

APPENDIX R62.05
NATIONAL PILOT LICENCE
WEIGHT-SHIFT CONTROLLED MICROLIGHT AEROPLANES
THEORETICAL TRAINING

1. Aim of training course

The aim of the course is to train a candidate to the level of proficiency required for the issue of a category rating for weight-shift controlled microlight aeroplanes, and to provide the training necessary to act as pilot-in-command of any weight-shift controlled microlight aeroplane, engaged in non-revenue flights under visual flight rules.

2. Theoretical knowledge course

2.1 The theoretical knowledge course must cover the subjects as detailed in the syllabus:

- (1) Principles of Flight
- (2) Air Law
- (3) Aviation Meteorology
- (4) Aircraft Engines, Airframes and Instruments
- (5) General Navigation
- (6) Human Performance Limitations and Passenger care

2.2 Restricted Radio Telephony Operator's Certificate as prescribed in AIC 30.9

3. Theoretical knowledge course syllabus

3.1 Principles of Flight

3.1.1 Principles of Flight - General

- (1) PHYSICS AND MECHANICS
 - (a) Speed, velocity, force
 - (b) Pressure – Bernoulli's Principle
 - (c) Motion of body along a curved path

Note: The student must have a good understanding of the speed squared law as applicable to Lift with specific reference to gusts and lulls, and their effect on your flight path.

- (2) AEROFOILS, LIFT AND DRAG
 - (a) Air resistance and air density
 - (b) Aerofoil shapes
 - (c) Lift and drag – Angle of attack and airspeed
 - (e) Drag – Induced, parasite – Form, skin, interference
 - (f) Lift/drag ratio and aspect ratio
 - (g) Wake turbulence
- (3) EQUILIBRIUM
 - (a) The four forces: Lift, weight, thrust and drag
 - (b) Centre of gravity (C of G) position
 - (c) The balance of the four forces: Straight and level
 Climbing
 Descending
- (4) STABILITY
 - (a) Positive, neutral, negative
 - (b) Lateral and directional stability

- (c) Longitudinal stability
- (d) Wash-out

- (5) FORMATION FLYING
 - (a) Law Governing
 - (b) Procedures and hazards

- (6) TURNING FLIGHT
 - (a) The forces in the turn
 - (b) Compensation for loss of lift

- (7) THE STALL
 - (a) Airflow separation
 - (b) Stalling angle – Relationship to airspeed
 - (c) Wing loading
 - (d) Wing loading increase with bank angle increase
 - (e) High-speed stall

- (8) AIRCRAFT PERFORMANCE
 - (a) Power curves
Effect of temperature, altitude, density, moisture etc.
Range and endurance
 - (b) Climbing performance
Rate of climb
Angle of climb
 - (c) Take-off and landing performance
Take-off run available
Take-off distance available
Landing distance available
 - (d) Take-off and initial climb - performance
Effect of –
 - i. Wind, wind gradient and wind shear
 - ii. Weight
 - iii. Pressure, altitude, temperature and density
 - iv. Ground surface and gradient
 - (e) Approach and landing – performance
Effect of –
 - i. Wind, wind gradient and wind shear
 - ii. Weight
 - iii. Turbulence and gusts
 - iv. Ground effect

3.1.2 Principles of flight – Weight shift control specific

- (1) FLYING CONTROLS
 - (a) Controlling the three axes: Vertical, Lateral, Longitudinal
Yaw, Pitch, Roll
 - (b) Operation and function of the base-bar
 - (c) Operation and function of thrust
 - (d) Principles and purpose of mass distribution
 - (e) Principles and effect of changes to the following:
 - hang point,

- batton bungee tension,
 - batten shapes
 - wing-tip washout
 - reflex.
 - (f) Operation and function of billow shift and roach
 - (g) Loss of bar movement in advanced spiral dive
- (2) AEROFOILS, LIFT AND DRAG
- (a) Distribution of lift, Centre of pressure with specific reference to swept back, washed out, flex wings with reflex
- (3) WEIGHT AND BALANCE
- (a) Limitations on aircraft weight
 - (b) Limitations in relation to wing specifications, i.e. size
 - (c) Weight calculations
- (4) THE STALL
- (a) Progressive stall characteristics of swept back washed out wing
 - (b) Whip Stall - tumble
- (5) PERFORMANCE
- (a) Performance of wing in rain
 - (b) Pendulum effect @ Rotation
 - (c) Pilot induced oscillations (P.I.O.), Causes, symptoms and recovery.
- (6) STABILITY
- (a) Relationship of gross weight to
 - control in pitch
 - control in turbulence
 - (b) Luff lines
 - (c) Reflex
 - (d) Swept back wings
- (7) LOAD FACTOR AND MANOEUVRES
- (a) Maneuvering speed limitations (gusty conditions)
 - (b) Effect on stalling speed
 - (c) Effect on glide slope
 - (d) Effect on base-bar trim position
 - (e) Effect on approach slope and round out technique

3.2 Air Law

- (1) Applicable acts, regulations and other documents
- (2) Structure and function of CAR's, CATS AIP's, Notams, AIC's and AIP supplements.
- (3) Classification of aircraft
- (4) Aircraft documentation
- (5) Aircraft equipment
- (6) Aircraft radio equipment
- (7) Aircraft weight schedule

- (8) Documents to be carried on board
- (9) Documents and records to be maintained and produced on request
- (10) Offences in relating to documents and records
- (11) Airworthiness aspects
- (12) Flight crew licensing
- (13) Microlight aeroplane pilot - Privileges and limitations
- (14) Microlight aeroplane ratings
- (15) Personal flying logbook
- (16) Airspace classification
- (17) General flight rules
- (18) Visual flight rules
- (19) Special flight rules
- (20) Flight operations
- (21) General provisions
- (22) Air traffic services
- (23) Flight plans
- (24) Air-proximity reporting procedures
- (25) Incident/accident reporting
- (26) International operations
- (27) Operation of Non-type certified aircraft
- (28) Marine living resources act and Proclaimed nature reserves

3.3 Aviation Meteorology

- (1) THE ATMOSPHERE
 - (a) Composition and structure
 - (b) Vertical divisions

- (2) PRESSURE, DENSITY AND TEMPERATURE
 - (a) Barometric pressure, isobars
 - (b) Changes of pressure, density and temperature with altitude
 - (c) Solar and terrestrial energy radiation, temperature
 - (d) Lapse rate
 - (e) Stability and instability
 - (f) Effects of radiation, advection subsidence and convergence

- (3) HUMIDITY AND PRECIPITATION
 - (a) Water vapour in the atmosphere
 - (b) Dew point and relative humidity

- (4) PRESSURE AND WIND
 - (a) High and low pressure areas
 - (b) Gradient wind
 - (c) Vertical and horizontal motion
 - (d) Effect of wind gradient and windshear on take-off and landing
 - (e) Relationship between isobars and wind, Buys Ballot's law
 - (f) Turbulence and gustiness
 - (g) Local winds, land and sea breezes, berg winds, valley winds

- (5) CLOUD FORMATION
 - (a) Cloud types
 - (b) Convection clouds

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- (c) Orographic clouds
- (d) Stratiform and cumulus clouds

- (6) VISIBILITY
 - (a) Fog, mist and haze
 - (b) Radiation, advection, frontal
 - (c) Formation and dispersal
 - (d) Reduction of visibility due to mist, snow, smoke, dust and sand
 - (e) Hazards of flight due to low visibility, horizontal and vertical

- (7) AIRMASSES
 - (a) Weather associated with pressure systems

- (8) FRONTS
 - (a) Formation of cold and warm fronts
 - (b) Associated clouds and weather, cold front

- (9) ICE ACCRETION
 - (a) Conditions conducive to ice formation
 - (b) Effects of hoar frost, rime ice, clear ice
 - (c) Effects of icing on microlight performance
 - (d) Precautions and avoidance of icing conditions
 - (e) Powerplant icing

- (10) THUNDERSTORMS
 - (a) Formation – airmasses, frontal, orographic
 - (b) Conditions required
 - (c) Development process
 - (d) Recognition of favourable conditions for formation
 - (e) Hazards
 - (f) Effects of lightning and severe turbulence
 - (g) Avoidance of flight in the vicinity of thunderstorms

- (11) FLIGHT OVER MOUNTAINOUS AREAS
 - (a) Hazards
 - (b) Influence of terrain on atmospheric processes
 - (c) Mountain waves, windshear, turbulence, vertical movement, rotor effects

- (12) CLIMATOLOGY
 - (a) General world circulation
 - (b) South African summer patterns
 - (c) South African winter patterns
 - (d) The South Westerly Buster
 - (e) The Cape Doctor
 - (f) The Black South Easter

- (13) ALTIMETRY
 - (a) Operational aspects of pressure settings
 - (b) Pressure altitude, density altitude
 - (c) Height, altitude, flight level

- (14) THE METEOROLOGICAL ORGANISATION
 - (a) Forecasting service

- (15) WEATHER ANALYSIS AND FORECASTING
 - (a) Weather charts, symbols, signs
 - (b) Significant weather charts
 - (c) Prognostic charts for general aviation

- (16) WEATHER INFORMATION FOR FLIGHT PLANNING
 - (a) Reports and forecasts for departure, *en route*, destination and alternate(s)
 - (b) Interpretation of coded information METAR, TAF
 - (c) Availability of ground reports for surface wind, windshear, visibility

- (17) METEOROLOGICAL BROADCASTS FOR AVIATION
 - (a) ATIS, SIGMET

- (18) MICRO-METEOROLOGY
 - (a) Rotors
 - (b) Venturies
 - (c) Katabatic and Anabatic winds
 - (d) Thermal activity
 - (e) Dust devils
 - (f) The immediate environment.
 - Wind indicators
 - Cloud forms
 - Topography
 - Dams

3.4 Aircraft Engines, Airframes and Instruments

- (1) UNDERCARRIAGE
 - (a) Structure
 - (b) Materials
 - (c) Wear and tear considerations

- (2) WING
 - (a) Structure
 - (b) Materials
 - (c) Wear and tear considerations
 - Repairs
 - Sail assessment
 - Wind
 - UV
 - Turbulence
 - Hard Landings

- (3) POWERPLANT AND SYSTEMS
 - (a) Engines – general
 - Principles of 2 and 4 stroke engines
 - (b) Maintenance

- spark plug replacement
 - air-filter cleaning
 - cooling system
 - V-belt adjustment
 - gearbox oil change
 - renewing carb rubbers
 - adjusting idle
 - exhaust springs
 - manufacturer maintenance schedule
 - lubrication
- (4) IGNITION SYSTEMS
- (a) Carburetion and Fuel system
 1. Principles of float type carburetor
 2. Fuel-bypass (choke)
 3. Recognition of faulty mixture
 4. Methods to maintaining correct mixture ratio
 - i. carburetor jetting and needle and seat inspection
 - ii. balancing carburetors
 5. Carburetor icing
 6. Emergency use of Fuel-bypass (choke)
 - (b) Fuel
 1. Types
 2. Suitability
 3. Hazards of avgas
 4. Contamination
 5. Fuel strainers and drains
 6. Fire hazards
 - i. containers
 - ii. transportation
 - iii. de-canting
 - (c) Electrical system
 1. general
 2. batteries
 3. circuit breakers and fuses
 4. recognizing malfunctions
 - (d) Propeller
 1. nomenclature
 2. construction, shape and types
 3. forces on blades
 4. designs
 5. effect of blade pitch changes
 6. maintenance and care
 7. tracking
 - (e) Instruments
 - (f) Airspeed indicator
 - (g) Altimeter
 - (h) VSI
 - (i) Magnetic compass
 1. Precautions when carrying magnetic objects
 2. Errors
 - (j) Engine instruments

- Temperature and pressure gauges
- (k) Digital instruments
- (l) RPM

3.5 General Navigation

- (1) FORM OF THE EARTH
 - (a) Axis, poles
 - (b) Meridians of longitude
 - (c) Parallels of latitude

- (2) DIRECTION
 - (a) True north
 - (b) Earth's magnetic field, variation – annual change
 - (c) Magnetic north
 - (d) Magnetic influences within the microlight
 - (e) Compass deviation
 - (f) Turning, acceleration errors
 - (g) Avoiding magnetic interference with the compass

- (3) DISTANCE
 - (a) Nautical mile, statute mile, kilometre

- (4) AERONAUTICAL MAPS AND CHARTS (TOPOGRAPHICAL)
 - (a) Projections and their properties
 - (b) Scale
 - (c) ICAO 1:250 000 and 1: 500 000 charts
 - (d) main properties
 - (e) Scale
 - (f) depiction of height
 - (g) Topography
 - (h) Relief
 - (i) Cultural features
 - (j) Aeronautical symbols
 - (k) Aeronautical information

- (5) CHARTS IN PRACTICAL NAVIGATION
 - (a) Plotting positions
 - (b) Latitude and longitude
 - (c) Bearing and distance
 - (d) Use of navigation protractor
 - (e) Measurement of tracks and distances
 - (f) Conversion of units

- (6) PRINCIPLES OF NAVIGATION
 - (a) IAS, RAS (CAS) and TAS
 - (b) Track, true and magnetic
 - (c) Wind velocity, heading and ground speed
 - (d) Triangle of velocities
 - (e) Calculation of heading and ground speed
 - (f) Drift, wind correction angle
 - (g) EET and ETA

- (h) Dead reckoning, position, fix
- (7) FLIGHT PLANNING
 - (a) Selection of charts
 - (b) Route and aerodrome weather forecasts and reports
 - (c) Assessing the weather situation
 - (d) Plotting the route
 - (e) Considerations of controlled airspace, airspace restrictions, danger areas, etc.
 - (f) Use of AIP and NOTAMS
 - (g) ATC liaison procedures in controlled airspace
 - (h) Fuel considerations
 - (i) *En-route* safety altitude(s)
 - (j) Alternate aerodromes
 - (k) Communications and radio/navaid frequencies
 - (l) Compilation of flight log
 - (m) Compilation of ATC flight plan
 - (n) Selection of check points, time and distance marks
- (8) PRACTICAL NAVIGATION
 - (a) Compass headings, use of deviation card
 - (b) Organisation of in-flight workload
 - (c) Departure procedure
 - (d) Maintenance of heading and altitude
 - (e) Use of visual observations
 - (f) Establishing position, checkpoints
 - (g) Revisions to heading and ETA
 - (h) Arrival procedures, ATC liaison
 - (i) Use of minute marker graph.
- (9) GLOBAL POSITIONING SYSTEM (GPS)
 - (a) Limitations
 - (b) Application
 - (c) Principles
 - (d) Presentation and interpretation
 - (e) Coverage
 - (f) Errors and accuracy
 - (g) Factors affecting reliability and accuracy
 - (h) Legalities

3.6 Human performance limitations

- (i) Human Performance Limitations and Passenger care
 - (1) Introduction
 - (2) Oxygen
 - (a) Hypoxia
 - (b) Hyperventilation
 - (3) Barotraumas
 - (4) Common ailments
 - (5) Decompression
 - (6) Air sickness
 - (7) Hearing

- (8) Sight
 - (9) Toxic hazards
 - (10) Blood pressure
 - (11) Epilepsy
 - (12) Alcohol and drugs
 - (13) Knowledge and the senses
 - (14) Disorientation
 - (15) Avoiding the air proximity
 - (16) Stress
 - (a) Management of stress
 - (b) Emotional factors
 - (c) Social psychology
 - 1. The Ego Factor
 - 2. Intermediate syndrome
- (ii) Passenger Care
- (1) Embarking / Disembarking
 - (2) Seatbelt and comfort
 - (3) Briefing
 - (4) Indemnity
 - (5) Open cockpit flying
 - (6) clothing, long hair and security
 - (7) cameras and loose articles
 - (8) Human performance limitation as applicable to your passenger
 - (9) Eye-contact and communication
 - (10) Air law as applicable to passengers
 - (11) Passenger seat and flying control access