

Check flight handbook

CAP 1038



Published by the Civil Aviation Authority, 2016

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

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First published 2013

Second edition December 2016

Enquiries regarding the content of this publication should be addressed to: ISPTechnicalSupportTeam@caa.co.uk

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Contents

Contents	1
Revision history	6
Glossary	7
Introduction	10
Chapter 1	11
The policy and background behind check flights	11
Introduction – The purpose of check flights	11
General	12
Background - terminology	12
EASA	12
Types of check flights	13
Check flight schedules	14
Implementation: Non-EASA aircraft	17
Introduction	17
Initial issue of C of A or National Permit to Fly	18
Renewal of a C of A or Permit to Fly	18
Check Flight Schedules (CFS)	18
Check flight results	19
Implementation: EASA aircraft	19
C of A issue – New aircraft	19
C of A Issue – Used aircraft from an EU Member State	19
C of A Issue – Used aircraft from a non-EU Member State	19
Light sport aircraft with an EASA Permit to Fly	20
C of A Issue – Export C of A from UK to a third country	21
Maintenance check flights	21
Chapter 2	23
Airworthiness guidance - when to perform check flights	23
When a check flight is necessary and who can perform it	23
Introduction	23
Individual responsibility	23
When check flights should be performed	24
Airworthiness Check Flights (ACF)	25

Check Flight Schedules (CFS) (See Chapter 5).....	26
Approved Pilots (See Chapter 3).....	27
Chapter 3	29
Eligibility of pilots to carry out check flights.....	29
Introduction	29
Procedures.....	29
Experience and ability requirements.....	30
Administrative aspects.....	30
Chapter 4	32
Insurance cover for check flights.....	32
Chapter 5	33
Use of schedules currently or formerly published by the UK CAA	33
Owner/Operator-initiated check flights using schedules formerly published by the UK CAA ..	33
Applicability of CAA AFTS or CFS.....	33
Conduct and monitoring of check flights	34
Individual responsibility.....	35
Pilots, owners, licensed engineers, approved organisations	35
Airworthiness review signatory.....	35
Flight manuals.....	36
Availability of check flight schedules.....	37
Conclusion	37
Chapter 6	38
Procedural aspects and preparation for a check flight.....	38
Introduction	38
Responsibility	38
Crewing.....	39
Insurance	40
Check Flight Safety	40
Limitations.....	42
Carriage of non-crew on check flights.....	42
Check flight conduct.....	43
Unserviceabilities	45
Weather.....	45
Unexpected results.....	46
Check flight checklist.....	46

Chapter 7	47
Conduct of check flights on light aircraft.....	47
Introduction	47
External/Internal check.....	47
Taxying and engine run-up checks.....	48
Take-off and landing.....	48
Climb.....	49
Cruise check	50
Stalling	50
Recovering from the stall	51
Spinning.....	52
Flight to Vne.....	52
Functioning checks.....	53
Post Flight	54
Chapter 8	55
Conduct of check flights on vintage and ex-military aeroplanes	55
Introduction	55
Check flight schedules.....	55
Check Flight Schedule 233	56
Check flight schedule for renewal check flights	56
Check flight pilot qualifications.....	56
Experience requirements: single engine propeller aircraft.....	57
Experience requirements: single engine jet aircraft.....	57
Experience requirements: multi engine aircraft	57
Checks conducted in accordance with Check Flight Schedule 233.....	57
Weather and operating limits.....	58
Safety equipment	58
Currency requirements.....	59
Conclusions.....	59
Chapter 9	61
Conduct of check flights on light gyroplanes	61
Introduction	61
External/Internal check.....	61
Taxying and engine run-up checks.....	61
Take-off and landing.....	62
Climb.....	62

Cruise check	63
Steep turns.....	63
Minimum speed.....	63
Descent at idle power	64
Flight to Vne.....	64
Functioning checks.....	65
Post flight	65
Chapter 10	66
Performance analysis fixed wing aircraft	66
Introduction	66
Interpretation of results.....	66
Calculation of rate of climb.....	66
Determination of mean values for performance determination	70
Climb performance assessment	71
Climb rate tolerances.....	72
Airworthiness check flights for all aircraft and series check flights of second-hand imported aircraft.....	72
Submission of climb rate results	74
Chapter 11	76
Post flight procedures and performance analysis: rotorcraft.....	76
After flight.....	76
Interpretation of results.....	76
Performance climb.....	77
Autorotation check	79
Chapter 12	80
Post flight reporting.....	80
Appendix A.....	81
Guidelines on the experience requirements for pilots to be eligible for conducting check flights....	81
Aeroplanes.....	81
Rotorcraft	81
Aircraft > 5,700 kg	82
Appendix B.....	84
CAA contacts list.....	84
CAA Aviation House	84
UK Regional Offices	85

Appendix C	86
Possible checklist items to be included in the planning of a check flight.....	86
Appendix D	87
List of documents required prior to conduct of a check flight.....	87
Appendix E	88
Example kneeboard schedule.....	88
Appendix F	90
List of documents required prior to conduct of a check flight.....	90
Appendix G	91
Example kneeboard schedule.....	91
Appendix H	92
Guidance on determination of achieved rate of climb.....	92
Introduction.....	92
Interpretation of results.....	92
Calculation of rate of climb.....	92
Determination of average check altitude and temperature.....	93
Appendix I	96
Climb performance tolerances.....	96
Introduction.....	96
Tolerances.....	96
Appendix J	98
Check flight certificate.....	98
Notes.....	100
General.....	100
Performance.....	100
Defects.....	101
Conclusions/Comments.....	101

Revision history

This publication at Issue 2 replaces Issue 1 of the CAA Flight Check Handbook, dated 29 November 2013 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
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 Weight
MTWA	Maximum 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
V _{mca}	Minimum Control Speed (Air)
V _{min}	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.
V _{mo}	Maximum Operating Speed
V _{ne}	Never Exceed Speed
V _{no}	Normal Operating Limit Speed
VOR	VHF Omni directional Radio
V _{toss}	Take Off Safety Speed
V _y	Climb Speed
ZFW	Zero Fuel Weight

Introduction

1. This Handbook was originally produced by the Civil Aviation Authority as a reference work for those pilots and FTEs carrying out Check Flights on UK registered aircraft; as such, it was intended for use by those pilots who have previously received adequate familiarisation with check-flight techniques and safety precautions and fully understood the significance and intent of the tests as well as the techniques used to minimise the risk associated with some tests. Furthermore, it has only ever been intended as an aide-memoire/refresher for pilots who have already been briefed: **it is not a stand-alone training document.**
2. The scope of this edition of the Handbook is reduced from earlier editions. This is because the CAA is no longer able to support the level of detailed information and guidance that has previously been provided. Nevertheless, it explains who should 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) and where there is conflict between this handbook and the equivalent documentation provided by the aircraft manufacturer, the manufacturer's documentation is always overriding.
3. This Handbook does not apply to experimental or certification flight testing, whether on prototype or modified established types. Such flights are carried out under 'B Conditions', 'E Conditions' or a Permit to Fly.
4. This Handbook will not be subject to any further amendment, because the CAA is no longer able to offer up-to-date guidance on check flight procedures. There are a number of flight-test accredited organisations which can provide guidance, as well as courses offered by the aircraft manufacturers that cover the safe conduct of check flights.

Chapter 1

The policy and background behind 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; these are being covered by EASA through its rulemaking task (MDM.097 (a) & (b))¹.
- 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. It is only intended as an aide-memoire/refresher for pilots who have already been briefed: **it is not a stand-alone briefing document**. 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).

¹ <https://www.easa.europa.eu/document-library/notices-of-proposed-amendments/npa-2012-08>

General

Background - terminology

- 1.5 Flight testing of aircraft provides a basis to establish compliance with certification requirements for new aircraft and changes to aircraft. Other check flights 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 is the European Union organisation responsible for aviation safety. The main activities of the organisation include strategy and safety management, certification of aviation products and oversight of approved organisations and EU Member States. In order to identify when a flight test or Check Flight is necessary reference should be made to the respective part of the EASA Regulations – Part 21 for certification related flights, and Part M for flights relating to continuing airworthiness. The UK requirements for flight checking in BCARs do not apply to EASA aircraft.
- 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 flight-test accredited organisations 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; and ‘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 appropriate Check Flight Schedule and, should be flown by a suitably 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 must only be conducted in accordance with schedules that have been reviewed and accepted by the manufacturer or an organisation approved in accordance with EASA Part 21 Subparts G or J or `BCAR A Chapter A8-21 (Approval of Organisations Responsible for Design or Production suitably qualified for the type. 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 that includes climb performance checks and handling checks that include checks on various flight characteristics.
- 1.19 Extensive CAA experience has shown that Check Flights flown in accordance with appropriate schedules will establish whether:
- 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:
- 4) Handling checks, which include 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 en-route landing configurations;
 - f) A qualitative assessment of the landing.

- 5) Performance checks - simple, free air pressure rate-of-climb measurements under known and predicted configurations and conditions.
- 6) 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, generic CAA schedules, which can be used for a range of aeroplane types, can still be obtained on a case-by-case basis on application to the CAA at the address given in Chapter 5 Appendix B.
- 1.23 If a Check Flight is planned on an aircraft for which a generic CFS is not applicable, the CFS must be agreed by the manufacturer, or an organisation approved in accordance with BCAR A Chapter A8-21 (Approval of Organisations Responsible for Design or Production suitably qualified for the type. The Check Flight Schedule should incorporate all the elements discussed above and in particular, a Check Flight Certificate.

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 (See Chapter 2).
- 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 organisation responsible for the check flight should 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: Non-EASA aircraft

Introduction

- 1.27 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.
- 1.28 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.

Initial issue of C of A or National Permit to Fly

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

For new aircraft, the Check Flight shall be conducted under the supervision of the aircraft Type Design Organisation, if applicable.

For used aircraft, it shall be conducted under the supervision of the applicant or operator.

Renewal of a C of A or Permit to Fly

1.30 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)

1.31 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 the CAA. These include climb performance checks and handling checks that combine checks on various flight characteristics.

1.32 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

- 1.33 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'.

Implementation: EASA aircraft

C of A issue – New aircraft

- 1.34 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

- 1.35 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.

C of A Issue – Used aircraft from a non-EU Member State

- 1.36 EASA Part M, M.A.904 and the 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 reference to a Check Flight report, if applicable, 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.

1.37 The CAA will not normally 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 in Chapter 2.

1.38 Note that there are three exceptions where a Check Flight may not be necessary:

- **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. Switzerland, 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

1.39 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).

- 1.40 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.

C of A Issue – Export C of A from UK to a third country

- 1.41 EASA regulations do not make provisions for the issue of an Export C of A when aircraft transfer registration to another EU Member State. The 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

- 1.42 The EASA Part M Regulations in M.A.301 paragraph (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.
- 1.43 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.
- 1.44 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. The latest information can be found in the comment-response document to EASA NPA 2012-08 Maintenance Check Flights (paragraph SPO-SPEC.MCF.115 Flight Crew Requirements), which can be accessed directly using the following link: www.easa.europa.eu/document-library/comment-response-documents/crd-2012-08. This is due to be finalised by the end of 2016.

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 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 an 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 may 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 the 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 an accredited flight test organisation for advice on content and safety procedures. It is important that the content and conduct of Check Flights is standardised as far as possible. It is the responsibility of the pilot conducting the Check Flight to ensure that the CFS is appropriate and suitable for the type of aircraft to be flown.

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. EASA is finalising Acceptable Means of Compliance and Guidance Material relating to MCFs, which include 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. The latest information can be found in the comment-response document to EASA NPA 2012-08 Maintenance Check Flights (paragraph SPO-SPEC.MCF.115 Flight Crew Requirements), which can be accessed directly using the following link: www.easa.europa.eu/document-library/comment-response-documents/crd-2012-08. This is expected to be finalised by the end of 2016.
- 2.14 For ACF, when the operator or maintenance organisation has decided that a check flight is needed, arrangements should be made to ensure that the check flight is carried out safely and in accordance with industry best practice. 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.
- 2.15 The LAA and the BMAA will continue with their own current arrangements for approving pilots to carry out Check Flights.
- 2.16 Additionally, this briefing procedure allows clear guidance to be given on all administrative aspects of the process. 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. In making this assessment it should be noted that the CAA's programme of check flight pilot briefings had a four-year currency limit associated with it, which lapsed if an ACF had not been completed in that period. More recently, the emerging EASA requirements for maintenance check flights specify a 36 months recency requirement. Consideration should therefore be given to this revised limitation.

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 may be carried out by the operator or maintenance organisation. As part of that process, the operator or maintenance organisation will have to be satisfied that the proposed Check Flight pilot is eligible to conduct Check Flights. Best practice suggests that a suitably qualified and experienced pilot should be used when it has been determined that a check flight is necessary.
- 3.2 The CAA no longer briefs pilots for conducting airworthiness check flights. Consequently, when it has been decided that a check flight is needed, arrangements should be in place to ensure that it is carried out safely and in accordance with industry best practice.
- 3.3 This Chapter **does not apply to Maintenance Check Flights**. EASA is finalising Acceptable Means of Compliance and Guidance Material relating to MCFs, 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. The latest information can be found in the comment-response document to EASA NPA 2012-08 Maintenance Check Flights (paragraph SPO-SPEC.MCF.115 Flight Crew Requirements), which can be accessed directly using the following link: www.easa.europa.eu/document-library/comment-response-documents/crd-2012-08. This rulemaking is due to be finalised by EASA by the end of 2016.

Procedures

- 3.4 Pilots intending to carry out Check Flights must be properly qualified and prepared for the task. To ensure that appropriate levels of safety are

maintained, Check Flights should be conducted by pilots who have satisfactory experience with the Check Flight Schedule to be used, and have received adequate familiarisation of check-flight techniques and safety precautions. 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.

- 3.5 Although the CAA can no longer brief suitable pilots for conducting check flights, nor maintain a list of briefed pilots, there will inevitably be a limited number of pilots who have previously been briefed by the CAA. Those pilots who have not carried out a Check Flight in the previous four years are no longer current and should be re-briefed in order to renew their validity. It is important therefore that records of satisfactorily completed check flights are retained to demonstrate the status of pilots' eligibility. Pilots whom are deemed suitable to carry out check flights should be listed in a CAMO's Exposition.

Experience and ability requirements

- 3.6 Although it is not feasible to lay down absolute experience and ability requirements for pilots, guidelines are provided in Appendix A to this Chapter.
- 3.7 In all cases, the pilot concerned must fully understand the significance and intent of the checks as well as the techniques used to minimise the risk associated with some checks.
- 3.8 The CAA may consider applications from sole owners of fixed wing aircraft who do not meet the criteria in Appendix A.
- 3.9 Note that extra qualifications will be needed in the case of Vintage and ex-Military aircraft flight checking (Check Flight Schedule 233).

Administrative aspects

- 3.10 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 should be re-briefed in accordance with this Chapter to renew their eligibility.

- 3.11 Pilots are reminded that the onus is on them to ensure that they are current for the task.
- 3.12 Note that, 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 Should the CAA become aware of a potential safety concern or that a Check Flight has not been adequately carried out or satisfactorily completed, the individual (and, if appropriate, the operating/engineering company) will be notified.

Chapter 4

Insurance cover for check flights

4.1 Operators of aircraft are now required by law to have certain minimum levels of insurance. Insurance requirements arise from EU legislation, specifically Regulation (EC) No 785/2004 (insurance requirements for air carriers and aircraft operators). Further information can be obtained from the following CAA webpage: www.caa.co.uk/Aircraft-register/Registration-information/Mandatory-insurance-requirements-for-aircraft.

4.2 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.

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

4.3 Insurance arrangements for the Check Flight are the responsibility of the Applicant, or the Owner where the Applicant is acting for the Owner. On those occasions where a CAA Surveyor (includes CAA Flight Test Engineers) 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.

4.4 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 schedules formerly published by the UK CAA

- 5.1 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. Consequently, the CAA is 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 Although 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, 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 the 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. **The 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 the CAA, in which it had a significant level of participation, together with the attendant expertise. The scheme demanded a level of control by the CAA of the eligibility of pilots to whom the task was devolved, and supervision of the output of those pilots. The introduction of EASA regulations and the subsequent 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 is concerned, owners/operators conducting 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, and appropriate records kept.

- 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 should be consulted by applicants regarding the suitability, or otherwise, of the pilot nominated to carry out and submit the results of the Check Flight.

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 that Check Flight is required, the responsibility for ensuring it 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, if applicable, 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 V_{mo} and M_{mo} 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, it should not be flown beyond declared AFM limits.

Availability of check flight schedules

- 5.14 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 any given CFS to an individual aircraft. Therefore the CAA has removed all of its CFSs from the CAA website. The CAA- generic schedules, e.g. CFS 2 for single-engine piston aircraft, will still be available on a case-by-case basis from the contacts given in Appendix B. If a non-generic CFS is planned to be used for a check flight required by the CAA, the CFS must be discussed with the CAA.

Conclusion

- 5.15 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 should be consulted for advice, or alternatively queries should be placed with the aircraft manufacturer. **The CAA does not accept any responsibility for the use of CAA Schedules on Check Flights not directly under their control.**

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 is only intended as an aide-memoire/refresher for pilots who have already been briefed – it is not a stand-alone briefing document. 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 appropriate, the Check Flight Schedules should 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 UK AIP GEN 1.5 paragraph 2.7. This 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 the 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 Whilst the aircraft commander must be suitably qualified and briefed for the purpose, (see Appendix A for details), there is no similar qualification for the first officer. Nevertheless, 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; 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 carried out 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.

- 6.6 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.
- 6.7 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

- 6.8 Operators are reminded of their obligations under CAP 562 Leaflet B-70 “Aircraft Insurance” to ensure that the check flight is covered under their Insurance.
- 6.9 Personnel participating should check that their own insurance policies are not invalidated by such flights and they need to be satisfied on this point before proceeding with the flight.

Check Flight Safety

- 6.10 Given that 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, the expectation should be that, unlike a normal flight, something may go wrong. Consequently, the good Check Flight pilot will 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), the manufacturer must be informed so that the matter can be resolved before proceeding.
- 6.17 The Check Flight Schedule should be presented in a pro-forma format such that the results are recorded directly on the Schedule. This will greatly assist the ease and flow of checks.

Carriage of non-crew on check flights

- 6.18 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 persons performing duties in the aircraft in connection

with the flight. Although, it is legal to carry persons other than crew on a Check Flight with a current C of A in force, it is strongly recommended that:

- 5) If they are being carried for weight and balance purposes, it is preferable to use ballast;
- 6) Before accepting any such persons on a Check Flight the pilot in command must inform them that the risk is greater than on an ordinary flight;
- 7) Since cabin crew are not normally carried, ensure such persons are suitably briefed on emergency procedures, including use of oxygen and emergency evacuation.

Check flight conduct

- 6.19 Safe check flights require 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.
- 6.20 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.
- 6.21 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.

- 6.22 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 former CAA Schedule will have been flown and de-bugged by CAA flight-test crews for the aircraft build standard that existed at the time; care should be taken that this is also 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 the stall warning system, or fuel jettison checks to be done 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.
- 6.23 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.
- 6.24 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

- 6.25 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

- 6.26 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.

- 6.27 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 never be carried out at night.

Unexpected results

- 6.28 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

- 6.29 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-mémoire 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.

Chapter 7

Conduct of check flights on light aircraft

Introduction

7.1 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 E.

External/Internal check

7.2 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

7.3 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

7.4 The aircraft should be flown as closely as possible to the 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. In some cases where full static power cannot be held against the brakes, this may be recorded by an FTE/FTO during the run. Although the Functioning Checks should be sequenced later in the flight in the 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

- 7.5 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.
- 7.6 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.
- 7.7 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

- 7.8 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

- 7.9 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.
- 7.10 The aircraft 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 if an aircraft exhibits any tendency to exceed this bank angle significantly or adopt any unusual attitude. If stall behaviour is incorrect in one particular configuration, this should be investigated on the ground **before** carrying out any further stalling checks.

- 7.11 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

- 7.12 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.
- 7.13 Should the aircraft drop a wing violently the correct recovery technique should be in accordance with the AFM or POH technique to 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

- 7.14 All aircraft on the UK Register cleared for aerobatics or spinning should have their spin characteristics checked. Consequently, a 2-turn spin should be 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

- 7.15 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

7.16 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:
 - 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).
 - 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

- 7.17 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.
- 7.18 Result analysis and tolerances are contained in Chapter 11 of this Handbook.

Chapter 8

Conduct of check flights on vintage and ex-military aeroplanes

Introduction

8.1 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 an initial and comprehensive Check Flight, using Check Flight Schedule 233, followed by a programme of continued Check Flights by the maintenance organisation. Note that Schedule 233 is in generic form and must only be used on an individual aircraft basis for the **initial** check flight assessment following agreement with the CAA. 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

8.2 All subsequent Check Flights must be conducted in accordance with an appropriate Check Flight Schedule agreed by the responsible CAMO. 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 CAMO and CAA where this results in a conflict with the Schedule.

- 8.3 As previously noted in Chapter 5, the CAA has removed its CFS from the CAA website. If a non-generic CFS is planned to be used, the CFS must be agreed with the CAMO.

Check Flight Schedule 233

- 8.4 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

- 8.5 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 the 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.

Check flight pilot qualifications

- 8.6 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 paragraphs 10.8 to 10.10 below.

Experience requirements: single engine propeller aircraft

- 8.7 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

- 8.8 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 of that escape system 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

- 8.9 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

- 8.10 Initial Check Flights 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, all pilots carrying out such checks must be specifically approved by the CAA each and every time Schedule 233 is used. When considering suitability of pilots, the general qualification levels indicated in Chapter 3 of this Handbook are not applicable to Check Flight Schedule 233 and the requirements of the preceding paragraphs should be used as guidelines.

Weather and operating limits

- 8.11 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 safeguarded 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

- 8.12 It should be regarded as mandatory for the check flight pilot 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. 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

- 8.13 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.
- 8.14 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

- 8.15 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.

- 8.16 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 be carried out 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 9

Conduct of check flights on light gyroplanes

Introduction

9.1 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 E.

External/Internal check

9.2 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

9.3 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

9.4 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

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 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

- 9.6 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

- 9.7 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 V_y . 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

- 9.8 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 (V_{mc} (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

- 9.9 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 $V_{MC}(\text{Power Off})$ 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 $V_{MC}(\text{Power Off})$. 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 V_{ne}

- 9.10 For this check, the pilot should adopt a flight path that will result in the speed slowly and progressively increasing to V_{ne} 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 V_{ne} 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

9.11 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:

- **Fuel System.** A good understanding of the fuel system is required prior to the CFS.
- **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

9.12 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. Chapter 13 Appendix I should be referred to with regard to data analysis.

Chapter 10

Performance analysis fixed wing aircraft

Introduction

- 10.1 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.

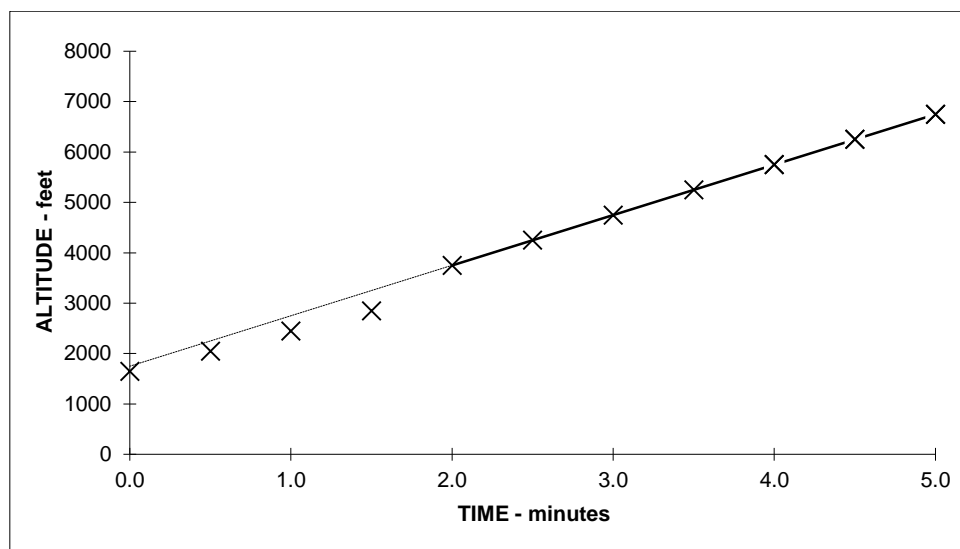
Interpretation of results

Calculation of rate of climb

- 10.2 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.
- 10.3 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.
- 10.4 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.

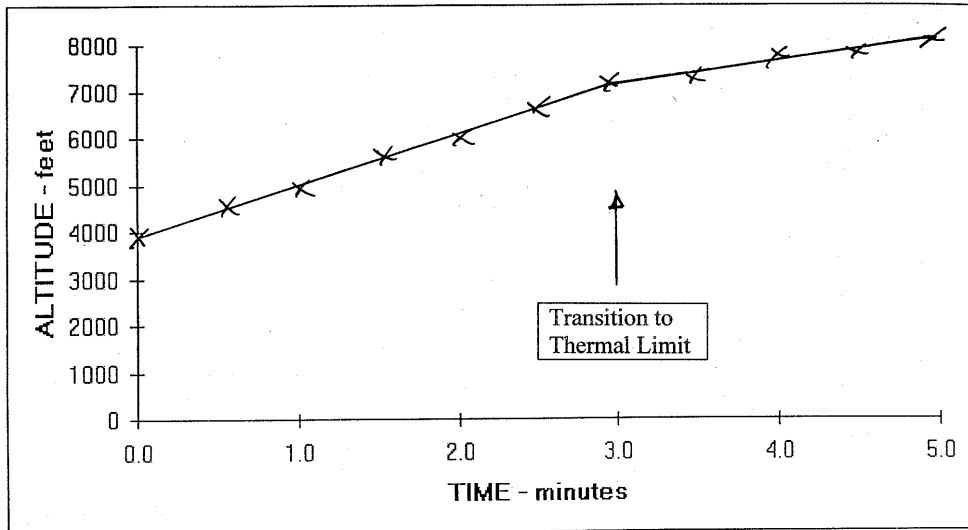
Figure 1: Elimination of invalid data



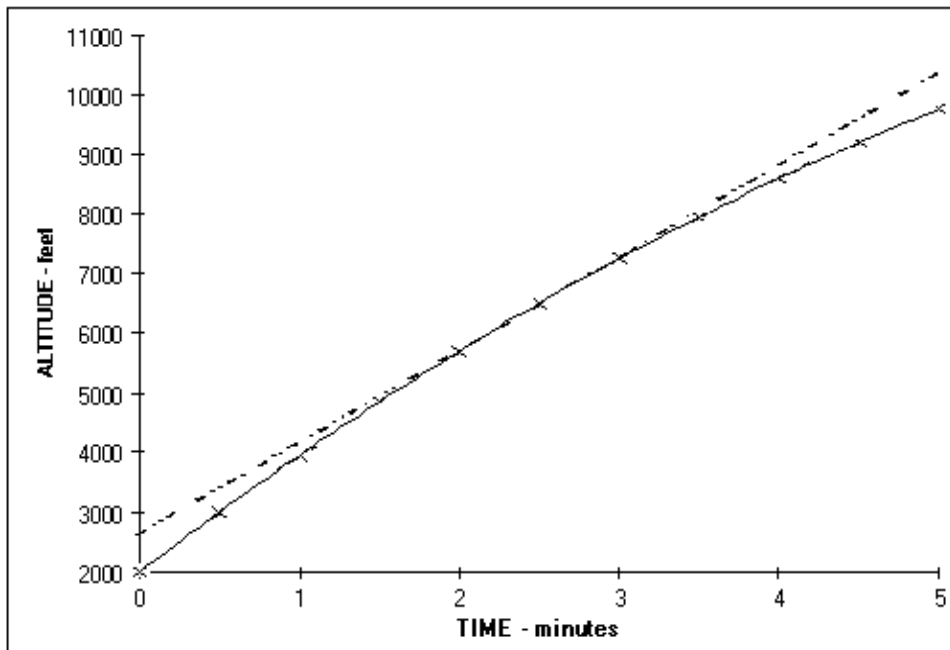
- 10.5 If the aircraft starts the climb with engine(s) operating on a mechanical limit, (e.g. torque), and at some point during the climb the engine(s) commence to operate on a temperature limit, then a kink in the climb graph may result. This is best avoided by carrying out the entire climb below or 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.

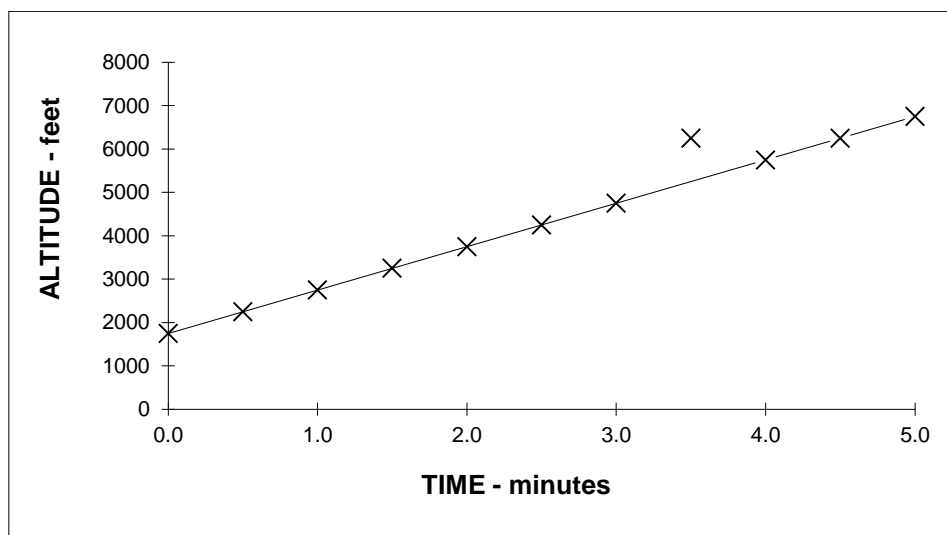
Figure 2: Transition from a mechanical to a thermal limit



- 10.6 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

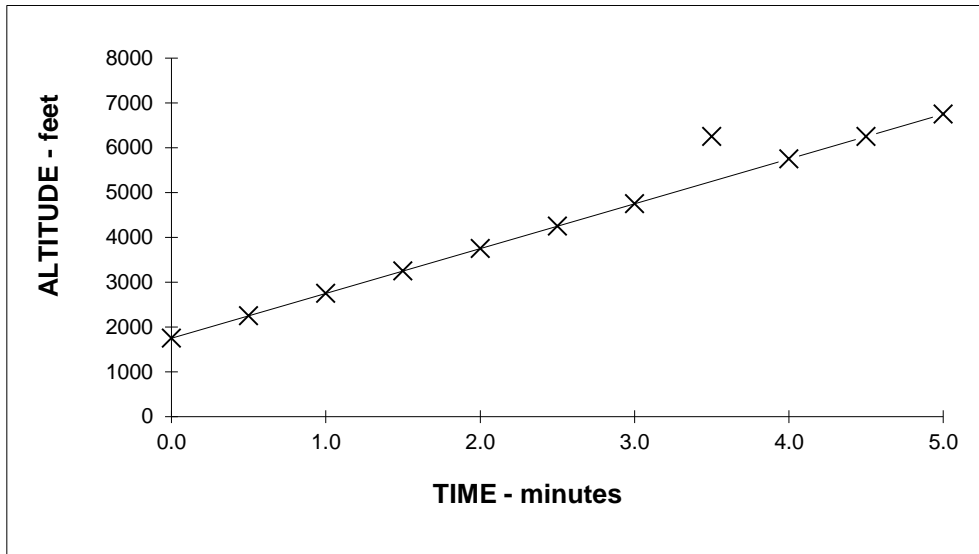
- 10.7 Occasionally, when plotting a performance climb, a “rogue” point will show up, (i.e. it lies well off the line used to join the other data points). This may occur for several reasons, e.g., it may be due to altimeter mis-reading or to thermal lift, etc, but it is important not to dismiss such 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

- 10.8 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



- 10.9 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.
- 10.10 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.

- 10.11 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

- 10.12 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, it must be investigated and rectified.
- 10.13 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.
- 10.14 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.

- 10.15 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.
- 10.16 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

- 10.17 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

	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. Relevant aircraft types include the Islander, Turbine Islander, Trislander and Twin Otter.

NOTE 2: To comply with Schedule 1 to Regulation 8 of the Air Navigation (General) Regulations 2006, 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 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

	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 2006 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 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

	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 2006, 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

10.18 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 at the addresses given in Appendix B, Chapter 5.

Chapter 11

Post flight procedures and performance analysis: rotorcraft

After flight

- 11.1 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.
- 11.2 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.
- 11.3 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

- 11.4 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

11.5 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 mid-climb 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 of climb performance

11.6 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

11.7 Where the achieved climb performance is not at an acceptable level, the following checklist, which is not necessarily definitive, may be considered when seeking a remedy:

1) General

- Pilot out of practice;
- Weather: turbulence, waves, and temperature inversion.

2) Instruments

- Incorrect reading of IAS (it is easy to confuse, or to substitute, CAS for IAS, or knots for mph);
- Faulty ASI (e.g. leaks, blockages including water, instrument unserviceable);

- Faulty altimeter (including static system);
- Faulty Outside Air Temperature Indicator;
- Faulty torque meter or manifold pressure gauge (including calibration errors);
- Faulty gas generator tachometer or turbine inlet temperature gauge;
- Faulty rotor rpm gauge;
- Faulty fuel gauge.

3) Weight

- Unrecorded growth of empty weight;
- Miscalculation of check weight.

4) Engine

- 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.
- Piston Engines: Some causes of power loss with piston engines are given below:
 - Air fuel ratio: Too rich mixture setting;
 - Preheating of induction air through wrong setting of carburettor heat lever;
 - Inability to achieve full throttle opening;
 - Incorrect fuel delivery pressure, causing too rich a mixture;
 - Lack of adequate cylinder compression, (e.g. spark plug seating);

- Incorrectly fitted exhaust system;
- Ignition timing;
- High engine temperatures;
- Carburettor ice accumulated during operation at part-throttle, failing to clear before operation at full throttle;
- Turbocharger inoperative.

Autorotation check

- 11.8 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.
- 11.9 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.

Chapter 12

Post flight reporting

- 12.1 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. 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).
- 12.2 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 the CAA to discuss a suitable timescale for such a re-fly.
- 12.3 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.

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 should be assessed by the operator on a case-by-case basis and recorded, written, justification kept.
- A8 The flight crew requirements for maintenance check flights currently being agreed by EASA in the CRD to NPA 2012-08 are considered to reflect best industry practice and as such are an acceptable replacement provision
- A9 The latest criteria are currently to be found in the comment-response document to EASA NPA 2012-08 Maintenance Check Flights (paragraph SPO-SPEC.MCF.115 Flight Crew Requirements) which can be obtained directly using the following link: www.easa.europa.eu/document-library/comment-response-documents/crd-2012-08.
- A10 These criteria cover crew qualifications and experience, including completion of a training course which shall include a flight training element.
- A11 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 operator before carrying out a Check Flight on a different type.
- A12 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.

Check flights on aircraft above 5,700kg

- A13 When selecting the flight crew for a check flight, the person/organisation requesting the flight be performed should specify minimum flight time criteria on the aircraft type, including pilot in command experience, and have ensured that the pilot has followed an appropriate training course that includes a flight training element. Pilots who have been briefed by the CAA and who have conducted a check flight on the type in the last 4 years maybe considered to

meet these criteria. The CAA supports operators making use of the courses offered by the aircraft manufacturers that cover the safe conduct of check flights as a means of qualifying additional pilots. This approach is consistent with the emerging crew training and experience requirements for Maintenance Check Flights currently being developed by EASA (see CRD to NPA 2012-08 and Draft Opinion which can be accessed directly using the following link:

www.easa.europa.eu/document-library/comment-response-documents/crd-2012-08).

Appendix B

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

www.caa.co.uk/Commercial-industry/Aircraft/Airworthiness/Certificates-and-permits/Check-flights/

E-mail queries to:

ISPTechnicalSupportTeam@caa.co.uk

Or for General Aviation aircraft:

Tel: +44 (0)1293 573988

Fax: 01293 573973

Email: GA.GA@caa.co.uk

Technical Governance and Support Services

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: SRGGatwick.RegionalOffice@caa.co.uk	tel: 01293 768600 fax: 01293 768601
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: SRGStirling.RegionalOffice@caa.co.uk	tel: 01786 457400 fax: 01786 457440

Appendix C

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 appropriate for the aircraft type and is the latest issue.
- 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.

Appendix D

List of documents required prior to conduct of a check flight

- D1 Certificate of Registration.
- D2 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.
- D3 Aircraft Flight Manual (or POH), including appropriate UK Supplements if applicable.
- D4 Weight and Balance Statement.
- D5 Radio Station Licence and Certificate of Approval.
- D6 Noise Certificate.
- D7 Certificate of Insurance.
- D8 Either:
- 1) Aircraft Technical Log; or
 - 2) Logbook for Aircraft/Engine/Propeller

Appendix E

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		Flt land	
Block OFF		Flt t/o	
Block Total:		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		

Appendix F

List of documents required prior to conduct of a check flight

- F1 Certificate of Registration.
- F2 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.
- F3 Aircraft Flight Manual (or POH), including appropriate UK Supplements if applicable.
- F4 Weight and Balance Statement.
- F5 Radio Station Licence and Certificate of Approval (If specifically required).
- F6 Certificate of Insurance.
- F7 Either:
- 1) Aircraft Technical Log; or
 - 2) Logbook for Aircraft/Engine/Propeller.

Appendix G

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		Flt land	
Block OFF		Flt t/o	
Block Total:		Flt Total	
Cyclic		Rudd	
throt		Mixt	carb air
trims		Brakes	Steer
Pwr chk rpm	L mag	R Mag	Carb Air
MaxRpm:			
Full Pwr brakes	MAP	Fuel Press	CHT
y/ n			
rpm			
Pre Rotate		Max Engine rpm	Max Nr
Elect system			
Fuel system			
Controls			

Appendix H

Guidance on determination of achieved rate of climb

Introduction

H1 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

H2 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.

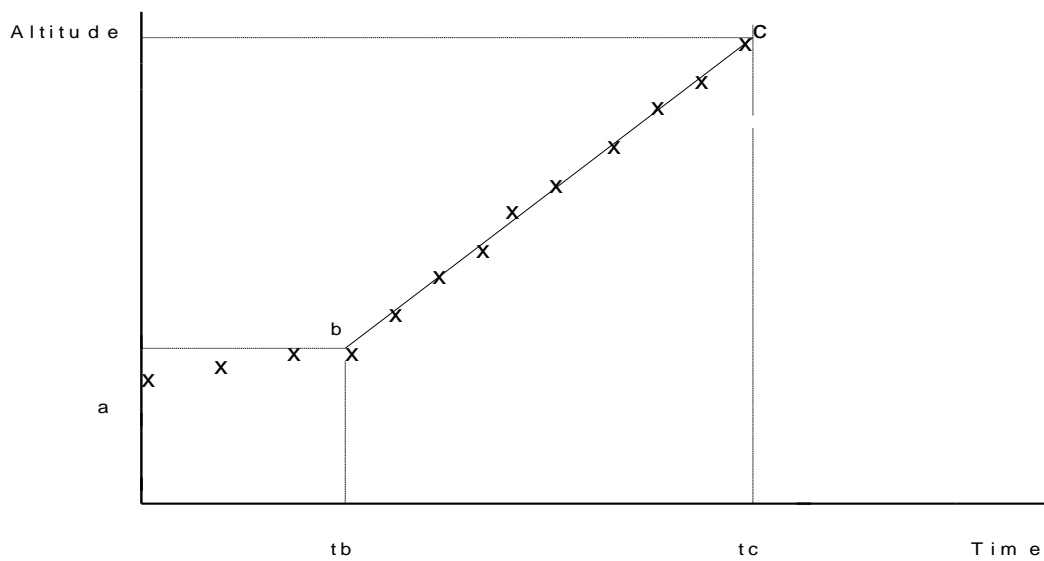
H3 It is not necessary to use all of a climb to determine the average rate of climb if some of the data are suspect. For example, the first 3 measurements in the climb may be of poor quality because the speed was too low and 'climb energy' was used to regain the correct VY. This could be allowed for 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.

- H4 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 mid-climb point and used to calculate the rate of climb (see Figure 3).
- H5 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.

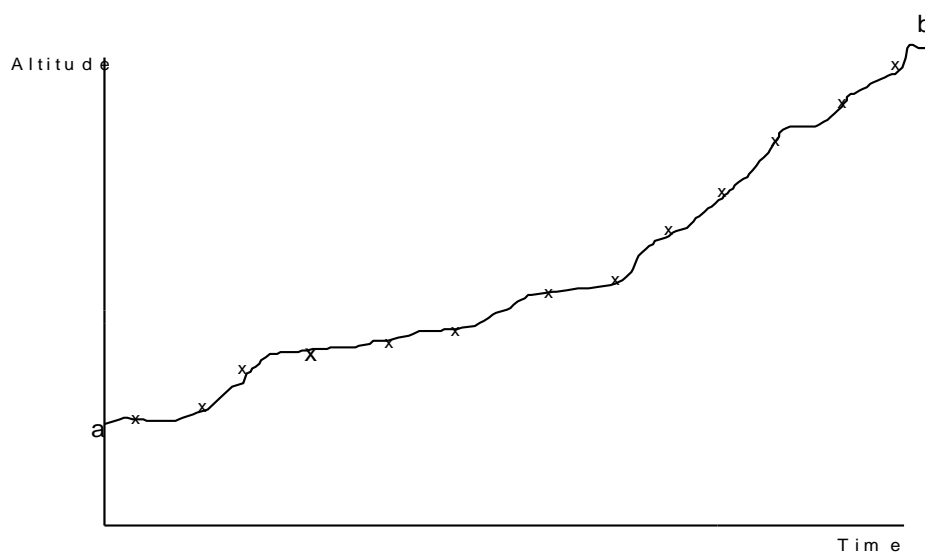
Determination of average check altitude and temperature

- H6 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 over-reading 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

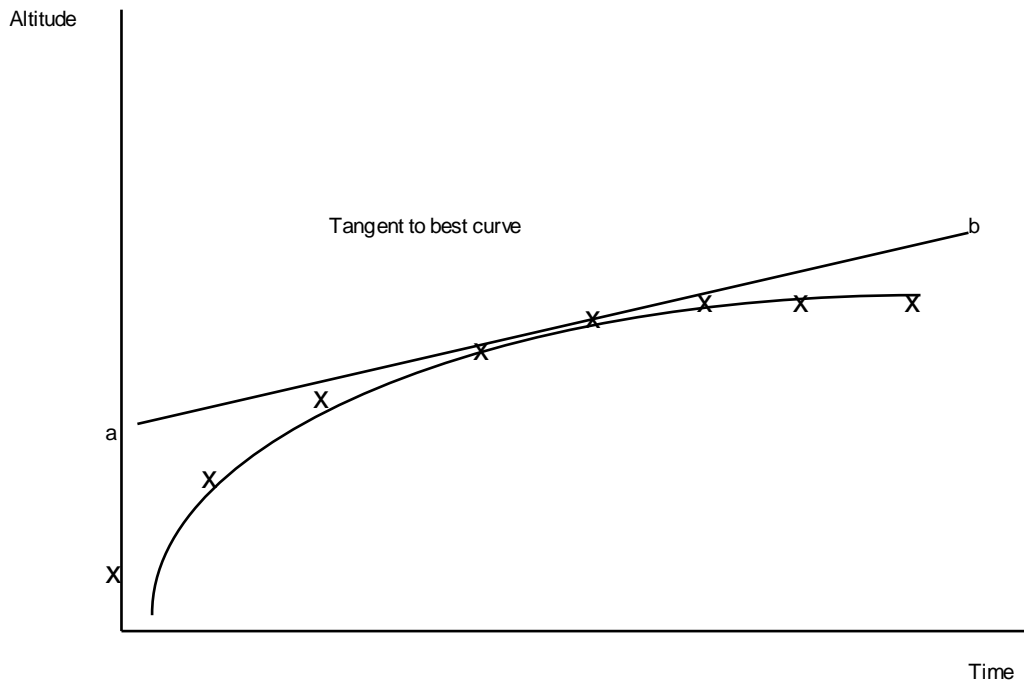
H7 Example of Correct Interpretation of Climb Results: Portion 'a' to 'b' is ignored, (due to incorrect airspeed, low level turbulence, etc.).

H8 Rate of climb = $(ht \text{ at } c) - (ht \text{ at } b) / (\text{time at } c) - (\text{time at } b)$.

Figure 2: Use of graphical method

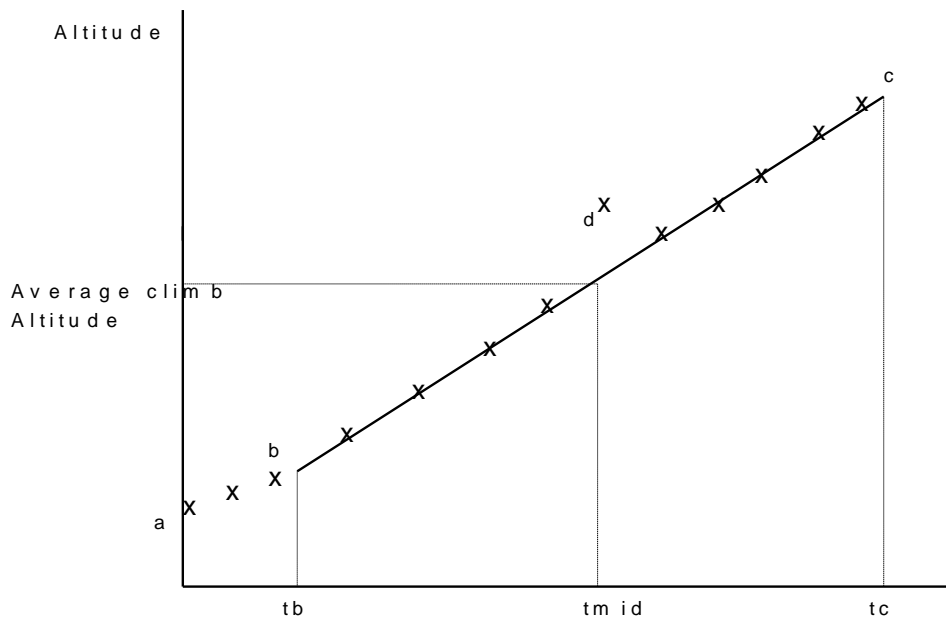
H9 Incorrect Use of Graph and Interpretation of Results: Rate of climb = $(ht \text{ at } b) / (ht \text{ at } a) / (\text{time at } b) - (\text{time at } a)$

Figure 3: Determination of rate of climb when 'best line' is a curve



H10 Rate of climb = (ht at b) - (ht at a) / (time at b) (time at a)

Figure 4: Determination of average climb altitude



H11 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 I

Climb performance tolerances

Introduction

- I1 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.
- I2 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 power units 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.
- I3 Provided that all concerned are satisfied with the condition of the rotorcraft and its power units, 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

- I4 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.

I5 If the shortfall is greater than 20 ft/min then it should be investigated as outlined above.

I6 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.

Appendix J

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	
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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) *	Airfield:		
Average Weight			The box below to be completed	Start Weight	kg/lbs*
Average Altitude		ft			
Average Temp.		°C	by the nominated engineer	Take-off cg:	
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

- J1 Reg: Enter the aircraft registration mark. If the aircraft is not on the UK register, add the manufacturer's serial number and expected UK registration (if known).
- J2 Pilot: Captain and co-pilot (where applicable).
- J3 Airfield: Departure airfield.
- J4 Start Weight: Actual all up weight at engine start. Also delete kg or lbs as appropriate.
- J5 Take-off cg: Actual cg at lift-off, preferably as a % of the Mean Aerodynamic Chord.

Performance

- J6 A full description of climb analysis is given in the CAA Handbook for Check Flights.
- J7 Climb: Enter in these columns data from the climb.
- J8 Average Weight: The aircraft all up weight at the midpoint of the measured climb.
- J9 Average Altitude: The altitude at which the line drawn to average the measured points passes through at the mid time.
- J10 Average Temp: The temperature at which the line drawn to average the measured points passes through at the mid time.
- J11 Speed: The target climb speed (Indicated Airspeed.)
- J12 Achieved Rate: The climb rate as given by the slope of the line drawn to average the measured altitude points in feet per minute.

- J13 Scheduled Rate: The expected gross rate of climb read from the appropriate graph in the Flight Manual with any adjustments for configuration differences.
- J14 Margin: The difference between the Scheduled and Achieved rates of climb, (negative if achieved is lower than scheduled).
- J15 Permitted Margin: The maximum allowable difference between the Scheduled and Achieved rates of climb.

Defects

- J16 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.
- J17 No.: The first column is to allow the items to be numbered.
- J18 Defect: Enter details of the defect.
- J19 -/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

- J20 Any conclusions, notes or comments useful for tracking defects may be entered.
- J21 Name: Only the pilot who carried out the test may sign this sheet.