manufacturer's name. The use of a replacement data plate should be included in the aircraft records. In cases where an original data plate was not fitted the CAA will verify that it has not previously approved another aircraft as a restoration from the same wreckage.
- 2.13 MSN vs. Military Serial: The aircraft should be identified by its Manufacturers Serial Number (MSN) as this is a constant that remains with the aircraft throughout its life. The applicant should always attempt to identify this. Ex-military aircraft are also often referred to by their military serial (e.g. XL598) and this is sometimes employed to identify them in favour of fuselage serial numbers.
- 2.14 The manufacturers serial number identity is the preferred identifier as the military serial numbers applied to the aircraft may change (for example on export to

another country). However, it is recognised that in some instances the MSN and the Serial Number are the same. For a limited number of aircraft, there is no record of the original MSN (for example some Spitfires built under sub-contract had the initial RAF serial applied as an MSN on the data plate). In these instances, the initial serial should be used as the identifier. This will not be acceptable where it is known that there is a definitive MSN to Serial tie-up.

- 2.15 Donor airframes: In some countries where re-use of the same registration is possible, further use of the registration may occur but on further example(s) of the same type, for example where the original has been written off. This could lead to a situation where effectively a donor aircraft is used in its entirety with only the registration paperwork remaining of the original aircraft. This is not acceptable to the UK CAA and genuine provenance of the actual aircraft will have to be demonstrated and recorded in the Applicant's design report submission.
- 2.16 However, provided that there is no conflict with the aircraft it is painted to represent (it is not acceptable to have two aircraft painted with exactly the same scheme and serial) the aircraft does not have to be physically marked as the donor aircraft, this only needs recording in the documentation.

Replicas and Reproductions

- 2.17 A replica aircraft is a copy of an aircraft of historical significance that has been constructed to the original design. It may be possible for such a replica to be considered for the issue of a Permit to Fly, provided that it is not intended to be series manufactured. Approval for the construction of replicas will normally be limited to single examples which conform to the original design. There are exceptions to this, for example where the original manufacturer has re-opened a new production line based on the original drawings and jigs. Any design changes, which, for example, might be to improve the safety characteristics, or to allow substitution of obsolete materials, should be discussed and agreed with the CAA. Examples of these would be the new build Yak-3 and Yak-9 aircraft (albeit powered by Allison engines in place of the original Klimov units).
- 2.18 Replicas of ex-military aircraft may be accepted for the issue of a Permit to Fly using similar investigation processes to an original aircraft. Aspects to be considered when deciding whether a replica may be accepted include:
- a. The likely number to be constructed;
 - b. The design standard adopted, including modification to the original standard; and
 - c. The production facilities and processes.
- 2.19 Other reproduction aircraft may be considered. These are a reasonable facsimile in appearance and construction of an aircraft made with similar materials, and having substantially the same type of powerplant and operating systems. An example of

this is the Yak-11 conversion to Yak-3/Yak-9 facsimile. In this case, as the original manufacturer and construction methods are not employed, the CAA will need greater assurance of the design and construction methods. For example, a material substantiation for the increased loads due to the change in capacity would be required – engine bearers, primary structure etc.

Flight Test and B Conditions

- 2.20 Each aircraft is required to have a flight test at the end of its restoration. In general this will be conducted by a suitably experienced pilot following discussion on the required Flight Test Schedule. It is however recognised that some specialist restoration and maintenance organisations have the same requisite capabilities as BCAR A8-9 organisations conducting flight trials under B Conditions. It is therefore considered that organisations that can demonstrate they have the necessary capabilities and arrangements in place that they could apply for an A8-9 B Conditions approval in order to allow themselves to self-authorise flight tests within the scope of their business.
- 2.21 Guidance on conducting Check Flights, eligibility of pilots and the relevant Schedules is contained with CAP 1038:
<http://publicapps.caa.co.uk/docs/33/CAP%201038%20JAN17.pdf>

Chapter 3 Criteria for the Issue of a Permit to Fly

General

- 3.1 Before an aircraft can be issued with a Permit to Fly, its design must be shown to satisfy an acceptable 'basis for approval'. The criteria for approval that may be used are dependent upon the types of aircraft concerned and are listed in BCAR Section A, Chapter A3-7.
- 3.2 Part of the basis for approval of ex-military aircraft is service experience (BCAR Section A, Chapter A3-7, paragraph 3.4). However, although it can be difficult to determine the numbers of accidents that have occurred, their causes and the aircraft utilisation, all of which will be relevant to an assessment of airworthiness, the onus is on the applicant or BCAR A8-25 Organisation to establish this information. When assessing service experience, incidents can be ignored if it is clear that they were due to specific military operations that would not occur in civil use. The service experience acceptance criteria depend on a number of factors including the complexity criteria (see BCAR Section A, Chapter A8-25) and the mass of the aircraft.
- 3.3 Service experience can be useful in determining that an aircraft or component is safe, but it has to be used with caution and cannot be used where it conflicts with the need to meet specific requirements.
- 3.4 In the case of the first of a new aircraft type to come on the register, an in-depth test flight will be needed to show compliance with the flight requirements. As noted in Chapter 2 Paragraph 1.5, in general this will be conducted by a delegated suitably experienced pilot following a briefing on the required Flight Test Schedule, or by a contracted CAA Test Pilot.

Complexity Categories - Determination and Consequences

- 3.5 If the CAA has not previously accepted an example of the type, the company A8-25 Supplement 2 signatory will normally propose a complexity category (BCAR A8-25 Supplement 2 Paragraph 1.2). In some cases, such classifications are easily assessed, but others may be very marginal. The company signatory may be required to make presentations to the CAA in order to justify the complexity classification. These presentations will include sufficient information on the design features of the type (including such as technical descriptions and Pilots Notes etc.) to justify the proposed classification. Specialised support and additional maintenance arrangements that may also be required are factors for consideration during classification.

- 3.6 In cases where the decision between Intermediate and Complex is marginal, these decisions are referred to an internal CAA Review Panel with a formal paper produced by the DLS based on the information of Paragraph 3.5 as noted above. In such cases, it is usual to cover the acceptability of the safety record concurrently.
- 3.7 Criteria for the classification by the CAA of ex-military aircraft as 'simple', 'intermediate' or 'complex' will be made according to the definitions shown in BCAR Section A, Chapter A8-25. However, to determine complexity category the following may be helpful:
- a. To distinguish between *Simple* and *Intermediate*:
 - *Simple* types are single piston engined fixed wing types only
 - All ex-military rotorcraft are at least *Intermediate*
 - The inclusion of ejection seats would render an aircraft at least *Intermediate*
 - b. The distinction between *Intermediate* and *Complex* classifications is not so definite and some distinguishing features that help the CAA determine classification are:
 - An aircraft may be classified *Complex* if the maintenance involvement is judged to be difficult or high, either because of packaging density within the airframe or because of the sheer extent of it. Examples include the Lightning, Harrier/Sea Harrier, Jaguar and the Vulcan respectively.
 - The general philosophy is that if powered flying controls are fitted, manual reversion must be possible in order to be able to control the aircraft away from populated areas or crowds in the event of a power control failure. This is why the AAN for the Sabre accepts the F-86A only as being eligible for the issue of a Permit to Fly in the *Intermediate* category. However, a dual powered system may be regarded as an acceptable alternative.
 - Auto-stabilisation systems (i.e. active control) that are required full-time would make the aircraft *Complex*.
 - Reheat does not necessarily render the aircraft *Complex*, as the system may consist of little more than a High Pressure pump and in cases of civil approval maximum weights achievable will be such that take-off performance would not be compromised significantly by failure of the system. For example, the MiG-17 has reheat and has been accepted for approval. However, the required use of throttleable reheat or the requirement for reheat on the remaining engine in the event of an engine failure would render the aircraft in the *Complex* category.
 - If the whole fuel system operates at high pressure (e.g. Lightning) this will incline the classification towards *Complex*.

- Reliance on integrated digital controls (such as Fly by Wire/Fly by Light), Electronic engine controls (FADEC), or reliance on EFIS/HUD will incline the classification towards *Complex*.
- Reliance on blown flying controls such as fitted to the Buccaneer will lead to the classification as being *Complex*.
- Reliance on reaction controls during any phase of flight to be approved will render the aircraft *Complex* (e.g. the Harrier in the hover).
- Use of advanced materials (e.g. Carbon Fibre Reinforced Composite or metal matrix composites/aluminium lithium) in primary structure will incline the classification towards *Complex*.

3.8 In the event of an aircraft being classified as Complex, the formal involvement of the original manufacturer (or a suitable, CAA accepted, equivalent design organisation) is required in the continued airworthiness support of the aircraft to be approved. This is to be written into the BCAR A8-25 exposition, countersigned by the OEM, and will cover OEM agreement of:

- a. Safety record;
- b. Design submission for initial approval;
- c. Justification of any post-service modifications;
- d. Continued airworthiness of the aircraft including particular aspects, which rendered the aircraft *Complex*;
- e. Confirmation of acceptability at each Permit renewal (at least annually).

3.9 Some types may only be considered supportable by the military service who operated them (where the service has taken on type airworthiness responsibilities) or by the original manufacturer. The Exposition of organisations approved to support *Complex* aircraft should include procedures detailing the necessary interface with the manufacturers providing support for the aircraft and of its critical equipment, and/or potentially an acceptable Military Authority. The nature and depth of such procedures will be subject to the agreement of the CAA. These procedures will also be required in the exposition referred to in subparagraph d) above.

3.10 In all cases where the type continues to be actively supported by the manufacturer (for example when the type is still in operational service), arrangement should be made where possible with the manufacturer to provide copies of all continued airworthiness information (i.e. Safety Bulletins, ST Instructions etc.) to the organisation and the CAA.