Advisory Circular
AC61-10

Revision 14
1 November 2024

Pilot Licences and Ratings – Type Ratings

General

Civil Aviation Authority (CAA) advisory circulars (ACs) contain information about standards, practices, and procedures that the Director has found to be an **acceptable means of compliance** with the associated rule.

Consideration will be given to other methods of compliance that are presented to the Director. When new standards, practices, or procedures are found to be acceptable they will be added to the appropriate AC.

Purpose

This AC describes an acceptable means of compliance with flight time experience and ground training requirements under Civil Aviation Rule Part 61 for the issue of an Aircraft Type Rating.

Related Rules

This AC relates specifically to Part 61 Subpart B – Aircraft Type Ratings.

Change Notice

Revision 14 makes changes to the Basic Turbine Knowledge (BTK) syllabi for pilots. We have separated the BTK pilot syllabus into two separate syllabi for Aeroplane and Helicopter respectively. The existing syllabus for Subject 64 has been amended to focus on Aeroplane and a completely new syllabus for Helicopter Subject 65 has been produced. We have also updated information on applying online and made minor corrections.

***Note**: If candidates already hold the BTK credit obtained before this syllabus change, it is still valid for either the Aeroplane or Helicopter turbine type rating issue, as it does not expire.*

~~Revision 13:~~

- ~~removes approved basic gas turbine knowledge exam equivalence for engineers with turbine engine aircraft ratings, and~~
- ~~replaces CASA Boeing 737 Type Rating equivalence with multi-crew aircraft, and~~
- ~~adds, in Appendices V and VII, a requirement for type training in helicopters and aeroplanes over 5700kg to include Original Equipment Manufacturers (OEM) recommendations and Operational Suitability Data (OSD) in the training syllabus.~~

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Version History

AC Revision No.	Effective Date	Summary of Changes
AC61-1.10	6 October 1998	The initial issue of this AC.
AC61-1.10 Rev.1	11 May 2006	Incorporated amendments related to the reissue of Part 61.
AC61-1.10 Rev.2	26 May 2006	Corrected the numbering in Sub Topic 64.18.2 and the numbering of Sub Topics 64.30.6 through to 64.34.6. Minor editorial amendments were made including replacing the word 'shall' in the demonstration of competency sections.
AC61-10 Rev. 3	9 May 2007	Re-numbered this AC from AC 61-1.10 to AC 61-10 as part of a project to standardise the numbering of all ACs.
AC61-10 Rev. 4	1 January 2009	Introduced a revised Appendix II Subject No 64 Basic Turbine Knowledge.
AC61-10 Rev. 5	13 May 2013	Introduced a syllabus of conversion training related to ex-military jet aircraft.
AC61-10 Rev. 6	28 May 2015	Amended 'Category A flight instructors' privileges in relation to LSA type aircraft (on page 6).
AC61-10 Rev.7	8 June 2015	Amended 'Category A flight instructors' privileges in relation to homebuilt and LSA type aircraft (on page 6).
AC61-10 Rev. 8	26 September 2016	Incorporated a revised syllabus at Appendix II, Subject No 64 Basic Turbine Knowledge.
AC61-10 Rev. 9	8 March 2019	Made minor editorial changes to foreign type ratings: • Change Notice updated • Version History inserted • The numbering system revised • Paragraph 2.2.1.1(c) amended
AC61-10 Rev.10	11 June 2019	Made minor editorial changes to Appendices IV and VII of this AC.
AC61-10 Rev. 11	21 June 2021	Made minor updates to Appendices III, IV and V: • aligning training requirements for fixed wing aircraft with those for helicopters, and • including Upset Prevention and Recovery Training (UPRT).
AC61-10 Rev.12	2 October 2023	Added a note on the online application process and updated section 2.4.1 to refer to online applications.

AC61-10 Rev.13	6 August 2024	Removed~~s~~ approved basic gas turbine knowledge exam equivalence for engineers with turbine engine aircraft ratings, and Replaced~~s~~ CASA Boeing 737 Type Rating equivalence with multi-crew aircraft, and Added~~s~~, in Appendices V and VII, a requirement for type training in helicopters and aeroplanes over 5700kg to include Original Equipment Manufacturers (OEM) recommendations and Operational Suitablity Data (OSD) in the training syllabus.
AC61-10 Rev.14	1 November 2024	Separates the BTK pilot syllabus into two separate syllabi for Aeroplane and Helicopter respectively. The existing syllabus for Subject 64 has been amended to focus on Aeroplane and a completely new syllabus for Helicopter Subject 65 has been produced. Updates information on applying online and makes minor corrections. ***Note 1:*** *If candidates already hold the BTK credit obtained before this syllabus change, it is still valid for either the Aeroplane or Helicopter turbine type rating issue, as it does not expire.* ***Note 2:*** *The following changes were made to the draft syllabi before publication*: ***Aeroplane syllabus:*** • Item 64.8.16 (c) – added “veins” • Item 64.8.30 – changed to: “Describe the factors that can cause compressor stall/surge” • Items 64.18.4 and 64.16 – removed “biojet” ***Helicopter syllabus:*** • Added item 65.6.6***: “***Describe the function of intake shrouds on turboshaft powered helicopters” • Amended items in 65.10.4 (a) • Deleted “multiple” in bullet point (a) • Changed bullet point (c) to “reverse flow annular” • Deleted bullet point (d) • Item 65.26.4 – added N1 and N2 to bullet points (a) and (b) respectively

Table of Contents

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1. Rule 61.53 Eligibility Requirements

***Note**: ~~From 2 October 2023~~ A~~a~~pplicants for pilot licences can now apply online through **MyAviation**, CAA's online portal for licensing requests, instead of filling in paper forms. **MyAviation** is CAA's preferred way to submit applications and is the equivalent of using the applicable paper form. Click the 'Online services' button on the CAA home page to get started.*

1.1 Flight time

1.1.1 **Rule 61.53(2).** The minimum conversion flight instruction times acceptable to the Director are detailed in Appendix I of this AC.

1.1.2 A type rating obtained under the Civil Aviation Regulations 1953 (in the group system) may be relied upon to obtain an individual aircraft type rating for a licence issued under Part 61, on production of logbook evidence of pilot in command (PIC) or co-pilot flight time in that aircraft type.

1.2 Turbine powered aircraft

1.2.1 **Rule 61.53(3)** requires an applicant for a type rating on a turbine powered aircraft to have passed an approved basic turbine knowledge examination. This requirement is a prerequisite to an applicant commencing conversion training for their first turbine type rating only. The written examination is based on Subject 64 syllabus items detailed in Appendix II of this AC.

1.2.2 The instructor conducting type conversion training is required to address the knowledge deficiencies identified in the trainee's knowledge deficiency report (KDR). The flight instructor must ensure that remedial action has occurred and that they have tested the applicant's knowledge on the deficient areas with content acknowledged against the relevant rule reference(s), before signing off the KDR(s).

1.2.3 Aircraft engineers who hold a credit in New Zealand AMEL Subject 8 meet this examination credit requirement.

1.2.4 Military pilots who can provide evidence that they have qualified as first or second pilot in gas turbine powered aircraft types meet this examination requirement.

1.2.5 Military engineers who can produce appropriate evidence of basic and specific type training on turbine power plants meet this examination requirement.

1.2.6 An examination credit in the subject of basic turbine knowledge which has been obtained in an ICAO Contracting State may be recognised in New Zealand if the applicant has obtained a type rating on a turbine powered aircraft in that country.

1.3 Aircraft type technical knowledge

1.3.1 **Rule 61.53(4)** requires an applicant for an aircraft type rating to demonstrate to an appropriately qualified flight instructor a satisfactory technical knowledge of the aircraft. This demonstration is based on items detailed in Appendix III for aeroplanes, and Appendix IV for helicopters, of this AC.

1.4 Type competency demonstration

1.4.1 **Rule 61.53(5)** requires a type competency demonstration (for any type rating) in the ability to perform competently every normal, abnormal, and emergency manoeuvre appropriate to the aircraft type for which the type rating is required.

(a) **For aircraft in excess of 5700 kg MCTOW** this demonstration generally consists of items detailed in Appendix V of this AC. A flight simulator, approved by the Director for conversion to type training, may be used for all or part of this demonstration.

(b) **For single pilot certificated aeroplanes not exceeding 5700 kg MCTOW** this is expanded on in the Demonstration of Competency - Type Rating - Aeroplane guide available on the CAA website Demonstration of Competency – Type Rating – Single Pilot Certificated Aeroplane This demonstration generally consists of items detailed in Appendix VI of this AC.

(c) **For helicopters** the Demonstration of Competency - Type Rating - Helicopter guide is on the CAA website Demonstration of Competency – Type Rating – Helicopter This demonstration generally consists of items detailed in Appendix VII of this AC.

1.5 Heavy aircraft and multi-engine helicopters

1.5.1 **Rule 61.53(6)** requires, for aircraft exceeding 5700 kg MCTOW or multi-engine helicopters, an 'approved' course of technical training and an 'approved' written examination. The course content and written examination are based on the items detailed in Appendix III and IV of this AC.

1.5.2 This requirement may be met by completion of a CAA technical training approved course by a certificated Part 141 or Part 119 organisations, where the certificate authorises the holder to conduct such training. The organisation must certify that a satisfactory standard of technical knowledge has been achieved in the required type rating technical examinations.

1.5.3 Before commencing training at an organisation outside New Zealand, applicants should ensure that the course is 'approved' by CAA. This information is available on the CAA website https://www.aviation.govt.nz/licensing-and-certification/pilots/flight-training/type-ratings/

1.6 Single engine helicopter

1.6.1 **Rule 61.53(7).** The approved written examination for this rule is detailed in Appendix IV of this AC.

1.6.2 This requirement would be met by certification that a satisfactory standard of technical knowledge has been achieved in the required type rating technical examinations by a certificated Part 141 organisation or by a certificated Part 119/135 organisation where the certificate authorises the holder to conduct such training.

1.6.3 In the case of a helicopter not exceeding 1500 kg MCTOW the required examination, based on the items in Appendix IV of this AC, may be conducted orally by an appropriately qualified flight instructor.

2. Rule 61.55 Issue

2.1 Logbook endorsement

2.1.1 **Rule 61.55(a)(1).** To meet the requirement of this rule the flight instructor must make an entry in form CAA 1373 - Pilot's Logbook.

2.1.2 **Rule 61.55(a)(2).** For the purposes of this rule the flight instructor submits a copy of the type rating training record to the Director.

(a) **For single pilot certificated aeroplanes**, form CAA 24061/13 is the acceptable type rating training record.

(b) **For the first turbine type,** the training record must contain a copy of the trainee's basic turbine knowledge examination credit and the knowledge deficiencies as addressed by the qualified instructor.

(c) **For a multi-crew aircraft type rating or a helicopter**, the acceptable type rating training record is as specified in the certificated Part 119 or Part 141 organisation's expositions.

2.1.3 Although the type rating is issued when it is entered in the pilot's logbook by an appropriately qualified flight instructor and the CAA database is updated on receipt of the training record, the type will not appear until the licence is reissued for any reason, or if separate application is made under rule 61.55(c).

2.1.4 A pilot who produces evidence that they have qualified as PIC on an aeroplane or a helicopter in the New Zealand Armed Forces may have that type endorsed on their civil licence provided the type is on the New Zealand civil aircraft register.

2.2 Director endorsed type rating in specified circumstances

2.2.1 Foreign type ratings

2.2.1.1 For the recognition of a foreign type rating the aircraft type must be active on the New Zealand aircraft register.

2.2.1.2 **Rule 61.55(b)(1)** The manner acceptable to the Director is as follows:

(a) **For single pilot certificated aircraft,** on the New Zealand civil aircraft register, for which a type rating or validation has been issued by a foreign Contracting State to the Convention, may be endorsed on a New Zealand licence provided the applicant produces evidence of having completed at least five hours as PIC on type, or the type is endorsed in the logbook by the holder of an appropriately qualified New Zealand flight instructor rating.

(b) **For multi-crew aircraft,** evidence the applicant has completed 500 hours as PIC or 1000 hours as first officer on the type is acceptable to the Director.

(c) **For multi-crew aircraft issued by CASA,** the type rating must be endorsed on the CASA licence. If the rating is not on the licence, then evidence the applicant has completed 500 hours as PIC or 1000 hours as first officer on the type is acceptable to the Director.

(d) For **Boeing 737 type ratings,** CAANZ recognises the following series as separate type ratings:

1. 737 Classic 100-200
2. 737 300-900
3. 737 Max.

Approved differences training for variants within a series is required to be undertaken within the training system of certified organisations.

2.2.2 Test pilots

2.2.2.1 **Rule 61.55(b)(2)** provides for a pilot who has been approved to act as a test pilot under rule 19.405(1), to have the aircraft type endorsed on the licence on completion of acceptable flight experience. The following flight experience is acceptable to the Director:

(a) **For single engine** land, waterborne and ski equipped aeroplanes or helicopters – 5 hours.

(b) **For multi engine** aeroplanes or helicopters – 10 hours.

(c) **For any other aircraft** as specified by the Director.

2.2.3 Category A flight instructors

2.2.3.1 **Rule 61.55(b)(3)** provides for the holder of a Category A flight instructor rating to have a specific aeroplane type, provided for under rule 61.5(o) as having similar characteristics, endorsed on the licence on completion of acceptable flight experience. The following PIC flight experience is acceptable to the Director:

(a) Single engine, fixed pitch, fixed tricycle undercarriage, land aeroplanes – 1 hour

(b) Single engine, fixed pitch, retractable tricycle undercarriage, land aeroplanes – 1 hour

(c) Single engine, constant speed, fixed tricycle undercarriage, land aeroplanes – 1 hour 30 minutes

(d) Single engine, constant speed, retractable tricycle undercarriage, land aeroplanes – 1 hour 30 minutes

(e) Single engine, fixed pitch, fixed undercarriage, tail wheel, land aeroplanes – 1 hour

(f) Single engine, constant speed, fixed undercarriage, tail wheel land aeroplanes – 2 hours.

2.2.3.2 Category A flight instructors are deemed to be type rated on all aircraft whose airworthiness certificate (C of A) is issued in the *special category* and described as *amateur-built* or *LSA*, provided they hold a type rating on a similar configuration (tricycle/tailwheel etc.).

2.3 First of type

2.3.1 **Rule 61.55(b)(4)** provides for a flight instructor who holds a first of type authorisation under rule 61.57, to have the aircraft type endorsed on the licence on completion of flight experience acceptable to the Director. The flight experience acceptable to the Director is that specified in the first of type authorisation.

2.4 Endorsement on licence

2.4.1 **Rule 61.55(c)** requires that, for the type to appear on the licence, the pilot must make an application to amend the licence and pay the appropriate fee to CAA. The application may be completed online using **MyAviation**, the Authority's online portal for licensing requests, instead of filling in paper forms. **MyAviation** is CAA's preferred way to submit applications and is the equivalent of using the applicable paper form.

2.5 Similar aircraft types

2.5.1 **Rule 61.55(d)** allows for an aircraft type rating to include any other aircraft, if in the opinion of the qualified flight instructor, the type is so similar as to require no further conversion instruction or type competency demonstration. The flight instructor must endorse the logbook with the type and submit to the Director a copy of the logbook entry.

2.5.2 The decision on similar type is entirely the responsibility of the qualified flight instructor who is current on type and conversant with the experience and ability of the candidate.

Appendix I - Aircraft Type Rating Minimum Flight Experience

For all aircraft

Demonstrate, to a qualified instructor, all normal and abnormal operations at or near to MCTOW.

For a single piston engine aeroplane land only

Initial issue is combined with the issue of an aeroplane pilot licence, subsequent types - 30 minutes.

For a single piston engine ski-plane

Using snow as the sole take-off and landing medium - 3 hours to include a minimum of 4 full stop landings on snow. Subsequent types - minimum of 4 full stop landings on snow.

For a single piston engine seaplane

Using water as the sole take-off and landing medium: initial issue - 5 hours, subsequent types - 2 hours.

For a piston multi-engine centreline-thrust aeroplane not exceeding 5700 kg MCTOW

Initial issue - 2 hours.

For a piston multi-engine (non centreline-thrust) aeroplane not exceeding 5700 kg MCTOW

Initial issue - 5 hours; subsequent types - 1 hour.

For a single engine helicopter not exceeding 5700 kg MCTOW

Initial issue will be combined with the issue of a helicopter pilot licence; subsequent types - 1 hour.

For a multi-engine helicopter not exceeding 5700 kg MCTOW

Initial issue - 5 hours, subsequent types - 3 hours.

For a helicopter exceeding 5700 kg MCTOW

Initial issue - 10 hours, subsequent types - 5 hours.

For an ex-military turbine aircraft

Initial Issue - 5 hours, subsequent types - 1 hour.

For any other aircraft

As specified by the Director.

Notes:

- *The minimum conversion flight time will be dual instruction unless otherwise specified and will be confined to exercises relative to conversion to the particular aircraft type.*
- *For simple single engine aeroplanes operating on land only, the minimum conversion flight time may (at instructor discretion) include the type competency demonstration in one flight.*
- *For more complex single pilot certificated aeroplanes the type competency demonstration may form part of the minimum flight experience requirement.*

- *For single engine aeroplanes operating on land only, the flight instructor who conducts the type competency demonstration may (at their discretion) include any variant or similar aircraft type they consider so similar as to not require further or specific instruction on that variant by adding that variant's designation to the competency demonstration record and pilot's logbook.*
- *For ex-military turbine aircraft, the minimum flight times shown would be for an experienced pilot. The type competency demonstration may form part of the minimum flight experience requirement. A private pilot or low experience commercial pilot should anticipate having to complete more flight hours prior to being able to demonstrate competency.*
- *In the case of a single seat type, the instructor issuing the rating is to be satisfied that the pilot has successfully completed ground training to an appropriate level. In addition, before making the appropriate logbook entry, the instructor is to personally observe from the ground the pilot's flying of the aircraft and be satisfied that an acceptable level of competence was displayed.*

• ~~Appendix II - Subject No 64 Basic Turbine Knowledge~~

~~A2.1 Each subject has been given a subject number and each topic within that subject a topic number. These reference numbers will be used on 'knowledge deficiency reports' and will provide valuable feedback to the examination candidate.~~

~~Sub Topic Syllabus Item~~

~~64.2 Basic Turbine Engine Theory~~

~~64.2.2 Describe Newton's third law of motion and its practical application as it relates to the operation of a turbine engine.~~

~~64.2.4 Describe how gas undergoes changes in pressure, volume and temperature in accordance with Boyle's and Charles' Laws.~~

~~64.2.6 Describe each of the following and their application to turbine engine operation:~~

~~(a) Bernoulli's Theorem~~

~~(b) Brayton constant pressure cycle~~

~~(c) the pressure-temperature cycle.~~

~~64.2.8 Describe the changes to pressure, temperature and velocity of the gas flow as it passes through each section of a turbine engine.~~

~~64.2.10 Describe the changes in the airflow characteristics of velocity, temperature and pressure through a divergent and convergent duct at subsonic and supersonic speeds.~~

~~64.4 Turbine Engine Types~~

~~64.4.2 Compare the working cycle of a turbine engine and a piston engine.~~

~~64.4.4 Describe the comparative advantages of turbine engines versus piston engines for aircraft propulsion.~~

~~64.4.6 Describe the basic constructional arrangements of the following engine types:~~

~~(a) turboprop~~

~~(b) turbo-shaft~~

~~(c) turbojet~~

~~(d) turbofan~~

~~(e) geared turbofan.~~

~~64.4.8 Describe the operating parameters and uses of each of the above engines.~~

~~64.4.10 Identify engines that fall into either the thrust producing or torque producing category.~~

~~64.4.12 Describe the following mechanical arrangements of a turbine engine:~~

~~(a) single-spool~~

~~(b) twin-spool~~

~~(c) triple-spool~~

~~(d) geared turbofan.~~

~~**64.6 Turbine Engine Inlet Systems**~~

~~64.6.2 Describe the purpose, design and principles of operation of the engine inlet duct.~~

~~64.6.4 Describe and explain the purpose of a subsonic divergent inlet duct.~~

~~**64.8 Turbine Engine Compressors**~~

~~64.8.2 Describe the purpose of a compressor in a turbine engine.~~

~~64.8.4 Describe the basic principles of operation of centrifugal and axial flow compressors.~~

~~64.8.6 Describe the compressor arrangements found on the various types of turbine engine.~~

~~64.8.8 Describe the comparative advantages of centrifugal and axial flow compressors.~~

~~64.8.10 Describe the merits of combined centrifugal and axial flow compressor combinations in turbine engines.~~

~~64.8.12 Describe typical compressor pressure ratios for the various types and configuration of turbine engine.~~

~~64.8.13 Describe the factors that affect compression ratio.~~

~~64.8.14 Define bypass ratio.~~

~~64.8.16 Describe the design of, and bypass ratios associated with, various bypass fans, from low bypass to ultra-high bypass.~~

~~64.8.18 Describe the purpose and function of:~~

~~(a) impellers~~

~~(b) inlet guide vanes (fixed and variable)~~

~~(c) rotor blades~~

~~(d) stator blades~~

~~(e) variable stator blades~~

~~(f) diffusers~~

~~(g) bleed valves/bands.~~

~~64.8.24 State the reasons why axial flow compressors have a higher number of stages than centrifugal compressors.~~

~~64.8.26 State the reason for the small pressure change per stage in an axial flow compressor.~~

~~64.8.28 State the reason for the decrease in size and increase in the number of compressor blades towards the rear of an axial flow compressor.~~

~~64.8.30 State the reasons for and advantages of multiple spool compressors.~~

~~64.8.32 For various types of compressor arrangements identify; N1, N2, and N3 and state whether each is HP, IP or LP.~~

~~64.8.36 Describe the common source of bleed air.~~

~~64.8.38 Explain what is meant by compressor stall/compressor surge.~~

~~64.8.40 State the conditions that are commonly known to produce compressor stall/surge with particular regard to:~~

~~(a) compressor maintenance~~

~~(b) blade damage~~

~~(c) intake damage/restriction~~

~~(d) engine handling/operation~~

~~(e) fuel scheduling.~~

~~64.8.42 Describe the symptoms of a compressor stall/surge.~~

~~64.8.44 Describe the operation of the following stall/surge control devices:~~

~~(a) variable angle inlet guide and compressor vane systems~~

~~(b) bleed valves~~

~~(c) bleed bands.~~

~~64.10 Turbine Engine Combustion Section~~

~~64.10.2 Describe the purpose and operation of the combustion chamber(s).~~

~~64.10.4 Describe the constructional features and principles of operation of the following types of combustion chamber:~~

~~(a) multiple can~~

~~(b) annular~~

~~(c) can annular~~

~~(d) reverse flow annular.~~

~~64.10.6 State the comparative advantages of each type of combustion chamber.~~

~~64.10.8 Describe the purpose of:~~

~~(a) swirl chambers~~

~~(b) air shrouds~~

~~(c) liners~~

~~(d) interconnectors.~~

~~64.10.10 Describe the uses of primary, secondary and tertiary air flow through and/or around a combustion chamber.~~

~~64.10.12 State the percentages of airflow typically used for cooling and for combustion.~~

~~64.10.14 Describe how flameout is caused and prevented.~~

~~64.12 Turbine Engine Turbine Section~~

~~64.12.2 State the purpose and operation of the turbine section.~~

~~64.12.4 Describe how a turbine blade extracts energy from the gas stream and drives the wheel/disc.~~

~~64.12.6 Describe the function of the following turbine assembly components:~~

~~(a) casing and associated structures~~

~~(b) wheel/disc~~

~~(c) shafts~~

~~(d) nozzle guide vanes~~

~~(e) blades.~~

~~64.12.8 Describe the~~ principles of operation and characteristics of the following turbine blade design types:

~~(a) impulse~~

~~(b) impulse-reaction~~

~~(c) reaction.~~

~~64.12.10 State which type of turbine blade design is most common and explain why this type of blade is preferred.~~

~~64.12.14 Identify factors which limit the power available from the turbine section.~~

~~64.12.16 Describe multi-stage turbines.~~

~~64.12.18 State the reasons for compressor-turbine matching and how this is achieved.~~

~~64.12.20 State why turbine assemblies increase in diameter towards the rear of the engine.~~

~~64.12.22 Define turbine blade creep and state the causal factors for this condition.~~

~~64.14 Turbine Engine Exhaust Section~~

~~64.14.2 State the function of the exhaust section.~~

~~64.14.4 Describe the exhaust gas flow through convergent and divergent passages.~~

~~64.14.6 State the purpose, and principles of operation of the following exhaust nozzle types:~~

~~(a) convergent~~

~~(b) convergent-divergent.~~

~~64.14.8 Describe the noise levels of different types of exhaust system and the various means of noise suppression.~~

~~**64.16 Thrust Reversers**~~

~~64.16.2 Describe thrust reversal.~~

~~64.16.4 Explain the purpose and operation of thrust reversal.~~

~~64.16.6 Describe the various types of thrust reverser.~~

~~**64.18 Turbine Engine Fuel Systems**~~

~~64.18.2 Compare and differentiate between AVGAS and turbine engine fuel (including Biojet) and describe methods of reducing the likelihood of fuelling with the wrong type.~~

~~64.18.4 State the differences between the various types of turbine engine fuel (including Biojet) and identify their common usage names.~~

~~64.18.6 Describe the function of the following turbine engine fuel system components:~~

~~(a) fuel control unit (hydro pneumatic, hydro mechanical and electro-hydro mechanical)~~

~~(b) fuel filters~~

~~(c) fuel heater~~

~~(d) governors and limiting devices~~

~~(e) main fuel pumps.~~

~~64.18.8 State the ideal fuel/air ratio for a turbine engine.~~

~~64.18.10 Describe the following properties in relation to turbine engine fuels:~~

~~(a) specific gravity~~

~~(b) fire hazard~~

~~(c) fuel icing.~~

~~64.18.12 State the effect of a change in specific gravity with respect to weight of fuel.~~

~~64.18.14 Describe the purposes of anti-icing and anti-microbiocidal additives in turbine engine fuels.~~

~~64.18.16 State the ground handling requirements and the safety precautions to be observed with the use of turbine engine fuels.~~

~~64.18.18 Describe the susceptibility of turbine fuels to water contamination over other types of aviation fuels.~~

~~64.18.20 Describe methods of fuel system contamination detection and control.~~

~~**64.20 Turbine Engine Lubrication Systems**~~

~~64.20.2 Describe the basic principles of operation of typical turbine engine lubrication systems.~~

~~64.20.4 Describe the function and principles of operation of the following turbine engine lubrication system components:~~

~~(a) oil cooler~~

~~(b) oil-fuel heat exchangers~~

~~(c) oil filters/screens (pressure and scavenge)~~

(d) oil system chip detectors and magnetic plugs

(e) valves (bypass/check/relief).

64.20.6 State the reason most turbine engines use fuel to cool the oil in preference to air.

~~**64.22 Turbine Engine Starting; Ignition; Relight; and Shutdown**~~

~~64.22.2 Describe the general precautions and safety checks prior to starting and ground running a turbine engine.~~

~~64.22.4 Describe general procedures for starting and shutting down a turbine engine.~~

~~64.22.6 Describe the positive cockpit indications of light-up during start.~~

~~64.22.8 Describe what is meant by self-sustaining rpm and how this is achieved.~~

~~64.22.10 Describe why it is important to accelerate an engine up to sustaining rpm as quickly and uniformly as possible.~~

~~64.22.12 Describe the causes, indications, effects and remedial actions for the following start defects:~~

~~(a) hung start~~

~~(b) hot start~~

~~(c) wet start~~

~~(d) compressor stall/surge during start~~

~~(e) tail pipe fire~~

~~(f) bleed band or bleed valve stuck in the open or closed position.~~

~~64.22.14 Describe why turbine engines are often fitted with separate low and high energy ignition systems.~~

~~64.22.16 Describe the conditions under which the ignition system(s) would be turned on.~~

~~64.22.18 Describe the requirement and general procedures for an engine relight in the air.~~

~~**64.24 Turbine Engine Air Cooling and Sealing**~~

~~64.24.2 Describe the requirement for cooling and sealing of turbine engine components.~~

~~64.24.4 Describe the uses of compressor bleed air for cooling and sealing.~~

~~64.24.6 Describe how turbine blades, discs and nozzles are cooled using compressor bleed air.~~

~~64.26 Turbine Engine Indicating and Instrumentation~~

~~64.26.2 Describe the following types of turbine engine indicators and instrumentation including their function and basic principles of operation:~~

~~(a) engine rpm~~

~~(b) engine pressure ratio~~

~~(c) engine torque~~

~~(d) fuel flow~~

~~(e) pressure indicators~~

~~(f) temperature indicators~~

~~(g) vibration indicators.~~

~~64.26.4 State the meaning of the following terms:~~

~~(a) EPR~~

~~(b) fan speed (N1)~~

~~(c) TIT~~

~~(d) ITT~~

~~(e) TOT~~

~~(f) TGT~~

~~(g) EGT~~

~~(h) JPT.~~

~~64.28 Turbine Engine Performance~~

~~64.28.2 Define the following terms and describe the relationship between them, and their application to engine operation:~~

~~(a) power~~

~~(b) thrust~~

~~(c) torque~~

~~(d) gross thrust~~

~~(e) net thrust~~

~~(f) thrust horsepower (THP)~~

~~(g) shaft horsepower (SHP)~~

~~(h) equivalent shaft horsepower (ESHP)~~

~~(i) specific fuel consumption (SFC).~~

~~64.28.4 Describe the effect of the following factors on turbine engine performance:~~

~~(a) airspeed~~

~~(b) ram effect~~

~~(c) altitude~~

~~(d) pressure~~

~~(e) temperature~~

~~(f) humidity~~

~~(g) bleed air.~~

~~64.28.6 Describe the methods of thrust augmentation.~~

~~64.28.10 Describe the propulsive efficiency of the following types of turbine engine:~~

~~(a) turboprop/turboshaft~~

~~(b) high bypass ratio turbofan~~

~~(c) low bypass ratio turbofan~~

~~(d) geared turbofan~~

~~(e) turbojet.~~

~~64.28.12 State the causes of the reduction in SFC with increasing airspeed in turboprop engines.~~

Appendix II a - Subject No 64 Basic Turbine Knowledge - Aeroplane

Note 1: *This syllabus is based on a ''basic'' level of knowledge applicable to the operation of a turbine engine, such as would be required by a pilot about to undergo training toward a type rating on their first turbine engine aeroplane.*

Note 2: *If candidates already hold the BTK credit obtained before this syllabus change, it is still valid for either the Aeroplane or Helicopter turbine type rating issue, as it does not expire.*

Each subject has been given a subject number and each topic within that subject a topic number. These reference numbers will be used on 'knowledge deficiency reports' and will provide valuable feed back to the examination candidate.

Sub Topic Syllabus Item

64.2 Basic Turbine Engine Theory

64.2.2 Describe Newton's third law of motion and its practical application as it relates to the operation of a turbine engine.

64.2.4 Describe how gas undergoes changes in pressure, volume and temperature in accordance with Boyle's and Charles' Laws.

64.2.6 Describe each of the following and their application to turbine engine operation:

(a) Bernoulli's Theorem

(b) Brayton constant pressure cycle

(c) the pressure-temperature cycle

64.2.8 Describe the changes to pressure, temperature and velocity of the gas flow as it passes through each section of a turbine engine.

64.4 Turbine Engine Types

64.4.2 Compare the working cycle of a turbine engine and a piston engine.

64.4.4 Describe the comparative advantages of turbine engines versus piston engines for aircraft propulsion.

64.4.6 Describe the basic constructional arrangements of the following engine types:

(a) turboprop

(b) turboshaft

(c) turbojet

(d) turbofan

(e) geared turbofan

64.4.8 Describe the operating parameters and uses of each of the above engines.

64.4.10 Identify engines that fall into either the thrust producing or torque producing category.

64.4.12 Describe the following mechanical arrangements of a turbine engine—

(a) single-spool

(b) twin-spool

(c) triple-spool

(d) geared turbofan

64.6 Turbine Engine Inlet Systems

64.6.2 Describe the purpose, design and principles of operation of the engine inlet duct.

64.6.4 Describe and explain the purpose of a subsonic divergent inlet duct.

64.8 Turbine Engine Compressors

64.8.2 Describe the purpose of a compressor in a turbine engine.

64.8.4 Describe the basic principles of operation of centrifugal and axial flow compressors.

64.8.6 Describe the comparative advantages of centrifugal and axial flow compressors.

64.8.8 Describe the merits of combined centrifugal and axial flow compressor combinations in turbine engines.

64.8.10 Describe typical compressor pressure ratios for the various types and configuration of turbine engine.

64.8.12 Define bypass ratio.

64.8.14 Describe the design of, and bypass ratios associated with, various bypass fans, from low bypass to ultra-high bypass.

64.8.16 Describe the purpose and function of:

(a) impellers

(b) inlet guide vanes (fixed and variable)

(c) rotor blades

(d) stator blades

(e) variable stator veins

(f) diffusers

(g) bleed valves / bands

64.8.18 State the reasons why axial flow compressors have a higher number of stages than centrifugal compressors.

64.8.20 State the reason for the small pressure change per stage in an axial flow compressor.

64.8.22 State the reason for the decrease in size and increase in the number of compressor blades towards the outlet end of an axial flow compressor.

64.8.24 State the reasons for and advantages of multiple spool compressors.

64.8.26 For various types of compressor arrangements identify; N1, N2, and N3 and state whether each is HP, IP or LP.

64.8.28 Explain what is meant by compressor stall/compressor surge.

64.8.30 Describe the factors that can cause compressor stall/surge, with particular regard to:

(a) compressor maintenance

(b) blade damage

(c) intake damage/restriction

(d) engine handling/operation

(e) fuel scheduling

64.8.32 Describe the indications of a compressor stall/surge control devices.

64.8.34 Describe the operation of the following stall/surge control devices—

(a) variable angle inlet guide and compressor vane systems

(b) bleed valves

(c) bleed bands

64.10 Turbine Engine Combustion Section

64.10.2 Describe the purpose and operation of the combustion chamber(s).

64.10.4 Describe the constructional features and principles of operation of the following types of combustion chamber:

(a) multiple can

(b) annular

(c) can annular

(d) reverse flow

64.10.6 State the comparative advantages of each type of combustion chamber.

64.10.8 Describe the purpose of:

(a) swirl chambers

(b) air shrouds

(c) liners

(d) interconnectors

64.10.10 Describe the uses of primary, secondary and tertiary air flow through and/or around a combustion chamber.

64.10.12 State the percentages of airflow typically used for cooling and for combustion.

64.10.14 Describe how flameout is caused and managed.

64.12 Turbine Engine Turbine Section

64.12.2 State the purpose and operation of the turbine section.

64.12.4 Describe the function of the following turbine assembly components:

(a) casing and associated structures

(b) wheel/disc

(c) shafts

(d) nozzle guide vanes

(e) blades

64.12.6 Describe the principles of operation and characteristics of the following turbine blade design types:

(a) impulse

(b) impulse-reaction

(c) reaction

64.12.8 State which type of turbine blade design is most common and explain why this type of blade is preferred.

64.12.10 Identify factors which limit the power available from the turbine section.

64.12.12 Describe multi-stage turbines.

64.12.14 State why turbine assemblies increase in diameter towards the rear of the engine.

64.12.16 Define turbine blade creep and state the causal factors for this condition.

64.14 Turbine Engine Exhaust Section

64.14.2 State the function of the exhaust section.

64.14.4 Describe the exhaust gas flow through convergent and divergent passages.

64.14.6 State the purpose, and principles of operation of the following exhaust nozzle types:

(a) convergent

(b) convergent-divergent

64.16 Thrust Reversers

64.16.2 Describe thrust reversal

64.16.4 Explain the purpose and operation of thrust reversal.

64.16.6 Describe the various types of thrust reverser.

64.18 Turbine Engine Fuel Systems

64.18.2 Describe the distinguishing features of aviation turbine fuel (AVTUR/Jet A1).

64.18.4 Compare and differentiate between AVGAS and turbine engine fuel and describe methods of reducing the likelihood of fuelling with the wrong type.

64.18.6 State the differences between the various types of turbine engine fuel and identify their common usage names.

64.18.8 Describe the function of the following turbine engine fuel system components:

- (a) fuel control unit (hydro pneumatic, hydro mechanical and electro-hydro mechanical)
- (b) fuel heater
- (c) governors and limiting devices
- (d) engine driven fuel pumps

64.18.10 State the ideal fuel/air ratio for a turbine engine.

64.18.12 Describe the following properties in relation to turbine engine fuels:

- (a) specific gravity
- (b) fire hazard
- (c) fuel icing

64.18.14 State the effect of a change in specific gravity with respect to weight of fuel.

64.18.16 Describe the purposes of anti-icing and anti-microbiocidal additives in turbine engine fuels.

64.18.18 Describe the susceptibility of turbine fuels to water contamination over other types of aviation fuels.

64.18.20 Describe methods of fuel system contamination detection.

64.18.22 Explain the precautions which can be taken to avoid fuel contamination with water and other impurities.

64.20 Turbine Engine Lubrication Systems

64.20.2 Describe the basic principles of operation of typical turbine engine lubrication systems.

64.20.4 Describe the function and principles of operation of the following turbine engine lubrication system components:

(a) oil cooler

(b) oil-fuel heat exchangers

(c) oil filters/screens (pressure and scavenge)

(d) oil system chip detectors and magnetic plugs

(e) valves (bypass/check/relief)

64.20.6 Differentiate between a wet sump and a dry sump oil system.

64.22 Turbine Engine Starting; Ignition; Relight; and Shutdown

64.22.2 Describe general procedures for starting and shutting down a turbine engine.

64.22.4 Describe the cockpit indications of a positive light-up during start.

64.22.6 Describe what is meant by self-sustaining rpm and how this is achieved.

64.22.8 Describe what is meant by a ‘blow out’ or ‘motoring’ cycle of the engine and state when this would be carried out.

64.22.10 Describe the causes, indications, effects and remedial actions for the following start defects:

(a) hung start

(b) hot start

(c) wet start

(d) tail pipe fire

64.22.12 Describe why turbine engines are often fitted with separate low and high energy ignition systems.

64.22.14 Describe the conditions under which the ignition system(s) would be turned on.

64.22.16 Describe the requirement and general procedures for an engine relight in the air.

64.24 Turbine Engine Air Cooling and Sealing

64.24.2 Describe the requirement for cooling and sealing of turbine engine components.

64.24.4 Describe the uses of compressor bleed air for cooling and sealing.

64.24.6 Describe how turbine blades, discs and nozzles are cooled using compressor bleed air.

64.26 Turbine Engine Indicating and Instrumentation

64.26.2 Describe the following types of turbine engine indicators and instrumentation including their function and basic principles of operation:

(a) engine rpm

(b) engine pressure ratio

(c) engine torque

(d) fuel flow

(e) pressure indicators

(f) temperature indicators

(g) vibration indicators

64.26.4 State the meaning of the following terms:

(a) EPR

(b) N1 (fan speed)

(c) ITT

(d) EGT

64.28 Turbine Engine Performance

64.28.2 Define the following terms and describe the relationship between them, and their application to engine operation:

(a) power

(b) thrust

(c) torque

(d) gross thrust

(e) net thrust

(f) thrust horsepower (THP)

(g) shaft horsepower (SHP)

(h) equivalent shaft horsepower (ESHP)

(i) specific fuel consumption (SFC)

64.28.4 Describe the effect of the following factors on turbine engine performance:

(a) airspeed

(b) ram effect

(c) altitude

(d) pressure

(e) temperature

(f) humidity

(g) bleed air

64.28.6 Describe the methods of thrust augmentation.

64.28.8 Describe the propulsive efficiency of the following types of turbine engine:

(a) turboprop

(b) high bypass ratio turbofan

(c) low bypass ratio turbofan

(d) geared turbofan

(e) turbojet

64.28.10 State the causes of the reduction in SFC with increasing airspeed in turboprop engines.

Appendix II b - Subject No 65 Basic Turbine Knowledge - Helicopter

Note 1: *This syllabus is based on a 'basic' level of knowledge applicable to the operation of a turbine engine, such as would be required by a pilot about to undergo training toward a type rating on their first turbine engine helicopter.*

Note 2: *If candidates already hold the BTK credit obtained before this syllabus change, it is still valid for either the Aeroplane or Helicopter turbine type rating issue, as it does not expire.*

Each subject has been given a subject number and each topic within that subject a topic number. These reference numbers will be used on 'knowledge deficiency reports' and will provide valuable feed back to the examination candidate.

Sub Topic Syllabus Item

65.2 Basic Turbine Engine Theory

65.2.2 Describe Newton's third law of motion and its practical application as it relates to the operation of a turbine engine.

65.2.4 Describe how gas undergoes changes in pressure, volume and temperature in accordance with Boyle's and Charles' Laws.

65.2.6 Describe each of the following and their application to turbine engine operation:

(a) Bernoulli's Theorem

(b) Brayton constant pressure cycle

(c) the pressure-temperature cycle

65.2.8 Describe the changes to pressure, temperature and velocity of the gas flow as it passes through each section of a turbine engine.

65.4 Turbine Engine Types

65.4.2 Compare the working cycle of a turbine engine and a piston engine.

65.4.4 Describe the comparative advantages of turbine engines versus piston engines for helicopters.

65.4.6 Describe the mechanical arrangements of a free power turbine in a turboshaft engine.

65.6 Turbine Engine Inlet Systems

65.6.2 Describe the purpose of the engine inlet duct.

65.6.4 Describe and explain the principles of operation of a Bellmouth inlet duct on a helicopter turboshaft engine.

65.6.6 Describe the function of intake shrouds on turboshaft powered helicopters.

65.8 Turbine Engine Compressors

65.8.2 Describe the purpose of a compressor in a turbine engine.

65.8.4 Describe the basic principles of operation of centrifugal and axial flow compressors.

65.8.6 Describe the comparative advantages of centrifugal and axial flow compressors.

65.8.8 Describe the merits of combined centrifugal and axial flow compressor combinations in turbine engines.

65.8.10 Describe the purpose and function of:

(a) impellers

(b) inlet guide vanes (fixed and variable)

(c) rotor blades

(d) stator blades

(e) variable stator vanes

(f) diffusers

(g) bleed valves / bands

65.8.12 State the reasons why axial flow compressors have a higher number of stages than centrifugal compressors.

65.8.14 State the reason for the small pressure change per stage in an axial flow compressor.

65.8.16 State the reason for the decrease in size and increase in the number of compressor blades towards the outlet end of an axial flow compressor.

65.8.18 Explain what is meant by compressor stall/compressor surge.

65.8.20 State the conditions that are commonly known to produce compressor stall/surge, with particular regard to:

(a) compressor maintenance

(b) blade damage

(c) intake damage/restriction

(d) engine handling/operation

(e) fuel scheduling

65.8.22 Describe the indications of a compressor stall/surge.

65.8.24 Describe the operation of the following stall/surge control devices:

(a) variable angle inlet guide vanes

(b) bleed valves

(c) bleed bands

65.10 Turbine Engine Combustion Section

65.10.2 Describe the purpose and operation of the combustion chamber(s).

65.10.4 Describe the constructional features and principles of operation of the following types of combustion chamber:

(a) can

(b) annular

(c) reverse flow annular

65.10.8 Describe the uses of primary, secondary and tertiary air flow through and/or around a combustion chamber.

65.10.10 State the percentages of airflow typically used for cooling and for combustion.

65.10.12 Describe how flameout is caused and managed.

65.12 Turbine Engine Turbine Section

65.12.2 State the purpose and operation of the turbine section.

65.12.4 Describe the function of the following turbine assembly components:

(a) casing and associated structures

(b) wheel/disc

(c) shafts

(d) nozzle guide vanes

(e) blades

65.12.6 Describe the principles of operation and characteristics of the following turbine blade design types:

(a) impulse

(b) impulse-reaction

(c) reaction

65.12.8 State which type of turbine blade design is most common and explain why this type of blade is preferred.

65.12.10 Identify factors which limit the power available from the turbine section.

65.12.12 Describe power and gas producer turbines.

65.12.14 Define turbine blade creep and state the causal factors for this condition.

65.14 Turbine Engine Exhaust Section

65.14.2 State the function of the exhaust section on a helicopter.

65.16 Reserved

65.18 Turbine Engine Fuel Systems

65.18.2 Describe the distinguishing features of aviation turbine fuel (AVTUR/Jet A1).

65.18.4 Compare and differentiate between AVGAS and turbine engine fuel and describe methods of reducing the likelihood of fuelling with the wrong type.

65.18.6 State the differences between the various types of turbine engine fuel and identify their common usage names.

65.18.8 Describe the function of the following turbine engine fuel system components:

(a) fuel control unit (hydro pneumatic, hydro mechanical and electro-hydro mechanical)

(b) FADEC

(c) fuel heater

(d) governors and limiting devices

(e) engine driven fuel pumps

65.18.10 State the ideal fuel/air ratio for a turbine engine.

65.18.12 Describe the following properties in relation to turbine engine fuels:

(a) specific gravity

(b) fire hazard

(c) fuel icing

65.18.14 State the effect of a change in specific gravity with respect to weight of fuel.

65.18.16 Describe the purposes of anti-icing and anti-microbiocidal additives in turbine engine fuels.

65.18.18 Describe the susceptibility of turbine fuels to water contamination over other types of aviation fuels.

65.18.20 Describe methods of fuel system contamination detection.

65.18.22 Explain the precautions which can be taken to avoid fuel contamination with water and other impurities.

65.20 Turbine Engine Lubrication Systems

65.20.2 Describe the basic principles of operation of typical turbine engine lubrication systems.

65.20.4 Describe the function and principles of operation of the following turbine engine lubrication system components:

(a) oil cooler

(b) oil-fuel heat exchangers

(c) oil filters/screens (pressure and scavenge)

(d) oil system chip detectors and magnetic plugs

(e) valves (bypass/check/relief)

65.20.6 Differentiate between a wet sump and a dry sump oil system.

65.22 Turbine Engine Starting; Ignition; and Shutdown

65.22.2 Describe general procedures for starting and shutting down a turbine engine.

65.22.4 Describe the cockpit indications of a positive light-up during start.

65.22.6 Describe what is meant by self-sustaining rpm and how this is achieved.

65.22.8 Describe what is meant by a ‘motoring’ or ‘dry-motoring’ cycle of the engine and state when and how this would be carried out.

65.22.10 Describe the causes, indications, effects and remedial actions for the following defects:

(a) hung start

(b) hot start

(c) wet start

(d) tail pipe (exhaust) fire

65.22.12 State the reason for temperature stabilisation on shutdown.

65.22.14 State the actions required in the event of a turbine temperature rise after shutdown.

65.24 Turbine Engine Air Cooling and Sealing

65.24.2 Describe the requirement for cooling and sealing of turbine engine components.

65.24.4 Describe the uses of compressor bleed air for cooling and sealing.

65.24.6 Describe how turbine blades, discs and nozzles are cooled using compressor bleed air.

65.26 Turbine Engine Indicating and Instrumentation

65.26.2 Describe the following types of turbine engine indicators and instrumentation including their function and basic principles of operation:

(a) engine rpm

(b) engine torque

(c) fuel flow

(d) pressure indicators

(e) temperature indicators

(f) vibration indicators

65.26.4 State the meaning of the following terms:

(a) NG/N1

(b) NP/N2

(c) NR

(d) TOT

(e) EGT

65.28 Turbine Engine Performance

65.28.2 Define the following terms and describe the relationship between them, and their application to engine operation:

(a) power

(b) thrust

(c) torque

(d) shaft horsepower (SHP)

65.28.4 Describe the effect of the following factors on turbine engine performance:

(a) altitude

(b) pressure

(c) temperature

(d) humidity

(e) bleed air

65.28.6 On a graph, draw a power available curve for a typical light turbine engine helicopter.

65.28.8 With respect to turbine engine helicopters, explain how maximum range is achieved.

65.28.10 Derive performance planning information from graphs published in turbine engine helicopter Flight Manuals, with emphasis on:

(a) hover ceiling

(b) hover IGE and/or OGE, at various all-up weights

(c) gross weight for hovering

(d) climb performance

(e) range and endurance

Appendix III - Technical Examination Syllabus—Aeroplane

An applicant for any aircraft type rating is required to demonstrate to an appropriately qualified flight instructor satisfactory technical knowledge for the aircraft type concerned. The following syllabus, appropriately modified to suit the aircraft type, would meet this requirement for aeroplanes.

In addition, for aircraft exceeding 5700Kg MCTOW, a CAA-approved course of technical training and an approved written examination are required. The course content, duration (flight and ground instruction times) as well as the written examination are to be based on but not limited to the OEM syllabus recommendations, FAA Flight Standardization Board (FSB), EASA Operational Evaluation Board (OEB) and OSD reports.

Primary flight controls and trims: Layout of various components and management, safety devices, precautions to be observed in operation and fault finding.

Carburettor heat and/or alternate air: Layout of various components and management, precautions to be observed in operation and fault finding.

Cowl flaps: Operating procedures and precautions to be observed in operation.

Mixture: Principle of operation, location and purpose of various components, operating procedure, precautions to be observed in operation and fault finding.

Propeller: Principle of operation, location and purpose of various components, operating procedure, feathering and un-feathering procedure, safety devices and fault finding.

Fuel system: Grade and specification of fuel, system layout and management, dumping facilities, fuel tank location, capacities, unusable fuel, consumption rates and safety devices, location and purpose of various components, emergency operation, precautions to be observed in operation and fault finding.

Oil system: Grade and specification of engine oil, system layout and management, tank capacities and location, safety devices, operating pressures, functional checks, emergency operation, location and purpose of various components, precautions to be observed in operation and fault finding.

Hydraulic system: Grade and specification of fluid, system layout and management, reservoir capacity and location, safety devices, operating pressures, functional checks, emergency operation, location and purpose of various components, precautions to be observed in operation, fault finding and remedial action to be taken in flight.

Pneumatic system: Layout and management, purpose and location of various components, operating pressures, emergency operation, functional checks, safety devices, precautions to be observed in operation and fault finding.

Electrical system and associated instruments: Layout and management, location and purpose of various components and circuits, functional checks, operating voltages, capacity and number of generators, alternators, inverters and batteries, safety devices, precautions to be observed in operation, emergency operation, fault finding and remedial action to be taken in flight.

Flaps: Layout and management, location and purpose of various components, functional checks, safety devices, precautions to be observed in operation, fault finding and remedial action to be taken in flight.

Speedbrakes: Layout and management, location and purpose of various components, functional checks, safety devices, precautions to be observed in operation, fault finding and remedial action to be taken in flight.

Landing gear: Layout and management, location and purpose of various components, functional checks, safety devices, precautions to be observed in operation, fault finding and remedial action to be taken in flight.

Brakes: Layout and management, location and purpose of various components, functional checks, safety devices, precautions to be observed in operation and remedial action to be taken in flight.

Avionics: To include where applicable, cockpit voice recorder system (CVR), flight data recording systems (FDR), health and usage monitoring systems (HUMS), flight management systems (FMS), attitude and heading reference systems (AHRS), air data computer (ADC), air data inertial reference units (ADIRU/SAARU), radar altimeters, altitude selectors, electronic flight information systems (EFIS), primary flight displays (PFD), head up displays (HUD), enhanced vision systems (EVS), navigation displays (ND) and/or multifunction displays (MFD), fully automatic digital engine control (FADEC), engine indicating and crew alerting systems (EICAS/ECAM), terrain awareness warning systems (TAWS), airborne collision avoidance systems (ACAS) and electronic checklists (ECL), layout and management, operating limitations, purpose and location of various components, precautions to be observed in operation, functional checks, safety devices, emergency operation, fault finding and remedial action to be taken in flight.

Auto-pilot: To include where applicable, flight directors, autothrottle, autoland, yaw dampers, rudder limiters, operating limitations, location and purpose of main components, operating procedure, safety devices, precautions to be observed in operation, fault finding and remedial action to be taken in flight.

Pitot-static system: Layout and management, location and purpose of various components, safety devices, functional checks, emergency operations, fault finding and remedial action to be taken in flight.

Vacuum/pressure system and associated flight instruments: Layout and management, purpose and location of various components, precautions to be observed in operation, functional checks, safety devices, emergency operation, fault finding and remedial action to be taken in flight.

Heating and environmental systems: Layout and management, location and purpose of various components, functional checks, precautions to be observed in operation, safety devices and fault finding.

De-icing and anti-icing systems: Layout and management, purpose and location of various components, precautions to be observed in operation, safety devices and functional checks.

Fire extinguisher systems: Layout and management, location and purpose of various components, fire warning devices, functional checks, action in event of fire and precautions to be taken in operation.

Pressurisation: Layout and management, location and purpose of various components, functional checks, emergency operation, precautions to be observed in operation, safety devices, fault finding and remedial action to be taken in flight.

Oxygen systems: Layout and management, location and purpose of various components, operating pressures, functional checks, emergency operation, safety devices, supply duration under various conditions, precautions to be observed in operation, fault finding and remedial action to be taken in flight.

Engines: Operating limitations, location and purpose of various components, operating procedure for starting, ground running, take-off, climb, cruising, landing and shutting down, functional checks, controls, safety devices, accessories, power control and interpretation of power charts, fuel and oil consumption, prevention of icing and fault finding.

Airframe: Type of structure, layout of various components and for waterborne aircraft the layout of the bilge system.

Weight and balance: Loading and centre of gravity calculations including, centre of gravity limits, use of load adjusters and loading charts, effect of fuel consumption on centre of gravity, effect of movement of crew, passenger or cargo on centre of gravity, effect of landing gear retraction on centre of gravity, precautions to be observed in loading and securing of load.

Aeroplane operations: Take-off and landing performance characteristics, aeroplane operating limitations, procedures to be followed in take-off, climb, landing and cruising in both symmetric and asymmetric flight, stalling speeds, safety speeds, interpretation of aeroplane flight manual data, use of radio and navigation equipment, including where applicable, aircraft communications addressing and reporting system (ACARS), controller-pilot datalink communications (CPDLC) and satellite communications (SATCOM), action in the event of forced landing on land or water and use of survival equipment including any aircraft parachute system (if applicable).

Appendix IV - Technical Examination Syllabus—Helicopter

An applicant for any aircraft type rating is required to demonstrate to an appropriately qualified flight instructor satisfactory technical knowledge for the aircraft type concerned. The following syllabus, appropriately modified to suit the aircraft type, would meet this requirement for helicopters.

In addition, for multi-engine helicopters a CAA-approved course of technical training (based on the OEM syllabus recommendations) and an approved written examination are required. The course content, duration (flight and ground instruction times) as well as the written examination are to be based on the OEM (including where relevant Category A performance), the OSD, FAA (FSB) and EASA (OEB) reports and the following syllabus, appropriately modified to suit the aircraft type.

An applicant for a type rating in a single engine helicopter not exceeding 5700 Kg MCTOW is required to pass an approved written examination in the normal, abnormal and emergency procedures of the helicopter's systems, performance and weight and balance calculations. This written examination is to be based on the following syllabus, appropriately modified to suit the aircraft type.

In the case of a helicopter not exceeding 1500 Kg MCTOW the required examination may be conducted orally by an appropriately qualified flight instructor. This oral examination is based on the following syllabus.

Primary flight controls and trims: Layout of various components and management, safety devices, precautions to be observed in operation and fault finding.

Carburettor heat and/or alternate air: Layout of various components and management, precautions to be observed in operation and fault finding.

Mixture: Principle of operation, location and purpose of various components, operating procedure, precautions to be observed in operation and fault finding.

Fuel: Grade and specification of fuel, system layout and management, dumping facilities, fuel tank location, capacities, unusable fuel, consumption rates and safety devices, location and purpose of various components, emergency operation, precautions to be observed in operation and fault finding.

Oil: Grade and specification of engine oil, system layout and management, tank capacities and location, safety devices, operating pressures, functional checks, emergency operation, location and purpose of various components, precautions to be observed in operation and fault finding.

Hydraulic system: Grade and specification of fluid, system layout and management, reservoir capacity and location, safety devices, operating pressures, functional checks, emergency operation, location and purpose of various components, precautions to be observed in operation, fault finding and remedial action to be taken in flight.

Electrical system and associated instruments: Layout and management, location and purpose of various components and circuits, functional checks, operating voltages, capacity and number of generators, alternators, inverters and batteries, safety devices, precautions to be observed in operation, emergency operation, fault finding and remedial action to be taken in flight.

Landing gear: Layout and management, location and purpose of various components, functional checks, safety devices, precautions to be observed in operation, fault finding and remedial action to be taken in flight.

Avionics: To include where applicable, cockpit voice recorder system (CVR), flight data recording systems (FDR), health and usage monitoring systems (HUMS), flight management systems (FMS), attitude and heading reference systems (AHRS), air data computer (ADC), air data inertial reference units (ADIRU/SAARU), radar altimeters, electronic flight information systems (EFIS), primary flight displays (PFD), head up displays (HUD), navigation displays (ND) and/or multifunction displays (MFD), fully automatic digital engine control (FADEC), engine indicating and crew alerting systems (EICAS/ECAM), terrain awareness warning systems (TAWS), airborne collision avoidance systems (ACAS) and electronic checklists (ECL), layout and management, operating limitations, purpose and location of various components, precautions to be observed in operation, functional checks, safety devices, emergency operation, fault finding and remedial action to be taken in flight.

Auto-pilot: Operating limitations, location and purpose of main components, operating procedure, safety devices, precautions to be observed in operation, fault finding and remedial action to be taken in flight.

Pitot-static system: Layout and management, location and purpose of various components, safety devices, functional checks, emergency operations, fault finding and remedial action to be taken in flight.

Vacuum/pressure system and associated flight instruments: Layout and management, purpose and location of various components, precautions to be observed in operation, functional checks, safety devices, emergency operation, fault finding and remedial action to be taken in flight.

Heating and environmental systems: Layout and management, location and purpose of various components, functional checks, precautions to be observed in operation, safety devices and fault finding.

De-icing and anti-icing systems: Layout and management, purpose and location of various components, precautions to be observed in operation, safety devices and functional checks.

Fire extinguisher systems: Layout and management, location and purpose of various components, fire warning devices, functional checks, action in event of fire and precautions to be taken in operation.

Engines: Operating limitations, location and purpose of various components, operating procedure for starting, ground running, take-off, climb, cruising, landing and shutting down, functional checks, controls, safety devices, accessories, power control and interpretation of power charts, fuel and oil consumption, prevention of icing and fault finding.

Rotor systems: Principle of main and tail rotor operation, location and purpose of various components, operating procedure, safety devices and fault finding.

Airframe: Layout of various components.

Weight and balance: Loading and centre of gravity calculations including, centre of gravity limits, use of load adjusters and loading charts, effect of fuel consumption on centre of gravity, effect of movement of crew, passenger or cargo on centre of gravity, effect of landing gear retraction on centre of gravity, precautions to be observed in loading and securing of load.

Helicopter operation: Take-off and landing performance characteristics, helicopter operating limitations, procedures to be followed in take-off, climb, cruising and landing, height/velocity diagram, interpretation of helicopter flight manual data, use of radio and navigation equipment, including where applicable, aircraft communications addressing and reporting system (ACARS) and satellite communications (SATCOM), action in the event of forced landing on land or water and use of survival equipment.

Appendix V - Demonstration of Competency for Aeroplanes exceeding 5700 kg MCTOW

For any type rating a demonstration of competency in the ability to perform every normal, abnormal and emergency manoeuvre appropriate to the aircraft type is required.

For aircraft in excess of 5700 Kg MCTOW this demonstration is based on the following syllabus and is referenced to the OEM recommendations and the type OSD. This includes any reference to type designation for the type rating on the licence, syllabus of training and syllabus of differences training recommended by the OEM.

A simulator, specifically approved by the Director for conversion to type training, may be used for all or part of this demonstration.

Pre-flight requirements

Aircraft flight manual, release to service, engine charts, AIPNZ, route guide.

Aircraft and engine limitations, emergency equipment and procedures.

Aircraft loading, trim sheets and flight planning, fuel requirements and fuel management.

External and internal inspection, location of critical items and the purpose of inspection.

Engine start and after start procedures and cockpit checks, selection of navigation and communication frequencies, taxiing and steering, instrument checks and ATS clearances.

Take-off checks, engines, instruments, systems, crew briefing and radiotelephone procedures.

Flight manoeuvres

Normal take-off and landing.

Crosswind take-off and landing.

Rejected take-off.

Take-off with engine failure immediately after decision speed (V_1).

All normal climb and descent manoeuvres.

Circling approach at minimum authorised circling altitude.

Missed approach from not more than 100 feet agl.

Stall onset in clean, take-off and landing configurations, at least one stall to be demonstrated with the aircraft in a turning configuration.

Steep turns through 360º in both directions, recommended bank angle 45º.

Approach to V_{MCA} with asymmetric power.

Where applicable, recovery from unusual attitudes applicable to aircraft type.

Instrument flight

Asymmetric climb and descent procedures.

Interception and tracking of predetermined bearings, airways procedures, including entering, maintaining and departing from holding patterns.

Descent to minimum altitude through intermediate and approach procedures using ILS, VOR or a non-precision radio navigation facility.

Missed approach from minimum altitude with asymmetric thrust.

Upset Prevention and Recovery Training (UPRT)

A relevant course of Upset Prevention and Recovery Training (UPRT) when identified in the OEM/OEB/OSD/FSB syllabus of training specific to type.

Emergency procedures

Engine fire and normal un-feathering or relight.

Emergency descent — pressurised aircraft.

Any other emergency procedures contained in the aircraft flight manual.

Normal and abnormal procedures

Each applicant is to demonstrate the proper use of the following systems, including the correct abnormal or emergency drills, or both, to be carried out in the event of failure or malfunction of the systems, appropriate to the aircraft type:

Auto-pilot

Anti-ice and de-icing systems

Electrical system — including failures where this may result in loss of flight instruments

Hydraulics and pneumatics

Air conditioning and pressurisation systems

Oxygen system

Weather radar

The candidate is to have received training in every emergency, normal and abnormal operation with the aeroplane or approved flight simulator loaded as far as is practicable to a weight which will give a positive indication of its flight and handling characteristics under adverse conditions. It is recommended that for normal operations, a short cross-country flight with a landing at an aerodrome other than the aerodrome of departure be completed so that the candidate can experience operating the aircraft at MCTOW. For abnormal operations (in aircraft), appropriate secure ballast should be used to achieve MCTOW.

Appendix VI - Demonstration of Competency for Aeroplanes not exceeding 5700 kg MCTOW

For any type rating a demonstration of competency in the ability to perform every normal, abnormal and emergency manoeuvre appropriate to the aircraft type is required.

The demonstration of competency requirements for single pilot certificated aeroplanes are expanded on, and assessed in accordance with the ‘Four Point Scale’ published in the ‘Demonstration of Competency, Type Rating, Single Pilot Certificated Aeroplane’ standards guide, available from the CAA website.

Form CAA 24061/13 is used to record conversion to type training flight time and the result of the type competency demonstration.

Instructor’s submitting the competency demonstration record (CAA 24061/13) are requested to do so as soon as practicable after the completion of the type rating issue.

Operation of aircraft systems

The candidate will demonstrate practical knowledge of the operation of at least four of the systems installed on the aeroplane.

Performance and limitations

The candidate will be required to demonstrate practical use of charts, tables and appropriate data to determine performance, including (as applicable) take-off, climb, one engine inoperative, cruise, endurance and landing.

Essential performance speeds are to be quoted from memory. Other aeroplane performance data may be determined from the Pilot’s Operating Handbook (POH) or the Aircraft Flight Manual (AFM).

Weight and balance, loading

The candidate will be required to complete accurate computations for a practical load that addresses all or most of the passenger and baggage stations. The computations are to use actual weights, and weight and balance data applicable to the aeroplane, including take-off weight, landing weight and the zero fuel weight. If a loading graph or computer is available with the aeroplane, it may be used.

The candidate is to have received training in every normal and abnormal operation with the aeroplane loaded as far as is practicable to a weight which will give a positive indication of its flight and handling characteristics under adverse conditions. It is recommended that for normal operations, a short cross-country flight with a landing at an aerodrome other than the aerodrome of departure be completed so that the candidate can experience operating the aircraft at MCTOW. For abnormal operations, appropriate secure ballast should be used to achieve MCTOW.

Documents and airworthiness

The candidate is to determine the validity of all documents required to be carried on board the aeroplane and determine that required maintenance certifications have been completed.

Pre-flight inspection

The candidate is to determine that the aeroplane is ready for the intended flight. All required equipment and documents are to be located and, so far as can be determined by pre-flight inspection, the aeroplane is to be confirmed to be airworthy. Visual checks for fuel quantity, proper grade of fuel, fuel contamination and oil level are to be carried out in accordance with the POH/AFM. If the aircraft design precludes a visual check, fuel chits, fuel logs or other credible procedures may be used to confirm the amount of fuel actually on board.

The candidate is to conduct an oral passenger safety briefing.

Engine starting and run-up

The candidate is to use the checklists provided by the aircraft manufacturer or owner/operator and use the recommended procedures for engine starting, warm-up, run-up and aeroplane systems checks to determine that the aeroplane is airworthy and ready for flight.

The candidate will demonstrate a practical knowledge of the elements related to recommended engine starting procedures, including the use of external power source, starting under various atmospheric conditions and the effects of using incorrect starting procedures.

The candidate is to take appropriate action with respect to unsatisfactory conditions (e.g. flooding) encountered or specified by the instructor.

Taxiing

Provided that traffic permits, the candidate is to taxi along taxiway centrelines where they exist. The candidate is to position the flight controls appropriately for wind conditions. During calm wind conditions the instructor will specify a wind speed and direction in order to test this ability.

While taxiing, the candidate will be expected to confirm the proper functioning of the flight instruments.

Take-off

The candidate is to demonstrate at least two of the following take-off procedures:

- Normal
- Crosswind
- Short field
- Soft surface
- Rough water
- Glassy water

Note: *The candidate must be able to explain the operational necessity for any variation from recommended speeds, e.g. gusty or crosswind conditions.*

Intentional engine shutdown and air-start (multi-engine only)

At an operationally safe height or the manufacturer's recommended minimum height, whichever is higher, the candidate will respond to a scenario presented by the instructor that requires an intentional engine shutdown. The candidate will then shut down and feather the appropriate engine (unless the POH/AFM advises against it) and complete the appropriate checklist(s).

The candidate will be asked to turn toward and away from the inoperative engine.

The instructor will require the candidate to restart the secured engine.

Engine failure (cruise flight)

At an operationally safe height or the manufacturer's recommended minimum height, whichever is higher, the instructor will simulate an engine failure during straight and level flight and/or during a medium turn. The candidate will be expected to control the aeroplane, carry out a forced landing, and in the case of a multi-engine aeroplane, identify the failed engine, perform the cause checks, and simulate feathering the propeller and shutting down the failed engine in accordance with the checklist.

Recovery from an approach to VMCA (multi-engine only)

At an operationally safe height or the manufacturer's recommended minimum height, whichever is higher, the candidate will demonstrate an approach to Vmc with one engine windmilling and recover by reducing power on the operating engine and reducing pitch attitude.

Engine failure during take-off

At an operationally safe speed the instructor will simulate an engine failure during the take-off and/or an emergency that dictates an aborted take-off as the most desirable option.

Engine failure after take-off

At an operationally safe height or the manufacturer's recommended minimum height, whichever is higher, the instructor will simulate an engine failure. The instructor will establish zero-thrust on the simulated inoperative engine (if applicable) after the candidate has simulated feathering the propeller.

Cruising flight

The candidate will establish the aeroplane in cruise flight at the flight planned true airspeed in accordance with the performance charts in the POH/AFM, placards displayed in the aeroplane, or any other means authorised by the manufacturer.

Steep turn

At an operationally safe height, the candidate will be asked to execute a steep turn through at least 180° at 45° angle of bank.

Stalling

At an operationally safe height or the manufacturer's recommended minimum height, whichever is higher, stalls will be approached from various phases of flight and in various configurations appropriate to the aeroplane type and in accordance with the flight manual.

The instructor will ask for two stalls, one in the clean configuration and one in the landing configuration with recovery at the stall or onset as appropriate to the aeroplane type, with minimum height loss.

Circuit

The candidate is to demonstrate correct circuit procedures, including departure and joining procedures for the aerodrome(s) being used.

The candidate is to demonstrate the overshoot procedure on command by the instructor or as required by Air Traffic Services (ATS) (one engine inoperative for multi-engine aircraft).

The ability to comply with ATS clearances or instructions while maintaining separation from other aircraft must also be demonstrated.

Approach and landing

The candidate will be required to demonstrate at least three of the following landing procedures:

- One engine inoperative (compulsory for multi-engine)
- Cross-wind
- Short field
- Soft surface
- Glide
- Snow (four required to be demonstrated)
- Normal
- Wheel
- 3 point
- Flapless
- Glassy water
- Rough water

Note: *The candidate must be able to explain the operational necessity for any variation from recommended speeds, e.g. gusty or crosswind conditions.*

Emergency procedures

The instructor will assess the candidate's knowledge of emergency procedures or abnormal conditions. Assessment may be carried out during any portion of the demonstration.

Assessment will be based on the candidate's ability to analyse simulated or real situations, take appropriate action and follow the appropriate emergency checklists or procedures for any three of the following simulated emergencies/malfunctions.

- Propeller over speed
- Cabin fire
- Landing gear malfunctions
- Flap failure
- Emergency descent
- Electrical fire
- Heater overheat
- Loss of oil pressure
- Cross-feed
- Vacuum system failure
- Electrical malfunctions
- Brake failure
- Door opening in flight
- Engine fire
- Primary Flight Display (PFD)
- Multi Function Display (MFD)
- Loss of fuel pressure
- Any other unique emergency

And in addition, for:

Seaplanes

Taxiing upwind, downwind and crosswind with and without the use of drogues, step work, mooring and slipping, ramp and beach techniques, use of standard buoy, anchoring and weighing anchor, varying water conditions and tidal effects.

Appendix VII - Demonstration of Competency for Helicopters

For any type rating, a demonstration of competency in the ability to perform every normal, abnormal and emergency manoeuvre appropriate to the helicopter type is required. This demonstration is referenced to the OEM recommendations and the type OSD. It includes any reference to type designation for the type rating on the licence, syllabus of training and syllabus of differences training recommended by the OEM (including where relevant for multi engine and Cat A operations).

Pre-flight inspection

The candidate is to determine that the helicopter is ready for the intended flight. All required equipment and documents are to be located and, so far as can be determined by pre-flight inspection, the helicopter is to be confirmed to be airworthy. Visual checks for fuel quantity, proper grade of fuel, fuel contamination and oil level are to be carried out in accordance with the POH/AFM. If the helicopter design precludes a visual check, fuel chits, fuel logs or other credible procedures may be used to confirm the amount of fuel actually on board.

The candidate is to conduct an oral passenger safety briefing.

Engine starting and run-up

The candidate is to use the checklists provided by the aircraft manufacturer or owner/operator and use the recommended procedures for engine starting, warm-up, run-up and helicopter systems checks to determine that the helicopter is airworthy and ready for flight.

The candidate will demonstrate a practical knowledge of the elements related to recommended engine starting procedures, including the use of external power source, starting under various atmospheric conditions and the effects of using incorrect starting procedures.

The candidate is to take appropriate action with respect to unsatisfactory conditions encountered or specified by the instructor.

The candidate is to have received training in every normal and abnormal operation with the helicopter loaded as far as is practicable to a weight which will give a positive indication of its flight and handling characteristics under adverse conditions. It is recommended that for normal operations, a short cross-country flight with a landing at an aerodrome other than the aerodrome of departure be completed so that the candidate can experience operating the aircraft at MCTOW. For abnormal operations, appropriate secure ballast should be used to achieve MCTOW.

Taxiing

Surface or air or both.

To include hovering — upwind, downwind and crosswind.

Hover patterns and hover turns on the spot to left and right.

While taxiing, the candidate will be expected to confirm the proper functioning of the flight instruments.

Take-off and landing

The candidate is to demonstrate normal and crosswind, including vertical take-off to hover and vertical landing from hover.

Minimum power take-off and roll-on (running) landing.

Maximum performance take-off and steep approach.

Confined areas operations and sloping ground landings.

Quick stops.

Emergencies

Autorotative approach with power recovery to the hover and engine failure in the hover.

Recovery from low RPM condition at altitude.

Settling with power (vortex ring state) and incipient stage recovery at altitude.

Incipient ground resonance.

Single engine operation for multi engine helicopters.

Primary Flight Display (PFD), Multi Function Display (MFD), Altitude Heading Reference System (AHRS) and Air Data Computer (ADC) failures (as applicable).

Appendix VIII - Syllabus of Additional Conversion Training for Ex-Military Jets

In addition to the requirements of Appendix II and III, jet transition training should be carried out in three phases.

1) Ground training
2) Flying training
3) Supervision/mentoring

The completion of phases 1 and 2 should be endorsed in the pilot's logbook by the supervising instructor and a copy of the training record (CAA24061/13) supplied to CAA.

The supervision/mentoring phase needs to be clearly understood by both parties and therefore carefully documented, either by logbook entry or separate letter.

Phase 1: Ground training

In addition to the topics addressed in Appendix II and III the following topics should be discussed where they are relevant to the aircraft type:

- Aircraft technical:
  - drag chute
  - speed brakes
  - ejection seats/parachutes
  - gear retraction on the ground
  - wing plan form – straight or swept wings
  - anti-skid braking
  - manual gear extension
  - powered flight controls
  - engine control and response.
- High speed aerodynamics
- Ground handling:
  - foreign object damage (FOD)
  - jet efflux
  - residual thrust
  - noise
  - nose wheel steering/castoring
  - brake failure – gear retraction on the ground.
- Take-off:
  - take-off performance – distance required/distance available
  - effect of weight on take-off performance
  - accelerate stop distances

  - refusal speeds
  - abort/eject-force land/turn back scenarios
  - low level climb out profiles
  - noise
  - speed versus traffic
  - rate of climb.
- Physiological aspects:
  - hypoxia
  - high altitude empty visual field (Myopia)
  - sustained G.
- Cruise/high altitude:
  - icing – airframe and engine
  - oxygen
  - TAS factor
  - aerodynamic/Mach stall
  - transonic airflow characteristics e.g. porpoising
  - swept wing stall characteristics
  - altitude required for manoeuvres
  - fuel planning and monitoring
  - ‘minimum’ and ‘emergency’ fuel planning and quantities for divert/recovery.
- Navigation:
  - high and low level navigation techniques
  - fuel planning and monitoring
  - ‘minimum’ and ‘emergency’ fuel planning and quantities for divert/recovery
  - low level diversion.
- Circuit/approach:
  - speed versus traffic
  - configuration
  - slowing down – use of speedbrakes/G
  - swept wing manoeuvring
  - angle of attack considerations and sink rate.
- Landing:
  - landing distance available/landing distance required
  - aircraft weight/speed effects on landing distance required
  - use of aim point and go around criteria
  - engine spool-up time

  - use of speed brakes, drag chute, normal braking
  - aquaplaning
  - raising gear on ground.
- Emergencies:
  - engine failure – hot and cold relights; forced landings; ejection.
  - engine vibration
  - engine and airframe fires
  - blown tyre
  - hydraulic failure
  - pneumatic failure
  - fuel system failures
  - electrical system failures
  - smoke in cockpit – air conditioning failure
  - bird strike
  - stuck throttle approach
  - pressurisation failure
  - emergency descents
  - canopy or under wing stores jettison
  - abandoning the aircraft.

Phase 2: Flying training

The flying training phase should include all the normal requirements of an aircraft type rating as described in Appendix VII and also include the following items if they are relevant to the aircraft type:

- High speed manoeuvring at high and low altitude with a specific emphasis on TAS, inertia and turn radius.
- Low speed manoeuvring at high and low altitude with a specific emphasis on TAS, inertia and turn radius.
- Altitude required for manoeuvres.
- General handling through the aircraft speed and altitude range noting in particular the differences in rates of roll.
- Energy management and aircraft handling with particular emphasis on lateral and vertical constraints such as airspace boundaries.
- Use of speed brakes.
- Sustaining G - maximum performance turns.
- Flying for range and endurance.
- Engine handling at high and low altitude with particular emphasis on spool-up times.
- Engine handling during manoeuvres with particular emphasis on energy management.

- Stalling - wing drop (in particular swept wing aircraft).
- High altitude aerobatics - above 10,000’.
- Low altitude aerobatics - not below 3,000’ initially.
- Simulated low level abort.
- Low climb out for turn back speed.
- Turn backs (if appropriate).
- Circuits:
    - curvilinear approaches
    - flapless landing - landing distance required
    - short field landing
    - glide approaches
    - touch and go, go around - engine spool-up.
- Precautionary forced landings.
- Stuck throttle approach - swept wing aircraft.
- Practice diversion to nearest suitable alternate airfield.

Phase 3: Supervision/mentoring

Newly-rated jet pilots may or may not require on-going ‘supervision or mentoring’ depending on their experience or background.

Low hour/GA background pilots should have on-going supervision and mentoring. The supervisor/mentor should be someone who is available to discuss or advise the jet pilot in situations where they want to:

- try something new, and/or
- vary or extend their operation e.g. operating from different airfields, different or advanced manoeuvres.

The supervisor should also monitor the operation of the jet aircraft itself to ensure its on-going safety from a pilot’s point of view.