Civil Aviation Authority

CAA Check Flight Handbook

CAP 1038

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CAA Check Flight Handbook

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Revision History

This publication at Issue 1 replaces Issue 2.3 of the CAA Flight Check Handbook, dated 16 December 2011 and previously available on the CAA website.

Glossary

AD	Airworthiness Directive
ADD	Aircraft Deferred Defect
ADF	Automatic Direction Finder
AFM	Aircraft Flight Manual
AFT	Airworthiness Flight Test (Airworthiness Flight Testing)
AFTS	Airworthiness Flight Test Schedule
AGL	Above Ground Level
AIC	Aeronautical Information Circular
AMC	Acceptable Means of Compliance
AMO	Aircraft Maintenance Organisation
ANO	Air Navigation Order (CAP 393)
AoA	Angle of Attack
AOC	Air Operator's Certificate
APU	Auxiliary Power Unit
ARC	Airworthiness Review Certificate
ARI	Additional Requirement for Import
ASI	Air Speed Indicator
ATC	Air Traffic Control
ATPL	Airline Transport Pilots License
AUW	All-Up Weight
AWD	Airworthiness Division
BITE	Built In Test Equipment
BCAR	British Civil Airworthiness Requirements
BMAA	British Microlight Aircraft Association
C of A	Certificate of Airworthiness
C of V	Certificate of Validity
CAMO	Continued Airworthiness Management Organisation
CAP	Civil Aviation Publication
CAS	Calibrated Airspeed
CFS	Check Flight Schedule
CG	Centre of Gravity
CRM	Cockpit Resource Management
CTP	Chief Test Pilot
DLS	Design Liaison Surveyor

DME	Distance Measuring Equipment
DR	Dutch Roll
EAS	Equivalent Airspeed
EASA	European Aviation Safety Agency
ECL	Engine Condition Lever
EGT	Exhaust Gas Temperature
ELA	European Light Aircraft
EPR	Engine Pressure Ratio
FADEC	Full Authority Digital Electronic Control
FM	Flight Manual
FTE	Flight Test Engineer
FW	Fixed Wing
HoD	Head of Department
HoFT	Head of Flight Test
IAS	Indicated Air Speed
ICAO	International Civil Aviation Organization
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
ITT	Inter-Turbine Temperature
JAR	Joint Aviation Requirements
LAA	Light Aircraft Association
LAMS	Light Aircraft Maintenance Schedule
LSA	Light Sport Aircraft
MAUW	Maximum All-Up Weight
MEL	Minimum Equipment List
MMEL	Master Minimum Equipment List
Mmo	Maximum Operating Mach Number
MOR	Mandatory Occurrence Report
MTOW	Maximum Take-Off Weight
MTWA	Maximum Take-off Weight Authorised
Nf	Free Turbine Speed
Ng	Gas Generator RPM
Nr	Rotor RPM
OAT	Outside Air Temperature
OEI	One Engine Inoperative
POH	Pilots Operating Handbook
RFM	Rotorcraft Flight Manual

RNAV	Area Navigation
ROC	Rate of Climb
RPM	Revolutions Per Minute
RRPM	Rotor RPM
RW	Rotary Wing
SARG	Safety and Airspace Regulation Group
SFC	Specific Fuel Consumption
SHINE	Second Hand Imported aircraft from a Non EC state
SOP	Standard Operating Procedure
TLS	Type Liaison Surveyor
TOT	Turbine Outlet Temperature
Tp	Test Pilot
V2	From BCAR Section D
VFR	Visual Flight Rules
V mc(power on)	Gyro Minimum Control Speed with power applied
V mc(power off)	Gyro Minimum Control Speed with no power applied
Vmca	Minimum Control Speed (Air)
Vmin	On aircraft with full low speed protection, the speed at which the aircraft stabilizes with full nose-up pitch control and the engines at idle.
Vmo	Maximum Operating Speed
Vne	Never Exceed Speed
Vno	Normal Operating Limit Speed
VOR	VHF Omni directional Radio
Vtoss	Take Off Safety Speed
Vy	Climb Speed
ZFW	Zero Fuel Weight

Introduction

1. This Handbook is produced by the Civil Aviation Authority as a reference work for those pilots and FTEs carrying out Check Flights on UK registered aircraft using CAA Check Flight Schedules (CFS); as such, it is intended for use by those pilots who have previously received adequate familiarisation of check-flight techniques and safety precautions and fully understand the significance and intent of the tests as well as the techniques used to minimise the risk associated with some tests. For occasions when a Check Flight is required, pilots must have been briefed by a member of the Airworthiness Team.

   NOTE: This Handbook is produced to assist pilots in the preparation and safe execution of Check Flights. Where there is conflict between this handbook and the equivalent documentation provided by the aircraft manufacturer, the manufacturer's documentation is overriding.

2. It explains who may carry out Check Flights and offers a number of technical guides to the various aspects of the Check Flight. It is not intended to replace the contents of an aircraft's Flight Manual (or Permit to Fly) which must always be regarded as overriding.

3. This Handbook does not apply to experimental or certification flight testing, whether on prototype or modified established types. Such checks are carried out under 'B Conditions' or a Permit to Fly for all other aircraft.

4. This Handbook will be subject to regular amendment, so as to be fully up to date with technical and administrative issues; pilots eligible to carry out Check Flights should check for updates periodically, and specifically before carrying out a Check Flight.

5. To ensure that the Handbook is as complete and as useful as possible, comments on the content are welcomed and should, in the first instance, be addressed to the Chief Test Pilot at:

   Airworthiness, Civil Aviation Authority, Aviation House, Gatwick Airport South, West Sussex RH6 0YR

   Or by e-mail at: requirements@caa.co.uk

CHAPTER 1

The Policy and Background behind CAA Check Flights

Introduction - The Purpose of Check Flights

1.1 The ICAO Airworthiness Manual, Volume 1, states the purpose of airworthiness Check Flights is to ensure that the aircraft's flight characteristics and its functioning in flight do not differ significantly from the normal characteristics for the type and to check the flight performance against the appropriate sections of the flight manual.

1.2 The principles and safety considerations that follow are applicable for both required and elective Check Flights for continuing airworthiness management. These Check Flights do not include maintenance Check Flights for specific items.

1.3 The purpose of this Handbook is to advise owners and operators and organisations involved in the management of the airworthiness of UK registered aircraft of the current CAA policy for flight-checking both EASA and non-EASA aircraft. This Chapter gives a summary overview of the present policy for import and the continued airworthiness requirements for aircraft on the UK Register. More detail on particular flight-checking techniques and requirements is given in the rest of this Handbook.

1.4 For the purpose of this Handbook, applicable EC Regulations will be referred to as the EASA Regulations and aircraft subject to these Regulations will be referred to as EASA aircraft. For non-EASA aircraft (which are defined in Annex II to Regulation (EC) No 216/2008), British Civil Airworthiness Requirements (BCAR) remain applicable (see below).

General

Background

1.5 Flight testing of aircraft provides a basis to establish compliance with certification requirements for new aircraft and changes to aircraft. Other flight testing referred to as Check Flights or in-flight surveys, can be carried out periodically on in-service aircraft as one of the processes to ensure that an aircraft continues to comply with the applicable airworthiness requirements. Additionally, maintenance Check Flights may be carried out following a maintenance activity on an aircraft to provide reassurance of performance or establish the correct functioning of a system that cannot be fully established during ground checks.

EASA

1.6 EASA has now assumed certain responsibilities for type certification and continuing airworthiness. The UK requirements in BCARs for flight checking do not apply to EASA aircraft. EASA Regulations came into force on 28 September 2008. In order to identify when a flight test or Check Flight is necessary refer to the respective part of the EASA Regulations, Part 21 for certification related flights, and Part M for flights relating to continuing airworthiness.

1.7 The EASA Regulations introduced a non-expiring Certificate of Airworthiness (C of A), which is underpinned by a prescriptive continuing airworthiness management system. Owner-operators of aircraft are responsible for ensuring the continuing airworthiness of their aircraft; Part M M.A.201 refers. These responsibilities require owner-operators or their contracted organisations under Part M subpart G to analyse the airworthiness status of the aircraft, including reported flight defects and performance issues. In fact this is nothing more than owners or operators at any level should already be doing. Each aircraft has to have a current Airworthiness Review Certificate (ARC) in order to continue to operate. This will initially be issued by the CAA with the issue of the C of A, for a validity period of 12 months. The renewal of the ARC will be performed by an organisation approved under Part M, Sub-Part G.

1.8 EASA aircraft are not subject to the systematic programme of Check Flight, previously carried out at the time of C of A renewal or to an agreed flight test-sampling programme. Owners/operators who establish a need to carry out periodic Check Flights, as part of their own airworthiness assurance process, should ensure that their Check Flight schedules and procedures are developed in accordance with current best practices. They may achieve this by consulting with the aircraft manufacturer or with CAA Airworthiness for advice on content and safety procedures.

1.9 Aircraft carrying out military, customs, police, search and rescue, fire-fighting, coastguard or similar activities or services are considered to be "State Aircraft" and as such are not subject to EASA Regulations. However, for the purpose of flight checking, those State Aircraft that are of a type issued with an EASA type certificate can be treated as EASA aircraft. Further information on this subject is to be found in CAP 562, Civil Aircraft, Airworthiness Information and Procedures, Chapter B, Leaflet B-60.

1.10 As discussed above, the term 'flight testing' has historically been a generic description of an activity associated with ensuring that an aircraft is airworthy. Although Part 21 continues to make reference to the term flight testing, Part M refers to "Check Flights" and "in-flight surveys". In the following paragraphs therefore the term "flight testing" will be used when discussing pre-certification actions; "Check Flight" will refer to required or elective verification activities that take place post type certification, such as for the issue of a C of A, or post maintenance; "in-flight surveys" are another form of Check Flight.

Types of Check Flights

1.11 Check Flights are required for fundamentally two different purposes, maintenance checks and continuing airworthiness management.

Maintenance Check Flight (MCF)

1.12 A MCF will often be required as part of a maintenance procedure to diagnose a fault or to ensure a fault has been rectified. This airborne test may be "prescribed" by a maintenance procedure, or it could be "elective" where an organisation deems it good engineering practice.

Airworthiness Check Flights (ACF)

1.13 ACFs are flights that may be conducted before or after a period of maintenance or at any convenient stage in an aircraft's Airworthiness Certificate revalidation cycle. These flights are flown to an agreed Check Flight Schedule and, should be flown by a suitably CAA briefed pilot (see paragraph 1.25 below).

The Scope of the Airworthiness Check Flight

1.14 Aircraft Performance: The aircraft's performance must meet the scheduled performance contained within the Aircraft Flight Manual (AFM) or Operations Manual (OM). The performance should not have significantly degraded since the last Check Flight and any measured degradation should be accounted for. For example one-engine-inoperative climb performance should meet scheduled figures; stall speeds should match AFM figures; helicopter autorevs should be within limits etc.

1.15 Handling Qualities: The aircraft should handle/fly as intended. Stall characteristics should be benign or normal for the type. The aircraft should fly in balance and within designed trim conditions. In the case of rotorcraft the low speed handling should be benign in addition to that of forward flight, etc.

1.16 Systems: All aircraft systems should be serviceable and fit for purpose or, if permissible, clearly labelled as inoperative. Systems used in the resolution of emergencies should also be operated, e.g. emergency lowering of undercarriage. Autopilots and Flight Control Systems, particularly on helicopters, should be comprehensively tested to ensure they perform as intended with degraded modes assessed where possible.

Check Flight Schedules

The Objectives and Content of Check Flight Schedules

1.17 The purpose of airworthiness Check Flights is to ensure that the aircraft's flight characteristics and its functioning in flight do not differ significantly from the normal characteristics for the type and to check the flight performance against the appropriate sections of the flight manual. These flights should only be conducted in accordance with schedules that have been approved by either the CAA or the manufacturer. The principles and safety considerations that follow are applicable for both required and elective Check Flights for continuing airworthiness management. These Check Flights do not include maintenance Check Flights for specific items.

1.18 It is important that the content and conduct of Check Flights is standardised as far as possible to ensure that the appropriate checks are always made. In order to achieve the objectives of Check Flights, they should be flown in accordance with a Check Flight Schedule agreed with the CAA. These include climb performance checks and handling checks that combine checks on various flight characteristics.

1.19 Extensive CAA experience has shown that Check Flights flown in accordance with appropriate schedules will establish that:

1. the handling characteristics are satisfactory and typical of the type;

2. the climb performance equals or exceeds the scheduled data; (Note that data is necessary in order to assess any future deterioration of performance in service.)
3. the aircraft and its equipment function satisfactorily and the aircraft continues to comply with its type design standard.

1.20 To be appropriate, the schedules should cover the following:

1. Handling checks, which combine checks on various flight characteristics:
   a) A qualitative assessment of the take-off;
   b) An assessment of the trim of the aircraft and the effectiveness of primary flight controls and trimmers, in steady flight;
   c) Hover manoeuvres for helicopters;
   d) Flight at maximum speed;
   e) Stalls in the take-off and landing configurations;
   f) A qualitative assessment of the landing.
2. Performance checks - simple, free air pressure rate-of-climb measurements under known and predicted configurations and conditions.
3. Tests to check functioning of the aircraft equipment in flight and safe, recoverable functioning of back-up systems e.g. emergency gear lowering, use of alternate braking systems. Controls, systems and equipment, which are used regularly, may be considered, for the purpose of the Schedule, to have been checked on the basis of normal usage.

1.21 Schedules for required Check Flights for EASA and non-EASA aircraft, which meet the above criteria are no longer available on the CAA website. This is because the CAA can no longer guarantee the applicability of a given CFS on an EASA aircraft due to the increasing number of different aircraft standards and large number of Supplementary Type Certificates appearing on EASA aircraft types.

1.22 For certain categories of aircraft below 5700 kg MAUW, the CAA generic schedules, which can be used for a range of aeroplane types, can still be obtained from the CAA website.

1.23 If a Check Flight is planned on an aircraft for which the generic CFS is not applicable, the CFS must be agreed by the CAA. Should an operator wish to develop an alternative schedule for required or elective Check Flights, this may be done provided that it incorporates all elements of the CAA schedule and in particular, the Check Flight Certificate. Any alternative schedule, when used for required Check Flights should have been reviewed and accepted by CAA Airworthiness; in seeking any such agreement, the operator should include details of arrangements for periodic review of their schedules.

Check Flight Results

1.24 After each Check Flight, the pilot who conducted the flight should complete the post-flight certificate, which lists all the defects found during the flight. This together with the completed Schedule comprises the Check Flight Report. Each defect should be classified according to its impact on safety. For required Check Flights, items requiring rectification before the issue, renewal or re-validation of the Airworthiness Review Certificate (ARC) or National Permit to Fly should be marked 'R'. Those items that require re-checking in-flight following rectification (such as inadequate climb performance) should, in addition, be marked 'FT'.

Pilots Conducting Check Flights

1.25 To ensure that appropriate levels of safety are maintained, Check Flights should only be conducted by pilots who have satisfactory experience with the appropriate CFS, and have received adequate familiarisation of check-flight techniques and safety precautions. For both required and elective Check Flights, it is necessary that the pilot concerned fully understands the significance and intent of the tests as well as the techniques used to minimise the risk associated with some tests. To achieve this CAA Airworthiness should be consulted in advance regarding the eligibility of pilots intending to conduct Check Flights.

1.26 Pilot acceptance criteria and procedures for conducting Check Flights should be included in the continuing airworthiness management exposition where applicable. Though it is not feasible to lay down absolute experience and ability requirements for pilots, guidelines are provided in this Handbook. In all cases, the CAA is seeking to be satisfied that the pilot concerned fully understands the significance and intent of the checks as well as the techniques used to minimise the risk associated with some checks.

Implementation: EASA Aircraft

C of A issue – New Aircraft

1.27 As part of a production assurance programme, a Check Flight for an individual aircraft to determine conformity with the type certification standard will have been carried out by the manufacturer prior to the issue of their statement of conformity (EASA Form 52)/ export C of A. No Check Flight is subsequently required for C of A issue of new aircraft.

C of A Issue – Used Aircraft from an EU Member State

1.28 The EASA Regulations are legally binding in each Member State and facilitate equal recognition of certificates issued in any Member State. When an aircraft with a valid C of A, including where applicable a valid associated ARC issued by an EU Member State transfers to the UK Register, no Check Flight is required for C of A issue.

Issue of a C of A – Used Aircraft from a Non-EU Member State

1.29 EASA Part M, M.A.904 and AMC refers to the airworthiness review that is required to be carried out on used EASA aircraft being imported from Non-EU Countries (currently referred to as (Second Hand Imported aircraft from a Non-EU state (SHINE)) and includes a Check Flight report as part of the documentation needed to support the airworthiness review. The responsibility for satisfying M.A.904 rests with the Continuing Airworthiness Maintenance Organisation (CAMO) or with the certifying staff of an ELA1 aircraft who is approved by the CAA to carry out airworthiness reviews and to make recommendations to the CAA.

1.30 The CAA has decided that it will no longer routinely be involved in these Check Flights. These organisations and individuals will therefore need to arrange for the Check Flight to be carried out and guidance material to assist in the determination of when a Check Flight is necessary and who can perform it, can be found below, in Chapter 2.

1.31 Note that there are two exceptions where a Check Flight may not be required:

- **Aircraft returning from short-term lease.** A number of owner or operators lease out aircraft at seasonal periods to reduce capacity. In certain cases the aircraft are transferred from the UK register to the register of a non-EU operator. In cases when the aircraft return to the UK register within 12 months and the owner or operator has arrangements in place to monitor the continuing airworthiness arrangements with the lessee, a Check Flight may not be necessary on its return.
- **Aircraft from Non-EU States having entered into arrangement with EASA.** A number of non-EU States have entered into a formal agreement with EASA and have committed to comply with the essential regulations as far as airworthiness procedures and practices are concerned. As of November 2005, Norway and Iceland have signed such agreements. Therefore, aircraft transferred from such states will be classified as if they are being transferred from an EU member state and will be treated accordingly for the purposes of Check Flight considerations.

Light Sport Aircraft with an EASA Permit to Fly

1.32 EASA has agreed that UK oversight will include Check Flights as part of the EASA process. During a number of such flights the CAA has identified significant issues on some LSA types primarily relating to the aircraft performance and the content of the Flight Manual (or Pilot Operating Handbook).

1.33 Consequently, for initial issue of the Permit to Fly for the first-of-type on the UK Register, or subsequent aircraft with significant differences, a Check Flight will be required.

Issue of a C of A - Export C of A from UK to a Third Country

1.34 EASA regulations do not make provisions for the issue of an Export C of A when aircraft transfer registration to another EU Member State. CAA will continue to accept applications for the issue of an Export C of A for aircraft to be exported to non-EU Member States. For the present the general provisions of BCAR Section A, Chapter A3-6 "Certificates of Airworthiness for Export" will apply with the exception that no Check Flight will be required unless specified by the importing State.

Maintenance Check Flights

1.35 The EASA Regulations in M.A.301 (8) identify maintenance Check Flights as part of the continuing airworthiness tasks necessary to ensure the serviceability of operational and emergency equipment. Maintenance organisations and licensed engineers are required to carry out maintenance and rectification in accordance with applicable current maintenance data. As part of this, the final function checks, measurements and assessment of operational adequacy will determine the acceptability of the work done and any associated performance.

1.36 For some maintenance tasks, the manufacturer prescribes in the aircraft's Maintenance Manual the need for Check Flights to be carried out. For other tasks involving, for example, work carried out on a system or component the correct functioning of which is affected by flight dynamics, air loads, airflows, or low temperatures and pressures, the certifying engineer will need to determine if a maintenance Check Flight is required to verify its operation. This decision will be influenced by the maintenance organisation's quality system, which is required by Part M to ensure that all maintenance is properly performed.

1.37 Note: EASA is developing Acceptable Means of Compliance and Guidance Material to help to determine when a maintenance Check Flight be performed and under which protocol and responsibilities. It is also establishing operational requirements and crew competence criteria for the performance of these flights. In the UK, these new criteria will be applicable to all operators performing maintenance Check Flights both on EASA and non-EASA aircraft alike and thus supersedes the material given for other types of Check Flights. (See EASA NPA 2012-08 et seq.)

Implementation: Non-EASA Aircraft

Introduction

1.38 British Civil Airworthiness Requirements (BCARs) continue to be applicable to non-EASA aircraft. For a C of A or Permit to Fly to be issued to a non-EASA aircraft it is necessary for the CAA to determine that the individual aircraft conforms to its type certification standard and is airworthy. To establish this, a Check Flight is required to be completed satisfactorily prior to the initial issue of the C of A or Permit to Fly.

1.39 However, it is no longer mandatory for a Check Flight to be conducted for the renewal of an Expiring C of A, a National ARC or C of V.

Nevertheless, the need for regular Check Flights, as part of the aircraft's continuing airworthiness assurance process, still needs to be considered, in accordance with the criteria in this Handbook.

Issue of C of A or National Permit to Fly

1.40 The Check Flights will be conducted in accordance with a CAA Check Flight Schedule as detailed below, as appropriate:

1. **New Aircraft:** The Check Flight shall be conducted under the supervision of the aircraft Type Design Organisation if applicable.
2. **Imported or Re-imported Aircraft:** Where the aircraft type and origin are well known to the CAA, the Check Flight may be devolved to the applicant, (or importing agents or Operators) provided that the pilot has been associated previously with CAA Check Flights on aircraft of the same, or closely similar, type. However, the CAA retains overall responsibility and may notify the applicant of its intention to carry out, or participate in, Check Flights.

Renewal of a C of A or Permit to Fly

1.41 It is no longer mandatory for a Check Flight to be conducted for the renewal of an Expiring National C of A, a National ARC or C of V. The responsibility for deciding when a Check Flight is required now falls upon the aircraft pilot-owner, maintainer or continuing airworthiness management organisation (as applicable). Guidance to assist in the determination of when a Check Flight is necessary is contained in Chapter 2 and details as to who can perform it are in Chapter 3.

Check Flight Schedules (CFS)

1.42 It is important that the content and conduct of Check Flights is standardised as far as possible to ensure that the appropriate checks are always made. In order to achieve the objectives of Check Flights outlined above, the Check Flights should be flown in accordance with a CFS agreed with CAA. These include climb performance checks and handling checks that combine checks on various flight characteristics.

1.43 It is the responsibility of the Airworthiness Review Signatories and the pilot conducting the Check Flight to ensure that the CFS is appropriate and correct for the type of aircraft to be flown. The CAA agreed generic schedules used on Annex II aircraft, e.g. CFS 2 for single-engine piston aircraft are available on the CAA website. If a non-generic CFS is planned to be used, the CFS must be agreed by the CAA.

Check Flight Results

1.44 After each Check Flight, the pilot who conducted the flight should complete the post-flight certificate, which lists all the defects found during the flight. This together with the completed Schedule comprises the Check Flight Report. Each defect should be classified according to its impact on safety. Items requiring rectification before the issue or renewal of the C of A or C of V should be marked ‘R’. Those items that require re-checking in-flight following rectification (such as inadequate climb performance) should, in addition, be marked ‘FT’.

CHAPTER 2

Airworthiness Guidance - When to Perform Check Flights

When a Check Flight is Necessary and Who Can Perform It

Introduction

2.1 As part of the continuing airworthiness oversight of an aircraft, the need for a Check Flight should be considered. The following paragraphs provide guidance to assist in the determination of when a Check Flight is necessary and who can perform it.

Individual Responsibility

Pilots, Owners, Licensed Engineers, Approved Organisations

2.2 The responsibility of deciding when a Check Flight is required either because of a maintenance requirement or for an airworthiness issue rests with the pilot-owner, operator, engineer, maintenance or continuing airworthiness management organisations. Once the decision is made, the responsibility for ensuring that the Check Flight is carried out cannot be delegated. The responsible person will also need to ensure that it is satisfactorily completed and the results recorded in the appropriate CFS.

Airworthiness Review Signatory

2.3 It is the responsibility of the Airworthiness Review Signatory, when conducting an airworthiness review, to decide whether a Check Flight was required during the review period, and if so, that it was carried out satisfactorily. Should it be identified that either a required Check Flight has not been performed or satisfactorily completed, including the accomplishment of any rectification action, then the airworthiness review should be considered as incomplete until such time as the issues are resolved.

2.4 For used EASA aircraft being imported from non-EU Countries, the Airworthiness Review Signatory should be aware of the requirement in EASA Part M, M.A.904 and AMC that refers to the airworthiness review for these aircraft. The review includes a Check Flight report as part of the documentation needed to support the airworthiness review. The responsibility for satisfying M.A.904 rests with the Airworthiness Review Signatory who will need to arrange for the Check Flight to be carried out.

2.5 Note that the Airworthiness Review Signatory includes all authorised individuals who are approved to carry out an Airworthiness Review for an aircraft with an EASA C of A, a National C of A or a National Permit to Fly for the purposes of making a recommendation to the CAA for the renewal of the Airworthiness Certificate, or, who are renewing the Airworthiness Certificate under their Organisation Approval. This also includes CAA personnel when they carry out the airworthiness review.

When Check Flights Should Be Performed

2.6 Prescribed Maintenance Check Flights: A prescribed maintenance Check Flight should be performed in accordance with recognised rectification/maintenance schedules.

2.7 Elective Maintenance Check Flight: In accordance with best engineering practice and considering:

- Engine(s) including control systems disturbance, overhaul or replacement ;
- Propeller(s) including control systems disturbance, overhaul replacement;
- Main and tail Rotor systems disturbance, overhaul replacement;
- Any flying control surface change, repair or re-rig (including trim tabs);
- Accident-related structural repair;
- Undercarriage replacement, repair or re-rig;
- Any pitot-static, Air Data Computer or associated component replacement or repair;
- Alpha probe repair or replacement;
- Any significant Fuel, Electric, Hydraulic or Pneumatic repair or replacement;
- Any Flight Control System disturbance or repair;

- For pressurised aircraft, any pressurisation system component replacement or repair;
- Significant or multiple gyroscopic flight instrument repair or replacement;
- Periods in storage;
- Following dismantling and re-assembly of aircraft.

Airworthiness Check Flights (ACF)

2.8 An aircraft's airworthiness will degrade over time. A number of factors affect the rate of degradation, e.g. flying hours, operating cycles, operating environments, hangarage, operational use etc. In the past, the CAA required that airworthiness Check Flights be conducted on a calendar-based cycle aligned with the renewal of the airworthiness certificate. It is the responsibility of the pilot-owner, operator, engineer, or approved organisation to determine when an airworthiness Check Flight is necessary. Therefore the individual or approved organisation should ensure that valid and consistent decisions regarding the need for a Check Flight are made and recorded. The CAA will review an organisation's procedures and decision making regarding Check Flights as part of the normal oversight process.

2.9 Evidence of abuse or neglect should indicate the need for an ACF. Equally, usage in a harsh environment may indicate the need to conduct Check Flights more often.

2.10 When considering the need for a Check Flight and, in particular the length of time between Check Flights, the traditional tried and tested calendar based periodicities should be considered. The one- and three- year cycle of ACFs has been demonstrated to serve the UK fleet well for many years. A decision to extend this period should be carefully considered and the following circumstances are examples of where consideration may be given to extending the period between airworthiness Check Flights:

- A low flying rate. Note that minimal or zero flying would be expected to warrant a Check Flight as part of the Airworthiness Review;
- Lower than expected number of cycles;
- Fewer operating cycles per flying hour;

- Good hangarage (warm and dry). Note that aircraft left outside for long periods with minimal flying would be expected to warrant a Check Flight as part of the Airworthiness Review;
- Gentle operational use with low payloads, reduced power requirements, routine low all-up weight operation etc.;
- Benign operating environment – not sea spray or salt laden air or extremes of hot/cold temperature, precipitation etc.;
- Owner/Operator regular "in-house" power performance checks;
- Operated in accordance with a benign spectrum of usage – e.g. long cruise flights rather than regular training sorties including circuits, repeated landings, autorotations, engine relights, etc.

2.11 In the past, completed airworthiness CFSs have been submitted to CAA Flight Department to allow oversight of the process and to monitor the performance of a fleet of aircraft types. It is no longer required to submit completed schedules. However a record of all Check Flights and their results should be kept with the aircraft records, so that there is auditable evidence available to indicate that appropriate action, including resolution of any defects, has taken place.

Check Flight Schedules (CFS) (See Chapter 5)

2.12 Owners, operators, licensed engineers or approved organisations who establish a need to carry out periodic Check Flights as part of their own airworthiness assurance process, or are required for commercial reasons to do so, should ensure that their Check Flight schedules and procedures are developed in accordance with current best practices. They may achieve this by consulting with the aircraft manufacturer or with CAA Airworthiness Team for advice on content and safety procedures. It is important that the content and conduct of Check Flights is standardised as far as possible. A number of generic CFS are available on the CAA website. However, the use of any CFS should be discussed and agreed with the CAA before proceeding. It is the responsibility of the pilot conducting the Check Flight to ensure that the CFS is appropriate and correct for the type of aircraft to be flown. In the event of doubt, the CAA should be contacted.

Approved Pilots (See Chapter 3)

2.13 To date, maintenance organisations and operators have been responsible for the oversight and selection of pilots used to conduct maintenance Check Flights (MCF). The suitability of pilots conducting MCF and appropriate safety precautions must be addressed. For ACF (see Chapter 3), the CAA oversees the group of pilots briefed and approved to conduct these flights. It is necessary that the pilot concerned fully understands the significance and intent of the tests to be conducted, as well as the techniques used to minimise the associated risk. There are two fundamental components to this requirement:

- The pilot has to be briefed about, and has often demonstrated, specific techniques required e.g. the conduct and documentation of the certification stall.
- The pilot must be briefed on safety and risk to ensure the pilot can perform the task safely and can exercise their own judgement.

2.14 The LAA and the BMAA will continue with their own current arrangements for approving pilots to carry out Check Flights.

2.15 Additionally, this briefing process allows clear guidance to be given on all administrative aspects of the process. Check Flight Pilots have a four-year currency requirement which lapses if they have not completed an ACF in that period. It is the responsibility of the Airworthiness Review Signatory to ensure that pilots conducting ACFs have been approved and are within their four year currency and documented procedures should be put in place to ensure that this always happens. If there is any doubt, the CAA Airworthiness Team, via flightdept.afts@caa.co.uk, should be contacted prior to the ACF.

CHAPTER 3

Eligibility of Pilots to Carry out Check Flights

Introduction

3.1 Conducting Check Flights is a significantly different activity from engineering or experimental testing and given adequate briefing and boundaries to the activity, it is CAA's experience that a significant portion of the Check Flight workload may be devolved to the operator or maintenance organisation. As part of that process, the CAA will have to be satisfied and confirm that the proposed Check Flight pilot is eligible to conduct Check Flights.

3.2 This Chapter outlines the process to confirm eligibility. It does not apply to **Maintenance** Check Flights. EASA is finalising Acceptable Means of Compliance and Guidance Material relating to maintenance Check Flights including protocols and responsibilities. These include operational requirements and crew competence criteria for the performance of these flights. Although this criteria will only apply to EASA aircraft, the CAA will adopt the EASA criteria for non-EASA aircraft.

Procedures

3.3 Pilots intending to carry out Check Flights must be accepted by the CAA prior to any such activity taking place. This acceptance will normally require the proposed pilot to be briefed by the CAA Airworthiness Team. In the case of aircraft less than 5,700 kg, exceptionally a briefing alone may be sufficient but normally, candidates should fly with a CAA test pilot or a Flight Test Engineer as a complement to and expansion of the briefing. For heavier aircraft, the procedure is for the pilot to have flown a Check Flight with a CAA test pilot.

3.4 Pilots seeking to confirm eligibility to carry out Check Flights should contact CAA Airworthiness.

Experience and Ability Requirements

3.5 Although it is not feasible to lay down absolute experience and ability requirements for pilots, guidelines are provided in Appendix A to this Chapter.

3.6 In all cases, the CAA is seeking to be satisfied that the pilot concerned fully understands the significance and intent of the checks as well as the techniques used to minimise the risk associated with some checks.

3.7 The CAA may consider applications from sole owners of fixed wing aircraft who do not meet the criteria in Appendix A.

3.8 Note that extra qualifications will be needed in the case of Vintage and ex-Military aircraft flight checking (Check Flight Schedule 233).

Administrative Aspects

3.9 Pilots are requested to complete a RECORD OF AIRCREW BRIEFING form in order to request consideration to act on behalf of the CAA to perform Check Flights or as part of their nomination to be included in a CAMO's Exposition. The successful candidate's surname, first name, aircraft type or category for which they may submit results, date of briefing/acceptance, Licence Number and the organisation for whom they conduct Check Flights will be held on a computer database. This database is maintained by the CAA and used by them to determine a pilot's eligibility to conduct CAA Check Flights. This database is only accessible to CAA Airworthiness but pilots or organisations may check eligibility upon request, see Appendix C for contact details. An example of the form used as a RECORD OF AIRCREW BRIEFING ON CAA CHECK FLIGHT POLICY is attached as Appendix B to this Chapter.

3.10 Given adequate recent experience on a particular type or class of aircraft, the CAA accepts that a pilot, having carried out a Check Flight in the previous four years, is current for that purpose. Pilots who have not carried out a Check Flight in the previous four years may not do so on CAA's behalf and a re-briefing and/or flight will be required for renewal of their eligibility.

NOTE: It should be remembered that each time a Check Flight is required by the relevant Requirements the appropriate organisation must contact the CAA Airworthiness Team to determine whether the CAA wish to participate.

3.11 Pilots are reminded that the onus is on them to ensure that they are current for the task and if in any doubt, the Airworthiness Team should be consulted.

3.12 Although a pilot may have been deemed eligible to perform Check Flights on an aircraft, in cases where the pilot does not hold a professional licence, and in all cases involving permit-to-fly aircraft, the pilot is not allowed to be remunerated.

3.13 Eligibility for pilots to conduct Check Flights on behalf of the CAA may be withdrawn where there is a perceived safety concern or should the CAA not be satisfied that the execution of such Check Flights has been adequate or where the submitted schedule has not been satisfactorily completed. Should this be necessary, the individual (and, if appropriate, the operating/engineering company) will be notified.

APPENDIX A

Guidelines on the Experience Requirements for Pilots to be Eligible for Conducting Check Flights

Aeroplanes

A1 A minimum of 500 hours total flying time for single-engine aircraft, or 1,000 hours total flying time, including a minimum of 100 hours on light twin aircraft as pilot in command, for twin-engine aircraft; and

A2 Recent experience on the particular aircraft type or similar aircraft types, amounting to at least 10 hours in the last 12 months for single-engine aircraft and 20 hours in the last 12 months for twin-engine aircraft; and

A3 Familiarity with, and in current spinning practice for, the checking of aircraft cleared for spinning. It is unlikely that pilots who are not either current flying instructors or in regular aerobatic practice meet this requirement.

Rotorcraft

A4 A minimum of 500 hours total flying time for single-engine rotorcraft, or 1000 hours total flying time for twin-engine rotorcraft; and

A5 Recent experience on the particular rotorcraft type or, for single engine rotorcraft below 2,730 kg, similar rotorcraft types, amounting to at least 20 hours in the last 12 months.

A6 Exceptionally Autogyro pilots may be approved to conduct Check Flights with less than 500 hours total experience subject to satisfactory experience demonstrated on the type of autogyro to be tested.

Aircraft > 5,700 kg

A7 For aircraft greater than 5,700 kg, the criteria above are unlikely to be appropriate. Eligibility will be based on a case-by-case basis. Applicants should contact CAA Airworthiness to arrange a briefing and/or a Check Flight demonstration.

A8 Where a fixed wing or rotorcraft pilot does not meet the requirements above, the CAA may find it acceptable to make allowances for some other compensating features. One example is a flying instructor or professional test pilot whose broader experience can compensate for shortcomings in other areas.

A9 Other than on fixed wing, piston engine aircraft of less than 5,700 kg MAUW and certain autogyros, eligibility to perform Check Flights is type specific. Therefore, a pilot who has been accepted for Check Flights on a particular type will need to confirm his/her eligibility with the CAA before carrying out a Check Flight on a different type.

A10 These guidelines are not applicable to pilots conducting checks on vintage and ex-military aircraft and for which Check Flight Schedule 233 applies. The experience requirements in such cases are contained in paragraphs 10.7 to 10.11 of Chapter 10 in this Handbook.

APPENDIX B

Record of Aircrew Briefing on Conduct of CAA Check Flights

See the next page.

CIVIL AVIATION AUTHORITY

N⁰ abcdxyz

RECORD OF AIRCREW BRIEFING ON CONDUCT OF CAA CHECK FLIGHTS

Surname		**First Name**		**Initials**	

Address (inc Post Code)		Tel. N°	
		Mobile N°	
		Fax N°	
		E-Mail	

Company		D of Birth		Licence N°	

Hours (Specific types – fixed wing & rotary)	Enter relevant types in the grey boxes and hours in the adjacent white boxes. On the last line (for fixed wing twin rating or type rated aircraft as applicable) fill in the type and the approximate date of first rating on that type.

Light Fixed Wing	Singles		Multi's		Totals	

Total FW		**Total RW**		**TOTAL FLYING**	

Type Rating SEP/MEP	Type/Date Date	/	/	/

Declaration	**Signature**	**Date**
The information given above is a true record at the time of signing. Should particulars change to affect my ability to perform Check Flights on behalf of the CAA I will contact CAA Aircraft Certification Department as soon as possible. I also agree to have the above information kept in a computer database.		

Other Comments (IRE/TRE/QFI, etc)

CAA use only	**Types listed below:**	

Briefed by (print)		Signed		Date	

CHAPTER 4

Insurance Cover for Check Flights

4.1 A routine Check Flight is flown wholly within the authorised loading and speed envelopes of the aircraft as laid down in the Flight Manual. The normal requirement to observe Flight Manual Limitations continues to apply throughout such Check Flights.

4.2 CAP 562, Leaflet B-70 (Insurance) draws the attention of owners and operators of aircraft to be flown by the CAA test pilots to the fact that neither the CAA nor the test pilot accepts responsibility for any damage to the aircraft or to third parties or to any person or property whatsoever. As a consequence, owners are therefore required to ensure that policies covering damage to their aircraft and to third parties are taken out and are suitably endorsed to cover flights by CAA test pilots. It is understood that, in general, insurers and underwriters are willing to extend cover of their aircraft policies for this purpose on request and without further charge.

NOTE 1: It is CAA policy that its staff do not fly in uninsured aircraft.

4.3 Where the pilot is not a CAA test pilot (see Note 2), it should be understood that the pilot is undertaking the flight on the Applicant's behalf. Insurance arrangements are the responsibility of the Applicant, or the Owner where the Applicant is acting for the Owner. On those occasions where a CAA Surveyor (see Note 3) accompanies the Applicant's pilot to act as the flight test observer, the Applicant or his pilot may be liable in the event of injury to the observer. Insurance cover should include this risk.

NOTE 2: In this Handbook, "CAA test pilot" means a pilot employed by the CAA and acting in that capacity on behalf of the CAA.

NOTE 3: "CAA Surveyor" in this context includes CAA Flight Test Engineers.

4.4 Where the pilot is not a CAA test pilot, the onus is on the pilot to satisfy himself as to the adequacy of the insurance arrangements, covering (at least) personnel on board, damage to the aircraft and injury or property damage to third parties.

CHAPTER 5

Use of Schedules, Currently or Formerly, Published by the UK CAA

Owner/Operator-Initiated Check Flights Using UK CAA Published Schedules

5.1 It is now no longer mandatory for a Check Flight to be conducted for the renewal of an Expiring C of A, a National ARC or C of V. Consequently, CAA are concerned about problems that might arise from the use of legacy Airworthiness Flight Test Schedules (AFTS), or newly published Check Flight Schedules (CFS), on Check Flights conducted voluntarily by owners/operators.

5.2 This guidance material is intended to draw your attention to issues, which require proper consideration, and to emphasize the basis on which any non-mandated Check Flights are conducted. The concerns involve three aspects: The applicability of the Schedule, the conduct and monitoring of the Check Flights, and the standard/applicability of the Flight Manual.

Applicability of CAA AFTS or CFS

5.3 In the past the CAA AFTS were prepared following UK Type Certification of the aircraft involved. They were tailored to the standard and configuration of the aircraft on the UK register. The Schedules assumed that any changes, which were required by UK Additional Requirements for Import (ARIs), had been incorporated. Other tests may have been specific to a UK variant and were dependent on optional items that the UK operator(s) of the type had specified. Use of the Schedules for flight testing aircraft of any other standard, such as those that are now accepted on to the UK register on the basis of an EASA type design, may therefore invalidate certain tests, or even have flight safety implications.

5.4 There may also be, in existence, Schedules for aircraft, which have now been withdrawn from UK service, despite continued operation of the type or variant in other countries. In such cases it is unlikely that CAA will have maintained current knowledge of the aircraft type. Subsequent modifications, service bulletins or AD's may invalidate a previously valid Schedule.

5.5 When considering the use of either a legacy CAA AFTS or CFS, careful consideration of the aircraft standard and configuration is essential to ensure the Schedule is applicable. CAA cannot accept responsibility for events or damage resulting from the use of these Schedules, where their use is not a requirement by the CAA.

Conduct and Monitoring of Check Flights

5.6 The Continuing Airworthiness Flight Test (CAFT) programme was an activity led by CAA, in which it had a significant level of participation, together with the attendant expertise. The scheme demanded a level of control by CAA of the eligibility of pilots to whom the task was devolved, and supervision of the output of those pilots. The cessation of the CAA-led mandatory nature activity has transferred the responsibility of deciding when a Check Flight is required to the owner/operator and means that the CAA no longer has a programme to determine and monitor the suitability of any pilot to conduct such voluntary tests. It should not be assumed therefore that previously-approved pilots remain current and competent to carry out elective Check Flights on their behalf.

5.7 Nevertheless, as far as any form of Check Flight on an EASA aircraft is concerned, owners/operators conducting elective Check Flights must satisfy themselves as to the competence of pilots, and as with other Personnel Requirements of M.A.706 of Commission Regulation (EC) No. 2042/2003 and BCAR Section A, Chapters A3-3 and A3-7, Check Flight pilots should be nominated. To that end, the CAA is willing to support training and familiarisation for pilots wishing to perform Check Flights.

5.8 For mandated Check Flights on non-EASA aircraft (i.e. for the issue of an airworthiness certificate in accordance with BCAR Section A, Chapters A3-3 and A3-7), the CAA Airworthiness Team will be able to confirm to applicants the eligibility, or otherwise, of the pilot nominated to carry out and submit the results of the Check Flight, should it have been decided that conduct of the Check Flight may be devolved to the applicant.

NOTE: Enquiries should be made prior to the conduct of the Check Flight.

Individual Responsibility

Pilots, Owners, Licensed Engineers, Approved Organisations

5.9 The responsibility of deciding when a Check Flight is required either because of a maintenance requirement or for an airworthiness issue is with the pilot-owner, operator, engineer, maintenance or continuing airworthiness management organisations. Once the decision is made, the responsibility for ensuring that the Check Flight is carried out cannot be delegated. The responsible person will also need to ensure that it is satisfactorily completed and the results recorded in the appropriate CFS.

Airworthiness Review Signatory

5.10 It is the responsibility of the Airworthiness Review Signatory, when conducting an airworthiness review, to decide whether a Check Flight was required during the review period, and if so, that it was carried out satisfactorily. Should it be identified that either a required Check Flight has not been performed or satisfactorily completed, including the accomplishment of any rectification action, then the airworthiness review should be considered as incomplete until such time as the issues are resolved.

5.11 For used EASA aircraft being imported from non-EU countries, the Airworthiness Review Signatory should be aware of the requirement in EASA Part M, M.A.904 and AMC that refers to the airworthiness review for these aircraft. The review includes a Check Flight report as part of the documentation needed to support the airworthiness review. The responsibility for satisfying M.A.904 rests with the Airworthiness Review Signatory who will need to arrange for the Check Flight to be carried out.

NOTE: The Airworthiness Review Signatory includes all authorised individuals who are approved to carry out an Airworthiness Review for an aircraft with an EASA Certificate of Airworthiness (C of A), a National Certificate of Airworthiness (National C of A) or a National Permit to Fly for the purposes of making a recommendation to the CAA for the renewal of the Airworthiness Certificate, or, who are renewing the Airworthiness Certificate under their Organisation Approval. This also includes CAA personnel when they carry out the airworthiness review.

Flight Manuals

5.12 Additional specific material to enable the conduct and analysis of results of Check Flights is sometimes needed. This has previously taken the form of a dedicated Supplement or Appendix to the Aircraft Flight Manual. This additional material included performance charts for use in analysing the performance climbs referenced in some Schedules. These charts give the performance in terms of rate of climb, whereas the main performance section of the Flight Manual will normally express climb performance in terms of gradients. In some cases it might be possible to calculate the scheduled performance from the gradient charts, but great care is necessary to ensure that the chart is applicable to the test flown, i.e. it refers to the same airspeed, power setting and engine air bleed condition and that it can be converted to provide ‘gross’ rather than ‘net’ performance. Where the Schedule requires a climb to be carried out with the ‘inoperative’ engine at idle rather than fully shutdown, the gradient charts in the main performance section of the Flight Manual are not applicable. They assume a fully shutdown engine and the effect of an idling engine (which can be very significant) will only be taken into account in any additional rate of climb charts prepared for that purpose.

5.13 As part of the generic procedures, the tests in the Schedules normally require the aircraft to be flown beyond Vmo and Mmo and hence outside the normal Flight Manual Limitations. Additional material in UK Flight Manuals permitted such excursions for the purpose of airworthiness flight-testing. In the absence of such a statement in the Flight Manual for the specific aircraft, owners/operators should consult manufacturers to determine a basis for small excursions beyond declared AFM limits.

5.14 Additional material may also include stall speeds in terms of indicated airspeed if the performance section of the Flight Manual only gives them in terms of CAS or EAS. Where quoted in the Schedules, values are usually indicated values.

Availability of Check Flight Schedules

5.15 Due to the increasing number of different aircraft standards and large number of Supplementary Type Certificates appearing on EASA aircraft types, the CAA can no longer guarantee the applicability of a given CFS on an EASA aircraft. Therefore the CAA has decided to remove many of its CFS from the CAA website. The CAA agreed generic schedules used on Annex II aircraft, e.g. CFS 2 for single-engine piston aircraft, will still be available on the website. If a non-generic CFS is planned to be used, the CFS must be agreed by the CAA.

5.16 Copies of Check Flight Schedules are available on the CAA website.

Conclusion

5.17 There is a responsibility on owners/operators to ensure that the use of legacy CAA AFTS or new CFS is appropriate for any elective Check Flights they wish to carry out. Where doubts exist with regard to the aircraft standard or details of the planned test programme the CAA Airworthiness Team should be consulted for advice, or alternatively queries should be placed with the aircraft manufacturer. CAA do not accept any responsibility for the use of CAA Schedules on Check Flights not directly under their control.

APPENDIX C
CAA Contacts List

CAA Aviation House

CAA Airworthiness
Aviation House
Gatwick Airport South
Gatwick
West Sussex
England
RH6 0YR

Check Flight Schedules and Pilot Eligibility

Tel: 01293 573113
Fax: 01293 573977
E-mail queries to: requirements@caa.co.uk

Applications and Approval Department

Aviation House
Gatwick Airport South
Gatwick
West Sussex
England
RH6 0YR

Application for issue and renewal of Certificates of Airworthiness

Tel: 01293 768374, Fax: 01293 573860

UK Regional Offices

Gatwick	Civil Aviation Authority Safety and Airspace Regulation Group Gatwick Regional Office Aviation House Gatwick Airport South West Sussex RH6 0YR Email: SRGSouthern.RegionalOffice@caa.co.uk	tel: 01293 768600 fax: 01293 768601
Luton	Civil Aviation Authority Safety and Airspace Regulation Group 2nd Floor, Plaza 668 Hitchin Road Stopsley, Luton LU2 7XH Email: SRGDataDistributionLuton@caa.co.uk	tel: 01582 393000 fax: 01582 393049
Manchester	Civil Aviation Authority Safety and Airspace Regulation Group First Floor, Atlantic House, Atlas Business Park, Simonsway Wythenshawe Manchester M22 5PR Email: SRGManchester.RegionalOffice@caa.co.uk	tel: 0161 2164500 fax: 0161 2164549
Stirling	Civil Aviation Authority Safety and Airspace Regulation Group First Floor, Kings Park House Laurelhill Business Park Stirling Scotland FK7 9JQ Email: StirlingRO@caa.co.uk	tel: 01786 457400 fax: 01786 457440

CHAPTER 6

Procedural Aspects and Preparation for a Check Flight

Introduction

6.1 This Chapter is provided to offer guidance for pilots on the planning and preparation, which is necessary for the safe accomplishment of a Check Flight; it also covers administrative and procedural matters. Normal maintenance procedures should be sufficient to ensure the general airworthiness of the aircraft prior to Check Flights, unless specific additional maintenance procedures are called for by the manufacturer's maintenance manual for particular tests, (e.g. fitment of angle of attack indicators). It may be necessary to prepare features, which enable rapid and easy return to service, (e.g. extending latches on drop-down oxygen), and preparation of work orders for restoring systems to "normal status", (e.g. stowing Ram Air Turbines, bleeding hydraulic systems). Fuel and loading requirements are selected to ensure compliance with the Flight Manual, subsequent sector needs, Check Flight duration, and operational and weather constraints. Where available, CAA Check Flight Schedules provide guidance on loading requirements.

6.2 For testing in RVSM airspace with a non-compliant aircraft a set procedure needs to be followed. This procedure is detailed in Air Information Circular (AIC) 38/2002. This AIC, (or its successor), should be consulted in plenty of time before the Check Flight is performed as a certain amount of coordination is required.

Responsibility

6.3 Responsibility for the safe conduct of any flight must always lie with the captain of the aircraft and that is as true for a Check Flight as it is for any other type of flight. The non-routine nature and requirements of a Check Flight require careful review and forethought, particularly when the Check is to be carried out by pilots more familiar with routine line operations rather than by a qualified test pilot.

Crewing

6.4 The minimum crew complement is stipulated in the AFM but it will be found useful to increase the minimum by at least one extra person to record the results, help with maintenance of a good visual lookout, etc. Whilst there is no requirement to increase the minimum crew it is strongly recommended by CAA; however, in the case of rotorcraft approved for single pilot operation, the use of an extra crew member is considered essential. Where an observer is carried, the Commander should ensure that he/she is:

1. capable of performing the relevant duties on the Check Flight; and
2. familiar with the checks to be carried out and their own duties in relation to such checks; and
3. adequately insured;
4. briefed on emergency procedures and use of safety equipment.

6.5 When a CAA test pilot is conducting the Check, he will normally occupy the captain's seat and be the handling pilot; the operator's pilot will be the aircraft commander except in specific, exceptional cases. CAA test pilots hold an appropriate ATPL that is suitably endorsed for them to carry out flights, not for Public Transport or Aerial Work, on all types and solely in the course of their duties as test pilots for the CAA. If a CAA Flight Test Engineer (FTE) is present then he will normally occupy the jump seat offering the best facilities for recording of the Check Flight results.

NOTE: The above requirement for the operator's/owner's pilot to be the aircraft commander may be waived as appropriate for checks carried out on aircraft of less than 2,730 kg MTOW.

6.6 If the Check is being carried out without a CAA test pilot present then the aircraft commander must have been briefed and accepted by the CAA for the purpose, (see Appendix A for details); whilst there is no similar qualification for the first officer, it is essential that he or she is fully aware of the sortie profile and the requirements which that places on them. All Check Flights should be preceded by a comprehensive pre-flight briefing and for more complex types; a dedicated simulator session may be found helpful. Wherever possible, all participating crew should be provided in advance with a copy of the Schedule so that they may familiarise themselves with the planned checks prior to the briefing. Whilst the Check Flight will always be scheduled within the Limitations of the Flight Manual, (including any Crew Training and Airworthiness Flight Testing Supplement/Appendix), the demands of the Check Flight Schedule mean that normal company minima/limitations may need to be temporarily set aside. Thus, there is a need for the whole crew to have a complete knowledge and understanding of the Check requirements.

6.7 Should any member of the crew be unhappy with any of the checks being performed or planned they must say so and the matter must be resolved before continuing.

6.8 Pilots new to performing Check Flights are strongly encouraged to seek the assistance of an experienced FTE or observer to accompany them on their first few Check Flights. Similarly, it is recommended that new FTEs/observers fly their first few Check Flights with experienced Check Flight pilots. There are considerable engineering and safety benefits in ensuring a good level of continuity in flight checking and efforts should be made to limit the number of FTEs involved.

Insurance

6.9 Operators are reminded of their obligations under CAP 562 Leaflet B-70 "Aircraft Insurance" to ensure that flying by the CAA's test pilots is covered under their Insurance.

Check Flight Safety

6.10 The main reason to check fly any aircraft is either to check conformity or to check for dormant failures of systems that may not routinely be exercised. Unlike a normal flight the expectation should be that something may go wrong and the good Check Flight pilot would have considered this possibility well before he/she takes to the air and, hopefully, any recovery techniques would have been discussed in the pre-flight briefing.

6.11 Always consider the consequences of your actions and ensure that you have a pre-planned strategy to recover from any significant problem areas, e.g. handling problems during stalling or landing gear becoming stuck in unusual configurations during emergency lowering checks, when you are hundreds of miles from home, (if possible leave such checks until you are closer to your final destination). During the pre-flight briefing careful consideration should be given to the 'what-if' scenarios. The engine shutdowns, high-speed flight, slow-speed flight and any form of manual-reversion flying should be carefully briefed and any recovery actions fully understood. During the Check Flight always use the checklist where they are available. During Check Flights the commander of the aircraft must be as certain as possible that any problem found was not down to an error in technique: one way to do this is to follow the checklists wherever possible!

6.12 The Check requirements may mean that significant deviations from company Standard Operating Procedures (SOPs) are required and that, in turn, means that extra vigilance on the part of all crew is required; to that end, it is essential that all crew members speak up when they feel that something is going awry or that the procedures/techniques being used are less than optimum. Many accidents have been caused by crew members being afraid to speak up or being ignored when they have done so; in flight checking it is essential that all crew be encouraged to call "stop" if unhappy with checks being planned or conducted and it is equally important that any and all such concerns be given full credence by the aircraft commander.

6.13 Notwithstanding the above, efforts should be made to ensure that wherever possible the company SOPs are followed as far as is practical. Particular vigilance is required when operating with a non-company pilot, e.g. when carrying out acceptance checks with a manufacturer's pilot. In such cases, the unusual flight regime, together with differing SOPs and the possible use of different languages merit particular care.

6.14 With the subject of Cockpit Resource Management (CRM) in mind, it is important to decide at the briefing stage who is going to do what: since many of the actions to be carried out may be unfamiliar to the crew, ensure that actions such as shutting down or retarding an engine, or fuel cross-feeding, etc, are carefully monitored by the other crew members. Maximum use should be made of the FTE to lead the checks, plan the sequence and record the results; this allows the pilot to dedicate more of his/her effort to the pure flying task. The FTE can also provide a useful monitoring function since he or she will not be so familiar with handling aircraft systems and that often provides a useful line of independent thought. Always integrate the FTE into the crew as fully as possible. Use the additional manpower at the planning stages to find the necessary data pages of the Flight Manual and if applicable, prepare them for use in the air. Make sure that the paperwork is sensibly available and clearly annotated for use during the test sequence.

6.15 Consider the full time use of headsets and intercom; it is critically important that everyone be fully aware of what is happening and with the crew possibly enhanced by one member, the use of intercom is highly recommended. This warrants careful consideration in aircraft types where intercom facilities are not provided at the observer's station; in such cases it is strongly recommended that arrangements be made for the observers to have intercom through the use of headset "splitters" etc.

Limitations

6.16 There may be occasions when the requirements of the Check Flight Schedule appear to conflict with Limitations or advice in the Flight Manual (FM); in all such cases, the FM must take priority. Specific dispensations may, when necessary, be given in an FM Supplement, (Flight Testing and Training), and crews should make themselves familiar with this Supplement before carrying out Check Flights. In the event of irreconcilable conflict(s), CAA Airworthiness must be informed so that the matter can be resolved.

6.17 Check Flight Schedules are presented in a pro-forma format such that the results are recorded directly on the Schedule. However, some legacy Schedules may still be in circulation in a "list of checks" format and in these cases it will be found helpful to prepare a form based on the list of checks. Care must be taken in the preparation of such forms, but when correctly done it will be found to greatly assist the ease and flow of checks.

6.18 A check should be made with the CAA, preferably via the Internet link shown earlier in this Handbook, that the most current issue of the Schedule is being used.

Carriage of Non-Crew on Check Flights

6.19 Where the C of A of an aircraft is yet to be issued or has been revoked, the terms of the EASA Permit to Test will prohibit the carriage of passengers during such flights except for passengers performing duties in the aircraft in connection with the flight. Although, it is legal to carry passengers on a Check Flight with a current C of A in force, it is strongly recommended that:

1. It is preferable to use ballast; and

2. Before accepting any passengers on a Check Flight the pilot in command must inform them that the risk is greater than on an ordinary flight;
3. Since cabin crew are not normally carried, ensure that all observers/passengers are suitably briefed on emergency procedures, including use of oxygen and emergency evacuation.

Check Flight Conduct

6.20 Safe flight checking requires the maximum of concentration on the task in hand and to facilitate this, the operational tasks should be minimized as far as possible; this can be aided by selection of a straightforward operating area allowing for sufficient freedom of operation. Consider briefing ATC by telephone prior to departure in order to outline your particular needs and give them a chance to make you aware of any difficulties or restrictions they face. Consider requesting blocks of altitude to work within rather than specific flight levels. It may be prudent to request navigational vectors from ATC to take away some of the navigation burden, (but be careful that towards the end of the flight you are not left hundreds of miles away from home!). Whenever possible use Traffic Information rather than a Basic Service. Give careful consideration to selection of a suitable alternate, particularly to weather, runway length and facilities, bearing in mind that it may be necessary to recover the aircraft with its systems somewhat degraded.

6.21 When making gear/flap selections, etc, that are to be timed by an observer, it is helpful to provide a 'countdown' to the actual selection; this allows greater accuracy and may avoid the need for repetition.

6.22 If a clipboard or kneeboard is used by the occupant of the second pilot's seat to record the results there is a possibility of fouling the controls. To reduce this possibility, the pilot must have briefed the observer on the need to ensure that the clipboard is well clear of the controls especially during manoeuvres requiring large control deflections such as low speed handling, autorotation, etc. The pilot should monitor the position of the clipboard during the flight to ensure that it is not in a potentially hazardous position. Whenever possible, flexible rather than rigid clipboards should be used. Where appropriate, consideration should be given to removing the dual controls if flying with an inexperienced observer.

6.23 Specific guidance for the conduct of Check Flights on various classes of aircraft will be found in Chapters: 7 to 11. However, in the interests of obtaining the maximum benefit from this Handbook, all pilots are encouraged to read all the technique sections. Properly conducted, the Check Flight should present little risk over and above that associated with normal operation of the aircraft. Any CAA Schedule to be used will have been flown and de-bugged by CAA flight-test crews; however, this may not be true for Schedules produced by other organisations. Wherever possible, fly the Schedule in the order given and operate the aircraft in accordance with the operator's normal procedures; if deviation from either is necessary for operational reasons then full account must be taken of aircraft configuration, etc. Bear in mind that some checks must be done in sequence to ensure valid results, e.g. stall checks completed before anti-icing systems exercised to avoid "latched on" resets in stall warning system or fuel jettison to take place after stall/performance checks if accurate weight required. Experience shows that it is best and most expeditious not to carry out Check Flights in controlled airspace where ATC requirements will necessarily take priority. It is usually best to exit and re-enter controlled airspace in accordance with ATC and company normal operating procedures.

6.24 Since Check Flights are often conducted with systems disabled, consider and plan for what might happen if a second failure occurs, e.g. the failure of a second generator or hydraulic system with a first system disabled.

6.25 It is very tempting to press on with a series of checks, assuming that the sequence as written provides protection against mishandling; whilst this is normally the case, it cannot be guaranteed, so do always consider Limitations before acting. This is particularly important when it has been necessary to vary the sequence of checks for any reason as a Limitation that was protected by the sequence may have become vulnerable due to the change of order. Always confirm the aircraft configuration after completion of a check and before moving on to the next item and, in particular, be aware that many of the check sequences finish at relatively low speed with alternate gear or flap extension, so be sure that the aircraft has been cleaned up again before accelerating for the recovery; there have been several instances of speed limitations being exceeded in the initial return for landing!

Unserviceabilities

6.26 It is often not worth proceeding with a Check Schedule when operating with unserviceable equipment, albeit in accordance with the MEL. Depending on their nature, such unserviceabilities may render the checks invalid and, possibly more significantly, you must bear in mind that the first failure has, in effect, already occurred and thus the probability of a "second" failure is that much more likely. Such situations may also involve "knock-on" effects that are not readily apparent when the subject is first considered. It is highly beneficial to have a list of the existing ADDs on the check aeroplane available at the briefing stage since their significance can then be considered in the calm of the briefing room.

Weather

6.27 Ensure that the weather is suitable for the checks to be carried out, e.g., there is little point in carrying out performance climbs in heavy turbulence or in cloud since both will reduce the performance, perhaps requiring a re-fly. Never carry out stalls or high-speed runs when there is significant atmospheric turbulence around; remember that the normal margins are significantly eroded and the associated gusts may put the aeroplane outside its certificated envelope. Be aware that after flight through icing conditions, some ice may remain on unprotected areas and this can have significant effects on handling and performance.

6.28 Check Flights should be carried out in day VMC and with a well-defined visible horizon since good attitude awareness may be necessary for precise control and in the remote event of extreme attitudes being reached, e.g. an unexpected and pronounced wing drop at the stall; in addition ensure that there is sufficient vertical clearance from cloud for any recovery to be completed visually. Check Flights should not be carried out at night.

Unexpected Results

6.29 If you encounter significant unexpected results, do not attempt to rectify or explore those results through experimentation or repetition. Seek advice from the ground and if none is available then return the aircraft and seek advice from the safety of the office. Do not hesitate to contact the CAA's Airworthiness for that advice or to pass on your experience; safety is paramount.

Check Flight Checklist

6.30 Finally, consider the production of a checklist to be used when a Check Flight is planned; Check Flights being relatively infrequent tasks in a pilot/FTE's working life, the use of such an aide-mémoirè may be found particularly helpful. Items for incorporation in a checklist are shown at Appendix A to this Chapter but please note that they should not necessarily be limited to those shown.

APPENDIX D

Possible Checklist Items to be Included in the Planning of a Check Flight

- Ensure that the copy of the Check Flight Schedule to be used is the latest issue.
- Check to see whether CAA wish to participate in the Check Flight.
- Provide an advance copy of the Schedule to all participating crew.
- Ensure that you have all the relevant paperwork: Schedules, AFM relight envelope, Flight Test Supplement, etc.
- Check that the insurance cover is adequate and current.
- Check fuel requirements and make any necessary arrangements.
- Check weight and balance requirements from first principles and not from 'drop-down' charts. Is ballast required? If so, make arrangements for its delivery and restraint.
- Is any extra instrumentation required, e.g. for stall checks?
- Ensure that a suitable briefing area will be available.
- Obtain a list of ADDs for review at the briefing.
- Obtain the Met. and plan suitable alternates as required.
- Liaise with ATC to ensure that they are aware of your requirements.
- Check that there are sufficient headsets and intercom facilities for all crew.
- Ensure that you are familiar with the location of all switches, circuit breakers, etc, to be used.
- If appropriate, ensure that adequate catering will be available.
- Establish where the aeroplane will be presented for acceptance. Make any abnormal transport arrangements.

CHAPTER 7

Conduct of Check Flights on Large Fixed Wing Aircraft

Pre-flight Walk-round

7.1 When carrying out the pre-flight walk-round inspection, be particularly vigilant, taking care to identify anything on the airframe that might affect the results, e.g. damaged leading edges or badly fitting panels/seals that could cause problems especially during the stalling or high-speed checks. Extend the inspection to include the cabin and the holds, ensuring that bar trolleys, baggage containers, etc, are adequately restrained. If ballast is being used, check that it is physically present, of a suitable material and suitably restrained, (materials such as sand whose weight varies considerably with water content are not recommended for use as ballast). If checks involve the use of circuit breakers, take time pre-flight to locate and identify them. Take care with the weight and balance calculations to ensure that the CG is within limits for the Check Flight and the weight is accurately known for performance calculations.

Flight with an Engine Shutdown

7.2 Flight with an engine shutdown is required for performance and relight checking; properly conducted, it will result in little extra risk. In general, when an engine has been shut down, ensure that to the maximum extent possible, it has been prepared for an immediate relight attempt should it be required. A few additional items to consider are:

1. If an air supply is required for relight, it is typically supplied by the other operating engine(s) or by an APU (if fitted); therefore, and particularly on a twin, consider abandoning the Check Flight if the APU (if applicable) is inoperative since failure of the live engine would leave the aircraft dependent on a windmilling relight of the shutdown engine.
2. Unless essential to remain within AFM limits, avoid cross-feeding fuel when the engine is shutdown; if cross-feed is essential then remember that it is typically safest to ensure that all cross-feed

valves, etc, are open before any pumps are turned OFF and ensure that all the pumps are back ON before any valves are re-closed.

3. When flying with engines shutdown, allow sufficient terrain clearance to deal with unexpected loss of a second engine. AIC 52/1999 gives recommended minimum safe heights for complete shutdown of engines for training purposes and this has been taken into consideration when planning the Check Flight Schedule. The Schedule Limitations for minimum safe heights must be adhered to.
4. Consider the procedure to be followed if the "good" engine fails while the other engine is already shutdown: it may be best to relight the shutdown rather than the failed unit.
5. Consider **before flight** if the Loss of All Engines procedure calls for relights to take place in a particular sequence and if or how that sequence could be affected by these checks.
6. Be kind to the engine! Observe the manufacturer's requirements for time at idle, (for propeller aircraft, bear in mind that drag can be very high with the engine at flight idle), prior to shutdown and following relight or any other more general handling advice.
7. Be aware that a number of older twin-engine aircraft may not have a climb capability with one engine shut down (so-called "false twins"). Although performance is not usually measured on such aircraft, engine airstarts are and in that case, very careful weather and position planning is required. Always ensure that the aircraft is capable of reaching an appropriate landing ground should the second engine fail to re-start.

Measurement of Climb Performance

7.3 Climb performance checks serve three main purposes:

1. For new types, they establish whether climb performance has been realistically scheduled.
2. For new or modified aircraft of established types, they monitor the effect of changes introduced over the years.
3. For aircraft in service, they detect deterioration of individual aircraft and of fleets.

7.4 Normally, the method for demonstrating the rate of climb for any given aircraft is as given in the relevant Check Flight Schedule, which also lays down the conditions under which climb checks are to be carried out.

General

7.5 The performance climb should only be carried out in smooth air, clear of cloud and away from hills that may produce wave action. Where practical, the climbs should be flown approximately across the prevailing wind to minimise the effect on climb rate. Note that on propeller driven types, experience has shown that the use of a "zero thrust" setting is never sufficiently accurate for performance measurements and thus the engine will need to be shut down and the propeller feathered or windmilling as appropriate.

Technique

7.6 The climb should be made as straight as possible with IAS maintained to within ±2 knots or mph of the target speed. Should these limits be inadvertently exceeded, a return to within limits should be made smoothly; avoid large and abrupt control inputs. The climb should be carried out on a constant heading to maximise performance, (it is best to inform ATC in advance so that a suitable heading can be agreed before the check commences), but if a turn becomes unavoidable for any reason, if it can be made using less than 10 degrees of bank it may not invalidate the result. At the low speeds usually associated with performance climbs, it may well be that 5 degrees of bank gives an acceptable rate of turn. Performance climbs are normally carried out over a 5-minute period to ensure that the results are not unduly influenced by any short-term perturbations.

7.7 The configuration and technique for the climb(s) is given in the AFM and in the Schedule and will require the critical engine to be either at idle or shut down (and feathered if propeller driven). As a general rule, sufficient rudder trim and bank angle, (up to a maximum of 5°), should be used to reduce the applied rudder pedal force to zero, if possible, and to maintain heading. If full rudder trim is needed it may be necessary to accept a residual force of up to 50 lbs in the take-off configuration. The aircraft should be fully trimmable in the en-route configuration. If less than 5° of bank is employed, and the slip ball kept in the middle with rudder, there could be too much trim drag, which spoils the rate of climb.

7.8 Care should be taken to observe Engine Limitations.

NOTE: For multi-engine aircraft, the single-engine climb should not be carried out below the minimum safety height of 3000 ft AGL.

Check Flight Data Recordings

7.9 The Check Flight Schedule will provide details of instrument readings to be recorded. Recording the climb data should not be started until the aircraft is stabilised in the climb at the correct speed and with the power set. In general the following parameters are recorded:

1. Altitude every 0.5 minutes, Airspeed, OAT and main engine setting parameters every minute.
2. All engine instrument readings should be taken once at approximately mid-climb.
3. A cross check of the ASIs should be carried out during the climb.

7.10 It is also necessary to establish the weight of the aircraft at a point approximately midway in each measured climb. This can be determined by reference to 'fuel gone' indicators, on a time and consumption basis or, where their accuracy is good enough, by reference to direct fuel gauge readings. It is acceptable to record the weight at the beginning and end of the climb and to use the average of the two for data reduction.

Engine Acceleration Checks

7.11 Many Schedules call for a check of the engine's ability to accelerate; this checks both the handling, particularly surge margins, and the time taken to achieve a given thrust level.

7.12 The configuration, altitude and speed, etc, required for the check will be specified in the Schedule but will normally be at relatively low altitude and in a landing configuration; the latter ensuring that the correct idle setting is used. Although, this is a relatively simple task, a high degree of concentration on engine parameters is required and thus it is recommended that wherever possible, the aircraft be flown by one pilot while the other concentrates on the engine checks; there will be a frequent need for various degrees of asymmetric thrust and care is needed to ensure accurate and safe flight.

7.13 In the absence of any specific advice from the airframe or engine manufacturer, the following technique is recommended to minimise thermal shock to the engine. If the engine is not automatically limited, e.g. by a FADEC system, then set the maximum check thrust and note the throttle position and relevant RPM values; it will be found helpful to mark the throttle quadrant at the achieved position so that the throttle can be rapidly set to that position during the check. For fully controlled engines, it is usually possible to slam to the stop or detent. Set the power back to the thrust for level flight and when stable, set the check engine to idle; it is important to achieve a stable value of idle before setting full thrust, but temper this with an attempt to minimise time at idle and, in any event, try not to exceed 15 seconds at idle. When ready, rapidly set the throttle to the target thrust/position and monitor very carefully. The initial acceleration is typically fairly slow but increases rapidly as the RPM rises. As the target RPM/EPR is achieved, ease the throttle back to ensure that there is no over-swing, a very small degree of anticipation may be required. Brief this exercise carefully with the observer since it may be necessary to throttle back before he/she calls the exercise complete. Match the throttles for level flight and repeat for the other engine(s). The time taken from idle to the check RPM/EPR is typically required to be less than 8 seconds, any exceptions to that generalisation will be clearly indicated in the Schedule.

Cabin Pressure Checks

7.14 These checks cover both ends of the spectrum, under- and over-pressurisation:

- For the low cabin pressure checks, it is sensible to limit the aircraft altitude to 20,000 ft; this ensures a minimum level of physiological comfort in the event of complete loss of control over the system. With the cabin altitude greater than 10,000 ft, use oxygen. If passengers or observers are carried, there should be portable oxygen sets available for their use.
- Before starting a check of maximum pressures, ensure that a never-exceed value of differential pressure is known and strictly observed.
- Take time to interpret the markings on the differential pressure gauge, they have been designed for use in normal operation and you will be operating in an unfamiliar area of the gauge; it is essential that the limitations for this check be rigorously observed. It is important not to be distracted during this check, concentrate on not exceeding the Limitations and ensure that the limit is approached at a rate that can be arrested in time to guarantee no exceedances.

- In all cases and following the checks, it is recommended that the cabin altitude and rate be returned to within normal parameters before switching from Manual to Auto, (if applicable), to ensure avoidance of large pressure surges or equipment BITE failures, etc.

Stalling and Slow Speed Checks

7.15 This is a check that often induces a degree of anxiety on the part of operator's pilots. If this is the case then defer the check until you are happy with the aircraft's handling at high angles of attack. Bear in mind that the objective of the checking is different from that normally seen in training since the aim is to check the aircraft's handling and performance rather than that of the pilot. As with so many checks, consider the "what if" scenarios, e.g. wing drops, engine surge, etc, and always define a point at which the check will be terminated if the desired result has not been achieved, (this is usually the predicted speed minus the allowed tolerance.) Some aircraft types are only checked as far as stall warning; be sure that the Schedule requirements are fully understood and do not be tempted to proceed beyond these requirements. Do not press blindly on if the target minimum speeds have not been met, many Check Flight Schedules define a minimum speed, i.e. target stall speed minus "X" knots or a maximum angle of attack at which recovery must be made. When that limit has been defined, stick to it and do not be tempted to press on a little longer to "see what happens." In order to give essential speeds the necessary prominence, it may be useful to bug only the trim and the minimum "never below" speeds. Ensure that there is plenty of height in hand for recovery; for large aeroplanes, all checks should be completed by a minimum of 8,000 ft above terrain or higher if required by the Schedule. Note that some aircraft types require the installation of extra (instrumentation) equipment for stall checks; under no circumstances should stall checks be conducted without that equipment fitted.

Stall Recovery Considerations

7.16 As mentioned above this is not a training stall but a check of the minimum flying speeds. The checks are not performed near the ground and therefore there is no need for a maximum power recovery to prevent the aircraft hitting the ground. To this end the recovery should not be performed using thrust, but elevator only until flying speed is achieved. Then power can be added gently and a normal full recovery made. The reason for this technique is that if only one engine spools up quickly you could have a handling problem as the aircraft's speed could be below minimum control speeds.

7.17 Some aircraft have a tendency to drop a wing at the stall; advice for correction of this should be contained in the Pilots' Operating Handbook (POH) or Flight Manual. Unlike normal training recovery techniques, current airworthiness requirements ensure that normal use of the flight controls, including the ailerons, throughout the approach, stall and recovery is permitted. It should be possible during the stall and recovery to contain any wing drop to within ± 20° of bank. Certain older aircraft types exhibit a marked degree of adverse aileron yaw at high Angles of Attack (AoA) and conventional use of aileron in this case may exacerbate the wing drop, possibly leading to a departure. In such aircraft, the classic technique for recovery is to use the rudder to contain the sideslip, accepting the wing drop, and then level the wings using the lateral controls during recovery and as the speed increases. Care should be taken not to pull out of the ensuing dive too rapidly as this may cause the aircraft to stall again. It is again emphasised that this check should never be carried out by anyone unfamiliar with the handling characteristics of the type under check and **if in any doubt, do not carry out stall checks**.

7.18 Should there be a wing drop, take care in any ensuing manoeuvres not to exceed the Limitations for flaps or landing gear and if in a nose down situation, remember the "g" limitations, especially with flaps extended. If control is lost at this stage, it may be safer to allow a speed exceedance than to apply excessive "g". This is an area that should be carefully briefed in the pre-flight briefing to ensure that the second pilot does not assist with control to 'help' the recovery, potentially causing the "g" limits to be exceeded.

7.19 Consideration should be given to engine handling during stall checks. With large fan engines at higher Angles of Attack (AoA), it is possible for the airflow in the intakes to become distorted, possibly leading to fan blade stress or to rising EGT/ITT or, in extremis, to surge. Therefore, when approaching the stall and during the initial recovery, engine parameters must be closely monitored. Remember that stall checks should be carried out at a safe altitude and therefore there should be no need to rush the recovery and thus CAA recommend the following techniques whenever possible:

1. As a first step, always positively lower the nose to reduce the angle of attack and start the speed increasing.

2. Roll to wings level if applicable.
3. Slowly increase power or thrust. Delaying the power increase has a number of beneficial effects:
    a) preventing any build up of sideslip at high AoA should the engines spool up asymmetrically. Remember that the airspeed at this point could be significantly below the minimum control speed;
    b) avoiding the pitch up, which is often exhibited with thrust increase on under-slung engines;
    c) avoiding the blade stresses or tip rub, which could occur at high power and at high AoA (a result of distorted inlet flow).

7.20 Nothing in the foregoing removes the need to make a minimum height loss recovery in accordance with the manufacturer's recommended technique should the pilot feel that circumstances so warrant.

7.21 As airspeed is reduced in the approach to the stall, many aircraft types display a mild directional "wander". The rudder should be used in a conventional sense to keep the slip ball centred since the presence of sideslip at the stall may result in a wing drop and may make the aircraft prone to spin. This problem is, of course, most pronounced on multi-engine types and considerable care may be necessary to ensure that the slip ball remains centred.

7.22 A clear margin is required between stall warning and the actual stall and this margin will usually be stated in the Check Flight Schedule. It is important to remember that even in cases where the stall warning and stall speeds are within tolerance, a further check must be made to ensure that the required margin is also met.

7.23 On some aircraft, the stall is defined or identified by the operation of a stick pusher. This may be for a number of reasons but it is important to realise that the pusher is there to identify the stall; it is not a stall warning or recovery system. However, since it typically provides the stall identification by application of a sudden and strong nose down elevator movement, this is clearly pro-recovery and the pilot must not resist the onset of the pusher. When a device such as a pusher is fitted to provide stall identification, no effort must be made to explore the aircraft's characteristics beyond pusher onset and stalls must never be attempted with the pusher disabled. Note that on some aircraft, the pusher is set to operate at an angle beyond that corresponding to the 1g stall. Where this is the case and an aerodynamic stall is observed prior to the pusher operating, **take stall recovery at that time**.

Flight at High Speed

7.24 Flight beyond Vmo/Mmo should be authorised in the Flight Manual Supplement for testing and training; in the case of the light aircraft, high speed is defined as greater than Vno but not greater than Vne so no special authorisation is required. Flight is conducted at such high speeds to check aircraft handling, panel integrity and systems performance. In particular, the operation of the over-speed warning system, (if applicable). Flight at such high speeds must only be conducted in smooth air and clear of cloud. The run to high speed should be conducted in a gentle dive if necessary and with a high level of power set; be prepared to adjust the power to ensure that the Limitations are not exceeded, this is particularly important for fixed pitch propeller types or where torque is used as a power setting parameter. Approach the limiting speeds gently and be prepared to initiate an immediate recovery should it be considered necessary. Exercise the flight controls gently at the high speeds ensuring that aircraft response is normal, remembering that the flying controls can become very powerful at high speeds. As Vmo/Mmo is exceeded the high-speed warning should sound and be clearly audible to all members of the minimum flight crew; with the warning sounding, listen with the intercom system microphones off as well as "live".

7.25 Carry out the check only at the altitudes listed in the Schedule, this will ensure that the aircraft is kept well away from the Vmo/Mmo "Crossover" point, which in turn will ensure that Mmo is not inadvertently exceeded while checking at Vmo or vice-versa. When satisfied at high speed, extend the speed brakes fully in one movement, if fitted, and ensure that the aircraft response is normal, then reduce the power to decelerate. Again, be aware that at these high speeds the response may be a little abrupt. If at any time during the run you experience unusual vibrations or noises, slow down immediately and have the cause investigated on the ground. However, if a panel should come off it may be more appropriate to reduce speed more slowly to prevent further damage occurring from a rapidly changing airflow. For severe vibration or a detached panel, diversion to the nearest suitable airfield should be considered.

Yaw Damper Checks

7.26 Many Schedules call for a check of the yaw damper system in flight. Such a check is typically performed by switching off the yaw damper(s), applying a **small** rudder doublet, (small amount of rudder pedal in one direction followed by a small amount in the opposite direction followed by a release of the pedals), then switching the damper(s) back on and ensuring that the Dutch Roll (DR) motion is adequately damped. It is essential that the rudder movement used to induce the DR be kept to the **minimum required** to produce an observable DR. Do not be tempted to use large rudder inputs under these circumstances to generate a high rate, clearly observable motion. Be certain that you are absolutely familiar with any specific recommended techniques for the prevention of DR should the motion rapidly increase in amplitude or the damper fail to activate on re-instatement. To avoid large transient control demands, if possible, switch the yaw dampers back on when the rates of roll and yaw are low.

Flying Control Checks

7.27 Any and all flying control checks should be carried out with care and thought. This is particularly so when carrying out checks such as switching hydraulic power on/off or surface neutralisation at high speed; in these cases there could be a sudden change of trim and it is important to be prepared for such an eventuality. This is especially important if there has been an unexpected change of trim when switching one way; **avoid switching back when holding out-of-trim forces** since this may result in a violent aircraft manoeuvre that could overstress the aircraft. Always, RELEASE ANY FORCES that you are holding before re-powering a flight-control system, even if by doing so the aircraft will enter an unusual attitude. It might be possible to put some bank on the aircraft to turn a large pitch-up into a turn manoeuvre before re-powering the system. For a pitch nose-down, it is essential to maintain wings level whilst recovering to the horizon before re-instating power to the controls. The aim is to prevent an unusually high or low pitch manoeuvre developing. Again, if de-powering a flight control system is called for in the Schedule it should be pedantically covered in the pre-flight briefing, including any recovery techniques. As a general rule the pilot flying should be the only person to re-power the system in an emergency.

CHAPTER 8

Conduct of Checks on Rotorcraft

Takeoff and Low Speed Handling Near the Ground

8.1 The purpose of the low speed handling checks is primarily to check that adequate control margins are available and that the rotorcraft response and engine handling is normal when operating out of wind.

Axial Turns

8.2 The axial turn should be carried out first in the direction that is normally more limiting in terms of yaw pedal authority; i.e. for a rotorcraft that has left pedal applied when hovering into wind the first turn should be towards the left. This ensures that the rotation can be stopped quickly if the rigging is incorrect.

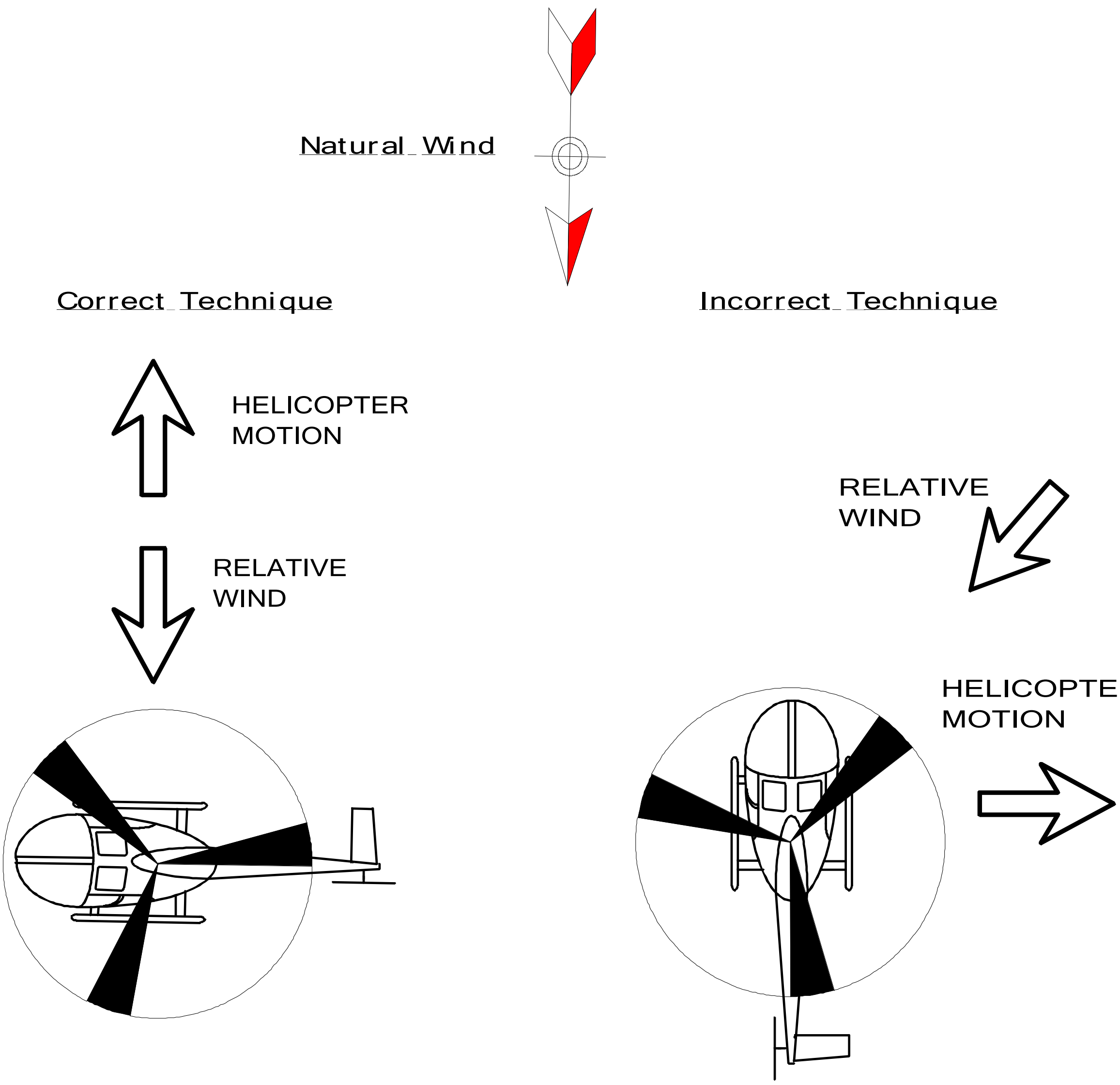
Sideways and Rearwards Flight

8.3 Sideways and rearwards flight should be carried out up to the airspeed limit stated in the Schedule. For sideways flight the rotorcraft should be rotated so that the natural wind is on the side of the rotorcraft and then gently accelerated into the wind and stabilised at the maximum speed. The mean natural wind speed should be added to the estimated ground speed to give the relative wind velocity. The rotorcraft should not be lined up nose into wind and then flown sideways as this does not give a relative wind directly on the side of the rotorcraft (see Figure 1).

8.4 For rearwards flight the rotorcraft should be lined up tail into wind (after checking that the intended track is clear of obstacles) and gently accelerated rearwards. This reduces the ground velocity compared with flying rearwards with the nose lined up into wind. The rotorcraft should be decelerated very slowly from rearward flight to avoid running out of aft cyclic control. It is acceptable for the rearwards flight to be carried out at a slightly greater height above the ground compared with sideways flight.

8.5 It must be ensured that {ground speed + wind speed} does not exceed the Flight Manual low speed envelope limitations. In any case, ground speed should be restricted to not more than 20 kt to avoid excessive ground speed in the event of engine or aircraft handling difficulties being encountered.

Figure 1: (Plan View)



Performance Climb

General

8.6 The performance data in the Flight Manual includes information on hover ceiling, takeoff distance, rate of climb, etc. This information is only valid for an individual helicopter if it meets the minimum standard that the data was based on. The performance of a helicopter can degrade in service due to a number of factors including general wear and tear, incorrect rigging, weight 'growth' and incorrect calibration of instruments. The easiest way of checking a helicopter's performance is an enroute height climb. This data is compared with the scheduled Data in the Flight Manual and a 'figure of merit' arrived at. Thus the performance climb carried out during the Check Flight is used as a measure of the helicopter's overall condition, not just its ability to climb.

8.7 The enroute performance climb should only be carried out in smooth air, clear of cloud and away from hills that may produce wave action. In general, the climb should not be started below 1000 ft AGL. This gives sufficient time to stabilise the climb at the correct conditions and avoids any low level turbulence. Recording the climb data should not be started until the helicopter is established in the climb at the correct conditions. For some types greater accuracy in determining the helicopter weight may be achieved by calculating the fuel consumed during the time elapsed since takeoff.

Technique

8.8 The climb should be made as straight as possible with IAS maintained to within +3 knots of the target speed, if possible, with either the slip ball or the slip string centred, depending on the appropriate technique for the type. Poor climb performance is likely if this is not achieved. Collective should be increased until the first limiting parameter is reached; care must be taken with turbine engines to avoid exceeding gas generator rpm or turbine temperature limits if these are reached before the torque or collective limit. On turbine engine helicopters climbing on the torque limit there will be a tendency for the torque to decrease with increasing altitude. Collective should be increased to maintain constant torque during the climb until an engine limit is reached. The OAT gauge reading will tend to lag the actual OAT and an accurate value for an altitude around the midpoint of the climb should be obtained, on completion of the test, by stabilising the helicopter in level flight at the climb speed for one minute and the OAT recorded on the Schedule.

8.9 On multi-engine helicopters, One Engine Inoperative (OEI) climbs are required. The off-line engine should not be shut down, but reduced to idle. Manipulation of the engine controls should only be performed at low power, (e.g. level flight at Vy), to avoid inadvertent use of high power on the driving engine.

8.10 Care must be taken to ensure that a free turbine "needle split" is achieved before commencing the climb, rather than just relying on a zero torque indication, to avoid any power contribution from the idling engine. On some multi-engine types the governing system may cause difficulties in achieving a needle split idle condition. In such cases, a specific check procedure is included in the CFS.

8.11 A number of types are now certificated with a 2 min/30 sec rating structure. In such types, it is not the intention at any stage of the flight to enter the 30 sec regime. Again, special check procedures detailed in the Schedule must be followed exactly both in setting up the OEI check condition, and also in returning to All Engine Operating (AEO) conditions to avoid any usage of the 30 sec rating.

8.12 When carrying out climbs, due consideration should be given to engine failure. In the event of an engine failure on a single engine helicopter, or failure of the driving engine on a twin engine helicopter in an OEI climb, the pilot must be prepared to react immediately by lowering the collective to prevent excessive rotor rpm decay.

8.13 For multi-engine type at the end of the climb, the collective should be lowered to reduce driving engine power to below AEO power levels prior to returning the idling engine to the Flight condition.

8.14 For all types, it is good practice to allow engine temperatures to stabilise following the high-power climb checks by flying at a lower power setting for a brief period, prior to entering autorotation.

Autorotation

8.15 The autorotation check has two main purposes: the first, to assess handling and vibration during the entry to autorotative flight, including turns and during the recovery from autorotation; the second, to ensure that the collective rigging is correct, (i.e. the scheduled rotor rpm is achieved with the collective fully down and the needles split). It is usually best to carry out two autorotations: one for each purpose. It is helpful to confirm the autorotative Nr chart before the check to have some idea, based on the ambient condition and weight, what Nr can be expected during the check. It should be borne in mind that a chart Nr above or below the power off limits does not imply that use of those Nr is acceptable. Normal power-off RFM limits must be observed at all times, and transient Nr must not be intentionally used.

Entry

8.16 The entry to either autorotation should be carried out with care at the recommended speed. This is not a training exercise so there is no need to simulate engine failure in order to enter autorotation. Entry should be effected by gentle lowering of the collective taking careful note of the RRPM. RRPM can be expected to rise as torque reduces towards zero but if full-down collective is reached with significant torque still indicated, suspect that the autorotative RRPM is set too low. If it is possible to achieve a needle split without reducing the engine(s) towards Ground Idle, (i.e. rolling off throttles/retarding ECLs), there is no need to do so as the check objective can be achieved provided there is a needle split. If there is residual torque with full-down collective and no needle split, extreme care must be taken when reducing the engine(s) towards Ground Idle to ensure that RRPM does not fall below power off limits. If the residual torque at full down collective with NO needle split looks abnormally high, it would be prudent to terminate the check and return to base to have the autorotative RRPM set higher before attempting the check again.

Handling Autorotation

8.17 The handling autorotation can be carried out at any weight and it is quite acceptable for the pilot to use collective to prevent RRPM going above the power off limits, i.e. there is no requirement for the handling check to be done with the collective fully down. Airspeed is normally kept at the Flight Manual recommended speed for minimum rate of descent, although some Check Flight Schedules call for a range of speeds to be flown. Turns are normally flown up to a maximum of 30° angle of bank, but check values of 10° to 20° are acceptable. During this check, care must be taken to maintain RRPM within the normal power off limits, the biggest problem normally being high RRPM, particularly in turns. During the turns in autorotation careful note should be made of whether there is sufficient pedal authority to maintain balance. Problems that can be encountered are high vibration, often 1R bounce, damper induced vibrations, pitch-lag instability and control-range limits being reached. If any divergent rotor oscillations are experienced, power should be restored immediately and the cause investigated on the ground.

8.18 Some Schedules call for a high-speed autorotation, usually for the purpose of checking availability of tail rotor pedal margins. Special care should be taken during any high-speed autorotation to be aware of height, especially when concentrating on the Check Flight task, and ensure that the recovery is initiated at a safe height.

Autorotative RPM Measurement

8.19 The Check Flight Schedule will specify an airspeed for this check, and may impose a maximum weight. If so, it will probably require a separate flight with ballast removed. The entry should be carried out as above looking for tendencies to high or low RRPM. For this check to be valid, several conditions apply. The lever must be fully down, (only if RRPM remains within the upper limit – the check fails if it is not possible to achieve full down collective and remain within the upper limit), airspeed must be correct with no flaring or accelerating, the aircraft must be in balanced straight flight and there must be a positive Nr/Nf split. If necessary, the engine(s) will need to be retarded to achieve a positive split. All flying should be smooth and gentle to avoid loading the rotor. The RRPM reading should be taken passing through the nominal height, (e.g. 2000 ft), and afterwards, return to this height to measure an accurate steady state outside air temperature.

Recovery from Autorotation

8.20 **Ensure that retarded engine(s) are restored to the flight condition before attempting recovery – this sounds obvious, but is easily forgotten.**

8.21 The Check Flight Schedule will require an engine acceleration check, (for turbine aircraft). For this check, the needles should be joined and a small, (usually specified), amount of torque applied. The collective should then be raised smoothly to achieve the upper specified torque within the time allowed. It may require several practices to achieve a smooth pull in the correct time. (A good guide to the final collective position required is to set up the final torque in steady state prior to the check to give a feel for the position).

8.22 If engine surge or poor acceleration is found, stop raising the collective immediately and be prepared to lower it if required to maintain RRPM. Beware of low RRPM if the engine does not accelerate correctly. A particular problem with slow accelerating engine(s) is for a large torque over-swing to occur, even after the final collective position is reached. Problems can be avoided by making several incrementally larger attempts until the check is achieved successfully or a limit or adverse characteristic is found.

8.23 The engine acceleration check should be carried out at an altitude that allows time for an engine to recover from surge should this be encountered.

Dive to Vne

8.24 The purpose of the Vne check is to ensure that there is no excessive vibration or handling problem at the extreme of the flight envelope. Before commencing any such high-speed manoeuvres, ensure that the appropriate Limitations are fully known and understood.

8.25 The helicopter should be accelerated to maximum speed in level flight before the dive to Vne. The entry height should be sufficient to allow stabilised straight flight at maximum continuous power and a turn to left and right to be carried out. The speed should not be allowed to decrease significantly during the turns. If excessive vibration or nose-up pitching is experienced collective should be lowered slightly and speed reduced.

Turbine Engine Checks

8.26 Engine checks on turbine engine helicopters include a power assurance check and, for some types, a check of engine topping or maximum gas generator speed, (e.g. Ng, N1, etc.).

8.27 The power assurance check should be conducted on the Check Flight, even if a check has already been performed on an earlier flight that day. Care should be taken to follow the AFM procedure exactly, including allowing the required time for engine parameters to stabilise.

Topping – Multi-engine Types

8.28 Topping, if required, is carried out in an OEI condition on multi-engine types. Detailed instructions will be included in the Schedule. The engine should be stabilized at maximum continuous or inter-contingency OEI power, then power increased until either the relevant limiting engine parameter is achieved, and/or rotor rpm droops as required. The time spent at this power level should be kept to an absolute minimum; the maximum permitted duration is stated in the Schedule. Careful briefing before carrying out this check and good crew coordination is required to ensure that the required data is recorded without exceeding time limitations at this high-power setting. The check should be conducted at an altitude high enough for the engine to be limited by either gas generator speed or turbine temperature rather than torque.

Maximum Power/Topping Check – Single-engine Types

8.29 Single-engine helicopters require either a check of take-off power, or a limited check of maximum Gas generator speed availability. This check may have to be carried out at low airspeed due to torque/airspeed limits and is carried out at altitude, usually after the performance climb. Where the check is carried out at low airspeed and high altitude, pilots should be alert to the potential for disorientation due to the reduced visual cues at altitude. Time spent at the limiting condition should be kept to the minimum necessary for the engine to stabilize on condition and the data to be recorded.

8.30 To achieve a true engine topping condition, most types require an altitude greater than 10,000 ft to ensure that the aircraft would be engine rather than transmission torque limited. This is considered impractical and unnecessary in typical UK ambient atmospheric conditions for Check Flights. In such cases, the check is conducted at the top of the performance climb at an altitude of approximately 5,000 ft. Power should be applied until the first engine or torque limit is reached. If the torque limit is reached before the engine gas generator speed/temperature limit/rotor rpm droop, this is considered acceptable. If rotor droop or engine limits are reached before the torque limit, check with the maintenance manual that this is normal for the ambient condition of the check. Pilots should not allow rotor rpm to droop below that specified in the Schedule or the minimum power on rotor rpm flight manual limit.

8.31 The advice above regarding the consequences of engine failure in the climb check also applies in both the above cases.

Automatic Flight Control Systems (AFCS)

8.32 Many helicopters, particularly those approved for IFR operations, are equipped with an AFCS providing stabilization and flight path control. Checks are carried out on these systems primarily to examine reversionary mode performance and failure/deviation annunciations, although limited evaluation of normal functioning is also carried out.

Attitude Based Systems

8.33 Checks of attitude stabilization are conducted by first ensuring the system is in attitude mode and trimming the aircraft at an airspeed below Vne. The aircraft is disturbed in one axis, e.g. 5° nose up by means of a cyclic input without re-trimming and the cyclic released gently to the trim position. The recovery of the aircraft to the datum attitude should be well damped. In multi-lane systems, these checks should also be conducted with each lane disengaged in turn. The pilot should be alert for dormant failures of one lane/axis, which would result in the aircraft being un-stabilised in that axis when the other lane is disengaged. Some systems are configured such that actuator authority is reduced when one lane is disengaged and the system is then more likely to saturate following a control disturbance.

Rate Based Systems (SAS)

8.34 With simple rate based systems, e.g. SAS, or when an attitude system is selected to SAS mode, the aircraft attitude would not be expected to return to the original datum, but nevertheless, pitch and roll rates should damp quickly to zero for correct behaviour.

Yaw Dampers (YSAS)

8.35 A number of helicopters, even those without full-time pitch and roll stabilization, are equipped with either simplex or duplex YSAS or yaw damper systems. To carry out this check, the aircraft can be disturbed in yaw by making a small collective down/up doublet with pedals fixed and the aircraft recovery noted. For simplex yaw dampers, this will first be conducted with the system engaged, then repeated with the system disengaged. Any resultant yaw/roll oscillation should damp quickly on re-engagement of the system. For duplex yaw dampers, the collective inputs should be performed with each lane of the system disengaged in turn.

Autopilot Upper Modes

8.36 Checks of flight path control/coupled flight director systems consist of brief examination of basic system performance and a closer examination of recovery from disturbances and excess deviation annunciations. Care should be taken to ensure that basic aircraft parameters – e.g. Vne, torque limitations, engine limitations – are not disregarded by becoming too engrossed in system performance.

System Checking

Hydraulic Systems – Simplex Systems

8.37 On helicopters with a simplex flying control hydraulic system, checks of control characteristics following hydraulic failure are conducted.

Hydraulics should be deselected at an airspeed defined in the Schedule and gentle manoeuvres flown, which may include flight to the maximum approved speed for this condition, turns, climbs and descents. Hydraulics should be re-engaged at the same speed at which they were disengaged.

8.38 Some helicopters have an accumulator to provide short-term hydraulic boost to allow the pilot to achieve a safe flight condition in the event of a failure, e.g. to decelerate following a hydraulic failure at high speed. In this case, hydraulics should be deselected at the defined speed and a series of gentle manoeuvres flown to ensure that the accumulators provide assistance for the required time. The manoeuvres should include airspeed changes, turns, climbs and descents to ensure the flying controls are sufficiently exercised. It is not necessary to continue the exercise until all assistance is lost.

Engine Handling

8.39 Engine response and characteristics should be acceptable during the conduct of the manoeuvres required in the Schedule and specifically during the engine acceleration check during recovery from autorotation as detailed earlier. Any other specific engine handling checks will be detailed in the Schedule and the procedures for these should be followed closely to avoid the potential for engine damage. Some engines will have manual reversion following governing system failure, and this failure case should be checked as required by the Schedule. During such checks, the pilot should ensure that the operational situation is unlikely to require rapid aircraft manoeuvring and care should be taken to avoid exceeding engine or rotor limitations. Careful handling of manual controls is usually required.

8.40 Further type specific systems checks are detailed in the Schedule covering aspects such as correct functioning of the electrical system, undercarriage, engine and fuel systems, etc. Most of these checks are straightforward, some of which are carried out rotors running on the ground.

Placards and Functioning

8.41 A check should be made that all cockpit placards are in place and that instrument marking is in accordance with the Flight Manual and in good condition.

8.42 A check should be made on the correct functioning of cockpit and other lighting.

CHAPTER 9

Conduct of Check Flights on Light Aircraft

Introduction

9.1 The conduct of a light aircraft Check Flight will always commence with a check of the aircraft documentation and as a minimum the documents listed in Appendix A must be available and in date. It is a good principle to determine the weight and balance at the earliest opportunity in order to provide a reasonable amount of time for the engineering organisation to satisfy these requirements and ensure that the aircraft is correctly prepared for the Check Flight. In addition, early determination of weight and balance will ensure that the correct climb speeds and stall speeds are extracted from the AFM. In general it is desirable that a Flight Test Engineer (FTE) or Flight Test Observer (FTO) be carried; however, this is not always possible and it is therefore imperative that suitable recording methods be determined before flight. It may be impractical to record results directly onto the Check Flight Schedule in flight; consequently, a kneeboard alternative may be preferred and from which the data may be transcribed during post flight analysis. An example kneeboard schedule is offered at Appendix F.

External/Internal Check

9.2 Vigilant internal and external checks are required, paying particular attention to the correct operation of all lights, stall warning vanes and pitot heating. In addition, it is most important that for adjustable seats/rudder pedals, ALL permutations are explored and that all locking mechanisms function correctly. All seat straps/harnesses must be checked for functionality. For aerobatic aircraft and those cleared for spinning this check is vital and should include a comprehensive check of the tightening/lengthening mechanisms including the negative G strap where fitted. In addition, where fitted, the securing mechanism for the cabin fire extinguisher must be checked for security.

Taxying and Engine Run-up Checks

9.3 Great care must be taken in congested areas particularly when the maintenance investigation has included work on the brakes. The captain's brakes should be checked at the earliest opportunity and, where fitted, the second pilot's brakes should be checked and compared to the captain's brakes for effectiveness. In addition, where fitted, the effectiveness of both pilots rudder pedal steering should be assessed. The effectiveness of the parking brake may be assessed during the power check, when the parking brake should be capable of holding the aircraft stationary. In general, to minimise the effect of wind, engine run-up should be carried out crosswind for fixed pitch propeller types unless either the crosswind is too strong or there are technical reasons why the particular engine(s) should only be run up into wind, (e.g. published notice of the danger of overheating electrical harnesses).

NOTE: Technical reasons why a short run-up should not be carried out crosswind are rare. The reasons for attempting to eliminate headwind effects are:

1. maximum static rpm provides a useful indication of engine power;
2. with a fixed-pitch propeller, variations in rpm are minimised, making for easier comparison with other check results;
3. with a constant-speed propeller, a run-up into wind can mask the inability of an engine to achieve the correct static rpm.

Take-Off and Landing

9.4 The aircraft should be flown as closely as possible to the take-off and landing speeds specified in the designated Manual. There should be no difficulties in controlling the aircraft and stall warning should not operate except in some cases for a brief moment during the lift off or landing flare. In cases where it is impractical to assess full static power at a designated holding point, this should be conducted on the runway prior to take-off. In some cases where full static power cannot be held against the brakes, this may be recorded by an FTE/FTO during the take-off run. Although the Functioning Checks are sequenced later in the flight in the appropriate Check Flight Schedule, it may be prudent to conduct them at an early stage, for example during the cruise to an appropriate area for the performance climb. In cases where repair or maintenance has concentrated upon the flying controls, consideration should be given to conducting this check within the immediate vicinity of the airfield as soon as possible after take-off.

Climb

9.5 In general, the performance climb should be conducted as close as possible to MTOW; consequently the performance climb should be initiated as soon as possible after take-off and be carried out in smooth air, clear of cloud and away from terrain that may produce wave action. In certain circumstances where data confirmation is required or performance is suspect, it may be prudent to conduct a "reciprocal" pair of climbs in opposite directions and (ideally) across the prevailing wind. Since the climb data presented in the AFM will be referenced to pressure altitude, it is essential that pilots remember to set Standard Pressure Setting (1013) prior to recording data, thus ensuring that recorded altitude data may be directly compared with that presented in the AFM. Furthermore, it is essential that the conditions referenced in the AFM for the climb are adhered to with the correct setting of RPM, manifold pressure (MAP) and flap/cowl flap setting, (also ensuring that carburettor heat is selected to full cold). Recording the climb data should not be started until the aircraft is established in the climb at the correct speed and configuration. It is important that climb weight be determined; however, many aircraft fuel gauges are not sufficiently accurate for this purpose; consequently a good rule-of-thumb for calculating climb weight is subtract the fuel used since take-off, which may be estimated as approximately 1/2 lb/HP/hr. The climb should be made on a constant heading and with the IAS maintained to within +/-2 knots or mph of the target speed.

9.6 For twin-engine aircraft, the climb should not be carried out below the minimum safety height of 3000 ft AGL and the aircraft must be trimmed in all three axes to reduce control forces to the minimum. Up to 5 degrees of bank angle may be applied to reduce the required rudder input, and hence drag. This will imply acceptance of a small sideslip angle, (slip ball not centred). Note, however, that the climb technique for some aircraft types specifies a wings level climb. Most light twin aircraft exhibit fairly poor single-engine climb performance at or near MTOW; consequently, it is important to thoroughly check performance data in the AFM to predict an approximate climb rate for the ambient conditions to be checked and only consider conditions that result in an identifiable and positive rate of climb. Should an aircraft exhibit negative climb performance, (i.e. a descent), when set to the correct speed and configuration, the climb should be abandoned. Furthermore, some older, vintage twins are known to have negative climb performance on one engine. Consequently these aircraft should not be checked in the single-engine configuration and data should be obtained from an all-engines climb instead.

Cruise Check

9.7 For single-engine aircraft it is usually practical to conduct the cruise check immediately following the climb and is simply a case of selecting straight and level attitude from the climb attitude and remaining at full power until the aircraft IAS stabilizes, noting the altitude, OAT and engine parameters.

Stalling

9.8 Stalling should be carried out well above the ground. For the very light aircraft 3000 ft agl is a recommended minimum height for completion of the recovery. For all other aircraft 5000 ft agl is recommended for completion of the recovery.

9.9 The ac should be trimmed at idle power at 1.5 x scheduled stall speed for each configuration following which the aircraft should be flown straight, (wings level, slip ball in the centre), and reducing IAS at a constant rate of 1 knot or 1 mph per second. The rate of descent that results from the above procedure should be accepted and speed should continue to be reduced until either a clear nose drop occurs or until full back stick is reached. In either case the minimum speed should be noted before recovery. Any tendency for a wing drop at the stall should be contained primarily with aileron assisted by rudder, unless the POH/AFM contains advice to the contrary. For Check-Flight purposes a wing drop is acceptable up to 20° angle of bank. Stalling should be abandoned for the particular configuration if an aircraft exhibits any tendency to exceed this bank angle or adopt any unusual attitude. It is normal to continue with the other configurations to see if they exhibit similar characteristics. However, once a configuration fails the stall test do not keep pushing further into the stall. Stop and recheck the weight and configuration before deciding how to proceed. If everything looks correct move on to the next configuration.

9.10 The speed at which the stall warning occurs and the speed at which the stall occurs should be noted. It may be necessary to repeat the stalls several times to acquire accurate data.

Recovering from the Stall

9.11 It should be remembered that this is not a training stall that is taught to enable a pilot to recover from an inadvertent stall close to the ground. In such an occasion it is important to roll wings level and use full power to get away from the ground. For Check Flights the aim is to find when the wing gives up its lifting capability. At all times the recovery should be started well above the ground, (at least 3000 ft), and therefore power need not be used for the recovery. The best technique to use is to ‘break’ the stall by moving the stick gently forward and then applying power as flying speed is achieved.

9.12 Should the aircraft drop a wing violently the correct recovery technique is to ease the stick in the direction of the nose and or wing drop to eventually gain flying speed – this should be done very gently. Once flying speed has been achieved, roll to the nearest horizon and then gently ease out of any ensuing dive. Power can be added gently during the dive recovery. Be careful if the flaps and/or undercarriage are down and try to get them up before their limiting speed. However, do not overstress the aircraft in “g” while trying to arrest the speed increase. It is usually better to have a speed overstress than a “g” overstress!

NOTE: Unless specifically required for continued flight above transition altitude, it is important to remember to re-set QNH following the setting of Standard Pressure Setting for the climb. Clearly this is most important prior to the Vne dive.

Spinning

9.13 All aircraft on the UK Register cleared for aerobatics or spinning are required to have their spin characteristics checked. Consequently, a 2-turn spin is flown in each direction. A minimum height of 4000 ft agl is recommended for the start of the recovery. A full seat harness or a diagonal shoulder strap must be fitted, as required by ANO Schedule 4, Scale B. Spinning should be planned before the flight and a parachute worn. It is important to note that the weight /cg envelope may be restricted for the purposes of spinning and this may require a separate flight following a change to the aircraft’s loading. If spinning cannot be carried out during the Check Flight it is acceptable to check the spin characteristics on a separate flight within 10 flying hours, and make an appropriate entry in the Schedule or add a separate spin check certificate.

Flight to Vne

9.14 For this check, the pilot should adopt a flight path that will result in the speed slowly and progressively increasing to Vne with a readiness to abandon the check immediately if any unusual characteristic should occur. Ideally, because of the height loss typically incurred, the check should not be started below 5000 ft. The observer should watch, wherever possible, ailerons and tailplane for vibration. If vibration, buffet, control buzz or any other unusual characteristics are felt, the throttle should be closed and the nose should be gently raised to reduce airspeed. On fixed pitch propeller aircraft, care should be taken not to exceed the maximum permissible rpm; should the max rpm occur at idle power before the published Vne figure is achieved, the dive should be abandoned and the fault investigated. On variable-pitch propeller-aircraft it is prudent to reduce rpm by approximately 200 rpm to allow for any fluctuation of the constant speed unit at Vne or during the subsequent recovery. When accelerating to Vne it may be necessary to adjust the throttle and steepen the angle of descent to compensate for the reduction in power.

Functioning Checks

9.15 The formal functioning of the primary flying controls may be conducted at any convenient point during the flight; however, initial checking immediately once safely airborne is required. In most cases the aerodynamic effects of the flap may be assessed during the stall sequence. In addition, the timing of powered services may be assessed during the configuration changes in preparation for the stalls. Should this be inconvenient, the powered services may be assessed at any convenient point in the flight. Furthermore, the functionality of all other aircraft systems is usually conducted concurrent with flight progress. However, special consideration should be given to the following systems:

1. Fuel System. A comprehensive understanding of the fuel system is required prior to the selection of the various permutations required in the Check Flight Schedule. This is particularly important when considering a multi-engine fuel system and crossfeed system.
2. Electrical System. When loading the aircraft electrical system, care must be taken to ensure that the load remains within system limits. For multi-engine aircraft, single unit limitations must be observed

during load transfers for check purposes. In general, two conditions exist for recording generator charge rate:

a) The ammeter is indicating the ability of the system to supply the load and charge the battery, in which case the ammeter indication is likely to be near 0 amps (a small positive charge to the battery).

b) The ammeter is indicating the selected load current.

3. Landing Gear. The emergency extension of the landing gear needs careful consideration. This is best discussed with the nominated engineer and should not be conducted without his/her approval. A checklist for conducting the check should be agreed between the crew and ground engineers prior to flight. In flight, the movement of the emergency extension manual mechanism must be treated with caution since its movement may be affected by the air load on the landing gear, which may affect the physical movement of the lever in the aircraft with the possibility of injury to the operator. Where the operation of the emergency system is not reversible in the air, (typically "blow-down" systems using compressed air), it should not be activated as part of a CAA required Check Flight. If possible, try to check any emergency system close to home base just in case it cannot be brought back in/up.

Post Flight

9.16 Post flight, a comprehensive check should be made that all cockpit placards are in place. In addition, a check should be made of the correct functioning of cockpit and other lighting.

Result analysis and tolerances are contained in Chapter 11 of this Handbook.

APPENDIX E

List of Documents Required Prior to Conduct of a Check Flight

E1 Certificate of Registration.

E2 Either:

1. C of A (and ARC) or Permit to Fly (if in date); or
2. EASA Permit to Test, Certificate of Fitness for Flight (under A -Conditions) or a National Permit to Test.

E3 Aircraft Flight Manual (or POH), including appropriate UK Supplements if applicable.

E4 Weight and Balance Statement.

E5 Radio Station Licence and Certificate of Approval.

E6 Noise Certificate.

E7 Certificate of Insurance.

E8 Either:

1. Aircraft Technical Log; or
2. Logbook for Aircraft/Engine/Propeller.

APPENDIX F

Example Kneeboard Schedule

Aircraft		G-	
Weight		CG	
Engineering Co:		Af Hrs Eng Hrs:	
History: C of A. ARC, Permit			
Field:	EG	Elev:	Freq:
Rwy	wind	QFE	QNH
OAT	Vis	Cloud	
ATIS:			
Block ON Block OFF Block Total:		Flt land Flt t/o Flt Total	
elev	Ail	Rudd	Trim
throt	prop	Mixt	carb air
trims	flaps	Brakes	Steer
Pwr chk rpm MaxRpm:	L mag	R Mag	Carb Air
Full Pwr brakes y/ n rpm	MAP	Fuel Press	CHT
Config		Vr / Vu	Stall warn Y / N
Flap Lim	Uo - t/o	t/o - dwn	Trim
	dwn - t/o	t/o - up	
normal Gear Gear Lim	Up - dwn	dwn - up	warn, MAP/rpm
Emerg Gear	Up-dwn	dwn - up	manoeuvre y / n
Elect system			
Fuel system			
Controls	E	A	R

CLIMB	Vy	flap/cowls/etc	
	Climb 1	OAT	Climb 2
0			
0.5			
1			
1.5			
2			
2.5			
3			
3.5			
4			
4.5			
5			
Rpm	MAP	CHT	Fuel press
Oil T	Oil P		
Vh	Rpm	MAP	Vacuum
Vne (plac)	Vne (Ach)	Trim	comment
Config			
Schedule			
Trim IAS (1.5)			
Warning IAS			
Warn Type			
Vs			
sequence			
full back stick?			
° of wing drop			

Left	Right
spiral/spin	spiral/spin
IAS/ alt	IAS/alt

CHAPTER 10

Conduct of Check Flights on Vintage and Ex-Military Aeroplanes

Introduction

10.1 Vintage and ex-military aeroplanes generally fly under a National Permit to Fly and there may be varying degrees of design organisation airworthiness support; the CAA may issue the National Permit to Fly based upon a 'good Service history' and an initial Check Flight coupled to management control of airworthiness by an approved organisation. The CAA does have the responsibility for ensuring that, albeit with limited exposure to the build standard of the aircraft, safety is maintained. This is in the main part achieved by the confidence gained by performing an initial comprehensive Check Flight, namely Check Flight Schedule 233, followed by a programme of continued Check Flights. Note that Schedule 233 is in generic form and may only be used on an individual aircraft basis following agreement with the CAA. Any subsequent decision to perform a Check Flight Schedule 233 MUST have a completely new and separate briefing by a CAA Airworthiness Test Pilot. It is not acceptable to perform further Schedule 233 Check Flights because you had been briefed to perform one in the past! In real terms this amounts to a relatively small intervention by the CAA while gaining a reasonable level of confidence about the safety of individual aircraft.

Check Flight Schedules

10.2 All Check Flights must be conducted in accordance with either the appropriate Check Flight Schedule published by the CAA or to a schedule approved by the CAA. For ex-military aircraft on the UK register, the pilot must observe any limitations stated on the Permit to Fly for that aircraft and to notify the CAA where this results in a conflict with the Schedule.

10.3 As previously noted in Chapter 5, the CAA has removed many of its CFS from the CAA website. The CAA agreed generic schedules used on Annex II aircraft, e.g. CFS 2 for single-engine piston aircraft, are still be available on the website. If a non-generic CFS is planned to be used, the CFS must be agreed by the CAA.

Check Flight Schedule 233

10.4 Check Flight Schedule 233 was specifically designed to cater for the limited design organisation support and limited knowledge of the airworthiness build standard of Private Ex-military and Vintage fixed wing aircraft. It should only be used for Series Check Flights and Permit Renewals following a substantial rebuild, (normally at least one or two 'shakedown' flights should be performed first by the Applicant). Check Flight Schedule 233 has the specific aim of providing the CAA with sufficient confidence in the safety of the aircraft to allow the said aircraft to fly in UK Airspace. The Schedule attempts to establish that the aircraft has satisfactory handling qualities by acting as a qualitative assessment of the aircraft.

Check Flight Schedule for Renewal Check Flights

10.5 Check Flights conducted for the purpose of renewing National C of A, a National ARC or C of V, other than those cases covered by paragraph 10.3 above, are no longer mandated by CAA. Consequently, the responsibility for deciding when a Check Flight is necessary, as part of the continuing airworthiness assurance process of the aircraft, now falls upon the aircraft pilot-owner, maintainer or CAMO (as applicable). Guidance to assist in this decision making process should consider the same parameters as for other aircraft.

10.6 When it is decided that a Check Flight is required, it should be conducted in accordance with a Check Flight Schedule agreed by CAA (see paragraph 10.3).

Check Flight Pilot Qualifications

10.7 For administrative convenience, the vintage and ex-military aircraft are divided into 3 classes; single engine propeller, single engine jet and multi engine types. The experience level applicable to each class is given in paragraphs10.8 to 10.10 below.

Experience Requirements: Single Engine Propeller Aircraft

10.8 The Pilot should have a minimum of 50 hours on medium (Harvard or similar), to large (Spitfire or similar), Vintage or Ex-military (tail wheel) propeller aircraft. In the case of air checking the larger propeller aircraft the 50 hours' minimum should include at least 20 hours on the larger propeller aircraft. For aircraft types not flown previously by the Pilot, in addition to the above, a thorough briefing by the owner or type-qualified pilot is required before the Check Flight is performed, this should, wherever possible, be immediately prior to the Check Flight. If the aircraft has more than one seat, a type-qualified pilot should be taken on the flight if at all possible.

Experience Requirements: Single Engine Jet Aircraft

10.9 The Pilot should normally be ex-military fast-jet qualified with at least 100 hours' first pilot on such aircraft. For aircraft types not previously flown, the guidelines above should be followed. For aircraft with assisted escape systems, a thorough briefing of the design and operating characteristics must also be obtained. A good understanding of the performance limitations and requirements of the type and the escape system is necessary before embarking on a Check Flight. This is particularly true with the swept wing types. Any ancillary stopping devices, such as braking parachutes should not normally be relied upon when calculating the take-off and landing distance requirements and the techniques to be used.

Experience Requirements: Multi Engine Aircraft

10.10 Because of the problems associated with the older twin aircraft under asymmetric conditions, it is of vital importance that the Pilot has appropriate experience. This experience must have been gained on representative types of aircraft, such as the Canberra or Anson. Such experience must include a significant exposure to asymmetric handling and performance. A minimum of 50 hours on this Class of aircraft is required.

Checks Conducted in accordance with Check Flight Schedule 233

10.11 Checks conducted in accordance with Check Flight Schedule 233 are more demanding than those required for routine Check Flights and require adequate knowledge of the techniques and consequences thereof. Therefore, a CAA test pilot will normally carry out such checks. However, by mutual agreement, the aircraft owner or his/her representative may be authorised to perform a one-off Schedule 233 Check Flight, but the Authority retains the right to participate in a representative number of Check Flight Schedule 233 flights. All non-CAA pilots carrying out such checks must be specifically approved by the

Authority and, in all cases, the approval process will include a briefing by a CAA test pilot for each and every time Schedule 233 is used. When considering suitability of non-CAA pilots, the general qualification levels indicated in Chapter 3 of this Handbook are not applicable to Check Flight Schedule 233 and the requirements in paragraph 3 above should be used as guidelines.

Weather and Operating Limits

10.12 Permit aircraft must be flown in day, VFR conditions. However, for flights in a new type where a type-qualified person cannot be carried in a second seat, (with appropriate flying controls), more stringent weather limits should be applied. For tail wheel propeller aircraft the crosswind should be kept to a minimum and, depending on the type, may be as little as 5 knots. Tailwinds must be avoided. Runway length is also a large consideration on any first flight in an unfamiliar aircraft and should always allow a significant margin over and above the notional minimum requirements. Be aware of grass strips; some aircraft need them but when damp, take-off and landing runs can be considerably lengthened. First flights in new jet aircraft types should also be by a suitable crosswind limit but it is generally less critical. However, some are particularly sensitive to wet runways and the consequent increase in landing distance. A general rule for the first flight in a new type should be a dry runway with a length where possible of double the AFM landing distance figure. Be aware that for the deployment of braking parachutes different crosswind limits often apply.

Safety Equipment

10.13 It is mandatory for CAA Test Pilots to wear a protective helmet together with a parachute and if the flight is over water, a life jacket, when performing Check Flights on high performance Vintage and Ex-military aircraft and it is strongly recommended that any other persons carrying out such Checks do the same. A check for serviceability of any 'onboard' safety equipment, including escape systems, should be made before flight. For optimum protection against cockpit fire hazards, the wearing of a NOMEX coverall is, again, strongly recommended. For flight over large expanses of water, the wearing of immersion suits is recommended. All flying clothing and safety equipment used by Pilots should be regularly checked and records of such checks kept.

Currency Requirements

10.14 Cost and limited availability of flying on these types can be a problem when considering pilot recency. However, experience in the Vintage and ex-military arena indicates that long gaps between flights on appropriate types are acceptable if the individual has sufficient previous experience. For instance, most display pilots will not fly a particular Class of aircraft over the winter months and although clearly not optimal, experience has shown that this situation can be managed safely. However, it would be prudent to spend some time at the start of a flight, in an aircraft Class not flown for some time, to refamiliarise oneself with the handling qualities before proceeding to perform the Check Flight; such re-familiarisation should include, wherever possible, a review of handling and performance following engine failure. It may be similarly prudent to perform a practice approach before the final landing. To give a reasonable level of currency on the medium to large propeller aircraft, a minimum of five flights in the past 12 months or one flight in the previous 30 days on this Class is recommended before flying solo on such aircraft. The jet aircraft are generally less technique dependent and three flights/one flight in the last 12/1 month(s) respectively is considered a suitable minimum. For asymmetric training, with the previous background requirements described above, and provided that the pilot receives regular exposure to asymmetric flying theory and practice then no extra training on the particular class of aircraft may be required; however, the wishes of the individual must always be respected in this area.

Conclusions

10.15 The Ex-military and Vintage aircraft world offers a unique set of challenges in the types of aircraft used and in their safe operation. Pilots must be appropriately qualified and prepared before undertaking Check Flights on such aircraft and the weather conditions for each flight should be carefully considered. It is imperative that all emergency systems, safety equipment, flying clothing and stopping devices are fully understood as well as fully checked.

10.16 The flight checking of vintage and ex-military aircraft demands a degree of skill and knowledge above that needed for more common types; such demand means that the check will either be done by CAA test pilots or by individuals specifically selected and briefed for the task. Elective Check Flights, being less demanding than initial issue Check Flight (CFS

233), will normally be performed by the owner/operator unless a pilot briefing is required.

CHAPTER 11

Conduct of Check Flights on Light Gyroplanes

Introduction

11.1 The conduct of a light gyroplane Check Flight will always commence with a check of the aircraft documentation and as a minimum the documents listed in Appendix A must be available and in date. It is a good principle to determine the weight and balance at the earliest opportunity in order to provide a reasonable amount of time for these requirements to be satisfied and ensure that the aircraft is correctly prepared for the Check Flight. In general it is quite acceptable that a Flight Test Engineer (FTE) or Flight Test Observer (FTO) be carried on a suitable 2 seat aircraft; however, this is not always possible and it is therefore imperative that suitable recording methods be determined before flight. It may be impractical to record results directly onto the Check Flight Schedule in flight; consequently, a kneeboard alternative may be preferred and from which the data may be transcribed during post flight analysis. An example kneeboard schedule is offered at Appendix H.

External/Internal Check

11.2 Vigilant internal and external checks are required with particular attention paid to the rotor system and pre-rotator mechanism. All seat straps/harnesses must be checked for functionality. In addition, where fitted, the securing mechanism for the cabin fire extinguisher must be checked for security.

Taxying and Engine Run-up Checks

11.3 The aircraft brakes should be checked at the earliest opportunity and, where fitted, the second occupant's brakes should be checked and compared to the captain's brakes for effectiveness. In addition, where fitted, the effectiveness of rudder pedal steering should be assessed. The effectiveness of the parking brake may be assessed during the power check, when the parking brake should be capable of holding the aircraft stationary. In general, engine run-up should be carried out prior to spinning up the rotors. If a quoted minimum static rpm is available conducting the engine run up cross wind will minimise the effect of wind through the prop. Engine checks should be conducted at the rpm recommended by the engine or aircraft manufacturer and annotated on the schedule.

Take-off and Landing

11.4 Where fitted the pre-rotator should be assessed for its effectiveness in accordance with guidance in the flight manual. If no such guidance is available the pre-rotation technique and max engine and rotor rpm achieved should be recorded on the Check Flight Schedule (General comments). The aircraft should be flown as closely as possible to the take-off and landing speeds specified in the designated Manual. There should be no difficulties in controlling the aircraft at these speeds. The approach should be flown at a low power setting and the landing conducted with idle power set. The undercarriage should be assessed to ensure the touch down is not too firm and that there is no tendency to roll over once the nose wheel is in contact with the ground.

Climb

11.5 In general, the performance climb should be conducted as close as possible to MTOW; consequently the performance climb should be initiated as soon as possible after take-off and be carried out in smooth air, clear of cloud and away from terrain that may produce wave action. In certain circumstances where data confirmation is required or performance is suspect, it may be prudent to conduct a "reciprocal" pair of climbs in opposite directions and (ideally) across the prevailing wind. Since any climb data available will be referenced to pressure altitude, it is essential that pilots remember to set Standard Pressure Setting (1013) prior to recording data, thus ensuring that recorded altitude data may be directly compared with that presented in the aircraft documentation or on previous Check Flights. Furthermore, it is essential that the aircraft is climbed at the same speed as itemised in the flight manual or schedule. Recording the climb data should not be started until the aircraft is established in the climb at the correct speed and configuration. It is important that climb weight be determined; however, many aircraft fuel gauges are not sufficiently accurate for this purpose; consequently a good rule-of-thumb for calculating climb weight is subtract the estimated fuel used since take-off. Normal practice is to climb for a minimum period of 3 minutes in order to be able to "smooth" the results to allow for light turbulence. A simple climb from 500 ft to 2000 ft might be acceptable but only if the performance data gathered clearly demonstrates the aircraft is climbing much better than scheduled.

Cruise Check

11.6 The cruise check may be conducted at any convenient stage during the flight and is simply a case of selecting a suitable cruise power and maintaining stable level flight and recording the data asked for within the schedule.

Steep Turns

11.7 The aircraft should be rolled into a turn and power added in an attempt to maintain height and speed. On a low power aircraft full power may be required. The AOB used should not cause the aircraft to descend or slow below its Vy. Typically around 40-50 degrees would be expected. During the turn an aft stick force should be required. Note the control position and/or force experienced and any unusual vibration. Note whether the aircraft's roll response is as crisp as you would expect or not. Record bank angle used and "g" experienced if a "g" meter is fitted.

Minimum Speed

11.8 A peculiarity of Gyroplanes is their ability to fly slowly under control without any of the obvious aerodynamic characteristics of a light fixed wing aircraft. It is important to be able to assess the minimum speed the aircraft can be flown in level flight (Vmc (power-on)). In conventional pusher types this will require full engine power and a very gradual deceleration to the point where any further slowing would cause the aircraft to descend. (On some types this speed may have been determined by controllability rather than performance issues). In practice it can take some time in calm air to determine this test point.

Descent at Idle Power

11.9 It is important to be able to assess how the aircraft would perform following an engine failure. This is best assessed safely by flying the aircraft with idle power set. The test should be commenced from not below 2000 ft agl over a suitable landing area should the engine stop during the test. A full power recovery should be achieved by 500 ft agl. During the descent the aircraft should be flown at the recommended airspeed with turns left and right at up to 30 degrees AOB. Rotor rpm should be noted along with vibration levels IAS, engine rpm and any handling issues. On satisfactory completion of this test Descent at V MC(Power Off) should be investigated by descending with the engine at idle power. The aircraft should be initially set up in an idle power descent as above and then carefully slowed to the quoted V MC(Power Off) As the aircraft is slowed satisfactory yaw control should be demonstrated. On completion of the test and not below 1000 ft agl the aircraft should be accelerated and engine power progressively increased to ensure a normal power on climb has been established not below 500 ft agl.

Flight to Vne

11.10 For this check, the pilot should adopt a flight path that will result in the speed slowly and progressively increasing to Vne with a readiness to abandon the check immediately if any unusual characteristic should occur. Ideally, because of the height loss typically incurred, the check should not be started below 2000 ft agl. The pilot should note engine rpm and be prepared to progressively close the throttle to prevent any risk of prop overspeed. As Vne is approached small control inputs should be used to roll up to 10° AOB. If unusual/excessive vibration, or any other unusual characteristics are felt, the throttle should be closed and the nose should be gently raised to reduce airspeed. Care should be taken not to exceed the maximum permissible engine or rotor rpm. Should the max engine rpm occur at idle power before the published Vne figure is achieved, the dive should be abandoned and the fault investigated.

Functioning Checks

11.11 The formal functioning of the primary flying controls may be conducted at any convenient point during the flight; however, an initial check should be conducted as soon as safely airborne. Furthermore, the functionality of all other aircraft systems is usually conducted concurrent with flight progress. However, special consideration should be given to the following systems:

1. Fuel System. A good understanding of the fuel system is required prior to the CFS.
2. Electrical System. It is unlikely that the aircraft will be fitted with much in the way of electrical systems but the generator should cope with full possible load and all gauges, instruments and avionics should fulfil their intended function.

Post Flight

11.12 Post flight, a comprehensive check should be made against the flight manual that all cockpit placards are in place. In addition, a check should be made of the correct functioning of cockpit and other lighting. Data gathered should be compared with the flight manual or the previous Check Flight data if available. The aircraft should climb within 70 ft/min of scheduled data. Tech 8 should be referred to with regard to data analysis.

APPENDIX G

List of Documents Required Prior to Conduct of a Check Flight

G1 Certificate of Registration.

G2 Either:

1. Permit to Fly (if in date); or
2. EASA Permit to Test, Certificate of Fitness for Flight (under A -Conditions) or a National Permit to Test.

G3 Aircraft Flight Manual (or POH), including appropriate UK Supplements if applicable.

G4 Weight and Balance Statement.

G5 Radio Station Licence and Certificate of Approval (If specifically required).

G6 Certificate of Insurance.

G7 Either:

1. Aircraft Technical Log; or
2. Logbook for Aircraft/Engine/Propeller.

APPENDIX H

Example Kneeboard Schedule

Aircraft		G-	
Weight		CG	
Engineering Co:		Af Hrs Eng Hrs:	
History: C of A. ARC, Permit			
Field:	EG	Elev:	Freq:
Rwy	wind	QFE	QNH
OAT	Vis	Cloud	
ATIS:			
Block ON Block OFF Block Total:		Flt land Flt t/o Flt Total	
Cyclic		Rudd	
throt		Mixt	carb air
trims		Brakes	Steer
Pwr chk rpm MaxRpm:	L mag	R Mag	Carb Air
Full Pwr brakes y/ n rpm	MAP	Fuel Press	CHT
Pre Rotate	Max Engine rpm	Max Nr	
Elect system			
Fuel system			
Controls			

CHAPTER 12

The Radio Air Check

Introduction

12.1 The basis for the radio air check originated with the Post Office as a requirement to certify a broadcasting station and since an aircraft may be designated as such there is a need to certify the aircraft as a broadcasting station on behalf of the Radio Standards Agency. Consequently the CAA undertakes this work on behalf of the third party. Individually the radio components that comprise the broadcasting station are subject to specific airworthiness requirements, which are the responsibility of the CAA.

Check Flight Schedule

12.2 CFS No 232 at Issue 1 is the basis for conducting the Check Flight and is required to be completed concurrently with the initial issue of an aircraft C of A. Continued assessment is not required during the life of the aircraft (broadcasting station); however, a radio air check may be called for by a certified engineer any time deemed necessary to establish the airworthiness or functioning integrity of the installed equipment.

12.3 Any checks carried out on the ground should be with the hatches/ canopy closed and the engine(s) operating.

Communication

Intercom

12.4 The intercom function will be continuously subject to a quality check when the check is conducted with two pilots/crew; however, should this not be the case, an independent system check is required. Where more crew positions are fitted, they will also require checking and the functionality of any associated switching will need to be checked. Since the intercom is not part of the broadcast station, its failure does not compromise the Radio Flight Check.

VHF Communication

12.5 Initial quality and serviceability of the VHF communication radios may be checked on the ground with ATC; however, for Check Flight purposes the radios must be checked at 2000 ft, 20 Nm from a ground station and the serviceability and quality of the signal confirmed. For aircraft equipped with 2 pilot positions, the Check should be repeated from the second pilot position. If fitted, HF communication may be checked at any stage during the flight, together with a check of the SELCAL facility (if fitted).

Navigation AIDS

VOR/ADF

12.6 Navigation aid assessment is best made by comparing radial/distances with a known ground feature. By plotting the radial/DME of the feature before departure and then placing the aircraft directly overhead, the accuracy of the equipment may be interpreted. Ideally, the check should also encompass the DME measurement of a TACAN station if possible. Displayed VOR bearing should be within ± 6° of true and ADF bearings within ± 5° to a distance not less than the declared service range of the ground station.

ILS

12.7 Both the localiser and glide path signals require checking for correct deflection; however, it is not necessary to complete a full ILS and the Check may be accomplished at a suitable range from a known facility. Markers may be checked by over-flying an airfield at altitude or by completing the full ILS procedure and over-flying the beacons. It is important to assess the switching and associated lighting to ensure that the correct facility is displayed in the desired navigational display. Note that the ILS localiser should be available at ranges up to 25 nm and the Glide slope to 15 nm from the ground station. The received signal should be reliable in climb and descents as well as with a bank angle associated with a Rate 1 turn.

Area Navigation

12.8 Any RNAV equipment fitted should be assessed for accuracy, and may be completed with the VOR/DME check over a known ground feature.

Miscellaneous

Transponder

12.9 A transponder check should be combined with a Mode-C encoding altimeter check, (if fitted), by making a check call to an airspace radar unit. This should be completed at 2000 ft above, and 20 Nm from, a known radar facility.

Defects

12.10 Any system defects should be recorded on the defect log of the Schedule and transcribed to the aircraft's technical log for rectification. The assessing pilot signs to confirm the functionality of the radio equipment to his satisfaction and the Schedule is passed to the nominated engineer for inclusion with the CFS, both of which are passed to the Area Office prior to the issue of a C of A.

CHAPTER 13

Performance Analysis Fixed Wing Aircraft

Introduction

13.1 This Chapter gives guidance on determination of the achieved rate of climb and its acceptability relative to scheduled levels. The data against which the results should be assessed is contained in the aircraft's UK Flight Manual if applicable, either in the basic performance data or a Supplement. If this data is not in the AFM, contact CAA Airworthiness for further guidance.

Interpretation of Results

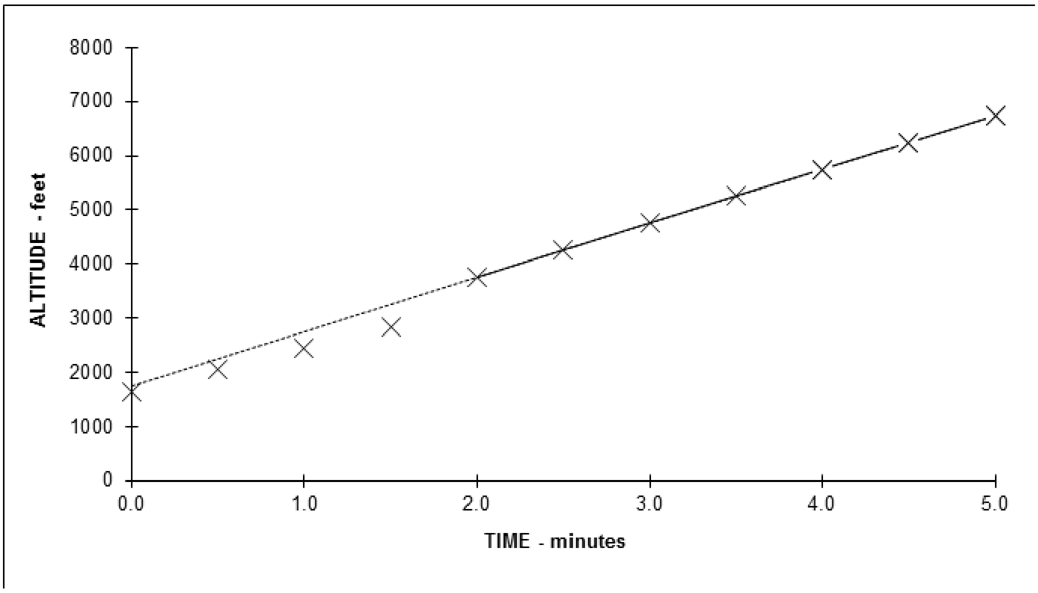
Calculation of Rate of Climb

13.2 It is good practice to take a "quick look" at the performance results whilst still airborne and for this first assessment of the achieved performance it is acceptable to subtract the pressure altitude at the start of the climb from the pressure altitude at the end of the climb and divide by the total climb time. This will not give a completely accurate result but is used to provide a gross error check; this may catch inadvertent errors in methodology such as incorrect configuration, engine or propeller settings and may permit the climb to be re-flown correctly at the time, thus avoiding the need for a subsequent re-fly.

13.3 The graphical method (shown later) of determining the average rate of climb is the only acceptable means for the final calculation. This method should allow 'rogue' data points to be discovered and eliminated from the determination of rate of climb and gives a clear picture of the quality of the climb, which may be difficult to see from an inspection of a table of results.

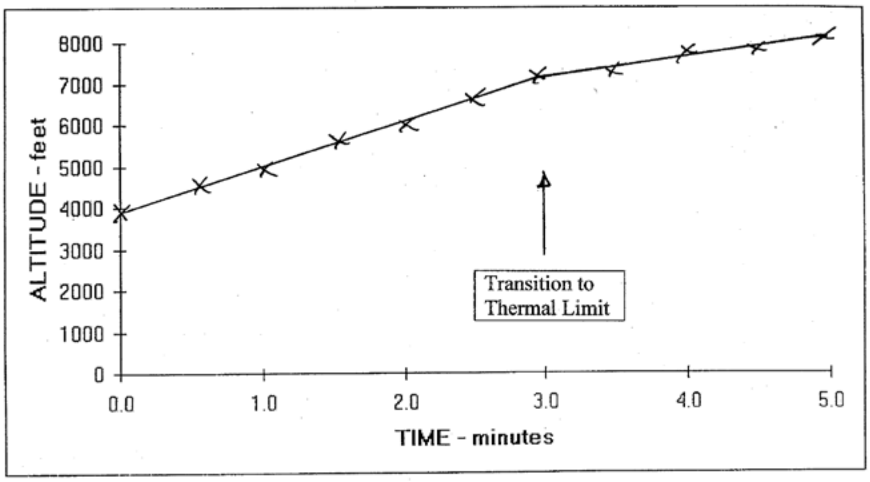
13.4 If some of the data is suspect, it may be neither necessary nor advisable to use all of a climb to determine the average rate of climb; this is illustrated in figure 1. In the example, the first 4 measurements in the climb are of poor quality, e.g., because the climb was started at a speed below schedule and the aircraft being accelerated to regain the correct climb speed. This could be allowed for by ignoring the first 4 points and a line drawn through the remaining part of the climb, as shown. Similarly, a temperature inversion near the end of the climb that reduced the climb rate could be eliminated. After eliminating known rogue or suspect data, the average ROC line should be drawn by 'eyeball averaging' and usually will not connect up every data point. Note that in order to ensure that variations to climb rate are averaged out to an acceptable extent, calculation of performance should not normally be made on data recorded over a period of less than 3 minutes. However, be careful not to reject apparently anomalous data without good reason or to suit a pre-conceived view of the outcome.

Figure 1: Elimination of invalid data



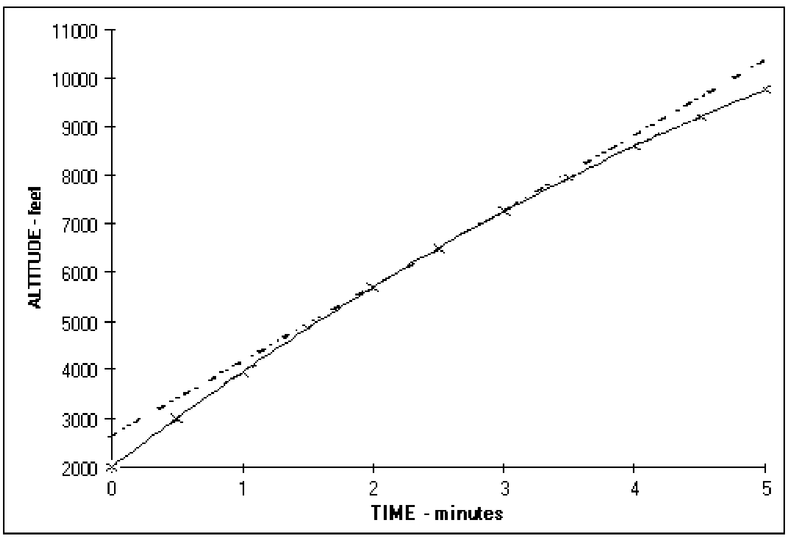
13.5 If the aircraft starts the climb with engine(s) operating on a mechanical limit, (e.g. torque), and at some point during the climb the engine(s) commence to operate on a temperature limit, then a kink in the climb graph may result. This is best avoided by carrying out the entire climb below or above the critical altitude/temperature. If this is not possible then only the portion of the climb above or below the "kink" should be used in determining the ROC and this portion compared with the relevant flight manual data. Alternatively, analyse both segments of the climb and average the results. However, careful study of the AFM before flight should enable the pilot to identify altitude/temperature combinations where this effect is likely to be a problem and thus enable the flight to be planned to avoid such areas. For reference, this effect is shown in Figure 2.

Figure 2: Transition from a mechanical to a thermal limit



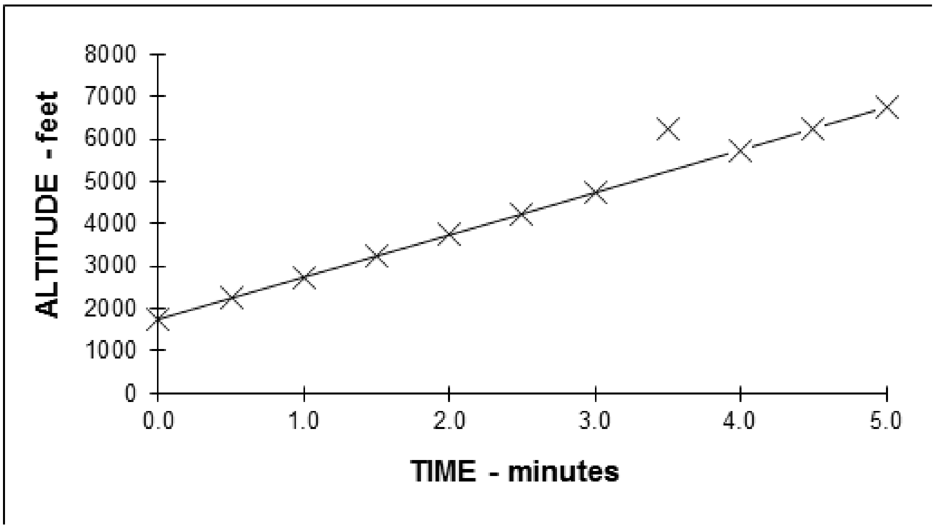
13.6 If the engine is operating on a thermodynamic limit throughout the climb then the pressure altitude versus time graph may show as a curve, i.e. rate of climb will reduce with height; in this case, a tangent to the curve could be drawn at the mid-climb point and used to calculate the rate of climb (see Figure 3). However, note that this effect is typically not very pronounced other than when the achieved climb rates are high and it is often more satisfactory to use the 'straight line' method to draw the achieved performance line.

Figure 3 Use of a tangent for calculation of performance



13.7 Occasionally, when plotting a performance climb, a "rogue" point will show up, (i.e. it lies well off the line used to join the other data points). This may occur for several reasons, e.g., it may be due to altimeter mis-reading or to thermal lift, etc, but it is important not to dismiss such a point too lightly and in the absence of an explanation, consideration must be given to its inclusion in the performance calculation. However, when the point has been positively identified as "rogue" then no account need be taken of it when drawing the climb line. This is illustrated in Figure 4.

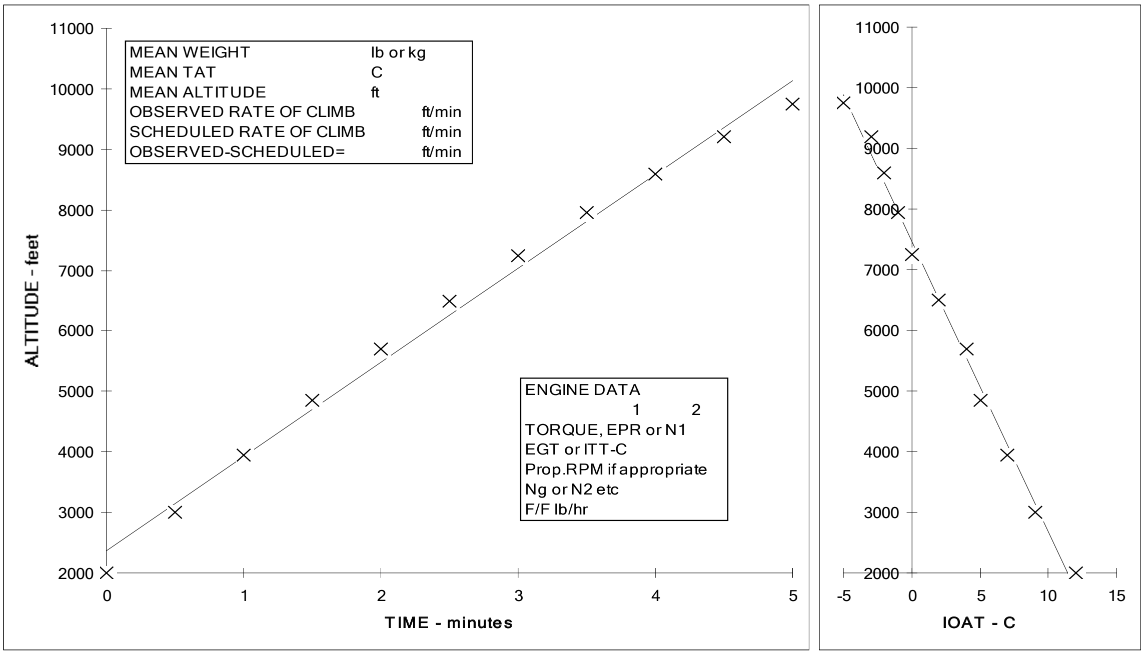
Figure 4 Elimination of rogue data points



Determination of Mean Values for Performance Determination

13.8 The average Check altitude should be read from the graph used to determine average ROC. It is the altitude at the mid-time point of the best line through the climb data, after elimination of any unusable portion(s) of the climb as described above (see Figure 5).

Figure 5 Determination and presentation of climb performance results



13.9 The average outside air temperature can be determined by plotting a graph of OAT versus Altitude and the OAT for the average altitude read off in the same way as for determination of the average altitude. Note that in the scheduling of performance data, various manufacturers use different terminology for temperature and some use a "ram" or "total" temperature while others use a "static" measurement either true or indicated. In all cases, take care to ensure that you are working with the correct temperature parameter and, in particular, be aware that conversion from total to static may be required, in which case there may be a "recovery factor" that needs to be taken into account. Where this is the case, the requirement and methodology should be clearly spelled out in the AFM.

13.10 In general, it is acceptable to calculate the mean weight for the climb by adding the weight at the start of the climb to that at the end of the climb and dividing the result by two.

13.11 Once the average rate of climb and mean weight are known, those, together with the temperature appropriate to the mean altitude, should be compared with that given in the AFM for the same conditions. Where the achieved rate exceeds the scheduled rate, no further action is required. However, should the achieved rate be below the scheduled, then action should be taken in accordance with the information below.

Climb Performance Assessment

13.12 New production aircraft should be capable of achieving their scheduled gross climb performance in normal weather conditions. However, a slight tolerance is acceptable and to that extent, a tolerance of up to minus 40 ft/min is allowed; if that allowance is exceeded, the CAA must be consulted.

13.13 Gross rate of climb is that which an average aircraft is expected to achieve in calm conditions and before any safety factors or decrements are applied. Net rate of climb is that used for calculation of the net flight path and includes the appropriate safety factors. This net data is usually presented as a Gradient and must not be used for climb performance checks unless the Net to Gross margins appropriate to the Certification Requirements are specifically included.

13.14 For continued airworthiness Check Flights and for all second-hand imported aircraft, a negative tolerance in accordance with the values below is permitted to cater for the effects of adverse weather, variable pilot skill and in-service deterioration. These tolerances are not intended to accommodate genuine aircraft performance shortfalls and in all cases where performance appears to be below schedule IT IS IMPORTANT THAT THE CAUSES ARE SOUGHT. The Nominated Person must be satisfied that an aircraft and its power-units are in all relevant respects serviceable and in reasonable condition. Should fleet trends reflect a performance shortfall then rectification action will be pursued. This may result in a correction to scheduled performance, which could have adverse commercial ramifications to operators of affected aircraft types. It is in everyone’s interest to ensure that aircraft operations are based on the highest performance standards and that those can be demonstrated during Check Flights.

13.15 Provided that the engineering organisation and the pilot are satisfied with the condition of the aircraft and its power-units, climb performance results may be accepted if they do not fall below the scheduled rate of climb obtained from the Flight Manual and having allowed for the negative tolerances listed below. However, it is emphasised that these tolerances are applicable to any particular airframe “on the day” and are not intended to permit an aircraft type, considered as a fleet, to fall and remain below the Scheduled value.

13.16 When the achieved climb rate falls below the scheduled value to the extent that it is beyond the applicable climb rate tolerance, the result is unacceptable. In this case, rectification action to address this performance shortfall is mandatory and unless agreed otherwise with the CAA, this should normally be accomplished before further flight for hire or reward takes place. As an interim measure, it may be possible to make a temporary allowance for any performance shortfall by imposing a restriction on operating weight to restore Scheduled Performance to an acceptable level. However, this must not be done without the agreement of CAA Airworthiness.

Climb Rate Tolerances

Airworthiness Check Flights for All Aircraft and Series Check Flights of Second-hand Imported Aircraft

13.17 The following negative tolerances, applicable to individual aircraft, may be applied to scheduled levels to allow for the effects of adverse weather or variable pilot skill. However, a deficit of greater than 40 ft/min is not acceptable unless there is a plausible reason for the increased deficit up to the values given below.

Table 1. Multi-engine Propeller Aircraft

	Take-off Climb (ft/min)	**En-Route (ft/min)**
Not exceeding 5700 kg (see note 1)	70	70 (See Note 2)
Between 5700 kg and 45000 kg (See Note 3)	70	70
Exceeding 45000 kg	120	120

NOTE 1: For aircraft using check climb speeds below 90 KIAS a reduced tolerance of 50 ft/min is applicable. Associated aircraft types include the Islander, Turbine Islander, Trislander, Twin Otter and Skyvan.

NOTE 2: To comply with Schedule 1 to Regulation 8 of the Air Navigation (General) Regulations 2009, on flights for the purpose of Public Transport, twin-engine types in Performance Group E are required to have an engine-out rate of climb not less than 150 ft/min at the take-off weight and ambient conditions if flight on instruments is necessary below the initial safety height. This should be borne in mind when considering acceptability of aircraft with sub-standard performance. Similarly to comply with the EASA Implementing Rules for commercial air operations contained in Commission Regulation (EU) No 965/2012 of 5 October 2012 ('Air Operations'), operations in Performance Class B are required to have minimum climb performance standards. These should be borne in mind when considering the acceptability of aircraft with sub-standard performance.

NOTE 3: For aircraft using check climb speeds below 90 KIAS a reduced tolerance of 60 ft/min is applicable. Associated aircraft types include the de Havilland Dash 8, Fokker F27, Shorts SD3-30 and SD3-60.

Table 2. Multi-engine Turbo-jet and Turbo-fan Aircraft

	Take-off Climb (ft/min)	**En-Route (ft/min)**
Not exceeding 5700 kg (see Note 1)	70	70 (See Note 2)
Between 5700 kg and 20000 kg	80	100
Exceeding 20000 kg (see note 3)	80	120

NOTE 1: For aircraft using check climb speeds below 90 KIAS a reduced tolerance of 50 ft/min is applicable.

NOTE 2: To comply with Air Navigation (General) Regulations 2009 Schedule 1 Regulation 8, on flights for the purpose of Public Transport, twin-engine types in Performance Group E are required to have an engine-out rate of climb not less than 150 ft/min at the take-off weight and ambient conditions if flight on instruments is necessary below the initial safety height. This should be borne in mind when considering acceptability of aircraft with sub-standard performance.

NOTE 3: For those aircraft that conduct a two-engines-inoperative en-route climb the tolerance shall be reduced to 60 ft/min.

Table 3. Single-engine Aircraft

	Take-off Climb (ft/min)	**En-Route (ft/min)**
Not exceeding 5700 kg	70	70 (See Note 1)

NOTE 1: To comply with Air Navigation (General) Regulations 2009, Schedule 1 to Regulation 8, on flights for the purpose of Public Transport, single-engine aeroplanes in Performance Group E are required to have a rate of climb not less than 500 ft/min, (fixed landing gear), or not less than 700 ft/min, (retractable landing gear), at the take-off weight and ambient conditions. This should be borne in mind when considering acceptability of aircraft with sub-standard performance. To comply with the EASA Implementing Rules for commercial air operations contained in Commission Regulation (EU) No 965/2012 of 5 October 2012 ('Air Operations'), operations in Performance Class B are required to have minimum climb performance standards. Depending upon the applicable Operating Regulation, the above points should be borne in mind when considering the acceptability of aircraft with sub-standard performance.

Submission of Climb Rate Results

13.18 The pilot or the Nominated Person has responsibility for ensuring that the climb data analysis is completed accurately and has identified any climb-rate shortfalls outside of the permitted tolerances prescribed in Chapter 12. Should any unacceptable results have been determined then they should be recorded in the technical log as a defect requiring rectification and clearance. Following appropriate rectification, a re-fly will need to be conducted to demonstrate satisfactory performance levels. In cases of difficulty, further advice and assistance may be obtained from CAA Airworthiness (email address: requirements@caa.co.uk).

CHAPTER 14

Post Flight procedures and performance Analysis: Rotorcraft

After Flight

14.1 All defects should be recorded on the Check Flight Certificate even if the necessary rectification action may seem trivial. These lists enable the CAA to identify problems with other rotorcraft of a particular type and so initiate the necessary corrective actions.

14.2 The Check Flight results should be compared with the Flight Manual or others designated on the C of A, and special note should be made of any features that would make the rotorcraft dangerous or unsafe. Generally speaking these include, but are not limited to:

1. Inadequate climb performance;
2. Engine power assurance below scheduled minimum;
3. Engine power limiter set too high or too low;
4. Autorotation RPM too low;
5. Unreliability of seat locking;
6. Any other functional items that bring with them special risks for a particular rotorcraft, having due regard to the work for which the helicopter is certificated.

14.3 Where the observed performance of a rotorcraft is outside the specified limits, the Organisation should ensure that such inspections or repair work as are considered necessary to restore it to an acceptable level are carried out. A further Check Flight should be carried out as necessary, (see also Appendix J).

Interpretation of Results

14.4 The data against which the results should be assessed should be that contained in the Manual designated on the C of A of the rotorcraft.

Performance Climb

General

14.5 The achieved rate of climb is determined from the Check Flight results. A graph of the height climb must be plotted and the best line drawn through the points. This line is then used to calculate the average rate of climb. For some rotorcraft in certain conditions the height versus speed time graph should be a curve, i.e. rate of climb reduces with height. In these cases a tangent to the curve could be drawn at the midclimb point and used to calculate the rate of climb. The achieved rate must be compared with the scheduled rate of climb extracted from the designated Manual, appropriate to the actual aircraft weight, the mean performance climb check altitude and the average outside air temperature at that altitude. The achieved and scheduled rate of climb **must** be recorded on the Check Flight Report. Further information on climb analysis is given in Appendix I.

Acceptability Climb Performance

14.6 When the comparison of achieved rate of climb with scheduled rate of climb is completed, a decision in accordance with the provisions of Appendix J should be made.

Common Causes of Inadequate Climb Performance

14.7 Where the achieved climb performance is not at an acceptable level, the following checklist, which is not necessarily definitive, may be applied in seeking a remedy:

1. General
    - a) Pilot out of practice;
    - b) Weather: turbulence, waves, and temperature inversion.
2. Instruments
    - a) Incorrect reading of IAS (it is easy to confuse, or to substitute, CAS for IAS, or knots for mph);
    - b) Faulty ASI (e.g. leaks, blockages including water, instrument unserviceable);
    - c) Faulty altimeter (including static system);
    - d) Faulty Outside Air Temperature Indicator;

e) Faulty torque meter or manifold pressure gauge (including calibration errors);

f) Faulty gas generator tachometer or turbine inlet temperature gauge;

g) Faulty rotor rpm gauge;

h) Faulty fuel gauge.

3. Weight

a) Unrecorded growth of empty weight;

b) Miscalculation of check weight.

4. Engine

a) Turbine engines: A turbine engine that is not producing its rated power will have a poor power assurance value. This is only relevant to the performance climb if the climb was carried out on an engine limit as opposed to a transmission limit, e.g. turbine temperature limit compared with a torque limit. The causes of torque indicating system inaccuracies must be considered. An over-reading torque meter will result in the power assurance being better than expected but climb performance will be poorer than expected if the climb is performed on the torque limit. An under-reading torque meter will have the opposite effects but bear in mind that in this case, the torque limit for the climb will have been exceeded and maintenance action may be required; it is therefore very important that the issue be accurately reported.

b) Piston Engines: Some causes of power loss with piston engines are given below:

i) Air fuel ratio: Too rich mixture setting;

ii) Preheating of induction air through wrong setting of carb heat lever;

iii) Inability to achieve full throttle opening;

iv) Incorrect fuel delivery pressure, causing too rich a mixture;

v) Lack of adequate cylinder compression, (e.g. spark plug seating);

vi) Incorrectly fitted exhaust system;

vii) Ignition timing;

viii) High engine temperatures;

ix) Carburettor ice accumulated during operation at partthrottle, failing to clear before operation at full throttle;

x) Turbocharger inoperative.

Autorotation Check

14.8 The primary purpose of the autorotation check is to ensure that the collective rigging is correct; i.e. the scheduled rotor rpm is achieved with the collective fully down and the needles split.

14.9 The stabilised rotor rpm at a given altitude, weight and OAT should be compared with the scheduled data in the Flight Manual or other approved document.

APPENDIX I

Guidance on Determination of Achieved Rate of Climb

Introduction

I1 The basic method of interpretation of climb performance results is given in the main section of the Chapter. This Appendix gives further guidance on determination of the achieved rate of climb.

Interpretation of Results

Calculation of Rate of Climb

I2 For a first assessment of the achieved performance, (e.g. while still airborne), it would be acceptable to subtract the height at the start of the climb from the height at the end of the climb and divide by the total climb time. The graphical method of determining the average rate of climb is the only acceptable means for the final calculation. The graphical method allows 'rogue' data points to be discovered and eliminated from the determination of rate of climb and gives a clear picture of the quality of the climb, which may be difficult to see from simply an inspection of a table of values.

I3 It is not necessary to use all of a climb to determine the average rate of climb if some of the data are suspect. For example, the first 3 measurements in the climb may be of poor quality because the speed was too low and 'climb energy' was used to regain the correct VY. This could be allowed for by ignoring the first 3 points and a line drawn through the remaining part of the climb, (remember the time of the climb used in the calculations would now be reduced from the original five minutes). Similarly, an inversion near the end of the climb that reduced the ROC could be eliminated. After eliminating known rogue or suspect data the average ROC line should be drawn by 'eyeball averaging' and should not connect up every data point, unless the climb was of perfect quality, see Figure 2.

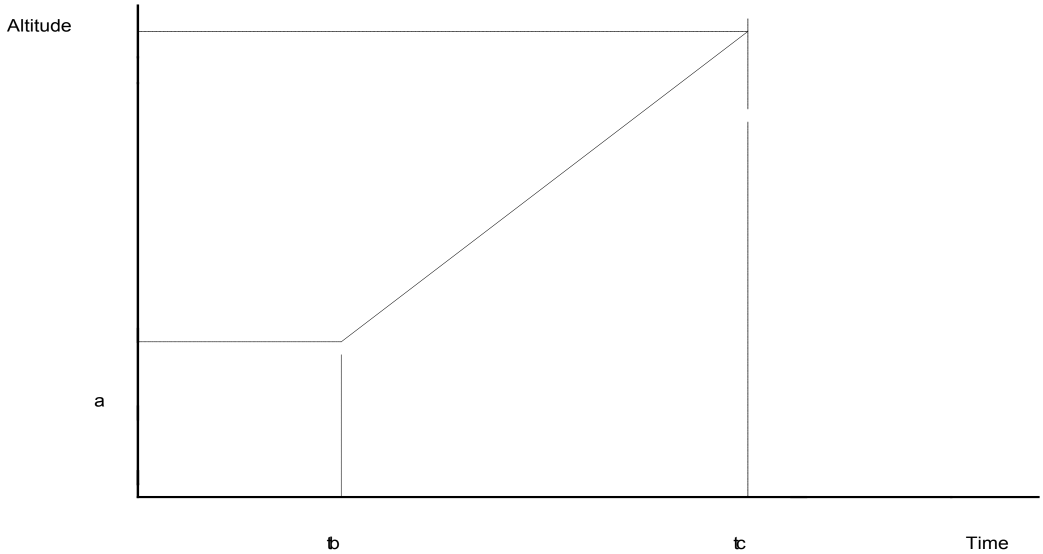
I4 If the rotorcraft starts the climb on a transmission limit, (e.g. torque), and at some point during the climb becomes engine limited, (e.g. Ng or TOT), a kink in the climb graph may result. This is best avoided by carrying out the entire climb below or above the critical altitude/ temperature. If this was not possible then only part of the climb data should be used in determining the ROC, either the transmission or engine limited sections. If the height versus time graph should be a curve, i.e. rate of climb reduces with height, a tangent to the curve should be drawn at the midclimb point and used to calculate the rate of climb (see Figure 3).

I5 If data points are discounted for a good reason there must be at least three minutes' worth of good climb data remaining to enable meaningful rate-of-climb data to be obtained.

Determination of Average Check Altitude and Temperature

I6 The average check altitude should be read from the graph used to determine average ROC. It is the altitude at midtime point of the best line through the climb data after elimination of any unusable portion(s) of the climb, (as described in paragraph above), see Figure 4. Using the altitude recorded during the flight at the midpoint may not give the most accurate result. For example the altimeter may have simply been misread or misrecorded at the mid climb point. The average outside air temperature can be determined by drawing a graph of OAT versus Altitude and the OAT for the average altitude read off. However, if the rate of climb was high the OAT gauge may lag resulting in an overreading of the temperature. If this was the case an allowance of approximately 1°C should be made. More recent revisions of Check Flight Schedules require the aircraft to be stabilised after the climb at approximately the mid climb altitude in order for an accurate OAT to be determined.

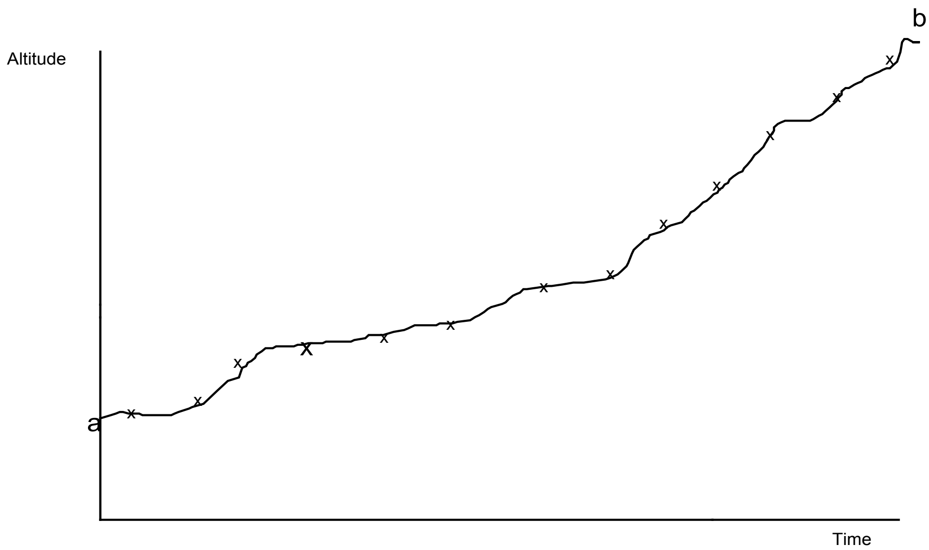
Figure 1: Elimination of Invalid Data



I7 Example of Correct Interpretation of Climb Results: Portion 'a' to 'b' is ignored, (due to incorrect airspeed, low level turbulence, etc.).

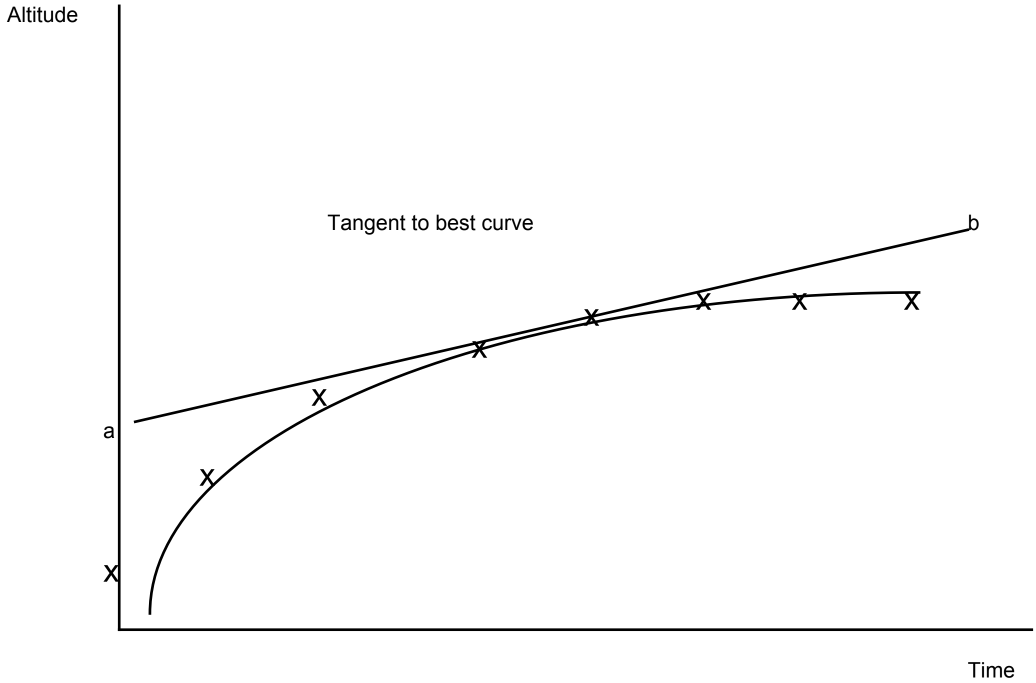
I8 Rate of climb = (ht at c) - (ht at b) / (time at c) (time at b)

Figure 2: Use of Graphical Method



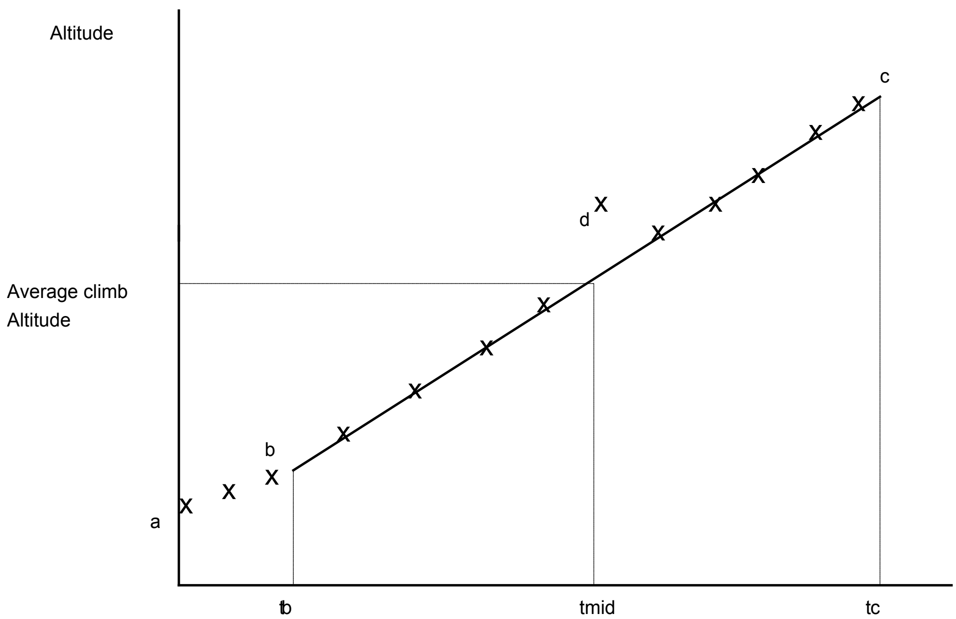
I9 Incorrect Use of Graph and Interpretation of Results: Rate of climb = (ht at b) (ht at a) / (time at b) (time at a)

Figure 3: Determination of Rate of Climb when 'best line' is a Curve



I10 Rate of climb = (ht at b) - (ht at a) / (time at b) (time at a)

Figure 4: Determination of Average Climb Altitude



I11 In this example portion ‘a’ to ‘b’ is ignored (due to suspect data). Midpoint of remaining portion ‘b’ to ‘c’ is mid. Average climb altitude is as shown above. Point ‘d’ may be ignored if a reason can be determined for it being so markedly away from the norm. Such “rogue” points should not be dismissed too lightly.

APPENDIX J

Climb Performance Tolerances

Introduction

J1 Climb performance checks serve three purposes:

1. For new types, they establish whether climb performance has been realistically scheduled.
2. For new rotorcraft of established types, they monitor the effect of changes introduced over the years.
3. For rotorcraft in service, they detect deterioration of individual rotorcraft and of fleets.

J2 In all cases where performance appears to be down IT IS IMPORTANT THAT THE CAUSES ARE SOUGHT. The Organisation should be satisfied that a rotorcraft and its powerunits are in all relevant respects serviceable and in reasonable condition. If a substandard condition of an individual rotorcraft is not isolated, unjustified action may be taken to reschedule performance for the type, with consequent penalty to all operators of that type.

J3 Provided that all concerned are satisfied with the condition of the rotorcraft and its powerunits, climb performance results may be accepted if they are within the negative tolerances listed in the paragraph below, which are applicable where the scheduled rate of climb has been obtained from the Manual designated on the C of A for the rotorcraft.

Tolerances

J4 If the climb performance deficit is not greater than 20 ft/min below that scheduled, this can be accepted without further investigation, as it can easily be the result of lack of practice on the part of the pilot, or slightly adverse weather conditions.

J5 If the shortfall is greater than 20 ft/min then it should be investigated as outlined above.

J6 If, after detailed investigation and when the Organisation is satisfied that all defects that might impair performance have been rectified, the rate of climb is greater than 70 ft/min below that scheduled, the results should be discussed with CAA Airworthiness.

NOTE: It is emphasised that this tolerance is to be applied only to an individual rotorcraft and should not be taken as a precedent for others of the same type.

CHAPTER 15

Post Flight Reporting

15.1 Following the Check Flight, it is essential that the outcome be reported fully and formally. This enables both the keeping of adequate records and monitoring of aircraft and type standards by the CAA. The following processes should be completed as a minimum:

1. Ensure that the Check Flight Schedule has been completed and all the appropriate data blocks filled.
2. If appropriate, calculate the performance.
3. Complete the Check Flight Report and Certificate. (An example, together with Notes on its completion, is shown at Appendix K to this Chapter). Note that the pilot who conducted the Check Flight must sign this certificate.
4. Transfer the defects from Check Flight Certificate to the aircraft's Technical Log.
5. Consider whether any of the defects observed warrant further, formal reporting under either Company reporting schemes or the Mandatory Occurrence Reporting (MOR) scheme. (ANO Article 117 refers).

15.2 Where checks have been omitted for any reason, (weather, unserviceabilities, etc.), ensure that this is clearly stated on the post flight Report, together with the need to re-fly them as appropriate. If necessary, contact CAA to discuss a suitable timescale for such a re-fly.

15.3 When completed, the Schedule, together with the Check Flight Certificate should, in the case of aircraft operating to a LAMS system, be forwarded to the appropriate CAA Regional Office. The paperwork for all other aircraft should be sent to the CAA, Applications and Approvals Section, at Aviation House.

15.4 When CAA receives the Certificate and Schedule, they will be reviewed for completeness and the performance data, (if applicable), will be entered into a database used to track the aircraft type's overall performance trends. As and when appropriate, CAA will contact the owner/operator/maintenance organisation for further details; in the absence of any such contact, the result may be assumed to be acceptable.

APPENDIX K

Check Flight Certificate

CHECK FLIGHT CERTIFICATE			
Aircraft (& Engine) Type XX			CFS XX iss 1
Aircraft Type:			
Date:	Pilot:	Observer:	Reg:

No.	Defect	-/R/FT

Conclusions/ Comments	

I CERTIFY that I have tested the above aircraft and have detailed the deficiencies and unsatisfactory features above. Those items annotated R or FT must be dealt with as shown in the following notes.

Name:	Signed:	Date:	Licence No.:
For CAA Use only	Report Logged by:	Date:	Report No.:

Performance Climb			(delete as applicable)* The box below to be completed by the nominated engineer	Airfield:	
Average Weight				Start Weight	kg/lbs*
Average Altitude		ft		Takeoff cg:	
Average Temp.		˚C			
Speed					
Achieved Rate		fpm	ENGINEER'S DECLARATION I certify that all the airtest results are within the specified allowable tolerances, and that the achieved climb rate was above*/below* scheduled. If below, complete box X:		
Scheduled Rate		fpm			
Margin		fpm			
Permitted Margin	-70	fpm	Signed:_________	Licence No_________	

Box X The climb rate was below scheduled but was accepted for the following reason:

___

Note: aircraft with climb shortfalls more than 70 fpm should not be accepted.

Notes

General

K1 Pilots using this document should be familiar with the tests and techniques needed. If the results are to be submitted to the CAA the pilot's eligibility to perform the Check Flight must be agreed with CAA Airworthiness. General notes on Check conduct can be found in the CAA Handbook for Check Flights.

K2 Reg: Enter the aircraft registration mark. If the aircraft is not on the UK register, add the manufacturers serial number and expected UK registration (if known).

K3 Pilot: Captain and co-pilot (where applicable).

K4 Airfield: Departure airfield.

K5 Start Weight: Actual all up weight at engine start. Also delete kg or lbs as appropriate.

K6 Takeoff cg: Actual cg at lift-off, preferably as a % of the Mean Aerodynamic Chord.

Performance

K7 A full description of climb analysis is given in the CAA Handbook for Check Flights.

K8 Climb: Enter in these columns data from the climb.

K9 Average Weight: The aircraft all up weight at the midpoint of the measured climb.

K10 Average Altitude: The altitude at which the line drawn to average the measured points passes through at the mid time.

K11 Average Temp: The temperature at which the line drawn to average the measured points passes through at the mid time.

K12 Speed: The target climb speed (Indicated Airspeed.)

K13 Achieved Rate: The climb rate as given by the slope of the line drawn to average the measured altitude points in feet per minute.

K14 Scheduled Rate: The expected gross rate of climb read from the appropriate graph in the Flight Manual with any adjustments for configuration differences.

K15 Margin: The difference between the Scheduled and Achieved rates of climb, (negative if achieved is lower than scheduled).

K16 Permitted Margin: The maximum allowable difference between the Scheduled and Achieved rates of climb.

Defects

K17 Enter all defects from the flight. All defects must also be entered in the Technical Log. Procedural items entered in the Technical Log, (such as re-stowing oxygen masks), need not be entered here. Items affecting flight safety, which were known before the flight, whether or not they were deferred, should be entered. In the latter case, the defect should be annotated accordingly after the details.

K18 No.: The first column is to allow the items to be numbered.

K19 Defect: Enter details of the defect.

K20 -/R/FT: Classify each defect according to its impact on safety. Items requiring rectification before further flight for hire or reward or before the issue of the C of A or National Permit to Fly should be marked ‘R’. Additionally, items that require re-checking in-flight following rectification, (such as inadequate climb performance), should be marked ‘FT’. Items requiring both should be marked ‘R/FT’.

Conclusions/Comments

K21 Any conclusions, notes or comments useful for tracking defects may be entered.

K22 **Name:** Only the pilot who carried out the test may sign this sheet.