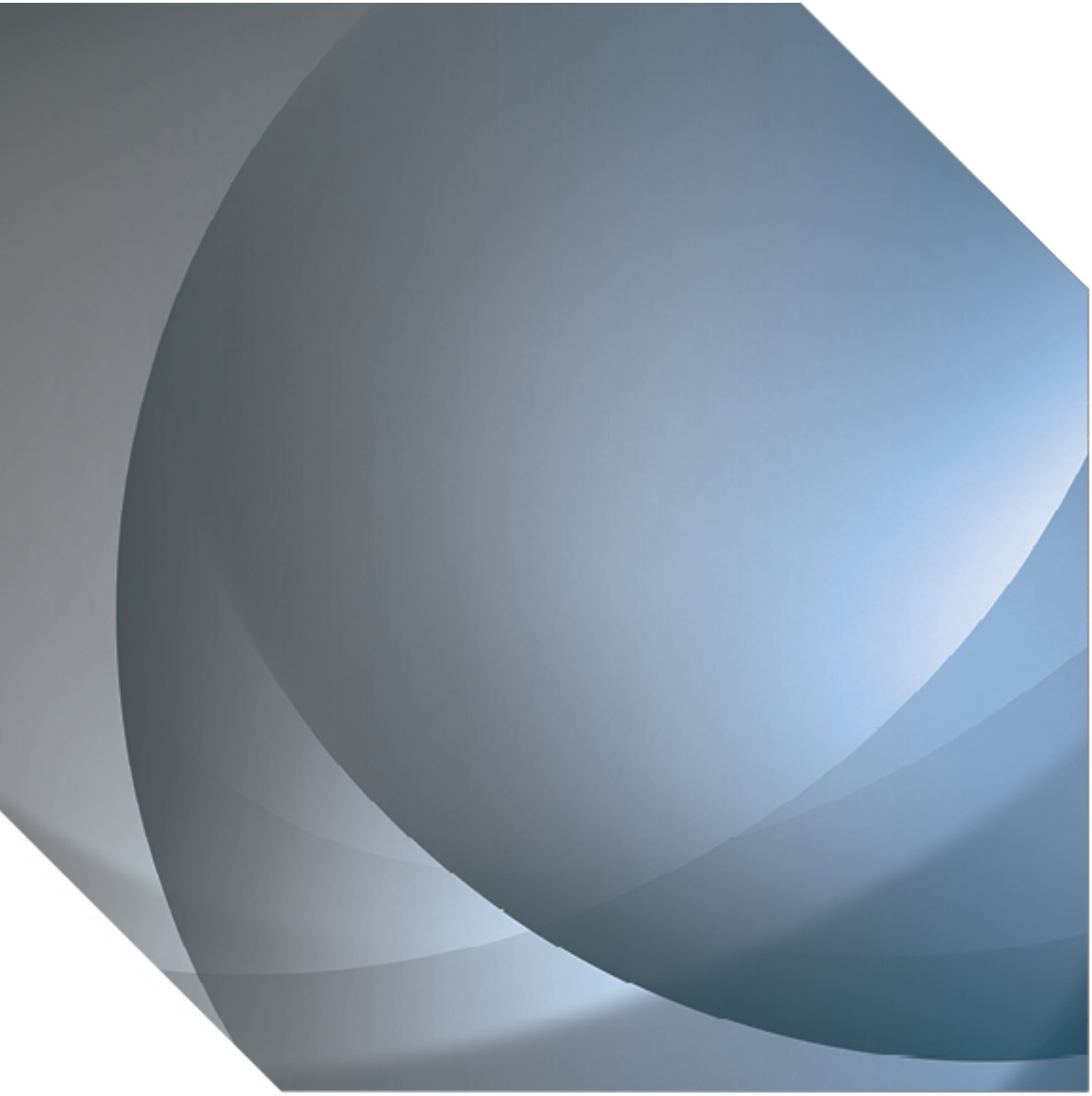
Multi Engine Piston Aeroplane Class Rating Training Syllabus

Including Centreline Thrust Variants

CAP 601



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Foreword

Background

JAR-FCL 1 (Aeroplane) was implemented on 1 July 1999. This introduced changes to multi-engine aeroplane training including the introduction of a multi-engine piston (MEP) class rating. CAP601 was drafted to provide guidance to Flight Training Organisations seeking approval to provide courses of training for the JAR-FCL MEP class rating. The requirements for multi-engine training and testing in Commission Regulation (EU) No 1178/2011 (the Aircrew Regulation) are very much the same as the requirements of JAR-FCL. Therefore, this document has been amended to be compliant with the Aircrew Regulation and reissued as a third edition.

This training syllabus is provided by the Civil Aviation Authority as guidance for Approved Training Organisations (ATOs) wishing to conduct training for the multi-engine piston (MEP) class rating in accordance with Part-FCL and specifically FCL.725.A.

Content

Part-ORA requires ATOs seeking approval to conduct courses of training for licences, ratings or certificates to submit a training programme, training manual and operations manual (ORA.ATO.125 and 130) detailing the proposed course of training. CAP601 may be used by ATOs to assist with the development of a training course and training manual in order to satisfy these requirements.

Multi-engine piston aeroplanes having two engines mounted with a common thrust axis do not qualify for the issue of a full MEP class rating as they exhibit no asymmetric properties. Training conducted on such aeroplanes is restricted to centreline thrust aeroplanes only. A suitable syllabus of training has been included in this document for such aircraft, and does not include the three and a half hours asymmetric training.

Rating Examinations

FCL.725 requires ATOs offering training for MEP class and type ratings to provide the aircraft rating written examinations as part of the approval process. Examinations should be based upon the course material, and not be general knowledge quizzes. All questions should be capable of being answered from the aircraft documents, course notes and associated material. Guidance on the formulation of written exam questions is provided in Chapter 5.

Advanced Twin Piston Aeroplanes

Since the first edition of CAP601 a number of advanced technology twin piston aeroplanes have been certified that are equipped with Electronic Flight Instrument System (EFIS)

displays and single lever engine operation - some with automatic feathering facilities. The operation of such types and variants may, in some regards, be much simpler than that of a “conventional” twin piston aeroplane. This leaves a pilot who has trained on such types for the initial issue of the MEP class rating in a vulnerable position when reverting back to a more conventional aeroplane. The MEP class rating syllabus is based upon the theory of conventional aeroplane operation and should not be over simplified because of the advance in technology. It is important that the MEP training course emphasises the theoretical differences between conventional and advanced systems. Specific differences training will be required before the holder of a MEP class rating can exercise the privileges of the rating on another type of aeroplane within the class. Such training must be endorsed by a suitably qualified instructor. Guidance on difference training courses for EFIS and single lever power controls is available in CAP804.

Chapter 1
Introduction

Syllabus

1.1 The purpose of this document is to provide an example syllabus of theoretical ground and flight training for applicants undertaking the multi-engine piston (MEP) class rating course in accordance with Part-FCL.

Aim

1.2 To give the applicant a sound theoretical knowledge of multi engine piston aircraft operation in accordance with the visual flight rules (VFR), and to teach the skills necessary for the safe and competent operation of such aircraft.

Course Structure

1.3 The course shall comprise of a ***minimum*** of 7 hours theoretical ground training, and a ***minimum*** of 6 hours flight training. The content of the theoretical ground training is given at Chapter 2; the content of the flight training, which shall include 3.5 hours of asymmetric training, is at Chapter 3. A flight training syllabus designed for centreline thrust aircraft is given in Chapter 4. The ground and flight training shall be integrated and co-ordinated so that the applicant gains the maximum benefit from time spent in the air. On completion of this training, the applicant shall pass a ground examination, set by the ATO and approved by the CAA. Details on examination preparation are contained in Chapter 5. In accordance with FCL.1030, the ATO/person responsible for the training shall certify satisfactory completion of the course of training and recommend the applicant for test. All requirements stated in this syllabus are to be regarded as a minimum. Applicants with Night and IMC qualifications may wish to do additional training in night and instrument flying.

Pre-Course Entry Requirements

1.4 Whilst it is theoretically possible to complete a course of PPL training on a MEP aeroplane, an applicant for a first ME class rating is required to have at least 70 hours flight time as pilot in command (PIC) on aeroplanes. It is therefore assumed that the majority of applicants for the MEP class rating will be in possession of at least a valid PPL (A) and have 70 hours experience as PIC before commencing the course. There are no planned solo exercises on the course.

Instruction

1.5 Either a Flight Instructor (FI) qualified in accordance with FCL.905.FI (h) or a Class Rating Instructor (CRI) qualified for multi engine instruction, shall conduct flight instruction on the course. The ground instruction shall take the form of lessons and briefings given by the FI, CRI, or an approved ground instructor.

Training Records

1.6 A student training record shall be maintained of all ground training conducted and of all flight-training exercises. The record, which must contain limited personal details of the applicant, shall be maintained for a period of 5 years from completion of the training.

Theoretical Examination

1.7 Applicants for a MEP class rating shall sit a multiple choice written examination on completion of the course. The examination pass mark is 75%.

Flight Tests

1.8 On completion of the course of instruction for the MEP class rating, including passing the theoretical examination, the applicant will be required to pass a Class Rating Skill Test with either a Flight Examiner (FE) or a Class Rating Examiner (CRE) in accordance with Appendix 9 to Part-FCL.

1.9 Applicants who complete their training in accordance with the centreline thrust aircraft syllabus will be issued with a MEP class rating limited to centreline thrust aircraft only.

Exemptions from Training

1.10 Holders of ICAO pilots licences with multi-engine piston privileges may be credited some or all of the flying and theoretical knowledge training. Further details are in CAP804.

Chapter 2

Theoretical Training

2.1 The MEP class rating course (FCL.725.A and AMC1 FCL.725 (a)) shall comprise of a minimum 7 hours of theoretical ground training on subjects associated with the operation of multi engine piston aircraft. It includes elements, some of which are generic and some of which are specific, to the type of aeroplane to be used on the course. The theoretical ground training shall be integrated with the flight training so that the maximum benefit is gained from time spent in the air.

2.2 The outline syllabus is as follows:

Lesson	Subject	Time
TH1	Aeroplane and Engine Systems	1 hr
TH2	Aeroplane and Engine Systems	1 hr
TH3	Constant Speed Propellers and Feathering	1 hr
TH4	Multi Engine Flight Principles	1 hr
TH5	Minimum Control & Safety Speeds	1 hr
TH6	Mass & Balance, performance and limitations	1 hr
TH7	Effects of Engine Failure on Systems and Performance	1 hr
	Total	7 hrs

2.3 A Flight Instructor (FI) or Class rating Instructor (CRI) qualified to give MEP class rating instruction shall give the theoretical ground-training lectures. Pre flight briefings may be combined with theoretical training in the form of a Long Briefing. Exceptionally; and subject to course approval; a suitably qualified ground instructor may be used to give theoretical ground lectures only; the FI or CRI shall then give additional pre-flight briefings.

2.4 The detailed content of each lesson should be as set out in the following pages. The Bibliography at Chapter 5 should provide the data base for general theory and principles whilst the Flight Manual/Pilot Operating Handbook should be used for information and data which is type specific.

2.5 Many multi engine aeroplanes used for training will have been certified in accordance with legacy certification standards (e.g. BCARs for UK Performance Groups C or E). More recent types will have been certified in accordance with CS-23. Any performance calculations and associated examinations should be based upon actual aeroplane performance given in the Aircraft Flight Manual/Pilot Operating handbook with consideration for any additional factors required or recommended for Commercial or non-Commercial Air Transport as appropriate. To that end, EASA Part-NCO, Part-CAT, Aeronautical Information Circulars (AICs) and CAA Safety Sense Leaflets may also be a useful source of course material.

Lesson: TH1 and TH2 - Aeroplane and Engine Systems

Duration: 1 hour

Aim: To understand all systems relevant to the operation of the multi engine piston aeroplane used on the course.

Lesson Content:

1. Aeroplane Systems (normal operation):
   - Fuel
   - Electrical
   - Flight Control (primary and secondary)
   - Automated flight control (autopilot)
   - Hydraulic
   - Pneumatic
   - Flight Instruments
   - Avionics/communication
   - Landing gear and Braking
   - Ice and rain protection
   - Oxygen
   - Emergency equipment location and operation (e.g. ELT, fire extinguisher, first aid kit, life jacket etc)
   - Other systems as applicable to type (e.g. pressurisation)
2. Engine Systems (normal operation):
   - Fuel
   - Oil
   - Starter
   - Ignition
   - Mixture
   - Turbochargers
   - Fire detection & control
3. Limitations:
   - Airframe:
     - Load factors
     - Speeds
   - Engine:
     - RPM/MAP
     - Temperatures and Pressures

4. Abnormal Operation & Emergency Procedures:
   - Refer to the Aircraft Flight Manual/Pilot Operating handbook for the aeroplane type

Performance Standard: The applicant shall be able to list and describe the aeroplane and engine systems and their operation, under normal and emergency conditions and with reference to the AFM/POH.

Lesson: TH3 - Constant Speed Propellers and Feathering

Duration: 1 hour

Aim: To learn the principles of constant speed, variable pitch (VP) propellers; propeller feathering mechanisms, and associated emergency drills.

Lesson Content:

1. Constant Speed Propellers:
   - Principles
   - Constant Speed Units
   - Synchronisation
   - Handling (type related)
2. Feathering:
   - Principles and Purpose
   - Feathering Mechanisms
   - Feathering Latches
   - Handling and Limitations (type related)
3. Over speed:
   - Causes of over speed
   - Control of over speeding propeller

Performance Standard: The applicant shall be able to describe the operation of a constant speed VP Propeller, its feathering system, and know the handling, safety, and feathering limitations for the aeroplane type.

NOTE: The advent of modern twin engine aeroplanes having automatically controlled VP propellers with single lever operation will mean that applicants trained on such aeroplanes will be required to undergo Differences Training before operating conventional 3 lever engine/propeller controls

Lesson: TH4 - Multi Engine Flight Principles

Duration: 1 hour

Aim: To understand the aerodynamic principles involved in multi engine flight under normal and asymmetric conditions.

Lesson Contents:

1. The multi-engine scene:
   - Rationale for 2 or more engines
   - Configurations of multi-engine aeroplanes
2. The multi-engine problem:
   - Engine failure situation, leading to:
     - Asymmetry
     - Control capability reduction
     - Performance reduction
     - Forced Landing considerations following loss of an engine at low speed and height i.e. immediately after take-off.
3. Aerodynamics of Asymmetry:
   - Thrust:
     - Offset thrust line
     - Asymmetric blade effect
   - Drag:
     - Offset drag line
     - Failed engine drag
     - Total drag
   - Lift:
     - Asymmetry
     - Slipstream effect
   - Unbalanced flight:
     - Effect of yaw
     - Sideslip/Side-forces
   - Thrust/Drag, side-force couples
4. Controllability in Asymmetric Flight:
   - Rudder, Aileron and Elevator:
     - Effectiveness
     - Limitations
     - Balanced/Unbalanced flight

- Effect of Bank/Sideslip
- Fin strength, and stall
- Residual unbalance - effect on controls
- Out of balance control loads
- Trimming

- IAS/Thrust relationship

Performance Standard: The applicant shall be able to describe the forces acting on a multi engine aeroplane, and describe the effects of engine failure.

Lesson: TH5 - Minimum Control and Safety Speeds

Duration: 1 hour

Aim: To learn the definitions of and factors affecting; critical/minimum control and safety speeds.

Lesson Content:

1. Minimum Control Speed (Vmc):
   - Definition
   - Derivation
   - Factors affecting:
     - Power
     - Mass/CofG
     - Altitude
     - Drag (e.g. undercarriage, flaps, etc; feathering)
     - Turbulence
     - Critical engine (if applicable)
   - Pilot handling:
     - Skill/strength
     - Reaction time
     - Effect of bank
2. Take-off Safety Speed (TOSS) (V2):
   - Definition
   - Derivation
3. Vmca; Vmc; V2 ; Vsse and other V codes (type related)

Performance Standard: The applicant shall be able to list the V speeds for the aeroplane type used on the course, and be able to describe the principles and factors affecting critical/ minimum control and safety speeds.

Lesson: TH6 - Mass and Balance, Performance and Limitations

Duration: 1 hour

Aim 1: To familiarise the applicant with the mass and balance calculations and practice calculations for the aeroplane type used on the course.

Lesson Content:

1. Revision of mass and balance principles
2. Application of principles to aeroplane type calculation
3. Practice sample calculations using POH/AFM data

Performance Standard: The applicant shall be able to perform, mass and balance calculations for the aeroplane type correctly.

Aim 2: To familiarise the applicant with performance calculations, and practice calculations for the aeroplane type used on the course.

Lesson Content:

1. Part-NCO, Part-CAT and Air Navigation (General) Regulations as applicable and for the time being in force.
2. Practice sample calculations using POH/AFM data to include, as appropriate, the one engine inoperative case:
   - WAT
   - Take off
   - Accelerate/Stop
   - Climb out - flight paths
   - En route ceiling, range, endurance
   - Descent
   - Landing

Performance Standard: The applicant shall be able to perform correctly, all mass and balance and performance calculations relevant to the aeroplane type.

Lesson: TH7 - Effects of Engine Failure on Systems and Performance

Duration: 1 hour

Aim: To learn the effects on in-flight performance, caused by one inoperative engine.

Lesson Content:

1. Effect on Systems:
   - Electrics
   - Hydraulic
   - Fuel
   - Air Conditioning and Pressurisation
   - Others (type related)
2. Effect on Power available and climb performance:
   - Excess power available
   - Optimum speeds
3. Effect on cruise:
   - Range
   - Endurance
4. Acceleration/Deceleration
5. Zero Thrust:
   - Definition
   - Purpose
   - Determination

Performance Standard: The applicant shall be able to list the systems affected by loss of a single power unit, and explain the subsequent effect on aeroplane handling and flight performance.

Chapter 3

Flight Training

3.1 The Flight Training element of the Multi Engine Piston (MEP) Class Rating course shall consist of 6 hours of dual instruction, and include 3.5 hours of asymmetric training. The outline syllabus is as follows:

Exercise	Description	Total Time	Asym
F1	Initial Type Conversion	1 hr	
F2	General Handling and Circuits	1 hr	
F3	Introduction to Asymmetric Flight	1 hr	1 hr
F4	Critical and Safety Speeds	1 hr	1 hr
F5	Asymmetric Circuits	1 hr	1 hr
F6	Asymmetric Performance and Circuits	1 hr	30 min
	Totals	6 hr	3 hr 30

3.2 Details of each flight exercise are set out in the following pages.

3.3 On satisfactory completion of the course, the applicant shall be competent to handle the aeroplane safely and confidently under both the normal and asymmetric condition. This should result in a pass at the Class Rating Skill Test in accordance with Appendix 9 to Part-FCL with a Flight Examiner (FE) or a Class Rating Examiner (CRE).

3.4 Where training is completed on aeroplanes having fixed landing gear, Differences Training is mandatory before operating MEP aeroplanes with retractable landing gear; this should include asymmetric practice. When training is completed on aeroplanes with retractable landing gear, there is no mandatory Differences Training required to fly an aeroplane with a fixed landing gear; performance considerations relating to aeroplanes with fixed landing gear shall also be discussed as part of the course. Where training is completed on a MEP aeroplane with no critical engine, the training shall include reference to aeroplanes with a critical engine.

3.5 Where MEP courses are completed on aeroplanes that have automatic engine control systems, and advanced instrumentation, ground training shall include conventional controls and instrumentation. Differences training will be mandatory before operating conventional multi engine aeroplanes.

Flight Exercise F1 - Initial Type Conversion

Duration: 1 hour

Aim: To learn the characteristics of a multi-engine aeroplane in normal flight.

Air Exercise:

1. Pre-flight Preparation and Aircraft Inspection
2. Start-up and Taxiing:
   - Cockpit familiarisation
   - Checklist procedures
   - Engine start
   - Engine fire on the ground
   - Taxiing: use of brakes and throttles
3. Take-off and Climb:
   - Check list procedures
   - Normal take-off/cross-wind take-off
   - After take-off checks
   - Normal climb, climbing turns
   - Throttle and VP propeller
4. Cruise:
   - Level off
   - Use of trim
   - Effect of flaps, undercarriage
   - Normal turns
   - Cruise checks
5. Engine Handling:
   - Engine temperatures and pressures
   - Use of: mixture control; carburettor de-icing and engine anti-icing
6. In Flight Emergencies (other than engine fire/failure):
   - Hydraulic
   - Electric
   - Airframe and engine icing
   - Fire
   - Propeller Overspeed
   - Others as per Flight Manual
7. Steep turns (45° bank)
8. Descending:

- Descent checks
- Normal descent and descending turns
- Mixture control
- Carburettor de-icing

9. Demonstration Normal Circuit:

- Checklist procedures
- Approach
- Normal landing

Skill Standard: The applicant shall be able to demonstrate competent handling of the aeroplane both in the air and on the ground, and be able to carry out normal operations in accordance with the aircraft checklist.

Flight Exercise F2 - General Handling and Circuits

Duration: 1 hour

Aim: To learn stall recognition and recovery, multi engine circuit procedures and to revise aeroplane and engine handling.

Air Exercise:

1. Start-up and Taxi
2. Take-off and Climb
3. Stalling:
   - Checks
   - Clean configuration - power off
   - Approach configuration – with power
   - Landing configuration – with power
   - Take-off configuration
4. Circuit Procedures - Both Engines Operative:
   - Normal configuration
   - Flapless approach and landing
   - Performance landing
   - Go-around
5. Undercarriage Emergency Procedures including lowering

Skill Standard: The applicant shall be able to demonstrate ability to handle all aspects of normal aeroplane operation including stall recovery with all engines operative.

Flight Exercise F3 - Introduction to Asymmetric Flight

Duration: 1 hour

Aim: To learn to recognise the symptoms of an engine failure, to identify the failed engine, carry out appropriate drills, and learn to operate the aeroplane safely following the total loss of power on one engine.

Air Exercise:

1. Take-Off and Climb
2. Simulated Engine Failure:
   - Effect of engine failure:
     - Visual
     - Instrument
     - Performance
   - Control after engine failure:
     - Yaw
     - Roll
     - Pitch
   - Identification of failed engine
   - Dead leg - dead engine
   - Instrument indications
   - Engine failure in turns:
     - Inboard, outboard
     - Identification
     - Control
   - Alternative method of control - close all throttles
3. Airspeed/Power Relationship:
   - Effect on control of:
     - Varying speed at constant power
     - Varying power at constant speed
   - Importance of feathering
4. Single-Engine Flight: (Consider engine cooling; weather and proximity of suitable airfield):
   - Demonstrate full feathering drill (engine shut-down) using checklist procedures.
   - Aeroplane handling with one engine inoperative:
     - Power required
     - Trim position for balanced flight

        - Flight controls positions for balanced flight
    - Demonstrate fuel cross-feed
    - Demonstrate un-feather drill using checklist procedures
    - Demonstrate zero thrust condition determination of 'zero thrust' settings
5. Practice aeroplane Handling In Asymmetric Flight

Skill Standard: The applicant shall be able to identify a failed engine, demonstrate safe handling of the aeroplane in asymmetric flight, and demonstrate the immediate actions required following an engine failure.

Flight Exercise F4 - Critical and Safety Speeds

Duration: 1 hour

Aim: To learn the advantages of propeller feathering and application of bank towards the live engine following loss of an engine at low speed.

Air Exercise:

1. Revise Engine Failure: Control and Identification
2. Critical Speeds:
   - Critical speed - wings level - windmilling engine
   - Critical speed - wings level – feathered prop (zero thrust)
   - Critical speed - wings level – feathered prop - 5° bank
3. Engine Failure during Take-off:
   - Engine failure below Take-Off Safety Speed (TOSS)
   - Engine failure at or above TOSS
   - Full Engine Failure After Take-Off (EFATO) Drill
   - Single engine climb
4. Practice of Feathering and Un-feathering Drill (engine shut-down)
5. Demonstrate Asymmetric Circuit, go-around and Landing

Skill Standard: The applicant shall demonstrate an understanding of the significance of critical speeds and take- off safety speeds (TOSS), and be able to carry out correctly the engine failure drill in flight or during take-off.

Flight Exercise F5 - Asymmetric Circuits

Duration: 1 hour

Aim: To learn to handle an engine failure shortly after take-off or on the go-around, to carry out the EFATO drills, an asymmetric circuit, go-around and a subsequent landing.

Air Exercise:

1. Take-off Brief
2. Engine Failure After Take-off
3. Asymmetric Circuit:
    - Power settings and speeds
    - Use of Flap
    - Undercarriage and flap operation
        - Normal
        - Emergency
        - Asymmetric Committal Height
        - Go-around;
            - Decision
            - Actions
        - Landing
            - Use of flap
            - Foot load
            - Taxiing

Skill Standard: The applicant shall be able to identify the engine failure after take-off, control the aeroplane; carry out the EFATO drills correctly, and fly an asymmetric circuit to go around or to continue to land.

Flight Exercise F6 - Asymmetric Performance and Circuit

Duration: 1 hour

Aim: To revise the effects of asymmetric operation on aeroplane systems and performance and to practise asymmetric circuits.

Air Exercise:

1. Effect On Aircraft Systems:
   - Engine parameters
   - Electrical system operation
   - Hydraulic system operation
   - Fuel system:
     - Cross feed
     - Fuel consumption
   - Other systems - type related
2. Effect on Aeroplane Performance of:
   - Feathering
   - Configuration (e.g. flaps, undercarriage)
   - Departure from scheduled speeds
3. Effect on Climb/Cruise Performance:
   - Climb
   - Range
   - Endurance
   - Descent
4. Asymmetric Circuits

Skill Standard: The applicant shall be able to operate the aeroplane safely in all phases of flight, including following total loss of power on one engine.

Chapter 4

Multi-engine Piston Aeroplanes with Centreline Thrust

Background

4.1 Aeroplanes having both engines located on a common axis with the aircraft centerline, do not exhibit the same asymmetrical control characteristics as aeroplanes fitted with outboard engines. Training conducted on such aircraft will not include the asymmetric training and will not qualify the applicant to operate aeroplanes having multi-engines other than those located on the aircraft centerline. A MEP Class rating conducted on Centerline Thrust aeroplanes will be endorsed with a Limitation prohibiting flight on all non-centerline thrust aeroplanes.

Theoretical Training

4.2 The theoretical knowledge syllabus shall be modified from the lesson content shown in Chapter 2 by eliminating references to asymmetric operation. For lessons TH1, TH2, TH5 and TH7 see Chapter 2. The detailed content of Exercise TH6C is shown in the following pages.

Lesson	Subject	Time
TH1	Aeroplane and Engine Systems	1 hr
TH2	Constant Speed Propellers and Feathering	1 hr
TH5	Mass & Balance	1 hr
TH6C	Effects of Engine Failure on Systems and Performance - Centreline Thrust	1 hr
TH7	Mass & Performance	1 hr
	Total	5 hrs

Flight Training

4.3 The Flight Training element of the Multi Engine Piston (centreline thrust) class rating course shall consist of a minimum of 4 hours of dual instruction, to include a minimum of 1hour of training in single engine operations. The outline syllabus is as follows:

Exercise	Description	TotalTime	Engine Failures
F1	Initial Type Conversion	1 hr	
F2	General Handling and Circuits	1 hr	
F3C	General Handling - Engine Failures	1 hr	30 min
F4C	Single Engine Performance and Circuits	1 hr	30 min
Totals	4 hr	1 hr	

4.4 Flight Exercises 1 and 2 shall follow the exercise content shown in chapter 3. The dedicated content of exercise F3C and F4C are shown in the following pages.

Theoretical Examination

4.5 The theoretical examination for a centerline thrust multi-engine piston aeroplane should include a minimum of 40 questions confined to centerline thrust aeroplanes.

4.6 Holders of a MEP Class rating limited to centerline thrust aircraft will be required to complete the asymmetric training exercises of at least 3.5 hours and pass a full MEP Class Rating theoretical examination and Skill Test on a MEP aeroplane that does not have centerline thrust.

THEORETICAL TRAINING

Lesson: TH6C - Effects of Engine Failure on Systems and Performance - Centerline Thrust

Duration: 1 hour

Aim: To learn the effects on in flight performance, caused by one inoperative engine

Lesson Content:

1. The multi-engine scene:
   - Rationale for 2 or more engines
   - Configurations of multi-engine aeroplanes
2. The multi-engine problem:
   - Engine failure situation, leading to performance reduction
   - Factors affecting:
     - Power
     - Mass/CofG
     - Altitude
     - Drag (e.g. undercarriage, flaps, etc; feathering)
     - Turbulence
3. Take-off Safety Speed (TOSS) (V2) and other V Speeds:
   - Definition
   - Derivation
4. Effect on Systems:
   - Electrics
   - Hydraulic
   - Fuel
   - Air Conditioning and Pressurisation
   - Others (type related)
5. Effect on Power:
   - Excess power available
   - Optimum speeds
6. Effect on cruise:

- Range
- Endurance

7. Acceleration/Deceleration
8. Zero Thrust:
   - Definition
   - Purpose
   - Determination

Performance Standard: The candidate shall be able to list the systems affected by loss of a single power unit, and explain the subsequent effect on aircraft flight-performance.

FLIGHT TRAINING

Flight Exercise F3C - Introduction to Engine Failure

Duration: 1 hour

Aim: To learn to recognise the symptoms of an engine failure; to identify the failed engine; carry out appropriate drills, and learn to operate the aeroplane safely following the total loss of power on one engine.

Air Exercise:

1. Normal Take-Off and Climb
2. Single-Engine Flight: (Consider engine cooling!):
   - Demonstrate full feathering drill (engine shut-down) using checklist procedures
   - Aeroplane handling with one engine inoperative:
     - Power required
     - Trim position
   - Demonstrate fuel cross-feed
   - Demonstrate un-feather drill using checklist procedures
   - Demonstrate zero thrust condition determination of 'zero thrust' settings
3. Simulated Engine Failure:
   - Effect of engine failure:
     - Visual
     - Instrument
     - Performance
   - Identification of failed engine
   - Instrument indications
4. Forced Landing Considerations.

Skill Standard: The applicant shall be able to identify a failed engine, demonstrate safe handling of the aeroplane, and state the immediate actions required following an engine failure.

Flight Exercise F4C - Circuits

Duration: 1 hour

Aim: To learn to handle an engine failure shortly after take-off, to carry out the EFATO drills, go-around and a subsequent landing.

Air Exercise:

1. Take-off Brief
2. Engine Failure After Take-off
3. Circuit:
   - Power settings and speeds
   - Use of Flap
   - Undercarriage and flap operation:
     - Normal
     - Emergency
     - Visual Committal Height
     - Go-around;
       - Decision
       - Actions
     - Landing
       - use of flap

Skill Standard: The applicant shall be able to identify the engine failure after take-off; control the aeroplane; carry out a circuit and a landing.

Chapter 5

Examination Paper Preparation

5.1 The provision of theoretical examination papers for multi-engine aeroplane Class and Type ratings is the responsibility of the training provider. Prior to use, all examination papers shall be submitted to the CAA for approval. The following information is provided as guidance to organisations compiling theoretical examinations for the MEP Class rating course.

5.2 Examination papers should be submitted to the CAA in a completed condition, exactly as they will be presented to the applicant. Papers should include applicant instructions, the paper number and details of: the time allowed, the pass mark, and any additional information required to answer the questions. A blank answer sheet should be provided together with a copy of the correct answers.

5.3 The number of questions shall reflect the complexity of the aircraft. 100 questions are required for a complex type rated aeroplane; it is considered that a minimum of 40 and a maximum of 60 questions reflects the level of complexity of a MEP class rated aeroplane. All questions shall be multiple-choice with 4 answers; the pass mark will be 75% based upon all questions asked, even if divided into subject groups. The total number of questions should be divisible by 4 to facilitate marking.

5.4 Subject Material shall be based upon the course teaching material. Where course notes are provided, it should be possible to answer all questions using the notes and the Aircraft Flight Manual. The following subject areas may be used as a guide however, it is recommended that the subject groups be mixed for MEP Class ratings.

Subject	Description	%
a	Aircraft structure and equipment, normal operation of systems and malfunctions	56
b	Limitations	12
c	Performance - flight planning and monitoring	16
d	Load, Balance and Servicing	8
e	Emergency procedures	8

NOTE: 60% of the questions asked should be applicable to the majority of MEP class aeroplanes. 40% of the questions should relate to the specific type used on the course. All "type" specific questions must be clearly identified from the generic questions.

Rules for Writing Multiple Choice Questions

1. The examiner should have a specific question that he wants the candidate to answer, related to a major field of knowledge in the syllabus, rather than minor detail. Purely academic questions, which have no practical use, should be, avoided.
2. Formulate the questions and answers as simply as possible: the examination is not a test of language; avoid complex sentences and repeating the same words.
3. Questions should have only one correct answer.
4. The answer should be absolutely correct and complete, or without doubt, the most preferable. Avoid responses that are similar or grammatically incorrect; random numbers, should not be used in numerical questions, answers should represent common errors in calculation. Answers such as "None of the above" or "all of the above," are correct/incorrect" are not acceptable.
5. Questions should be capable of being read and understood in approximately 45 seconds, a further period of up to 45 seconds may then be allowed to answer it.
6. The question should be constructed so that it can be answered without the presence of the 4 answers; alternatively, it should form part of a statement, which can be completed from knowledge. Questions such as "which of the following are correct?" are of little value.
7. There are some questions where it is not possible to find 4 plausible answers; this can often be solved by turning the question around such that the answer effectively becomes the question; this enables plausible alternative answers to be matched with the revised question.
8. Where the same words appear in every answer, they form a constant and do not contribute in any way to the answer. If they are required to make good English they can be moved directly to the question. In some cases they can be eliminated entirely.
9. Questions relating to a sequence of events can often be presented as a simple table rather than a long-winded description. Answers should not include excessively long lists.

Example of a good question:

Q. The function of a turbo-charger is to:

A. improve performance at sea level

B. automatically maintain a constant manifold pressure during a climb

C. increase manifold pressure during a climb

D. improve engine performance on short runways

Example of a typical poor question:

Q. Which of the following responses is correct?

A. The term critical engine is used to describe the engine which if failed will lead to the largest yawing moment for a given set of conditions
B. The closer the engines are placed to the aircraft's centerline the greater will be the yawing moment from the operating engine when flying on asymmetric power
C. The term critical engine will only apply to a conventional twin-engine aircraft if it has propellers, which rotate in opposite directions
D. None of the above responses is correct

It is longwinded and difficult to determine the point; answer D contradicts the question, and would make little sense if it were correct! Is the question concerned with finding a correct response? It clearly states so, but it is also attempting to establish if the candidate has any knowledge of critical engines, what knowledge is not clear.

The same question could be rewritten in two different ways:

Q1. The critical engine is the engine, which following a total loss of power on that engine, can result in:

A. the largest possible yawing moment
B. the least possible yawing moment
C. a swing away from the critical engine
D. an inboard movement of the thrust centerline

This uses 43 words compared to 87, a saving of 50%;

or:

Q2. Asymmetric blade effect occurs because:

A. the plane of rotation of the propeller is not perpendicular to the relative air flow
B. the critical engine has failed
C. the non-critical engine has failed
D. both engines rotate in the same direction

Both questions now use fewer words than the original example.

Chapter 6
Bibliography

The following bibliography is suggested for study covering ground and flight elements of the multi-engine piston course:

CAA- EASA Publications

CAP 393	The Air Navigation Order (2009) as amended
Part-FCL and AMC/GM FCL	The Aircrew Regulation, specifically Subpart H and the associated AMC
Standards Document 55	Guidance for the Approval of Training Organisations
CAA Handling Sense leaflet 01	Twin piston aeroplanes
CAP 804	FCL requirements, policy and guidance
CAP 468	BCAR, Section L (Aeroplanes below 5700kg)
CS-23	Normal, Utility, Aerobatic and Commuter Category Aeroplanes

Additional briefing material

- Pre Flight Briefing Manual – Multi Engine Course - Mike Woodgate ISBN 1 874505 10 1
- Multi-Engine Piston - David Robson. Publisher Pooleys; ISBN 1 84037 107 2
- Flying Training Manual for the PPL - Multi-engine Rating - R D Campbell Publisher: Blackwell Science (UK); ISBN: 0632028068
- Mechanics of Flight - A C Kermode. Publisher: Prentice Hall; ISBN: 0582237408
- The Aircraft Performance Requirement Manual – RV Davies Publisher: The Crowood Press; ISBN: 1853101680
- Flight Manual, Checklist, for the Aeroplane type

APPENDIX A

Student Record - MEP Training Course

COURSE	MEP	CAA REF				
Name:						
Address:						
Tel:			Work:			
Date Course Commenced:			Date Course Completed:			
Licence Held:			Ratings:			
Licence/Logbook Checked:			Pre-entry Requirements:			
70 Hrs PIC			(MEP) Written Exam Passed			
Comments:						
Hours Flown:		Ground Training Hours:				
I certify that the above Training Record is correct Head of Training Company Name Date:						

SAMPLE

APPENDIX B

MEP Training Record

MEP TRAINING RECORD

STUDENT NAME:

Date	Aircraft or Ground	Exercise	Time	Total Hours	Remarks	Instructor Name	Spare

SAMPLE