Schedule 3 Aeronautical knowledge standards

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APPENDIX 1. FLIGHT CREW LICENCES AND AIRCRAFT CATEGORY RATINGS

SECTION 1.1 BASIC AERONAUTICAL KNOWLEDGE (BAK)

Unit 1.1.1 BAKC: Basic aeronautical knowledge – all aircraft categories

1. Reserved

2. Terminology

2.1 Direction of flight

2.1.1 Describe direction using the following methods:

(a) as a 3 figure group;

(b) as a 2 figure group;

(c) in the clock code.

2.1.2 Define the meaning of aircraft heading (HDG).

2.1.3 Describe the differences between the following terms when used to describe direction:

(a) true (T);

(b) magnetic (M);

(c) compass (C).

2.2 Distance, speed and velocity

2.2.1 State the units used for lateral distance in respect of the following:

(a) navigation;

(b) visibility.

2.2.2 Define the meaning of knot (kt) when used to express aircraft speed.

2.2.3 Define wind velocity (W/V).

2.2.4 Differentiate between the following acronyms:

(a) IAS;

(b) CAS;

(c) TAS;

(d) GS.

2.3 Time

2.3.1 Express time as a 4 figure group (24 hour time).

2.3.2 Convert local standard time to UTC.

2.3.3 Convert UTC to local standard time.

2.4 Units of measurement

2.4.1 State the units used to describe vertical measurement and the differences between the following:

(a) height;

(b) altitude;

(c) elevation.

2.4.2 State the unit of measurement used to express:

(a) runway dimensions;

(b) temperature;

(c) atmospheric pressure;

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(d) weight;

(e) volume (liquids);

(f) visibility.

2.5 Basic physics

2.5.1 Describe the meaning of kinetic and potential energy and the relationship to basic aircraft operations.

2.5.2 Describe the meaning of ‘aircraft energy state’ with respect to kinetic and potential energy.

2.5.3 Describe the effects on ‘aircraft energy state’ of acceleration, deceleration, climb and descent.

3. Power plants and systems – basics

3.1 Piston engine aircraft

3.1.1 Describe the basic principle of operation of a 4 stroke cycle internal combustion engine and state the purpose and function of the following components:

(a) cylinders;

(b) pistons;

(c) piston rings;

(d) inlet/exhaust valves;

(e) crank shaft;

(f) cam shaft;

(g) spark plugs.

3.1.2 Describe the effect of increasing altitude and temperature on engine performance and how the following affect the power output of an engine:

(a) throttle lever position;

(b) RPM.

3.1.3 State the function of the following engine components and/or features:

(a) carburettor;

(b) throttle;

(c) magneto, dual ignition;

(d) alternator;

(e) battery, battery compartment vent;

(f) propeller;

(g) circuit breaker, fuse, bus bar;

(h) impulse start;

(i) oil cooler;

(j) fuel tank vents.

3.1.4 In relation to power plants and systems, state the purpose and importance of monitoring the following gauges:

(a) RPM (tachometer);

(b) CHT and EGT;

(c) voltmeter, ammeter, loadmeter;

(d) fuel pressure;

(e) oil temperature and pressure.

3.1.5 Describe the purpose and function of an engine lubrication system in relation to engine cooling.

3.1.6 State the purpose of mixture control and describe the effect of excessively rich and lean mixture strengths on engine operation.

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3.1.7 Describe the advantages and disadvantages of a simple carburettor and a direct injection system.

3.1.8 List typical services provided by the following systems in a light aircraft and the actions a pilot would take to rectify or detect a malfunction:

(a) hydraulic system;

(b) electrical system;

(c) ignition system;

(d) vacuum system.

3.2 Fuels and oils

3.2.1 Describe the following in relation to fuels:

(a) the sources of fuel contamination;

(b) the advantages and disadvantages of fuelling prior to overnight parking;

(c) how to identify different grades of aviation fuel;

(d) the hazards/problems with:

(i) mixing different hydraulic fluids;

(ii) using incorrect grades of fuel.

3.3 Engine handling

3.3.1 State the causes and effects of detonation, limited to improper use of mixture control, MP/RPM, and use of incorrect fuel octane.

3.3.2 Describe the effect on an engine of the following:

(a) prolonged idling;

(b) using incorrect mixture settings in flight.

3.3.3 State reasons for the following limitations/actions:

(a) minimum oil pressure;

(b) minimum/maximum oil temperature;

(c) minimum/maximum CHT;

(d) maximum RPM;

(e) ignition checks: pre-take-off and shutdown;

(f) prolonged use of starter motor;

(g) use of pitot heat on the ground;

(h) engine warm up on prolonged descents.

3.3.4 Explain the significance of blue or black exhaust smoke produced by an aircraft piston engine.

3.4 Malfunctions

3.4.1 For paragraphs (a), (b) and (c), the components are listed in paragraph (d):

(a) describe the cockpit indications which may suggest a malfunction or failure of a component;

(b) state the actions (if any) a pilot should take to rectify a malfunction or failure of a component;

(c) describe the consequences if a malfunction or failure of a component listed above cannot be rectified;

(d) the following is a list of components that applies to paragraphs (a), (b) and (c):

(i) alternator;

(i) magneto;

(ii) battery;

(iii) ignition switch;

(iv) fuel vent (blockage), fuel/booster pump;

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(v) oil cooler, cowl flaps;

(vi) vacuum pump;

(vii) hydraulic brakes.

3.4.2 For paragraphs (a) and (b), the piston-engine gauges are listed in paragraph (c):

(a) with reference to engine gauge indications, identify reasons for an abnormality and state pilot actions (if any) to rectify a problem;

(b) state the consequences if the problem cannot be rectified by the pilot;

(c) the following is a list of piston-engine gauges that applies to paragraphs (a) and (b):

(i) oil temperature and pressure;

(i) CHT;

(ii) fuel pressure;

(iii) tachometer;

(iv) ammeter/load meter;

(v) voltmeter;

(vi) engine icing.

3.4.3 Describe the method for checking the operation of carburettor heat prior to take-off.

3.4.4 State the atmospheric conditions of outside air temperature and relative humidity, engine control settings and power conditions which are conducive to the formation in a carburettor, including the severity of the icing, of the following:

(a) throttle ice;

(b) fuel evaporation ice;

(c) impact ice.

3.4.5 State the danger of progressive throttle increments if engine icing is not diagnosed.

3.4.6 Describe the use of carburettor heat for:

(a) anti-icing;

(b) de-icing;

(c) ground operation.

3.4.7 Describe the difference between the use of ‘alternate air’ and ‘carburettor heat’ controls.

3.4.8 State the effect of the application of carburettor heat on engine performance and engine instrument indications.

3.4.9 Describe the symptoms of fuel vaporisation and the method of rectification.

3.5 Flight instruments

3.5.1 Explain the colour code markings on an airspeed indicator (ASI).

3.5.2 Describe the basic operation of the primary flight instruments and associated systems.

3.5.3 State:

(a) the effect of a blockage of the pitot or static source on the indications displayed by each pressure instrument; and

(b) the effect of using an alternate static source located inside the cockpit, on the reliability of pressure instrument indications; and

(c) the effect of low suction and loss of electrical power on the reliability of the gyroscopic flight instruments; and

(d) the causes of toppling of gyroscopic instruments and identify conditions under which they would re-erect; and

(e) how, when and why a directional indicating gyro should be synchronised with the magnetic compass.

3.5.4 Describe the methods to determine the serviceability of the primary flight instruments and magnetic compass.

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4. Aerodynamics

4.1 Basic aerodynamics

4.1.1 Basic physics – aircraft energy state in terms of the following:

(a) kinetic energy;

(b) potential energy;

(c) inertia.

4.1.2 Explain the meaning of the following terms:

(a) aerofoil, angle of attack, relative airflow;

(b) centre of pressure, centre of gravity;

(c) lift, weight, thrust, drag.

4.1.3 Describe the meaning of the following terms in respect of an aerofoil:

(a) chord;

(b) span;

(c) camber;

(d) aerodynamic stall.

4.2 Lift and drag

4.2.1 State whether lift and drag of an aerofoil will increase or decrease with changes in the following:

(a) airspeed;

(b) angle of attack.

4.2.2 Explain the following types of drag which affect a subsonic aircraft in flight:

(a) parasite (zero lift) – form, interference, skin friction;

(b) induced (lift dependent).

4.2.3 State how total drag varies with airspeed.

4.3 Climbing

4.3.1 Describe the difference between rate of climb and angle of climb.

4.4 Wake turbulence

4.4.1 List the factors that affect the strength of vortex flow with respect to the following:

(a) aircraft weight;

(b) speed;

(c) wing shape.

4.4.2 State the primary control hazard that may result from a vortex encounter.

4.4.3 Describe the following:

(a) approximate flow direction around each vortex; and

(b) approximate location of vortices (in still air) generated by a preceding aeroplane during:

(i) cruise flight; and

(ii) take-off and landing; and

(c) approximate take-off/touchdown points and flight profiles which should be used to avoid wake turbulence.

4.4.4 State the effect of wind and atmospheric turbulence on the following:

(a) strength of vortices;

(b) longevity of vortices;

(c) location and direction of movement of vortices.

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4.5 Thrust stream turbulence (jet blast or rotor downwash)

4.5.1 Describe how the hazard from thrust stream turbulence varies with changes in engine power and distance from the source.

5. Navigation

5.1 Charts

5.1.1 Identify the major features displayed on visual charts.

5.1.2 State the charts used to identify controlled airspace (CTA) and prohibited, restricted and danger (PRD) areas.

5.2 Documentation

5.2.1 Determine runway data from ERSA for a given airport.

5.2.2 Determine data pertaining to Prohibited, Restricted and Danger areas.

5.2.3 Use ERSA to determine the time a restricted area is active.

6. Operations, performance and planning

6.1 Airworthiness and aircraft equipment

6.1.1 State the documents required to determine the serviceability of an aircraft.

6.1.2 Describe how to certify the aircraft for flight.

6.1.3 Describe the process to record an aircraft defect on a release to service document (maintenance release).

6.2 Take-off and landing performance

6.2.1 Differentiate between pressure height and density height.

6.2.2 Describe how to use an altimeter to obtain:

(a) local QNH at an aerodrome;

(b) pressure height of an aerodrome;

(c) elevation of an aerodrome.

6.2.3 Calculate the following:

(a) density altitude given pressure altitude (or elevation and QNH) and temperature;

(b) pressure altitude given airfield elevation and QNH.

6.2.4 State the effect (increase/decrease) of the following factors on take-off, landing, and take-off climb performance:

(a) strength of headwind/tailwind component;

(b) air temperature;

(c) QNH;

(d) airfield elevation;

(e) ground effect and windshear;

(f) frost on an aircraft.

6.2.5 Explain the following terms:

(a) maximum structural take-off and landing weight;

(b) climb weight limit.

6.3 Speed limitations

6.3.1 Explain the following terms/abbreviations:

(a) normal operating speed (V_{NO});

(b) never exceed speed (V_{NE});

(c) maximum manoeuvre speed (V_A);

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(d) turbulence penetration speed (V_B);

(e) limit and design load factors.

6.3.2 Describe situations which may result in an aircraft exceeding speed limits and load factor limits.

6.4 Weight and balance

6.4.1 Explain the meaning of the following terms used in the computation of weight and balance data:

(a) datum;

(b) arm;

(c) moment;

(d) station;

(e) centre of gravity and limits;

(f) empty weight;

(g) operating weight;

(h) MTOW;

(i) zero fuel weight (MZFW);

(j) MLW.

6.4.2 Calculate the following weight and balance information:

(a) MTOW;

(b) capacity and arm of the baggage lockers;

(c) capacity, arm, grade and specific gravity of the fuel;

(d) location and arms of the seating.

6.4.3 Determine if an aircraft is loaded within the prescribed CG for the aircraft.

6.4.4 State the likely results of exceeding aircraft weight limits.

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Unit 1.1.2 RBKA: Basic aeronautical knowledge – aeroplane

1. Reserved

2. Power plants and systems

2.1 Piston engine

2.1.1 Describe the method of using a manual mixture control for an aircraft piston engine fitted with a fixed pitch propeller.

2.1.2 State what indications would signify the presence of engine icing in an aircraft fitted with a fixed pitch propeller.

3. Aerodynamics

3.1 Lift and drag

3.1.1 State whether lift and drag of an aerofoil will increase or decrease with changes in flap settings.

3.1.2 For the following, recall the typical angles of attack at which a basic low-speed aerofoil:

(a) generates maximum lift (16°);

(b) is most efficient (best L/D: 4°).

3.1.3 Describe how the angles of attack relate to the following:

(a) stall speed;

(b) best glide speed.

3.1.4 State the relationship between attitude, angle of attack and airspeed in level flight.

3.2 Flight controls

3.2.1 Describe the primary and further effects of the elevator, rudder and aileron on an aeroplane's movement about its longitudinal, lateral and normal (vertical) axes.

3.2.2 Describe the effect of changes in power and airspeed on pitch trim and on the effectiveness of the elevator, rudder and ailerons.

3.2.3 Describe the purpose of trim controls.

3.2.4 State the effect of lowering or raising flap on lift, drag and attitude.

3.3 Climbing

3.3.1 State the effect (increase/decrease) on climb rate and angle resulting from changes in the following:

(a) weight;

(b) power;

(c) airspeed (changed from recommended);

(d) flap deflection;

(e) headwind/tailwind component, windshear;

(f) bank angle;

(g) altitude and density altitude.

3.4 Descents

3.4.1 State the effect on rate, angle of descent and attitude resulting from changes in the following:

(a) power – constant IAS;

(b) flap – constant IAS.

3.4.2 State the effect of headwind/tailwind on the glide path and glide distance (relevant to the earth's surface).

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3.4.3 Explain why gliding at any indicated airspeed other than the recommended glide speed will reduce the distance that can be achieved in still air.

3.5 Turning

3.5.1 Describe what is meant by a balanced turn.

3.5.2 Describe the terms ‘g’ wing loading load factor.

3.5.3 During a level turn, state the effect (increase/decrease) of bank angle on the following:

(a) stall IAS, including the rate of increase of stall speed with increasing bank;

(b) the aircraft’s structure (load factor) and possible airframe damage if limits are exceeded.

3.5.4 List reasons for avoiding steep turns:

(a) shortly after take-off; and

(b) during a glide, particularly on approach to land.

3.5.5 Explain why an aeroplane executing balanced level turns at low level may appear to slip or skid when turning downwind or into wind.

3.5.6 Given level flight stall speed, determine the stall speed and load factor during turns at 45 and 60 degrees bank.

3.6 Stalling, spinning and spiral dives

3.6.1 Describe:

(a) the symptoms when approaching the stall; and

(b) the characteristics of a stall.

3.6.2 Explain:

(a) the effect of using ailerons when approaching and during the stall; and

(b) why an aeroplane may stall at different speeds.

3.6.3 State the effect (increase/decrease/nil) of the following variables on the level flight stall IAS:

(a) power;

(b) flap;

(c) wind shear vertical gusts;

(d) manoeuvres;

(e) weight;

(f) frost and ice;

(g) altitude.

3.6.4 Describe the aerodynamic principles of stall recovery.

3.6.5 Describe manoeuvres during which an aeroplane may stall at an angle which appears to be different to the true stalling angle.

3.6.6 Differentiate between a spin and a spiral dive in a light aeroplane and describe the standard recovery technique from each.

3.7 Taxi, take-off, landing

3.7.1 Describe situations which may cause an aeroplane to ‘wheel barrow’ and state the recommended pilot action in the event of such an occurrence.

3.7.2 Describe the effect of a cross-wind on high- and low-wing aeroplanes during taxi, take-off and landing.

3.7.3 List the advantages of taking-off and landing into wind.

3.7.4 Compare a flapless approach to an approach with flap in terms of:

(a) attitude during descent; and

(b) approach path angle; and

(c) threshold and touchdown speeds; and

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(d) landing roll.

3.7.5 Describe the effect of wind shear (wind gradient) and ground effect on aerodynamic and flight characteristics and identify.

3.8 Structural damage

3.8.1 Describe the effect of structural damage, including bird strikes, with emphasis on:

(a) stall characteristics; and

(b) controllability.

4. Operations and performance

4.1 Take-off and landing performance

4.1.1 State the effect (increase/decrease) of the following factors on take-off, landing, and take-off climb performance:

(a) runway slope;

(b) wet runway surface;

(c) slushy runway surface.

4.2 Aircraft limitations

4.2.1 Explain the following terms/abbreviations:

(a) flap operating speed (V_{FO});

(b) flap extended speed (V_{FE}).

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Unit 1.1.3 RBKH: RPL Basic aeronautical knowledge – helicopter

1. Reserved

2. Power plants and systems

2.1 Piston engine

2.1.1 Describe the method of setting the correct mixture in a helicopter fitted with a piston engine.

2.1.2 State what indications would signify the presence of carburettor or induction ice.

2.2 Helicopter engines and systems

2.2.1 Describe pilot actions that can be performed to rectify a malfunction related to the following:

(a) main and tail rotor systems:

(i) abnormal vibrations from main and tail rotor systems;

(ii) flight control systems;

(iii) trimming devices;

(iv) stabilisers;

(b) transmissions:

(i) clutches;

(ii) free-wheel units;

(iii) rotor brakes;

(c) oil systems:

(i) reservoirs;

(ii) pressure pumps and filters;

(iii) pressure gauges;

(iv) temperature gauges;

(v) scavenge pumps;

(vi) oil coolers;

(vii) pressure relief valves;

(viii) oil cooler by-pass valves;

(ix) dipsticks.

3. Aerodynamics – helicopter

3.1 Lift and drag

3.1.1 State the aerodynamic properties of a rotor blade in respect of the following:

(a) aerofoil shape;

(b) blade twist;

(c) blade taper.

3.1.2 Match each of the following terms with an appropriate definition:

(a) rotor thrust;

(b) rotor drag;

(c) total reaction;

(d) relative airflow;

(e) rotational airflow;

(f) induced airflow;

(g) centrifugal reaction;

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(h) rotor disc;

(i) coning angle.

3.2 Hovering flight

3.2.1 Label a diagram showing the vectors acting on a rotor blade in hovering flight.

3.2.2 Define each of the following terms:

(a) ground effect;

(b) tail rotor drift;

(c) rotor shaft tilt effect;

(d) re-circulation.

3.2.3 Describe each of the following:

(a) vortex ring state (settling with power);

(b) loss of tail rotor effectiveness (LTE);

(c) the conditions leading to LTE;

(d) the appropriate recovery action.

3.3 Rotor blade freedom of movement

3.3.1 In regard to rotor blade freedom of movement describe each of the following terms:

(a) feathering;

(b) flapping;

(c) flapping to equality;

(d) dragging;

(e) advance angle;

(f) phase lag.

3.4 Forward flight

3.4.1 In regard to forward flight, define the following terms:

(a) dissymmetry of lift;

(b) flapback;

(c) cyclic limits;

(d) airflow reversal;

(e) retreating blade stall;

(f) compressibility;

(g) inflow roll;

(h) translational lift.

3.4.2 Describe the vectors acting on various sections of a rotor blade in forward flight.

3.5 Power requirements

3.5.1 Define each of the following terms:

(a) rotor profile drag;

(b) induced drag;

(c) parasite drag.

3.5.2 Describe the power available and power required curves and their relationship to the following:

(a) best speed for range;

(b) best speed for endurance;

(c) best rate of climb;

(d) best angle of climb.

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3.5.3 Select from a list, the statement which best describes:

(a) overpitching;

(b) the conditions leading thereto;

(c) the appropriate recovery action.

3.6 Autorotative flight

3.6.1 Describe the following terms:

(a) autorotative force;

(b) autorotative section.

3.6.2 Describe the effect on autorotative flight from variations in the following:

(a) all-up-weight;

(b) density altitude;

(c) airspeed;

(d) rotor RPM.

3.6.3 Label a diagram showing the vectors acting on a rotor blade section during forward autorotative flight.

3.6.4 Label a diagram showing the vectors acting on a rotor blade section during an autorotative flare.

3.7 Other conditions

3.7.1 Select from a list the statement which best describes:

(a) ground resonance;

(b) mast bumping;

(c) dynamic roll-over;

(d) the conditions leading to:

(i) ground resonance;

(ii) mast bumping;

(iii) dynamic roll-over;

(e) the appropriate recovery action for each condition in paragraph (d).

4. Operations, performance and planning

4.1 Helicopter limitations

4.1.1 State the reasons for the following limitations:

(a) maximum rotor RPM – power on;

(b) maximum rotor RPM – power off;

(c) minimum rotor RPM – power on;

(d) minimum rotor RPM – power off;

(e) never exceed speed – power on;

(f) never exceed speed – power off;

(g) maximum sideways speed;

(h) maximum rearward speed;

(i) maximum take-off weight;

(j) maximum all up weight;

(k) minimum operating weight;

(l) maximum positive and negative flight load factors.

4.2 Helicopter landing sites

4.2.1 Recall the requirements for basic and secondary HLS in respect of the following:

(a) physical specifications;

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(b) operational requirements;

(c) general conditions of use.

4.3 Take-off and landing weight

4.3.1 Describe the effect of the following variables on the take-off and/or landing performance of a helicopter:

(a) weight;

(b) power;

(c) ground effect.

4.3.2 Determine hover performance in and out of ground effect given the following:

(a) gross weight;

(b) pressure altitude;

(c) temperature;

(d) flight manual performance charts.

4.4 Weight and balance

4.4.1 Recall the meaning of the term ‘lateral centre of gravity range’ when it is used in the computation of weight and balance data.

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Unit 1.1.4 RBKG: RPL Basic aeronautical knowledge – gyroplane

1. Power plants and systems

1.1 Prerotation systems

1.1.1 Describe types of prerotation systems and their operation.

2. Aerodynamics

2.1 Lift and drag

2.1.1 Match each of the following terms with an appropriate definition in relation to a gyroplane rotor:

(a) production of lift by rotor;
(b) advancing and retreating blades;
(c) autorotation;
(d) rotor disc area;
(e) blade coning;
(f) tip path plane;
(g) disc loading;
(h) translational lift;
(i) retreating blade stall;
(j) dissymmetry of lift;
(k) teetering hinge;
(l) centrifugal force;
(m) effect of engine torque;
(n) self-governing aspect;
(o) reverse airflow;
(p) coordinated flight.

3. Rotor systems

3.1 Rotor systems

3.1.1 Describe the operation of the cyclic control.

3.1.2 Describe the operation and application of the following:

(a) trim devices;
(b) rotor RPM gauge;
(c) rotor brake;
(d) prerotator/spin-up control;
(e) achieving rotor rigidity;
(f) securing rotor blades;
(g) ground effect.

4. Operations and performance

4.1 Take-off and landing performance

4.1.1 Describe effect of a cross-wind during taxi, take-off and landing.

4.1.2 Describe use of height-velocity diagram.

4.1.3 State effect (increase/decrease) of the following factors on take-off, landing, and take-off climb performance:

(a) strength of headwind/tailwind component;

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(b) air temperature;

(c) density height (non-standard conditions);

(d) airfield elevation;

(e) runway slope and surface, including wet and soft runways;

(f) ground effect and windshear;

(g) long and/or wet grass;

(h) best angle of climb and best rate of climb.

4.2 Descents

4.2.1 State the effect on rate, angle of descent and attitude resulting from changes in the following:

(a) power – constant IAS;

(b) idle power – constant IAS.

4.2.2 Describe methods of achieving maximum rate of descent.

4.2.3 State the effect of headwind/tailwind on the glide path and glide distance (relevant to the earth's surface).

4.2.4 Describe risks associated with minimum forward airspeed descents.

4.3 Turning

4.3.1 Describe rotor disc position in a turn.

4.3.2 Describe what is meant by a balanced turn in relation to the yaw string.

4.3.3 Explain why a gyroplane executing balanced level turns at low level may appear to slip or skid when turning from downwind and into wind and from into wind to downwind.

4.3.4 State use of power in maintaining a level turn.

4.3.5 Describe method of losing height in a turn.

4.4 Level flight

4.4.1 Describe the factors that determine maximum airspeed in level flight.

4.4.2 Describe the factors that determine minimum airspeed for sustained level flight.

4.4.3 Describe the power available and power required curves and their relationship to the following:

(a) best speed for range;

(b) best speed for endurance;

(c) backside of the power curve;

(d) behind the power curve.

4.5 Landing

4.5.1 Explain slowing rotor RPM post-landing.

4.6 Gyroplane limitations

4.6.1 Understand the causes and effects of, and avoidance and recovery procedure for, the following:

(a) power pushover;

(b) pilot-induced oscillation (PIO);

(c) gust-induced oscillation (GIO);

(d) fast taxi/low rotor RPM;

(e) turning limitations during taxi in windy conditions;

(f) rapid acceleration on take-off;

(g) rotor shake on take-off;

(h) lift off low airspeed/high angle of attack;

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(i) blade flapping/overteetering;

(j) negative flight load manoeuvres;

(k) high-speed flight;

(l) spiral descent;

(m) extending the glide;

(n) extreme turbulence;

(o) ground resonance;

(p) behind power curve/minimum level flight speed;

(q) taxiing on rough terrain;

(r) unsecured rotor blades;

(s) rotor blade contamination.

4.7 Other

4.7.1 Explain why gliding at any indicated airspeed other than the speed for minimum rate of descent will reduce the gliding distance that can be achieved in still air.

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Unit 1.1.5 RBKS: RPL Basic aeronautical knowledge – airship – *Reserved*

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SECTION 1.2 General aeronautical knowledge (AK)

Unit 1.2.1 RARO: RPL aeronautical radio operator

1. Reserved

2. Aeronautical radio telephony

2.1 Operation of aeronautical radio systems

2.1.1 Meets the English language to Aviation English language standard (AEL).

2.1.2 Recall the phonetic alphabet and the method of transmitting numerals.

2.1.3 Recall the correct use of aircraft call-signs.

2.1.4 State standard radio procedures for outside controlled airspace (OCTA).

2.1.5 State how transmission of time is conducted.

2.1.6 State how to listening to the radio.

2.1.7 State how to establish and maintain communications.

2.1.8 State the hazards of clipped transmissions and the consequences.

2.1.9 Correct procedure for the conduct of a routine pre-flight test of an aircraft radio-telephone, including the following:

(a) use of radio transmit and receive selector switches;

(b) turning radio on;

(c) selecting correct frequencies;

(d) use of squelch control;

(e) selection of radio navigation equipment;

(f) correct use of a microphone;

(g) use of intercom and public address system;

(h) voice activated systems.

2.1.10 Describe the correct procedure for routine fault finding and correction.

2.1.11 State the standard phraseology to be used to report aircraft positions in the circuit and the required calls for local flights.

2.1.12 State the responsibilities of an aeronautical radio operator in relation to the following:

(a) secrecy of communications;

(b) unauthorised transmissions.

2.1.13 Describe the function of each of the following components of an aeronautical radio system:

(a) power source/battery switch;

(b) radio master;

(c) fuses and circuit breakers;

(d) microphone;

(e) transmitter;

(f) receiver;

(g) antenna;

(h) headphones and speaker.

2.1.14 Describe the difference between a distress and an emergency message and the standard phrases used in both cases.

2.1.15 Accurately extract radio failure procedures from ERSA.

2.1.16 In relation to the use of an aeronautical radiotelephone, describe the controls used to transmit and receive, including audio panel selections.

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2.2 Radio waves

2.2.1 Describe the basic principles and characteristics of radio waves, wave propagation, transmission and reception for the following:

(a) radio frequency band ranges (MF, HF, VHF, UHF);

(b) properties of radio waves and the effective range of transmissions;

(c) propagation of paths of radio waves:

(i) ground waves;

(ii) sky waves;

(d) factors affecting the propagation of radio waves and reception:

(i) terrain;

(ii) ionosphere;

(iii) sun spot activity;

(iv) interference from electrical equipment;

(v) thunderstorms;

(vi) power attenuation;

(e) radio antennas:

(i) characteristics of antennas;

(ii) use of antennas.

2.2.2 Describe the limitations of VHF and HF signals and factors affecting quality of reception and range of signal.

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1. Reserved

2. Power plants and systems

2.1 Piston engines

2.1.1 Describe the meaning of full throttle height.

2.1.2 Describe the effect of increasing altitude and temperature on engine performance.

2.1.3 Describe the effect of the following factors on engine performance:

(a) fuel/air mixture strength;

(b) density height and altitude for:

(i) normally aspirated engines; and

(ii) turbocharged/supercharged engines.

2.2 Supercharging

2.2.1 Describe the purpose of supercharging.

2.2.2 Describe the common methods used to achieve supercharging.

2.2.3 Describe the device(s) used to limit supercharging of the intake system.

2.2.4 Describe the actions a pilot should take if engine limits are exceeded due to supercharging.

2.3 Flight instruments

2.3.1 Explain the following terms:

(a) pitot-static system;

(b) pitot pressure static pressure;

(c) alternate static source;

(d) pressure error;

2.3.2 Describe the meaning of the following airspeeds:

(a) indicated (IAS);

(b) calibrated (CAS);

(c) true (TAS).

2.3.3 For the following pressure instruments, state the effect of the factors listed under each instrument on the accuracy of the indications for that instrument:

(a) ASI:

(i) blockage/leaks (pitot or static);

(ii) manoeuvre induced errors (for example, sharp pull out from a dive);

(b) VSI:

(i) blockage of the static source;

(ii) lag;

(iii) the benefits of a IVSI;

(c) Altimeter:

(i) blockage of the static source;

(ii) lag;

(iii) incorrect subscale settings;

(iv) errors due to changes in atmospheric temperature and pressure.

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2.3.4 For a direct reading magnetic compass, describe the principles of construction in relation to the following:

(a) magnetic needles point to magnetic north;

(b) fluid decreases oscillations and friction;

(c) fluid in the compass should not contain bubbles;

(d) pendulosity of magnet systems causes errors.

2.3.5 State the effect of the following errors on compass indications in the southern hemisphere:

(a) turning errors;

(b) acceleration errors.

2.3.6 State the purpose and use of a compass correction card to determine magnetic heading.

2.3.7 Describe the methods used to determine the serviceability of the primary flight instruments before commencing a flight.

3. Aeronautical radio telephony

3.1 Operation of aeronautical radio systems

(a) recall the phonetic alphabet and the method of transmitting numerals;

(b) recall the correct use of aircraft call-signs;

(c) state standard radio procedures for OCTA;

(d) state how time is transmitted in a message;

(e) state how to effectively listen to the radio;

(f) state how to establish and maintain communications;

(g) state the hazards of clipped transmissions and the consequences.

3.2 Routine pre-flight test of an aircraft radio-telephone

(a) for the following, describe the correct technique and procedure for conducting a routine pre-flight test of an aircraft radio telephone:

(i) use of radio transmit and receive selector switches;

(ii) turning radio on;

(iii) selecting correct frequencies;

(iv) use of squelch control;

(v) selection of radio nav equipment;

(vi) correct use of a microphone;

(vii) use of intercom and public address system;

(viii) voice activated systems.

3.3 Fault finding and corrective action

3.3.1 State the correct procedure for routine fault finding and the corrective actions a pilot should take in relation to a fault.

3.4 Reporting position in circuit and for local flights

3.4.1 State the standard phraseology to be used to report the position of an aircraft in the circuit and required calls for local flights.

3.5 Responsibilities of an aeronautical radio operator

3.5.1 State the responsibility of an aeronautical radio operator for the following:

(a) secrecy of communications;

(b) unauthorised transmissions.

3.6 State the function of the following components of an aeronautical radio system

(a) power source/battery switch;

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(b) radio master;

(c) fuses and circuit breakers;

(d) microphone;

(e) transmitter;

(f) receiver;

(g) antenna;

(h) headphones and speaker.

3.7 Distress and emergency messages

3.7.1 Describe the difference between a distress and emergency message and the standard phrases used.

3.8 Radio failure procedures

3.8.1 Extract and use the radio failure procedures from ERSA.

3.9 Radiotelephone controls

3.9.1 In relation to the use of an aeronautical radiotelephone, describe the controls used to transmit and receive, including audio panel selections.

3.10 Radio waves

3.10.1 Describe the basic principles and characteristics of radio waves, wave propagation, transmission and reception:

(a) radio frequency band ranges (MF, HF, VHF, UHF);

(b) properties of radio waves and the effective range of transmissions;

(c) propagation of paths of radio waves:

(i) ground waves;

(ii) sky waves.

(d) factors affecting the propagation of radio waves and reception:

(i) terrain;

(ii) ionosphere;

(iii) sun spot activity;

(iv) interference from electrical equipment;

(v) thunderstorms;

(vi) power attenuation;

(e) radio antennas:

(i) characteristics of antennas;

(ii) use of antennas.

3.10.2 Describe the limitations of VHF and HF signals and factors affecting quality of reception and range of signal.

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Unit 1.2.3 GNSSC: Basic GNSS and en route GPS navigation principles – all categories

1. Reserved

2. Global navigation satellite system (GNSS)

2.1 GNSS operation

2.1.1 Describe the principles of operation, performance limitations and errors of a GNSS system, including the following:

(a) methods of position fixing using a GNSS system;

(b) the GNSS operating procedures which provide safeguards against navigational error and loss of situational awareness;

(c) GNSS operating procedures for typical navigational tasks using a specific type of aircraft equipment;

(d) indications of waypoint passage;

(e) GNSS operational and serviceability checks;

(f) the human factors limitations associated with the use of GNSS equipment;

(g) the requirements applicable to pilots and equipment for GNSS operations.

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Unit 1.2.4 PAKA: PPL aeronautical knowledge – aeroplane

1. Reserved

2. Power plants and systems

2.1 Propellers

2.1.1 List reasons for propeller overspeed in aeroplanes fitted with a fixed pitch propeller and state the remedial action a pilot should take in the event of an overspeed.

2.2 Aircraft systems

2.2.1 Describe or state the function of the following typical components installed in aeroplanes, including the possibility of 'overpowering the system and associated precautions a pilot should take:

(a) stall warning devices;

(b) auto-pilot components, including the following:

(i) roll attitude heading pitch controls;

(ii) trim indicator;

(iii) cut-out mechanisms.

3. Take-off and landing performance

Note: Use of take-off and landing charts is included in 'Type' training.

3.1.1 State the effect (increase/decrease) of the following factors on take-off, landing, and take-off climb performance:

(a) strength of headwind/tailwind component;

(b) air temperature;

(c) QNH;

(d) density height (non-standard conditions);

(e) airfield elevation;

(f) runway slope;

(g) surface conditions, including the following:

(i) wet runway;

(ii) dry runway;

(iii) slushy runway;

(h) ground effect and windshear;

(i) frost on an aircraft.

3.1.2 Differentiate between pressure height and density height.

3.1.3 Describe how to use an altimeter to obtain the following:

(a) local QNH at an aerodrome;

(b) pressure height of an aerodrome;

(c) elevation of an aerodrome.

3.1.4 Explain the following terms:

(a) maximum structural take-off and landing weight;

(b) climb weight limit.

3.1.5 State the likely results of exceeding aircraft weight limits.

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Unit 1.2.5 PAKH: PPL aeronautical knowledge – helicopter

1. Reserved

2. Aircraft general knowledge

2.1 Engine and transmission systems

2.1.1 Describe the actions a pilot should take in the event of a malfunction of an exhaust driven supercharger or waste gate and the likely indication of the malfunction.

2.1.2 Reserved.

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Unit 1.2.6 PAKG:: PPL aeronautical knowledge – gyroplane

1. Power plants and systems

1.1 Rotor systems

1.1.1 Describe the differences between the following rotor systems:

(a) semirigid rotor;

(b) articulated rotor.

1.1.2 Explain each of the following terms in relation to a gyroplane rotor:

(a) vectors acting on various sections of a rotor blade in flight;

(b) rotational velocity;

(c) pitch angle;

(d) rotor force;

(e) reverse flow;

(f) axis of rotation;

(g) state the relationship between CG position, rotor force and stability;

(h) relationship of thrust line profile and CG.

1.2 Take-off and landing performance

1.2.1 Differentiate between pressure height and density height.

1.2.2 Describe how to use an altimeter to obtain:

(a) pressure height of an aerodrome;

(b) elevation of an aerodrome.

1.2.3 Explain the following terms:

(a) maximum structural take-off and landing weight;

(b) climb weight limit.

1.2.4 State the likely results of exceeding gyroplane weight limits.

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Unit 1.2.7 PAKP: PPL aeronautical knowledge – powered-lift – ***Reserved***

Unit 1.2.8 PAKS: PPL aeronautical knowledge – airship – ***Reserved***

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3. Reserved

4. Aircraft general knowledge

4.1 Power plants

4.1.1 Describe the purpose and principle of operation of a simple carburettor in terms of the following:

(a) idling jets;

(b) main jets;

(c) acceleration jets.

4.1.2 State the precautions to be observed to avoid detonation when operating a supercharged engine.

4.1.3 Supercharging

(a) state the purpose of supercharging;

(b) list the types of superchargers for the following:

(i) geared (mechanically driven:

(ii) turbo (exhaust driven);

(c) state the purpose and function of the following components:

(i) geared superchargers:

(ii) impeller;

(A) diffuser;

(iii) turbo-chargers

(A) compressor;

(B) waste gate (fixed, manual and automatic).

4.2 Aircraft systems

4.2.1 Explain the function of the following typical components mentioned in pilot operating handbooks:

(a) fuel system components, including the following:

(i) auxiliary/booster pump;

(ii) fuel drain;

(iii) fuel pressure gauge;

(iv) fuel flow gauge;

(v) check valves;

(b) lubrication system, including the following:

(i) by-pass valves;

(ii) oil cooler;

(iii) wet sump system;

(iv) dip stick;

(c) electrical and ignition systems, including the following:

(i) alternator generator;

(ii) voltage regulator overvoltage relay;

(iii) ammeter voltmeter;

(iv) circuit breaker fuse;

(v) battery ampere hours;

(vi) bus bar battery master switch;

(vii) starter motor starter relay;

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(viii) dual ignition distributor ignition switch;

(ix) external power receptacle, ground/flight switch;

(d) hydraulic system components, including the following:

(i) accumulator;

(ii) actuators;

(iii) check valve restrictors;

(e) typical fire protection detectors, including the following:

(i) overheat – thermal switches;

(ii) rate of temperature rise – thermocouple;

(iii) flame;

(f) typical fire protection warning devices, including the following:

(i) lights;

(ii) audio;

(g) types of fire extinguisher and usage;

(h) engine cooling devices, including the following:

(i) fins;

(ii) baffles;

(iii) cowl flaps.

4.2.2 Describe or state the function of the typical retractable undercarriage system components mentioned in pilot operating handbooks, including the following:

(a) uplocks/downlocks;

(b) anti-retraction devices;

(c) aural/visual warning devices;

(d) emergency systems;

(e) free fall;

(f) electric, hydraulic, pneumatic.

4.2.3 Describe or state the function of the following typical components mentioned in pilot operating handbooks, including considering the possibility of overpowering the system and the associated precautions pilots should take when operating these system:

(a) fuel system components, including the following:

(i) auxiliary/booster pump;

(ii) fuel drain;

(iii) fuel pressure gauge;

(iv) fuel flow gauge;

(v) check valves.

(b) lubrication system, including the following:

(i) by-pass valves;

(ii) oil cooler;

(iii) wet sump system;

(iv) dip stick.

(c) stall warning devices;

(d) electrical and ignition systems, including the following:

(i) alternator generator;

(ii) voltage regulator overvoltage relay;

(iii) ammeter voltmeter;

(iv) circuit breaker fuse;

(v) battery ampere hours;

(vi) bus bar battery master switch;

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(vii) starter motor starter relay;

(viii) dual ignition distributor ignition switch;

(ix) external power receptacle, ground/flight switch;

(e) hydraulic system, including the following:

(i) accumulator;

(ii) actuators;

(iii) brake master cylinder;

(iv) check valve restrictors.

(f) auto-pilot, including the following:

(i) roll attitude heading pitch controls;

(ii) trim indicator;

(iii) cut-out mechanisms.

(g) typical fire protection detectors, including the following:

(i) overheat – thermal switches;

(i) rate of temperature rise – thermocouple;

(ii) flame;

(h) typical fire protection warning devices, including the following:

(i) lights;

(ii) audio;

(i) types of fire extinguishers and usage;

(j) engine cooling devices, including the following:

(i) fins;

(ii) baffles;

(iii) cowl flaps.

4.3 Barometric flight instruments

4.3.1 Explain the relationship between the following airspeeds:

(a) indicated (IAS);

(b) calibrated (CAS);

(c) true (TAS);

(d) equivalent (EAS).

4.3.2 Explain the basic principle of operation and construction of the following instruments:

(a) ASI;

(b) VSI;

(c) altimeter;

(d) artificial horizon;

(e) direction indicator;

(f) rate of turn indicator;

(g) turn coordinator.

4.3.3 State the effect of the following factors on the accuracy of pressure instrument indications:

(a) ASI:

(i) blockage/leaks (pitot or static); and

(ii) manoeuvre induced errors (for example, sharp pull out from a dive);

(b) VSI:

(i) blockage of the static source; and

(ii) lag;

Note: Student should be aware that an IVSI compensates for lag errors.

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(c) altimeter:

(i) blockage of the static source; and

(ii) lag; and

(iii) incorrect subscale settings; and

(iv) errors due to changes in atmospheric temperature and pressure.

4.4 Gyroscopic flight instruments

4.4.1 Explain the gyroscopic properties of rigidity and precession.

4.4.2 In relation to gyroscopic flight instruments:

(a) compare the advantages and disadvantages of air driven and electrically driven gyroscopes;

(b) state the effect on a directional indicator of the following:

(i) apparent wander/drift;

(ii) maximum at the poles, zero at the equator;

(iii) transport wander;

(c) describe the advantages of a directional indicator fitted with a flux valve.

4.5 Direct reading magnetic compass

4.5.1 Describe the principle of construction of a magnetic compass.

4.5.2 Explain how needles point to magnetic north.

4.5.3 Describe how fluid decreases oscillations and friction and why the chamber should not contain air bubbles.

4.5.4 Explain how pendulosity of magnet systems causes errors.

4.6 Aeronautical radio telephony

4.6.1 Operation of aeronautical radio systems:

(a) recall the phonetic alphabet and the method of transmitting numerals;

(b) recall the correct use of aircraft call-signs;

(c) state standard radio procedures for OCTA;

(d) state how transmission of time is conducted;

(e) state how to listening to the radio;

(f) state how to establish and maintain communications;

(g) state the hazards of clipped transmissions and the consequences.

4.6.2 Correct procedure for the conduct of a routine pre-flight test of an aircraft radio-telephone in the following:

(a) use of radio transmit and receive selector switches;

(b) turning radio on;

(c) selecting correct frequencies;

(d) use of squelch control;

(e) selection of radio navigation equipment;

(f) correct use of a microphone;

(g) use of intercom and public address system;

(h) voice activated systems.

4.6.3 State procedure for routine fault finding and correction.

4.6.4 State the standard phraseology for positions in the circuit and required calls for local flights.

4.6.5 State the responsibilities of an aeronautical radio operator with respect to the following:

(a) secrecy of communications;

(b) unauthorised transmissions.

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4.6.6 State the function of the following components of an aeronautical radio system:

(a) power source/battery switch, radio master, fuses and circuit breakers;

(b) microphone;

(c) transmitter;

(d) receiver;

(e) antenna;

(f) headphones and speaker.

4.6.7 Describe the difference between a distress and emergency message and the standard phrases used.

4.6.8 Extract radio failure procedures from ERSA.

4.6.9 In relation to the use of an aeronautical radiotelephone describe the controls used to transmit and receive, including audio panel selections.

4.7 Radio waves

4.7.1 Describe the basic principles and characteristics of radio waves, wave propagation, transmission and reception:

(a) radio frequency band ranges (MF, HF, VHF, UHF);

(b) properties of radio waves and the effective range of transmissions;

(c) propagation of paths of the following types of radio wave:

(i) ground waves;

(ii) sky waves;

(d) factors affecting the propagation of radio waves and reception with respect to the following:

(i) terrain;

(ii) ionosphere;

(iii) sun spot activity;

(iv) interference from electrical equipment;

(v) thunderstorms;

(vi) power attenuation;

(e) the following types of radio antennas:

(i) characteristics of antennas;

(ii) use of antennas.

4.7.2 Describe the limitations of VHF and HF signals and factors affecting quality of reception and range of signal.

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5. Reserved

6. Engine and systems

6.1 Propellers

6.1.1 Compare the performance characteristics of various propeller and engine systems, including the following:

(a) aeroplanes with fixed pitch propellers and those fitted with a variable pitch propeller;

(b) engine operation (within limits) at high MP/low RPM and low MP/high RPM;

(c) normally aspirated and turbocharged/supercharged engines.

6.1.2 Explain the following with regard to a variable pitch propeller adopting either a full fine or full coarse pitch when the propeller oil pressure is lost:

(a) centrifugal twisting moment (CTM) tends to reduce (fine) pitch;

(b) counter weights, when used, increase (coarsen) pitch;

(c) oil pressure is used to decrease pitch if counterweights are fitted;

(d) oil pressure is used to increase pitch if counterweights are not fitted.

6.1.3 Describe the following terms:

(a) blade angle, helix angle/pitch;

(b) propeller thrust and torque;

(c) thrust horsepower (THP);

(d) brake horsepower (BHP);

(e) asymmetric blade effect.

6.1.4 Describe how a propeller converts engine power into thrust and explain what is meant by fine and course pitch stops.

6.2 Constant speed units (CSU)

6.2.1 Explain the principle of operation of a CSU.

6.2.2 Describe the effect of a CSU malfunction on engine operation.

6.2.3 Explain the method of using engine controls in the event of a malfunction of a CSU.

6.2.4 Describe the cockpit indications in an aeroplane fitted with a variable pitch propeller which could signify:

(a) the presence of engine ice; and

(b) when engine ice has been cleared after application of ‘carb heat’.

6.2.5 Explain the effect of using carburettor heat on aeroplanes fitted with a CSU.

6.2.6 Describe how power output is controlled when operating aeroplanes fitted with a variable pitch propeller and describe how engine instruments are used to monitor power.

6.2.7 List the precautions necessary if operating a variable pitch propeller when:

(a) conducting ground checks; and

(b) changing power (i.e. use of throttle/RPM levers).

6.3 Undercarriage system

(a) describe the purpose and function of the following:

(i) oleos/shock struts;

(ii) shimmy dampers;

(iii) nose wheel steering/castering;

(b) describe the purpose and function of the following retractable undercarriage components:

(i) uplocks/downlocks;

(ii) anti-retraction devices;

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(iii) aural/visual warning devices;

(iv) emergency systems;

(v) free fall;

(vi) electric, hydraulic, pneumatic.

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7. Reserved

8. Helicopter general knowledge

8.1 Engine and transmission systems

8.1.1 For each of the following systems, explain its function and that of the major components listed below the system and state the indications that a pilot would observe if the system or one of the components malfunctioned:

(a) exhaust driven supercharger systems (turbochargers):

(i) compressors;

(ii) turbines;

(iii) waste gates;

(b) main and tail rotor systems:

(i) abnormal vibrations from main and tail rotor systems;

(ii) flight control systems;

(iii) trimming devices;

(iv) stabilisers;

(c) transmissions:

(i) clutches;

(ii) free-wheel units;

(iii) rotor brakes;

(d) oil systems:

(i) reservoirs;

(ii) pressure pumps and filters;

(iii) pressure gauges;

(iv) temperature gauges;

(v) scavenge pumps;

(vi) oil coolers;

(vii) pressure relief valves;

(viii) oil cooler by-pass valves;

(ix) dipsticks.

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Unit 1.2.12 CAKG: CPL aeronautical knowledge – gyroplane

1. Propellers

1.1 Compare performance characteristics of various propeller and engine systems, including the following:

(a) gyroplanes with fixed-pitch propellers and those fitted with a variable-pitch propeller;

(b) engine operation (within limits) at high MP/low RPM and low MP/high RPM;

(c) normally aspirated and turbocharged/supercharged engines.

1.2 Explain the following in relation to a variable-pitch propeller adopting either a full fine or full coarse pitch when the propeller oil pressure is lost:

(a) centrifugal twisting moment (CTM) tends to reduce (fine) pitch;

(b) counter weights, when used, increase (coarsen) pitch;

(c) oil pressure is used to decrease pitch if counterweights are fitted;

(d) oil pressure is used to increase pitch if counterweights are not fitted.

1.3 Describe the following terms:

(a) blade angle, helix angle/pitch;

(b) propeller thrust and torque;

(c) thrust horsepower (THP);

(d) brake horsepower (BHP).

1.4 Describe how a propeller converts engine power into thrust and explain what is meant by fine and coarse pitch stops.

2. Constant speed units (CSU)

2.1 Explain the principle of operation of a CSU.

2.2 Describe the effect of a CSU malfunction on engine operation.

2.3 Explain the method of using engine controls in the event of a malfunction of a CSU.

2.4 Describe the cockpit indications in a gyroplane fitted with a variable-pitch propeller which could signify:

(a) the presence of engine ice; and

(b) when engine ice has been cleared after application of carburettor heat.

2.5 Explain the effect of using carburettor heat on gyroplanes fitted with a CSU.

2.6 Describe how power output is controlled when operating gyroplanes fitted with a variable-pitch propeller and describe how engine instruments are used to monitor power.

2.7 List the precautions necessary if operating a variable-pitch propeller when:

(a) conducting ground checks; and

(b) changing power (i.e. use of throttle/RPM levers).

3. Undercarriage system

3.1 Describe the purpose and function of the following:

(a) oleos/shock struts;

(b) shimmy dampers;

(c) nosewheel steering/castoring.

3.2 Describe the purpose and function of the following retractable undercarriage components:

(a) uplocks/down locks;

(b) anti-retraction devices;

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(c) aural/visual warning devices;

(d) emergency systems;

(e) free fall;

(f) electric, hydraulic, pneumatic.

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Unit 1.2.13 CAKP: CPL aeronautical knowledge – powered-lift – *Reserved*

Unit 1.2.14 CAKS: CPL aeronautical knowledge – airship – *Reserved*

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SECTION 1.3 AERODYNAMICS (AD)

Unit 1.3.1 CADC: CPL aerodynamics – all aircraft categories

1. Reserved

2. Aerodynamics

2.1 Terminology

2.1.1 Explain the following terms and their effect on lift and drag production:

(a) aerofoil span, chord, camber, thickness/chord ratio;

(b) relative airflow and angle of attack;

(c) laminar and turbulent boundary layers.

2.1.2 Explain the different types of drag and state the effect on total drag resulting from changes in IAS, aircraft weight and height, if any.

2.2 Bernoulli's theorem and Coanda theory

2.2.1 Apply Bernoulli's theorem of constant energy flow to describe how an aerofoil produces lift, limited to the variation of kinetic energy (dynamic pressure) and potential energy (static pressure) as air flows through a venturi or over a aerofoil.

2.2.2 Explain Coanda theory and the effect on lift production.

2.3 Power requirements

2.3.1 Describe the power available and power required curves and best speeds for range and endurance, best rate of climb and best angle of climb.

2.4 Lift and drag

2.4.1 Explain the meaning of the following terms used in the lift and drag formulae viz:

(a) C_L and C_D – depend on shape and angle of attack of an aerofoil;

(b) $\frac{1}{2} \rho V^2$ – defines dynamic pressure (IAS);

(c) S – defines surface area.

2.5 Manoeuvres

2.5.1 Explain the forces of lift, weight, thrust and drag acting on an aircraft in the following cases:

(a) steady level flight;

(b) a steady climb;

(c) a steady descent;

(d) a balanced level turn.

2.6 Performance considerations

2.6.1 Give reasons for flying for maximum still air range and endurance.

2.6.2 Given that certain flight conditions remain constant, explain the effect of changes in headwind/tailwind component on level flight range and endurance.

2.6.3 List/identify aerodynamic and engine considerations which are required to achieve maximum still air range and endurance when operating an aircraft with the following types of engine:

(a) normally aspirated engine;

(b) turbocharged/supercharged engine.

2.6.4 From (theoretical) power required and power available graphs identify the following:

(a) best still air range speed;

(b) best endurance speed;

(c) maximum level flight speed.

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Unit 1.3.2 CADA: CPL aerodynamics – aeroplane

1. Reserved

2. Aerodynamics

2.1 Changes in angle of attack

2.1.1 Explain the effect of changes in angle of attack up to the stalling angle on the following:

(a) pressure changes above and below an aerofoil;

(b) changes in airflow characteristics streamlined to turbulent;

(c) lift and drag;

(d) the boundary layer.

2.1.2 With reference to C_L, C_D, C_L/C_D graphs identify angles of attack associated with the following:

(a) minimum drag – maximum level flight speed;

(b) maximum lift – stalling angle;

(c) best C_L/C_D – best glide range and still air range.

2.2 Aerodynamic design features

2.2.1 Explain the purpose of the following design features/controls:

(a) anhedral dihedral aspect ratio sweepback wash-out;

(b) wing spoilers flaps vortex generators;

(c) trim tabs.

2.3 Lift and drag

2.3.1 With reference to C_L, C_D, C_L/C_D graphs, explain the angles of attack associated with the following:

(a) minimum drag – maximum level flight speed;

(b) maximum lift – stalling angle;

(c) best C_L/C_D – best glide range and still air range.

2.3.2 State the effect on total drag resulting from changes in IAS, aircraft weight and height.

2.4 Manoeuvres

2.4.1 Explain the relationship between speed, bank angle, radius and rate of turn during a balanced level turn.

2.4.2 For a given IAS, determine the approximate angle of bank to achieve a rate 1 turn (360^o in 2 minutes).

2.4.3 Explain the following:

(a) power must be applied to maintain speed in a level turn;

(b) an aeroplane tends to overbank in level and climbing turns and not in descending turns.

2.4.4 Explain the following:

(a) the effect of aileron drag on turn performance at low airspeed;

(b) how the following design features offset this drag:

(i) frise ailerons;

(ii) differential ailerons.

2.5 Performance considerations

2.5.1 Using power required and power available graphs, identify the following:

(a) stall speed (power on);

(b) the region of reverse command (sometimes described as the ‘back of the power curve’).

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2.5.2 Describe the following terms and cite situations that may result in an aeroplane exceeding load factor and wing loading limits:

(a) load factor;

(b) ‘g’;

(c) wing loading.

2.5.3 Given that certain flight conditions remain constant, explain the effect of the following:

(a) changes in weight and altitude (height) on:

(i) angle of attack and IAS in level flight;

(ii) level flight range and endurance;

(iii) turn rate and radius;

(iv) glide range and endurance;

(b) changes in headwind/tailwind component on:

(i) glide range;

(ii) endurance;

(c) changes in power on turn rate and radius.

2.5.4 Explain how the energy state of an aircraft changes with changes in altitude and airspeed.

2.6 Stability and control

2.6.1 Explain the effect of the factors listed below on the stability and control of an aeroplane in each of the following 3 planes of movement:

(a) longitudinal stability:

(i) position of CG;

(ii) movement of centre of pressure;

(iii) changes in thrust;

(iv) tailplane moment;

(b) lateral stability:

(i) high versus low set wings;

(ii) dihedral versus anhedral;

(iii) sweepback;

(c) directional stability:

(i) large fore/aft displacement of the CG;

(ii) large versus small fin and rudder moment.

2.6.2 Describe the relationship between directional and lateral stability (spiral instability) and state the effect of spiral instability on the control of an aeroplane.

2.6.3 Recognise statements/diagrams which describe static and dynamic stability.

2.6.4 Describe the controllability problems associated with flight in the region of reverse command.

2.6.5 Explain the purpose of the following:

(a) trim tabs (fixed and cockpit controlled);

(b) balance tabs;

(c) anti-balance tabs;

(d) aerodynamic balance;

(e) mass balance.

2.6.6 Explain the function of the items mentioned in 2.6.5 in relation to the movement of a main control surface.

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2.7 Taxi, take-off and landing

2.7.1 Describe the stability and control characteristics of nose wheel aeroplanes during ground operation.

2.7.2 Describe the result of the following factors on the controllability of an aeroplane:

(a) propeller torque and slipstream effect;

(b) gyroscopic effect;

(c) asymmetric blade effect.

2.7.3 Describe the term ‘ground effect’ and its effect on aeroplane performance.

2.8 Stalling, spinning and spiral dives

2.8.1 Describe the following:

(a) symptoms of approaching stall;

(b) characteristics of a stall in the following circumstances:

(i) straight and level;

(ii) turning;

(iii) climbing and descending turns.

2.8.2 Explain the following:

(a) the effect of using ailerons when approaching and during the stall;

(b) why an aeroplane may stall at different speeds.

2.8.3 List the effect (increase/decrease/nil) of the following variables on the level flight stall IAS:

(a) power;

(b) flap;

(c) wind shear vertical gusts;

(d) manoeuvres;

(e) weight;

(f) frost and ice;

(g) altitude.

2.8.4 Describe the aerodynamic principles of stall recovery.

2.8.5 Describe manoeuvres during which an aeroplane may stall at an angle which appears to be different to the true stalling angle.

2.8.6 Differentiate between a wing-drop at the stall, spin and spiral dive in a light aeroplane and describe the standard recovery technique from each.

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Unit 1.3.3 CADH: CPL aerodynamics – helicopter

1. Reserved

2. Aerodynamics

2.1 Rotorblade aerodynamics

2.1.1 Explain the aerodynamic properties of a rotor blade in respect to the following:

(a) aerofoil shape;

(b) blade twist;

(c) blade taper.

2.1.2 Explain the following terms:

(a) rotor thrust;

(b) rotor drag;

(c) total reaction;

(d) relative airflow;

(e) rotational airflow;

(f) induced airflow;

(g) centrifugal reaction;

(h) rotor disc;

(i) coning angle.

2.2 Hovering flight

2.2.1 Describe the vectors acting on a rotor blade in hovering flight.

2.2.2 Define each of the following items:

(a) ground effect;

(b) tail rotor drift;

(c) rotor shaft tilt effect;

(d) recirculation.

2.2.3 Explain the meaning the following, including the conditions leading thereto and appropriate recovery action:

(a) vortex ring state (settling with power);

(b) loss of tail rotor effectiveness (LTE).

2.3 Rotor blade freedom of movement

2.3.1 Describe the following terms:

(a) feathering;

(b) flapping;

(c) flapping to equality;

(d) dragging;

(e) advance angle;

(f) phase lag.

2.4 Forward flight

2.4.1 Explain the meaning of each of the following terms:

(a) dissymmetry of lift;

(b) flapback;

(c) cyclic limits;

(d) airflow reversal;

(e) retreating blade stall;

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(f) compressibility;

(g) inflow roll;

(h) translational lift.

2.4.2 Describe the vectors acting on various sections of a rotor blade in forward flight.

2.5 Power requirements

2.5.1 Select from a list the statement which best describes:

(a) overpitching;

(b) the conditions leading thereto;

(c) the appropriate recovery action.

2.6 Autorotative flight

2.6.1 Explain the meaning of each of the following terms:

(a) autorotative force;

(b) autorotative section.

2.6.2 Describe the effect on autorotative flight of variations in:

(a) all-up-weight;

(b) density altitude;

(c) airspeed;

(d) rotor RPM.

2.6.3 Describe the vectors acting on a rotor blade section during forward autorotative flight.

2.6.4 Explain the vectors acting on a rotor blade section during an autorotative flare.

2.7 Other conditions

2.7.1 Explain the following phenomena and the conditions that can lead to them arising and the appropriate recovery actions to be taken when they arise:

(a) ground resonance;

(b) mast bumping;

(c) dynamic roll-over.

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Unit 1.3.4 CADG: CPL aerodynamics – gyroplane

1. Aerodynamics

1.1 Rotor blade aerodynamics

1.1.1 Explain the aerodynamic properties of a rotor blade in respect to the following:

(a) aerofoil shape;

(b) blade twist.

1.1.2 Explain the meaning of the following terms:

(a) rotor force;

(b) rotor drag;

(c) total resultant;

(d) relative wind;

(e) rotational airflow;

(f) dissymmetry of lift;

(g) centrifugal force;

(h) blade coning;

(i) blade flapping/overteetering;

(j) retreating blade stall;

(k) translational lift.

1.1.3 Explain the vectors acting on a rotor blade in flight.

1.1.4 Calculate rotor disc loading.

1.1.5 Explain the causes and effects of, and avoidance and correct recovery procedure for, the following:

(a) power pushover;

(b) flight on backside of the power curve;

(c) flight behind the power curve;

(d) rotor vibration on take-off;

(e) negative flight load manoeuvres;

(f) high-speed flight;

(g) ground resonance;

(h) pilot-induced oscillation;

(i) lift off/low airspeed and high angle of attack.

2. Autorotative flight

2.1 Explain the meaning of the following terms:

(a) autorotation;

(b) autorotation in forward flight;

(c) vertical autorotation.

3. Manoeuvres

3.1 Explain the relationship between speed, bank angle, radius and rate of turn during a balanced level turn.

3.2 For a given IAS, determine the approximate angle of bank to achieve a rate 1 turn (360º in 2 minutes).

3.3 Explain height/velocity diagram.

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Unit 1.3.5 CADP: CPL aerodynamics – powered-lift – *Reserved*

Unit 1.3.6 CADS: CPL aerodynamics – airship – *Reserved*

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SECTION 1.4 ATPL AIRCRAFT GENERAL KNOWLEDGE (AG)

Unit 1.4.1 AGKC: ATPL aircraft general knowledge – all aircraft categories

1. Reserved

2. Advanced aerodynamics

2.1.1 Explain the following airspeeds;

(a) IAS;

(b) CAS;

(c) EAS;

(d) TAS.

2.1.2 Explain the aerodynamic forces acting on an aircraft in flight.

3. Airframe and systems

3.1 Actuating systems

3.1.1 With reference to the basic principles of hydromechanics, explain and compare the following:

(a) transmission of force by an incompressible fluid;

(b) transmission of force by a compressible fluid.

3.2 Hydraulic systems

3.2.1 For the following:

(a) describe the functioning of a typical hydraulic system comprising main, standby and emergency systems that have multiple pumps and services;

(b) describe the purpose and function of the major components of a hydraulic system comprising:

(i) pumps;

(ii) accumulators;

(iii) reservoirs;

(iv) selector valves;

(v) check (one-way) valves;

(c) recognise on a diagram the symbols for major components of a hydraulic system and be able to trace the functioning of a diagrammatic system (system detail at the level of typical operations manual diagram);

(d) describe the typical services operated by a hydraulic system and for a typical system, how priority is allocated to certain services.

3.3 Fuel system

3.3.1 Jet fuels

(a) Avtur (Jet A1) – difference from other fuel cuts:

(i) volatility;

(ii) additives (discussion only);

(b) specific gravity:

(i) meaning;

(ii) variation with temperature;

(iii) effect of variation.

3.3.2 Carriage of fuel on aircraft

(a) fuel tanks:

(i) individual tanks;

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(b) CG balance during fuel usage;

(c) problems:

(i) algae, corrosion, water content;

(d) need for venting.

3.3.3 Operation of fuel system

(a) understand function of a typical multi-engine fuel system with multiple fuel tanks, tank-to-tank transfer;

(b) understand purpose/function of major components (for example, engine-driven pumps (HP/LP), fuel tank pumps, override/transfer pumps jettison pumps, fuel/oil heat exchange, vent lines, single-point refuelling;

(c) recognise on diagrams the symbols for major components and be able to trace the functioning off a diagrammatic system (system details at level of flight manual diagrams);

(d) understand suction feed/transfer as backup for pressure feed/transfer.

3.3.4 Operational considerations

(a) fuel temperature (max/min):

(i) need for fuel heating (oil, bleed air);

(b) cooling/lubrication of pumps;

(c) cooling of oil/hydraulic systems:

(i) effect of fuel flow rates;

(d) minimum fuel level:

(i) pick-up for delivery to engine;

(ii) maintain oil/hydraulic cooling;

(iii) effects of aircraft attitude;

(iv) fuel jettison.

3.3.5 Fuel system monitoring

(a) gauges:

(i) fuel contents, flow meters;

(ii) effect of check angle;

(iii) likely errors;

(b) warning systems;

(i) low fuel level, low pressure warning;

(c) measurement of tank contents:

(i) dipstick/dripstick/floatsticks;

(ii) importance of having aircraft level;

(iii) precautions in use.

3.4 Electrical systems

3.4.1 Selected components

(a) bus:

(i) concept of a bus;

(ii) common terminology:

hot bus, emergency bus, essential bus.

(b) circuit breaker:

(i) function, precautions if resetting;

(ii) multiple CB panels – need for identification;

(iii) grid system of nomenclature (for example, CB G22 on P3 panel);

(c) battery:

(i) types of high performance batteries in common use;

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(ii) charge/discharge characteristics;

(iii) precautions needed;

(d) AC generation:

(i) advantages of AC versus DC;

(ii) types of generator:

(A) permanent magnet generator;

(B) field excitation generator;

(C) differences between them;

(iii) constant speed drive:

(A) purpose;

(B) disconnecting drive;

(e) TR unit:

(i) purpose;

(ii) function of diodes/RCRs;

(f) power distribution:

(i) connecting generator to a bus;

(ii) connecting multiple generators to bus system;

(A) split buses;

(B) paralleling generators;

(iii) priority supplies in event of partial failure.

3.4.2 Operation of electrical system

(a) functioning of a typical AC-based electrical system with multiple generators, multiple AC and DC buses, APU and GPU;

(b) recognise on a diagram the symbols for the major components, and be able to trace the functioning of the diagrammatic system. (system detail at the level of typical Operations Manager diagram).

3.4.3 The aircraft structure as an electrical conductor.

4. Power plants – turbine engine

4.1 Theory of thrust

4.1.1 Explain the thrust formula for turbine engines and for thrust, state the functional relationship between airspeed, air density, pressure and temperature, and RPM.

4.2 Principle of operation

4.2.1 Describe the basic principles of jet propulsion theory with reference to the following:

(a) working cycle:

(i) gas flow;

(ii) changes in velocity, pressure, temperature;

(iii) engine pressure ratio;

(b) the differences and advantages of the following types of engine:

(i) centrifugal flow;

(ii) axial flow.

5. Engine instruments

5.1 Displays

5.1.1 Describe the basic features of the following commonly available types of displays:

(a) pointer-and-dial;

(b) vertical strip;

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(c) EICAS.

5.1.2 Explain the purpose of monitoring engine parameters in regards to the following:

(a) comparison of engine performance;

(b) trends;

(c) identification of malfunctions/failures.

5.1.3 In relation to identifying an engine gauge with its engine:

(a) explain the desirability of being able to rapidly identify the correct gauge engine combination; and

(b) give examples of good/bad instrumentation layouts; and

(c) describe the consequence of engine misidentification.

6. Flight instrumentation systems

6.1 Application of computers used in aircraft

6.1.1 Describe how the following computer-based systems and technologies are used in aircraft:

(a) flight management systems;

(b) performance management systems;

(c) fly-by-wire aircraft.

6.2 Electronic flight instrument system (EFIS)

6.2.1 In relation to EFIS:

(a) describe the advantages of EFIS compared to conventional system; and

(b) list typical inputs and outputs; and

(c) describe typical data inputs; and

(d) describe typical control panels and display units; and

(e) provide examples of typical aircraft installation.

6.3 Flight management system (FMS)

6.3.1 In relation to a typical FMS:

(a) describe the advantages of FMS compared to conventional system; and

(b) explain the general principles of operation; and

(c) list the typical inputs and outputs; and

(d) describe typical control panel and display units; and

(e) provide examples of typical aircraft installations.

6.4 Total air temperature (TAT) gauge

6.4.1 In relation to TAT:

(a) explain the purpose and operation of TAT gauges and the following terms:

(i) ram rise;

(ii) recovery factor; and

(b) describe typical indicators of a TAT gauge in relation to malfunctions.

7. Warning and recording equipment

7.1 Ground Proximity Warning Systems (GPWS)

7.1.1 In relation to typical GPWS:

(a) explain the purpose and operation of GPWS; and

(b) describe the modes of operation and operating envelopes; and

(c) describe hard and soft aural and visual warnings; and

(d) list the typical inputs and outputs; and

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(e) describe the limitations and restrictions in function and use; and

(f) describe typical GPWS displays and control panels.

7.2 Airborne Collision Avoidance System (ACAS)

7.2.1 Explain the basic concepts of ACAS operation.

7.2.2 Describe the effect on ACAS operation for each mode of operation that an be selected on the TCAS/Transponder control panel selected by the flight crew.

7.2.3 Describe the limitation of ACAS for tracking aircraft fitted with Mode A/C transponders.

7.2.4 Describe the range of the altitude band in which traffic are displayed in normal operation.

7.2.5 Explain the traffic display visual symbology used to determine the possibility of conflict with other aircraft and associated aural warnings.

7.2.6 Describe how 'proximate' aircraft are displayed on the traffic display.

7.2.7 Describe the aural and visual alerts for the following:

(a) 'intruder' aircraft;

(b) 'threat' aircraft.

7.2.8 Describe pilot actions in response to the following:

(a) ACAS Traffic Advisory (TA) alert;

(b) ACAS Resolution Advisory (RA) alerts.

7.2.9 State the standard phraseology pilots should use to communicate with ATC in the following cases:

(a) in response to an ACAS RA alert;

(b) on cessation of a RA alert.

7.2.10 Explain the requirements for complying with ACAS RA instructions as overriding Air traffic Control (ATC) directions.

7.2.11 Describe the reporting/notification obligations when ACAS alerts are generated.

7.3 Digital Flight Data Recorder (DFDR)

7.3.1 In relation to a typical DFDR system:

(a) explain the purpose and function of DFDR; and

(b) describe the typical data coverage available; and

(c) describe the physical appearance of a set of gauges of typical recorder and recorded data.

7.4 Health Usage Monitoring System (HUMS)

7.4.1 Explain the purpose and function of HUMS, including the following:

(a) actuation;

(b) down loading.

7.5 Cockpit Voice Recorder (CVR)

7.5.1 In relation to a typical CVR system:

(a) explain the purpose and function of a CVS; and

(b) describe a typical audio/radio channel coverage available in a multi-seat flight deck environment; and

(c) describe the physical appearance of a set of gauges of a typical recorder and control panel.

7.6 Master Warning Systems (MWS)

7.6.1 In relation to a typical MWS:

(a) explain the purpose and function of the system; and

(b) describe the typical warning systems incorporated or covered by a MWS; and

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(c) describe the aural and visual outputs for the following:

(i) warnings;

(ii) cautions;

(d) describe the features of a typical displays;

(e) explain take-off inhibiting of MWS outputs.

7.7 Fire Detection, Warning, Extinguishing Systems

7.7.1 Describe the following in relation to fire detection, warning and extinguishing systems:

(a) types of systems commonly used in aircraft; and

(b) typical warnings; and

(c) system limitations; and

(d) actuation mechanisms; and

(e) effects.

8. Global Navigation Satellite Systems

8.1 GNSS operation

8.1.1 For the following, describe:

(a) the principles of operation, performance limitations and errors of a GNSS system, including:

(i) methods of position fixing using a GNSS system;

(ii) the GNSS operating procedures which provide safeguards against navigational error and loss of situational awareness;

(iii) GNSS operating procedures for typical navigational tasks using a specific type of aircraft equipment;

(iv) indications of waypoint passage;

(v) GNSS operational and serviceability checks;

(vi) the human factors limitations associated with the use of GNSS equipment;

(vii) the requirements applicable to pilots and equipment for GNSS operations.

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Unit 1.4.2 AGKA : ATPL aircraft general knowledge – aeroplane

1. Reserved

2. Advanced aerodynamics

2.1 Review of terminology

2.1.1 Definitions

(a) Mach No;

(b) reference speeds, including M_{CRIT}, V_{MO}, M_{MO}, $V_{S.}$

2.2 Aerodynamic forces

(a) review forces acting in flight;

(b) balance of forces in trimmed asymmetric flight;

(c) V_{MCA} and V_{MCG}.

2.3 Shock waves

(a) reasons for their formation at subsonic speeds;

(b) their effect on the handling and operation of the aircraft;

(c) high-speed buffet and its possible similarity to low-speed buffet and speedbrake buffet.

2.4 Performance and speed

(a) manoeuvring and gust envelope;

(b) changes to C_L and C_D with increasing speed at constant angle of attack;

(c) performance degradation, the effect of Mach drag on thrust required and fuel flow;

(d) aileron reversal;

(e) effects of wing sweep back;

(f) maximising low-speed performance (use windshear on take-off as discussion case).

2.5 Performance and altitude

(a) effect of high altitude on:

(i) buffet boundaries;

(ii) stall and stability;

(iii) manoeuvring capability (inertia effects);

(b) stall and V_{MCA} considerations with engine failure at high altitude.

3. Airframe and systems

3.1 Flight controls

3.1.1 Review flight controls

(a) primary flight controls:

(i) ailerons; and

(ii) elevators; and

(iii) rudder;

(b) secondary flight controls:

(i) spoilers/airbrakes;

(ii) trim systems:

(iii) flying tail, stabiliser trim.

3.1.2 Leading edge flaps

(a) review trailing edge flaps;

(b) leading edge flaps/devices:

(i) purpose/function of leading edge flaps;

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(ii) types in common use;

(iii) typical interconnection with trailing edge flaps;

(c) common methods of operation:

(i) hydraulic;

(ii) electric;

(iii) pneumatic (outline knowledge only is required; actuating systems are at later section).

3.1.3 Powered controls

(a) methods of transmitting demand to control surfaces;

(b) feedback;

(c) feel, natural or artificial;

(d) possibility or availability of manual reversion.

3.2 Landing gear

3.2.1 Wheel systems

(a) arrangements:

(i) multi-wheel;

(ii) bogie wheel;

(iii) effects on PCN/ACN;

(b) main components;

(c) brief outline of typical retract/extend operation:

(i) normal, alternate, emergency operation;

(ii) landing gear doors may be disabled under some conditions.

3.2.2 Wheels and tyres

(a) wheels and brake energy limits, thermal plugs;

(b) cooling charts, minimum turn-around times.

3.2.3 Braking systems

(a) typical multi-wheel systems:

(i) typical sources of power for normal, alternate, emergency use;

(A) hydraulic supply and back-up;

(B) emergency air bottles.

(b) parking brake;

(c) principles of operations/limitations of:

(i) anti-skid system;

(ii) auto brake system.

3.2.4 Hydroplaning

(a) cause and effect;

(b) factors affecting hydroplaning, including speed formulae.

3.2.5 Steering systems

(a) types available:

(i) rudder pedal steering;

(ii) hand/wheel/tiller steering;

(iii) body-gear steering on some aircraft;

(b) degree of steering commonly available with each:

(i) understand that some steering systems are incompatible with asymmetric brake and/or power, while others are improved by them.

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3.3 Actuating systems

3.3.1 Pneumatic systems

(a) basic system knowledge as for hydraulics;

(b) compare system differences with hydraulic system;

(c) compare operating differences with hydraulic system;

(i) speed of response;

(ii) force available;

(iii) supply of operating fluid;

(iv) weight of system.

3.4 Airconditioning and pressurisation

3.4.1 Typical air supply system

(a) power sources:

(i) engine driven compressors;

(ii) bleed air:

(A) gas turbine compressor;

(B) turbo charger compressor;

(b) typical services provided;

(c) availability of services:

(d) possibility of limitations under take-off or asymmetric power conditions, or during engine start.

3.4.2 Airconditioning system

(a) types of systems:

(i) freon;

(ii) air cycle machine;

(b) brief outline of operation of system;

(i) single zone cabin;

(ii) multiple zones;

(c) purpose of/necessity for humidifiers.

3.4.3 Pressurisation system

(a) terminology:

(i) cabin altitude, differential pressure;

(b) brief outline of operation of typical system:

(i) supply;

(ii) outflow valves;

(iii) overpressure and negative pressure relief;

(iv) control of cabin altitude and rate (no detail of internal mechanism of controller required);

(c) normal pressurised zones in the aircraft;

(d) rapid decompression, cabin altitude warning.

3.5 Ice and rain protection

3.5.1 Distinction between anti-ice and de-ice system.

3.5.2 Pneumatic systems (brief coverage only)

(a) where used:

(i) leading edges;

(b) limitations.

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3.5.3 Thermal ice protection

(a) where used:

(i) propellers, flying surfaces, air intakes, pitot and other sensors, windshields;

(b) methods:

(i) electrical, air, oil;

(c) limitations.

3.5.4 Fluid ice protection

(a) where used:

(i) inflight leading edge of flying surfaces, propellers, windshield;

(ii) ground de-icing;

(b) limitations.

3.5.5 Rain removal from windscreen

(a) methods:

(i) wipers;

(ii) fluid dispersant;

(iii) air jets.

3.5.6 Effects on aeroplane performance (discussion only)

(a) ice accumulations;

(b) use of ice control systems.

3.6 Fuel system

3.6.1 Carriage of fuel on aircraft

(a) structural consequences:

(i) wing bending;

(ii) zero-fuel weight;

(iii) CG movement;

(b) understand suction feed and gravity feed/transfer as backup for pressure feed/transfer.

3.6.2 Operational considerations

(a) minimum fuel levels:

(i) pick-up for delivery to engine;

(ii) maintain oil/hydraulic cooling;

(iii) effect of aircraft attitude (for example, missed approach);

(b) fuel jettison:

(i) legislation;

(ii) precautions to be observed;

(iii) minimum fuel after jettison (stand-pipes).

4. Power plants – turbine engine

4.1 Principle of operation

(a) types of engine:

(i) differences and advantages:

(ii) bypass ratio;

(b) turboprop:

(i) advantages and limitations/problems.

4.2 Engine constructions

(a) intake (subsonic only):

(i) location on airframe relative to free-stream airflow;

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(ii) location relative to engine (for example, B727 centre engine);
(iii) vulnerability to icing;

(b) compressor:
(i) purpose/function of compressor;
(ii) centrifugal;
(A) single/multiple;
(iii) axial;
(A) single/twin;
(iv) inlet guide vanes;
(v) vulnerability to icing;
(vi) bleed air provisions;
(vii) compressor stalling:
(A) causes, symptoms, avoidance;
(B) unloading compressor during start;

(c) fan:
(i) purpose and function of fan;
(ii) relationship to compressor;
(iii) inlet guide vanes;
(iv) reverse thrust;

(d) combustion system:
(i) purpose and function of combustion system;
(ii) combustion chamber:
(A) individual;
(B) annular;
(iii) fuel injectors;
(iv) igniters;
(v) air/fuel ratios;

(e) turbine:
(i) purpose/function of turbine;
(ii) single, twin, and triple turbines:
(A) for example, driving two-stage compressor with fan;
(iii) thermal and mechanical stress;
(iv) effects of damage;
(v) monitoring turbine temperature:
(A) desired to monitor inlet temperature;
(B) difficulties/compromise in monitoring;
(C) terminology – EGT, TGT, TIT;
(vi) reverse thrust mechanisms;
(A) cascade, buckets;
(B) safety interlocks;

(f) exhaust:
(i) purpose and function of exhaust;
(ii) sources of noise;
(iii) hushkits.

4.3 Turbo-prop

(a) drive train from engine:
(i) flight range; and

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(ii) ground range;

(b) control of propeller:

(i) variable speed engine;

(ii) constant speed engine;

(c) reverse thrust:

(i) concept of zero thrust;

(d) feathering;

(e) propeller brake.

4.4 Auxiliary power unit (APU)

(a) purpose/function of APU;

(b) types commonly available;

(c) outputs available;

(d) availability determined by AFM:

(i) use in flight;

(ii) start in flight;

(iii) outputs available in flight.

4.5 Operational considerations

(a) use of reverse thrust:

(i) effectiveness with decreasing speed;

(ii) instability of airflow in reverse at low ground speeds;

(iii) monitoring and precautions;

(iv) deliberate or inadvertent use in flight (where not permitted by AFM);

(b) use of bleed air:

(i) effect on thrust and performance;

(ii) engine indications:

(A) EGT;

(B) RPM;

(C) EPR.

4.6 Engine starting

(a) air-driven starters:

(i) characteristics;

(ii) sources of air;

(iii) failure to disconnect;

(b) critical engine RPM:

(i) initiating fuel flow/ignition;

(ii) self-sustaining RPM;

(iii) stable idle;

(c) typical engine start sequence;

(d) typical start malfunctions:

(i) cause and remedy for each of the following:

(A) fails to light off;

(B) hot start;

(C) hung start;

(D) fails to stabilise at idle;

(E) starter fails to disengage;

(F) torching/tailpipe fire.

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5. Engine instruments

5.1 EPR gauge

(a) inputs;

(b) displays:

(i) analogue and digital readout;

(ii) setting target EPR:

(A) manual and auto settings;

(c) typical appearance of a set of gauges in a modern multi-engine aircraft.

5.2 Torque meter

(a) inputs and methods of functioning;

(b) types of indicators and units of torque;

(c) typical appearance of a set of gauges in a modern multi-engine aircraft.

5.3 RPM indicator

(a) types of display:

(i) RPM or percentage;

(ii) 100% not necessarily a limit and markings;

(b) multiple RPM displays – N1, N2, N3:

(i) conventional order of numbering;

(c) typical appearance of a set of gauges in a modern multi-engine aircraft.

5.4 Turbine temperature indicator

(a) types of display:

(i) analogue;

(ii) digital;

(b) overtemp warnings;

(c) typical appearance of a set of gauges in a modern multi-engine aircraft.

5.5 Fuel consumption

(a) flowmeters:

(i) analogue and digital indications;

(ii) importance on start-up and shutdown;

(b) fuel-used gauges:

(i) may be separate or incorporated with flowmeter;

(c) typical appearance of a set of gauges in a modern multi-engine aircraft.

6. Automatic flight control system (AFCS)

6.1 Autopilot (AP)

(a) purpose/function of AP;

(b) common types (different axes);

(c) components;

(d) typical heavy aircraft AP controller;

(e) command and manual modes, including typical submodes:

(i) ALT/HDG/IAS/MACH/VS hold;

(ii) VORLOC/ILS/INS tracking;

(iii) FMS coupling;

(iv) autoland and auto-go-around;

(f) typical limitations/restrictions.

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6.2 Flight Director (FD)

(a) purpose/function of FD;

(b) common types of presentation:

(i) V-bars;

(ii) cross-bars;

(c) typical components;

(d) typical heavy aircraft FD controller;

(e) typical modes of operation; mode indicator.

6.3 Auto-throttle (AT)

(a) purpose/function of AT;

(b) typical modes of operation:

(i) thrust hold;

(ii) speed hold;

(iii) VNAV coupling;

(c) auto-derate of take-off power;

(d) typical engage/disengage/go-around controls;

(e) typical limitations/restrictions.

6.4 Autoflight

(a) relationship between AT, FD and AP;

(b) relationship between FMS and AT/FD/AP;

(c) redundancy requirements for autoland.

6.5 Flight envelope protection in autoflight

(a) types for protection available:

(i) high speed; low speed;

(ii) alpha floor;

(iii) flap/gear speed protection;

(b) functioning of typical system:

(i) inputs; and

(ii) outputs;

(c) modified functioning during flare and touchdown;

(d) alternate law, reversionary modes.

6.6 Associated autosystems

(a) yaw damper:

(i) purpose and function of yaw damper:

(A) typical low and high speed behaviour requiring installation of yaw damper;

(ii) method of functioning:

(A) input and output;

(iii) series and parallel types;

(A) advantages and disadvantages of each type;

(iv) typical yaw damper controls;

(b) automatic pitch trim:

(i) purpose and function of auto-trim;

(ii) input and output;

(iii) typical auto-trim controls;

(c) thrust computation:

(i) purpose and function of thrust computation system;

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(ii) input and output;

(iii) relationship to FMS.

7. Warning and recording equipment

7.1 Overspeed Warning System

(a) components:

(i) inputs; and

(ii) outputs;

(b) may be selectable according to weight/CG/fuel distribution;

(c) typical selectors and warning indicators:

(i) aural warnings; and

(ii) visual warnings.

7.2 Stall Warning

(a) purpose/function of system;

(b) components of a typical heavy aircraft system:

(i) ADC inputs, including AOA;

(ii) stick shaker and pusher;

(iii) visual and aural warnings.

7.3 Take-off Warning System (TWS)

(a) Purpose and function of TWS;

(b) typical items monitored;

(c) aural/visual warnings.

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Unit 1.4.3 AGKH: ATPL aircraft general knowledge – helicopter

1. Reserved

2. Advanced aerodynamics

2.1 Review of terminology

2.1.1 Definitions

(a) reference speeds, including V_{TOSS}, CDP, landing decision point (LDP);

(b) define; tip path, tip path plane, axis of rotation, shaft axis, disc area, chord line, pitch angle, angle of attack, coning angle, feathering, feathering axis, disc loading, blade loading, solidity, flapping, dragging, teetering rotor, articulated rotor, semi rigid rotor.

2.1.2 Aerodynamic forces

(a) Effect of RAF on angle of attack, induced airflow and effects, total reaction, rotor thrust, torque, torque reaction, rotor thrust/rotor drag ratio, forces opposing weight, factors influencing rotor thrust, Bernoulli's theorem, Hookes joint effect.

2.1.3 Stability

(a) static and dynamic stability;

(b) stability during hover;

(c) stability during forward flight;

(d) effect of off-set flapping hinges;

(e) effect of stabiliser bar;

(f) effect of centre of gravity (CG);

(g) effects of altitude and speed on stability;

(h) effect of horizontal stabilizer.

2.1.4 Forward flight

(a) arrangement of forces and effects of CG position;

(b) basic aspects-tilting the disc through cyclic;

(c) dissymmetry of lift, dissymmetry lift elimination through flapping;

(d) flapback, designs to reduce flapping amplitude, Delta-3 hinge, offset pitch horn;

(e) reverse flow, transitional lift, inflow roll.

2.1.5 Climbing and descending

(a) forces in a vertical climb;

(b) horse power available (HPAV) curve and factors affecting the HPAV: altitude, DA, collective setting;

(c) rate and angle of climb and relationship to HPAV and horse power required (HPREQ) curve;

(d) effect of wind, altitude, and sling loads on rate and angle of climb;

(e) forces in a vertical descent;

(f) over pitching;

(g) rate and angle of descent and relationship to HPAV and HPREQ curves;

(h) effect of wind, all up weight (AUW), altitude and sling loads on rate and angle of descent.

2.1.6 Hovering

(a) definition;

(b) hover in and out of ground effect (IGE, OGE);

(c) factors affecting ground effect, height, DA, AUW, nature of surface, slope, wind, recirculation.

2.1.7 Turning

(a) centripetal force and angle of bank;

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(b) rate and radius of turn, relationship of angle of bank;
(c) steep turn, load factor, power requirement;
(d) forces in climbing and descending turns;
(e) effect of attitude and bank angle on rate and radius of turn;
(f) effect of AUW on rate/radius;
(g) effect of wind when turning around a ground feature;
(h) effects of slipping and skidding.

2.1.8 Autorotation
(a) definition;
(b) autorotative forces/drag;
(c) effects of airflow on vertical autorotation;
(d) effects of airflow on forward autorotation;
(e) rate of descent requirements for autorotation:
(i) minimum rate of descent, maximum air range;
(f) effect of weight, altitude, temperature.

2.1.9 Rotor blades
(a) feathering, taper, washout, lift distribution;
(b) flapping, flapping to equality;
(c) dragging;
(d) changing blade CG;
(e) limits of rotor RPM.

2.1.10 Tail rotor
(a) principles of operation – pitch control;
(b) primary and additional purpose;
(c) auto rotation;
(d) tail rotor drift;
(e) tail rotor roll;
(f) tail rotor flapping, shrouded rotors.

2.1.11 Ground resonance
(a) definition;
(b) causes of ground resonance;
(c) recovery action.

2.1.12 Vortex ring state
(a) how vortex rings develop;
(b) effect of ROD-flow and tip vortex action on rotor thrust;
(c) effects of power and airspeed on vortex ring state;
(d) flight conditions leading to vortex ring state;
(e) tail rotor vortex ring state;
(f) loss of tail rotor effectiveness (LTE).

2.1.13 Retreating blade stall
(a) conditions which could cause retreating blade stall;
(b) effect of reverse flow, effect of airspeed on stall angle;
(c) factors effecting the advancing blade;
(d) symptoms and recovery from retreating blade stall;
(e) methods to minimize retreating blade stall (swept tips);
(f) effect of altitude on VNE.

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(g) forward speed limiting factors.

2.1.14 Blade sailing, dynamic roll-over, mast bumping

(a) definitions;

(b) cause of blade sailing and prevention;

(c) forces in dynamic roll-over;

(d) avoidance of dynamic roll-over;

(e) factors effecting mast bumping/flapping amplitude;

(f) avoidance of mast bumping.

3. Airframe and systems

3.1 Flight controls

3.1.1 Review flight controls:

(a) primary flight controls;

(i) pitch and roll (cyclic), yaw, collective;

(ii) trim systems;

(iii) canted tail rotor;

(iv) sweep back on tips;

(v) shrouded tail rotor.

3.1.2 Aerodynamic enhancements:

(a) canted tail rotor;

(b) sweep back on tips;

(c) shrouded tail rotor;

(d) tail surfaces, fins, end plates, stabilators.

3.1.3 Powered controls:

(a) methods of transmitting demand to control surfaces;

(b) feedback;

(c) natural and artificial feel;

(d) possibility/availability of manual reversion.

3.2 Airconditioning

3.2.1 Typical air supply system:

(a) power sources:

(i) engine, transmission, driven compressor;

(ii) bleed air;

(iii) gas turbine compressor;

(iv) turbo-charger compressor;

(b) typical services provided;

(c) availability of services:

(i) possibility of limitations during take-off and landing or during engine start.

3.2.2 Airconditioning system

(a) types of systems:

(i) freon;

(ii) air cycle machine;

(b) brief outline of operation of system:

(i) single zone; and

(ii) multi-zone;

(c) purpose and need for humidifier.

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3.3 Ice and rain protection

3.3.1 Distinction between anti-ice and de-ice systems.

3.4 Landing gear

3.4.1 Wheel systems

(a) main components;

(b) brief outline of typical retract and extend operation:

(i) normal operation;

(ii) alternative operation;

(iii) emergency operation.

3.4.2 Wheels and tyres

(a) Wheel and brake energy limits.

3.4.3 Braking systems

(a) typical systems;

(b) typical sources of power for normal, alternate and emergency systems -hydraulic supply and backup emergency air bottles;

(c) parking brake.

3.4.4 Steering systems

(a) types available:

(i) tail rotor steering (pedals);

(ii) differential braking;

(b) degree of steering available with each-possibility of rollover.

3.5 Actuating systems

3.5.1 Basic principles of hydromechanics

(a) principle of transmission of force by an incompressible fluid;

(b) brief comparison with use of a compressible fluid.

3.5.2 Thermal ice protection

(a) where used:

(i) flying surfaces;

(ii) air intakes;

(iii) pitot and other sensors;

(iv) windshields;

(b) methods:

(i) electric;

(ii) air;

(iii) oil;

(c) limitations.

3.5.3 Fluid ice protection

(a) where used:

(i) ground de-icing;

(b) limitations.

3.5.4 Rain removal from windscreen

(a) wipers.

3.5.5 Effects on helicopter performance

(a) ice accumulation;

(b) use of engine air bleed ice control systems.

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4. Power plants – turbine engine

4.1 Engine design

(a) types of engine:
  (i) differences and advantages;
  (ii) centrifugal flow;
  (iii) axial flow;
  (iv) bypass engine;
  (v) bypass ratio;

(b) power train:
  (i) fixed shaft – 'clutch';
  (ii) free power turbine;
  (iii) twin pack, combining gear box;
  (iv) torque sharing.

4.2 Engine construction

(a) intake:
  (i) purpose and /function of intake;
  (ii) location relative to engine;
  (iii) vulnerability to icing;

(b) compressor:
  (i) purpose and function of compressor;
  (ii) centrifugal, axial;
  (iii) single, twin, and multiple:
    (A) inlet guide vanes;
    (B) vulnerability to icing;
    (C) bleed air provisions;
    (D) compressor stalling;
  (iv) causes, symptoms, avoidance;
  (v) unloading compressor during start.

(c) combustion system:
  (i) purpose (function of combustion system);
  (ii) combustion chamber;
  (iii) individual/annular:
    (A) fuel injectors;
    (B) igniters;
    (C) air/fuel ratios.

(d) turbine:
  (i) purpose/function of turbine;
  (ii) thermal and mechanical stress;
  (iii) effects of damage;
  (iv) monitoring turbine temperature;
  (v) need to monitor inlet temperature;
  (vi) difficulties/compromise in monitoring;
  (vii) terminology – TIT, ITT, TGT, etc.

(e) exhaust:
  (i) purpose/function of exhaust;
  (ii) sources of noise;

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(iii) EGT, JPT;

(f) torque measuring/torque sharing:

(i) governor inputs.

4.3 Auxiliary power unit (APU)

(a) purpose/function of APU;

(b) types commonly available;

(c) outputs available;

(d) availability determined by AFM:

(i) use in flight;

(ii) start in flight;

(iii) outputs available in flight.

4.4 Operational considerations

(a) use of bleed air;

(i) effect on performance;

(ii) engine indications;

(iii) EGT, RPM.

4.5 Engine starting

(a) electrical starters;

(i) source of power;

(ii) cross tie requirements;

(b) critical engine RPM:

(i) initiating fuel flow/ignition;

(ii) self-sustaining RPM;

(iii) stable idle;

(c) typical engine start sequences;

(d) typical start malfunctions:

(i) cause and remedy;

(ii) fails to light off;

(iii) hot start;

(iv) hung start;

(v) fails to stabilise at idle;

(vi) starter fails to disengage;

(vii) torching/tailpipe fire;

(e) starter/generator:

(i) principle of operation and function.

5. Engine instruments

5.1 Torque meter

(a) inputs and methods of functioning;

(b) types of indicators and units of torque;

(c) typical appearance of a set of gauges in a modern multi-engine helicopter.

5.2 RPM indicator

(a) types of display:

(i) RPM, percent;

(ii) 100% not necessarily a limit-biasing;

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(b) multiple RPM displays – N1, N2, NR:
    (i) conventional order of numbering;
(c) typical appearance of a set of gauges in a modern multi-engine helicopter.

5.3 Temperature indicator

(a) types of display:
    (i) analogue/digital;
(b) over temperature warnings;
(c) typical appearance of a set of gauges in a modern multi-engine helicopter.

5.4 Fuel consumption

(a) flow meters:
    (i) analogue/digital indications;
    (ii) importance on start-up and shutdown;
(b) fuel-used gauges:
    (i) may be separate or incorporated with flow meter;
(c) typical appearance of a set of gauges in a modern multi-engine helicopter.

5.5 Inflight tracking

5.5.1 Principles of operation.

5.6 Monitoring systems

(a) indicators, units;
(b) warning systems;
(c) mechanical and electrical remote signal transmission systems;
(d) HUMS operation and indication.

6. Stability augmenation and autoflight control, system (AFCS)

6.1 AFCS

(a) purpose/function of AP:
    (i) common types (different axes)/inputs;
    (ii) pitch;
    (iii) collective;
    (iv) other;
(b) components;
(c) typical AP controller;
(d) command and manual modes:
    (i) typical submodes;
    (ii) Stability Augmentation System (SAS);
    (iii) attitude retention system (ARS/ATT);
    (iv) ALT/HDG/IAS hold;
    (v) VOR/LOC/ILS/INS/GNSSGNSS tracking;
    (vi) FMS coupling;
    (vii) auto hover;
(e) typical limitations/restrictions.

6.2 Flight director (FD)

(a) purpose/function of FD;
(b) common types of presentation:
    (i) V-bars;

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(ii) cross-bars;

(c) typical components;

(d) typical FD controller;

(e) typical modes of operation:

(i) mode indicator.

6.3 Autoflight

(a) relationship between FD and AP;

(b) relationship between FMS and FD/AP;

(c) redundancy requirements.

7. Warning and recording equipment

7.1 Auto Voice Activated Decision System (AVADS)

(a) AVADS:

(i) principles of operation;

(ii) warnings;

(iii) limitations.

7.2 Rotor overspeed and underspeed warning system components

(a) inputs;

(b) outputs.

7.3 Health Usage Monitoring System (HUMS)

(a) actuation;

(b) down loading.

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Unit 1.4.4 AAGP: ATPL aircraft general knowledge – powered-lift – *Reserved*

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Unit 1.4.5 FAGC: FE aircraft general knowledge – all categories

1. Reserved

2. Advanced aerodynamics

2.1 Terminology

2.1.1 Definitions

(a) Mach No;

(b) reference speeds, including MCRIT, VMO, MMO, Vs.

2.2 Aerodynamic forces

(a) forces acting in flight;

(b) V_{MCA} and V_{MCG}.

2.3 Shock waves

(a) reasons for their formation at subsonic speeds;

(b) their effect on the handling and operation of the aircraft;

(c) high-speed buffet and its possible similarity to low-speed buffet and speedbrake buffet.

2.4 Performance and speed

2.4.1 performance degradation, the effect of Mach drag on thrust required and fuel flow.

3. Airframe and systems

3.1 Flight Controls

3.1.1 Review flight controls:

(a) primary flight controls:

(i) ailerons, elevators, rudder;

(b) secondary flight controls:

(i) spoilers/airbrakes;

(ii) trim systems:

flying tail, stabiliser trim.

3.1.2 Leading edge flaps:

(a) review trailing edge flaps;

(b) leading edge flaps/devices:

(i) purpose/function of LE flaps;

(ii) types in common use;

(iii) typical interconnection with TE flaps;

(c) common methods of operation:

(i) hydraulic, electric, pneumatic (outline only; actuating systems are at later section).

3.1.3 Powered controls:

(a) methods of transmitting demand to control surfaces;

(b) feedback;

(c) feel, natural/artificial;

(d) possibility/availability of manual reversion.

3.2 Landing gear

3.2.1 Wheel systems;

(a) arrangements:

(i) multi-wheel;

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(ii) bogie wheel;

(iii) effects on PCN/CAN;

(b) main components;

(c) brief outline of typical retract/extend operation:

(i) normal, alternate, emergency operation;

(ii) LG doors may be disabled under some conditions;

3.2.2 Wheels and tyres

(a) wheels and brake energy limits, thermal plugs;

(b) cooling charts, minimum turn-around times.

3.2.3 Braking systems

(a) typical multi-wheel systems:

(i) typical sources of power for normal, alternate, emergency use:

(A) hydraulic supply and back-up;

emergency air bottles.

(b) parking brake;

(c) principles of operations/limitations of:

(i) anti skid system;

(ii) auto brake system.

3.2.4 Steering systems

(a) types available:

(i) rudder pedal steering;

(ii) hand/wheel/tiller steering;

(iii) body-gear steering on some aircraft;

(b) degree of steering commonly available with each:

(i) understand that some steering systems are incompatible with asymmetric brake and/or power, while others are improved by them.

3.3 Actuating systems

3.3.1 Pneumatic systems

(a) basic system knowledge as for hydraulics;

(b) compare system differences with hydraulic system;

(c) compare operating differences with hydraulic system:

(i) speed of response;

(ii) force available;

(iii) supply of operating fluid;

(iv) weight of system.

(d) airconditioning and pressurisation.

3.3.2 Typical air supply system

(a) power sources:

(i) engine driven compressors;

(ii) bleed air:

(A) gas turbine compressor;

turbo charger compressor;

(b) typical services provided;

(c) availability of services:

(d) possibility of limitations under take-off or asymmetric power conditions, or during engine start.

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3.3.3 Airconditioning system

(a) types of systems:

(i) freon;

(ii) air cycle machine;

(b) brief outline of operation of system;

(i) single zone cabin;

(ii) multiple zones;

(c) purpose of/necessity for humidifiers.

3.3.4 Pressurisation system

(a) terminology:

(i) cabin altitude, differential pressure;

(b) brief outline of operation of typical system:

(i) supply;

(ii) outflow valves;

(iii) overpressure and negative pressure relief;

(iv) control of cabin altitude and rate (no detail of internal mechanism of controller required);

(c) normal pressurised zones in the aircraft;

(d) rapid decompression, cabin altitude warning.

3.4 Ice and rain protection

3.4.1 Distinction between anti-ice and de-ice system.

3.4.2 Pneumatic systems (brief coverage only)

(a) where used:

(i) leading edges;

(b) limitations.

3.4.3 Thermal ice protection

(a) where used:

(i) propellers;

(ii) flying surfaces;

(iii) air intakes;

(iv) pitot and other sensors;

(v) windshields;

(b) methods:

(i) electrical;

(ii) air;

(iii) oil;

(c) limitations.

3.4.4 Fluid ice protection

(a) where used:

(i) inflight leading edge of flying surfaces, propellers, windshield;

(ii) ground de-icing;

(b) limitations.

3.4.5 Rain removal from windscreen

(a) methods:

(i) wipers;

(ii) fluid dispersant;

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(iii) air jets.

3.4.6 Effects on aeroplane performance (discussion only)

(a) ice accumulations;

(b) use of ice control systems.

3.5 Fuel system

3.5.1 Carriage of fuel on aircraft

(a) structural consequences:

(i) wing bending;

(ii) zero-fuel weight;

(iii) CG movement;

(b) understand suction feed and gravity feed/transfer as backup for pressure feed/transfer.

3.5.2 Operational considerations

(a) minimum fuel levels:

(i) pick-up for delivery to engine;

(ii) maintain oil/hydraulic cooling;

(iii) effect of aircraft attitude (for example, missed approach);

(b) fuel jettison:

(i) legislation;

(ii) precautions to be observed;

(iii) minimum fuel after jettison (stand-pipes).

4. Power plants – turbine engine

4.1 Principle of operation

(a) types of engine:

(i) differences and advantages;

(ii) bypass ratio;

(b) turboprop:

(i) advantages; and

(ii) limitations; and

(iii) problems.

4.2 Engine constructions

(a) intake (subsonic only):

(i) location on airframe relative to free-stream airflow;

(ii) location relative to engine (for example, B727 centre engine);

(iii) vulnerability to icing;

(b) compressor:

(i) purpose/function of compressor;

(ii) centrifugal:

(A) single/multiple;

(iii) axial:

(A) single/twin;

(iv) inlet guide vanes;

(v) vulnerability to icing;

(vi) bleed air provisions;

(vii) compressor stalling:

(A) causes, symptoms, avoidance;

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(B) unloading compressor during start;

(c) fan:

(i) purpose/function of fan;

(ii) relationship to compressor;

(iii) inlet guide vanes;

(iv) reverse thrust;

(d) combustion system:

(i) purpose/function of combustion system;

(ii) combustion chamber:

(A) individual/annular;

(iii) fuel injectors;

(iv) igniters;

(v) air/fuel ratios;

(e) turbine:

(i) purpose/function of turbine;

(ii) single/twin/triple turbines:

(A) for example, driving two-stage compressor with fan;

(iii) thermal and mechanical stress;

(iv) effects of damage;

(v) monitoring turbine temperature:

(A) desired to monitor inlet temperature;

(B) difficulties/compromise in monitoring;

(C) terminology – EGT, TGT, TIT;

(vi) reverse thrust mechanisms:

(A) cascade, buckets;

(B) safety interlocks;

(f) exhaust:

(i) purpose/function of exhaust;

(ii) sources of noise;

(iii) hushkits.

4.3 Turbo-prop

(a) drive train from engine:

(i) flight range; and

(ii) ground range;

(b) control of propeller:

(i) variable speed engine;

(ii) constant speed engine;

(c) reverse thrust:

(i) concept of zero thrust;

(d) feathering;

(e) propeller brake.

4.4 Auxiliary power unit (APU)

(a) purpose/function of APU;

(b) types commonly available;

(c) outputs available;

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(d) availability determined by AFM:
    (i) use in flight;
    (ii) start in flight;
    (iii) outputs available in flight.

4.5 Operational considerations

(a) use of reverse thrust:
    (i) effectiveness with decreasing speed;
    (ii) instability of airflow in reverse at low-ground speeds;
    (iii) monitoring and precautions;
    (iv) deliberate or inadvertent use in flight (where not permitted by AFM);
(b) use of bleed air:
    (i) effect on thrust and performance;
    (ii) engine indications:
        (A) EGT;
        (B) RPM;
        (C) EPR.

4.6 Engine starting

(a) air-driven starters:
    (i) characteristics;
    (ii) sources of air;
    (iii) failure to disconnect;
(b) critical engine RPM:
    (i) initiating fuel flow/ignition;
    (ii) self-sustaining RPM;
    (iii) stable idle;
(c) typical engine start sequence;
(d) typical start malfunctions:
    (i) cause and remedy for each of the following:
        (A) fails to light off;
        (B) hot start;
        (C) hung start;
        (D) fails to stabilise at idle;
        (E) starter fails to disengage;
        (F) torching/tailpipe fire.

5. Engine instruments

5.1 EPR gauge

(a) inputs;
(b) displays:
    (i) analogue/digital readout;
    (ii) setting target EPR:
        (A) manual/auto settings;
(c) typical appearance of a set of gauges in a modern multi-engine aircraft.

5.2 Torque meter

(a) inputs and methods of functioning;
(b) types of indicators and units of torque;

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(c) typical appearance of a set of gauges in a modern multi-engine aircraft.

5.3 RPM indicator

(a) types of display:
  (i) RPM or percentage;
  (ii) 100% not necessarily a limit and markings;
(b) multiple RPM displays – N1, N2, N3:
  (i) conventional order of numbering;
(c) typical appearance of a set of gauges in a modern multi-engine aircraft.

5.4 Turbine temperature indicator

(a) types of display:
  (i) analogue;
  (ii) digital;
(b) overtemp warnings;
(c) typical appearance of a set of gauges in a modern multi-engine aircraft.

5.5 Fuel consumption

(a) flowmeters:
  (i) analogue and digital indications;
  (ii) importance on start-up and shutdown;
(b) fuel-used gauges:
  (i) may be separate or incorporated with flowmeter;
(c) typical appearance of a set of gauges in a modern multi-engine aircraft.

6. Automatic flight control system (AFCS)

6.1 Autopilot (AP)

(a) purpose/function of AP;
(b) common types (different axes);
(c) components;
(d) typical heavy aircraft AP controller;
(e) command and manual modes, including typical submodes:
  (i) ALT/HDG/IAS/MACH/VS hold;
  (ii) VORLOC/ILS/INS tracking;
  (iii) FMS coupling;
  (iv) autoland and auto-go-around;
(f) typical limitations/restrictions.

6.2 Flight Director (FD)

(a) purpose/function of FD;
(b) common types of presentation:
  (i) V-bars;
  (ii) cross-bars;
(c) typical components;
(d) typical heavy aircraft FD controller;
(e) typical modes of operation:
  (i) mode indicator.

6.3 Auto-throttle (AT)

(a) purpose/function of AT;

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(b) typical modes of operation:
  (i) thrust hold;
  (ii) speed hold;
  (iii) VNAV coupling;
(c) auto-derate of take-off power;
(d) typical engage/disengage/go-around controls;
(e) typical limitations/restrictions.

6.4 Autoflight

(a) relationship between AT, FD and AP;
(b) relationship between FMS and AT/FD/AP;
(c) redundancy requirements for autoland.

6.5 Flight envelope protection in autoflight

(a) types for protection available:
  (i) high speed, low speed;
  (ii) alpha floor;
  (iii) flap/gear speed protection;
(b) functioning of typical system:
  (i) inputs and outputs;
(c) modified functioning during flare and touchdown.
(d) alternate law, reversionary modes.

6.6 Associated autosystems

(a) yaw damper:
  (i) purpose/function of yaw damper:
    (A) typical low/high speed behaviour requiring installation of yaw damper;
  (ii) method of functioning:
    (A) input and output;
  (iii) series and parallel types:
    (A) advantages/disadvantages of each type;
  (iv) typical yaw damper controls.

7. Automatic pitch trim

(a) purpose/function of auto-trim;
(b) input and output;
(c) typical auto-trim controls.

8. thrust computation

(a) purpose/function of thrust computation system;
(b) input and output;
(c) relationship to FMS.

9. Warning and recording equipment

9.1 Overspeed warning system

(a) components:
  (i) inputs; and
  (ii) outputs;
(b) may be selectable according to weight/CG/fuel distribution;

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(c) typical selectors and warning indicators:
    (i) aural warnings; and
    (ii) visual warnings.

9.2 Stall warning

(a) purpose/function of system;
(b) components of a typical heavy aircraft system:
    (i) ADC inputs, including AOA;
    (ii) stick shaker and pusher;
    (iii) visual and aural warnings.

9.3 Take-off warning system (TWS)

(a) purpose/function of TWS;
(b) typical items monitored;
(c) aural/visual warnings.

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SECTION 1.5 FLIGHT RULES AND AIR LAW (FR)

Unit 1.5.1 RFRC: RPL flight rules and air law – all aircraft categories

1. Reserved

2. Elements

2.1 Documentation

2.1.1 Explain the reason for recording flight time in a logbook and state what other information that must be recorded.

2.1.2 State the different documents that contain aviation legislation, aeronautical information and general operating rules.

2.1.3 Explain the purpose of the aircraft maintenance release and how it is used.

2.2 Licence privileges and limitations (RPL)

2.2.1 State the limitations of the RPL.

2.2.2 Describe the requirements for maintaining the privileges of the RPL.

2.2.3 State the medical standards and limitations for the holder of an RPL.

2.2.4 State the privileges of a licence holder with respect to the following:

(a) conducting daily inspections;

(b) signing a maintenance release;

(c) reporting defects.

2.3 Conditions of flight

2.3.1 Recall/apply the following rules/requirements:

(a) rules of the air;

(b) the requirements relating to the operation of aircraft on, and in the vicinity of, an aerodrome and the conditions relating to turns after take-off;

(c) separation minima between a/c for take-off and landing at a non-controlled aerodrome;

(d) rules relating to restrictions on smoking in aircraft during take-off, landing and refuelling;

(e) VFR and visual meteorology conditions (aeroplanes) for operations below 10,000 ft;

(f) altimetry procedures for flight below 10,000 ft.

2.3.2 State the rules relating to the following:

(a) the use of drugs and alcohol, and recall the minimum period between alcohol consumption and flight departure;

(b) temporary medical unfitness.

2.3.3 Recall the meaning of the following light signals directed at an aircraft:

(a) steady ‘green’ and steady ‘red’;

(b) ‘green’, ‘red’ and ‘white’ flashes.

2.3.4 Recall regulations relating to the minimum heights for flights over the following:

(a) populated areas;

(b) other areas.

2.3.5 State the limitations imposed on the following:

(a) acrobatic flight;

(b) flight over public gatherings.

2.3.6 Recall the requirements for landing prior to the end of daylight.

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2.4 Air service operations

2.4.1 Extract from legislation references, the restrictions pertaining to the carriage of passengers on certain flights.

2.4.2 Apply the following regulations/rules/orders relating to the responsibilities of a pilot in command:

(a) before flight, requirements regarding the following:

(i) fuels and oils;

(ii) fuelling of aircraft;

(iii) starting and ground operation of engines;

(iv) appropriate passenger briefing;

(b) during flight, requirements and regulations regarding:

(i) the operation and safety of the aircraft and the authority of the pilot in command;

(ii) dropping of articles from an aircraft in flight.

2.4.3 Recall the legislation requirements that apply during the following phases of a flight:

(a) before flight:

(i) removal of locking devices;

(ii) security of doors, hatches;

(iii) tank caps;

(iv) testing of flight controls;

(v) removal of frost and ice;

(vi) instrument checks;

(vii) security of safety harness prior to solo flight in a dual control aircraft;

(viii) when and how a fuel system inspection is performed;

(ix) carriage of passengers in a control seat;

(x) carriage of infants and children;

(b) during flight:

(i) occupation of seats;

(ii) wearing of seat belts;

(iii) adjustment of seats;

(iv) manipulation of aircraft controls by pilots, and by unauthorised persons.

2.5 Aerodromes

2.5.1 With reference to a diagram of the aerodrome(s) used for training:

(a) identify movement areas; and

(b) explain the significance of the following markings:

(i) taxiway;

(ii) runway;

(iii) helipad.

2.5.2 With reference to a diagram, identify the following positions in a circuit:

(a) downwind leg;

(b) base leg;

(c) cross-wind leg;

(d) upwind leg;

(e) dead side of the circuit.

2.5.3 Explain the significance of a white cross on the movement area.

2.5.4 Identify and explain the purpose of the following aerodrome markings:

(a) runway markings;

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(b) runway threshold markings;

(c) runway end markings;

(d) cone and gable markers;

(e) taxiway markings;

(f) holding points/bays;

(g) a double white cross adjacent to a primary wind indicator.

2.6 Airspace

2.6.1 Describe the difference between controlled airspace and non-controlled airspace.

2.6.2 State which documents are used to identify controlled airspace and explain if a prescribed airspace is active or inactive.

2.7 Emergencies and SAR

2.7.1 Describe what the intermittent use of navigation and landing lights by an aircraft are used to indicate.

2.7.2 State the difference between an incident and an accident.

2.7.3 Determine the reporting requirements following an incident or accident.

2.7.4 Explain the term SARTIME and how it might be used.

2.7.5 State the document that contains emergency procedures.

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Unit 1.5.2 PFRC: PPL Flight rules and air law – All aircraft categories – *Reserved*

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Unit 1.5.3 PFRA: PPL flight rules and air law – aeroplane

1. Reserved

2. Elements

2.1 Documentation

2.1.1 Describe the method of obtaining publications and know why it is important to update these documents.

2.1.2 Given an item of operational significance:

(a) select the appropriate reference document – CAR, CAO, AIP (Book), CAAP; and

(b) extract relevant and current information from these documents.

2.1.3 Decode information contained in ERSA, NOTAM and AIP supplements.

2.1.4 Understand the terms and abbreviations in AIP GEN that are relevant to flight in accordance with VFR.

2.2 Pilot licences, privileges and limitations (PPL)

2.2.1 For the PPL with aeroplane category rating, describe the following:

(a) privileges and limitations of the licence;

(b) recent experience requirements;

(c) classification of operations.

2.2.2 Apply the rules pertaining to flight and duty time limitations for PPL licence holders.

2.3 Flight rules and conditions of flight

2.3.1 Describe which documents must be carried on board an aircraft during flight in Australian airspace.

2.3.2 Apply the relevant rules that relate to the following:

(a) carriage and discharge of firearms;

(b) aerodromes where operations are not restricted to runways;

(c) the conditions relating to flight in PRD areas.

2.3.3 Give examples of situations which would require a ‘security’ prefix prior to a radio call.

2.4 Air service operations

2.4.1 Apply the relevant rules that relate to the following:

(a) a pilot’s responsibilities before flight;

(b) aerodrome meteorological minima;

(c) carriage of:

(i) cargo;

(ii) sick and handicapped persons;

(iii) parachutists;

(iv) flotation and survival equipment;

(v) animals and dangerous goods.

2.4.2 State the requirements to test radio equipment prior to taxi and maintain a listening watch.

2.5 Aerodromes

(a) identify and explain the purpose of the following aerodrome, LA and HLS markings:

(i) runway markings;

(ii) runway threshold markings;

(iii) runway end markings;

(iv) cone and gable markers;

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(v) taxiway markings;

(vi) holding points/bays;

(vii) a double white cross adjacent to a primary wind indicator;

(viii) a horizontal white dumbbell;

(ix) movement areas;

(x) HLS markings.

2.5.2 Identify the following positions in a circuit:

(a) downwind leg;

(b) base leg;

(c) cross-wind leg;

(d) upwind leg;

(e) dead side of the circuit.

2.5.3 Explain the significance of a white cross on the movement area.

2.6 Airspace

2.6.1 Differentiate between the various classifications of airspace.

2.6.2 With respect to the following terms listed in (a) to (g), explain each term and, if applicable, identify airspace boundaries on appropriate charts, and extract vertical limits of designated airspace from charts or ERSA*:*

(a) flight information service FIR, FIA, OCTA;

(b) ATC service CTA, CTR;

(c) radio ‘reports’ and ‘broadcasts’;

(d) VFR route and lanes of entry;

(e) PRD areas;

(f) CTAF areas;

(g) controlled aerodromes.

2.6.3 Apply permitted tracking tolerances for VFR aircraft to avoid controlled airspace.

2.6.4 Know the requirements and procedures to be adopted when operating:

(a) in any class of airspace;

(b) from or into:

(i) any licensed aerodrome;

(ii) a CTAF(R).

2.6.5 Altimetry:

(a) recall the datum from which an altimeter indicates height when the following are set on the subscale:

(i) area QNH;

(ii) local QNH;

(iii) QFE;

(iv) standard pressure setting;

(b) recall the procedures that are carried out with the altimeter at the transition altitude and the transition layer on climb and descent;

(c) derive from AIP the transition layer for any given area QNH;

(d) recall the method of using an altimeter to derive Local QNH;

(e) calculate height error caused by setting the altimeter subscale incorrectly;

(f) recall the meaning of the following:

(i) height;

(ii) altitude;

(iii) flight level;

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(g) recall the following parameters from the ICAO standard atmosphere:

(i) MSL temperature;

(ii) pressure lapse rate.

2.7 Emergencies, accidents, incidents

2.7.1 Extract emergency procedures from the ERSA.

2.7.2 State the conditions under which a pilot may declare a mercy flight and select occasions when a mercy flight must not be undertaken.

2.7.3 Extract from AIP the responsibilities of a pilot regarding the notification of accidents and incidents.

2.7.4 *Reserved*

2.7.5 Describe examples of ‘hazards to navigation’ that must be reported by pilots.

2.8 Security

2.8.1 Explain the term ADIZ and extract:

(a) the general requirements for operations in this zone; and

(b) the action by the pilot of the intercepted aircraft.

2.8.2 State the powers vested in a pilot in command.

2.9 Emergencies and SAR

2.9.1 Describe what the intermittent use of navigation and landing lights by an aircraft are used to indicate.

2.9.2 State the difference between an incident and an accident.

2.9.3 Determine the reporting requirements following an incident or accident.

2.9.4 Explain the term SARTIME and how it might be used.

2.9.5 State the document that contains emergency procedures.

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Unit 1.5.4 PFRH: PPL Flight rules and air law – Helicopter

1. Reserved

2. Elements

2.1 Documentation

2.1.1 Explain the reason for recording flight time in a logbook and state what other information that must be recorded.

2.1.2 Given an item of operational significance:

(a) select the appropriate reference document – CAR, CAO, AIP (Book), CAAP; and

(b) extract relevant and current information from these documents.

2.1.3 Decode information contained in ERSA, NOTAM and AIP supplements.

2.1.4 Understand the terms and abbreviations in AIP GEN that are relevant to flight in accordance with VFR.

2.2 Pilot licences, privileges and limitations (PPL)

2.2.1 For the PPL with helicopter category rating, describe the following:

(a) privileges and limitations of the licence;

(b) recent experience requirements.

2.2.2 Apply the rules pertaining to flight and duty time limitations for PPL licence holders.

2.3 Flight rules and conditions of flight

2.3.1 Describe which documents must be carried on board an aircraft during flight in Australian airspace.

2.3.2 Apply the relevant rules that relate to the following:

(a) carriage and discharge of firearms;

(b) aerodromes where operations are not restricted to runways;

(c) the conditions relating to flight in PRD areas.

2.3.3 ***Reserved***

2.3.4 Describe the following:

(a) rules of the air that apply to helicopter operations;

(b) the requirements relating to the operation of aircraft on, and in the vicinity of, an aerodrome and the conditions relating to turns after take-off and their application to helicopters;

(c) separation minima between aircraft for take-off and landing at a controlled aerodromes;

(d) visual meteorology conditions for operations below 10,000 ft and below 700 ft in relation to helicopter operations;

(e) restrictions on smoking in aircraft during take-off, landing and refuelling;

(f) altimetry procedures for flight below 10,000 ft.

2.3.5 Apply the rules relating to the following:

(a) the use of drugs and alcohol and recall the minimum period between alcohol consumption and flight departure;

(b) temporary medical unfitness.

2.3.6 Recall the requirements relating to the minimum heights for flights over the following:

(a) populated areas;

(b) other areas.

2.3.7 Recall the meaning of the following light signals directed at an aircraft:

(a) steady ‘green’ and steady ‘red’;

(b) ‘green’, ‘red’, and ‘white’ flashes.

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2.3.8 Apply the limitations imposed on the following:

(a) acrobatic flight;

(b) flights over public gatherings.

2.3.9 Recall the requirement to plan to and prior to the end of daylight.

2.4 Air service operations

2.4.1 Apply the relevant rules that relate to the following:

(a) a pilot's responsibilities before flight;

(b) aerodrome meteorological minima;

(c) flights over water;

(d) carriage of:

(i) cargo;

(ii) sick and handicapped persons;

(iii) parachutists;

(iv) dangerous goods;

(v) animals;

(vi) flotation and survival equipment.

2.4.2 State the requirements to test radio equipment prior to taxi and maintain a listening watch.

2.4.3 Extract the restrictions pertaining to the carriage of passengers on certain flights.

2.4.4 Apply the following rules relating to the responsibility of a pilot in command:

(a) before flight:

(i) requirements of the following:

(A) fuel and oil;

(B) fuelling aircraft;

(C) starting and ground operations of engines;

(ii) appropriate passenger briefing;

(b) during flight, requirements regarding the operation and safety of the aircraft and the authority of the pilot in command.

2.4.5 Recall the following requirements:

(a) before flight:

(i) the conditions regarding the following:

(A) removal of locking devices;

(B) security doors, hatches, tank caps;

(C) testing of flight controls;

(D) removal of frost and ice;

(E) instrument checks;

(ii) fuel system inspections, including when inspections are required and how they are performed;

(iii) carriage of passengers in a control seat;

(iv) carriage of infants and children;

(b) during flight:

(i) seat occupation and seat belt requirements:

(A) occupation of seats;

(B) wearing of seat belts;

(C) adjustment of seat belts;

(ii) manipulation of aircraft controls:

(A) by pilots;

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(B) not permitted by unauthorised persons.

2.4.6 Recall the precautions pertaining to the security of safety harnesses and other equipment prior to solo flight in dual control aircraft.

2.5 Aerodromes

2.5.1 State a pilot's responsibilities with regard to the use of aerodromes.

2.6 Airspace

2.6.1 Differentiate between the various classifications of airspace.

2.6.2 With respect to the following terms listed in (a) to (g), explain each term and, if applicable, identify airspace boundaries on appropriate charts, and extract vertical limits of designated airspace from charts or ERSA*:*

(a) flight information service FIR, FIA, OCTA;

(b) ATC service CTA, CTR,;

(c) radio 'reports' and 'broadcasts';

(d) VFR route and lanes of entry;

(e) PRD areas;

(f) CTAF areas;

(g) controlled aerodromes.

2.6.3 Apply permitted tracking tolerances for VFR aircraft to avoid controlled airspace.

2.6.4 Reserved

2.6.5 Altimetry:

(a) recall the datum from which an altimeter indicates height when the following are set on the subscale:

(i) area QNH;

(ii) local QNH;

(iii) QFE;

(iv) standard pressure setting;

(b) recall the procedures that are carried out with the altimeter at the transition altitude and the transition layer on climb and descent;

(c) derive from AIP the transition layer for any given area QNH;

(d) recall the method of using an altimeter to derive Local QNH;

(e) calculate height error caused by setting the altimeter subscale incorrectly;

(f) recall the meaning of the following:

(i) height;

(ii) altitude;

(iii) flight level;

(g) recall the following parameters from the ICAO standard atmosphere:

(i) MSL temperature;

(ii) pressure lapse rate.

2.7 Emergencies, accidents, incidents

2.7.1 State the conditions under which a pilot may declare a mercy flight and select occasions when a mercy flight must not be undertaken.

2.7.2 Extract from AIP the responsibilities of a pilot regarding the notification of accidents and incidents.

2.7.3 Reserved

2.7.4 Describe examples of 'hazards to navigation' that must be reported by pilots.

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2.8 Security

2.8.1 Explain the term ADIZ and extract:

(a) the general requirements for operations in this zone; and

(b) the action by the pilot of the intercepted aircraft.

2.8.2 State the powers vested in a pilot in command.

2.9 Emergencies and SAR

2.9.1 Describe what the intermittent use of navigation and landing lights by an aircraft are used to indicate.

2.9.2 State the difference between an incident and an accident.

2.9.3 Determine the reporting requirements following an incident or accident.

2.9.4 Explain the term SARTIME and how it might be used.

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Unit 1.5.5 PFRG: PPL flight rules and air law – gyroplane

1. Flight Rules

1.1 Documentation

1.1.1 Given an item of operational significance:

(a) select the appropriate reference document – CAR, CASR, CAO, AIP (Book), CAAP; and

(b) extract relevant and current information from these documents.

1.1.2 Decode information contained in ERSA, NOTAM and AIP supplements.

1.1.3 Understand the terms and abbreviations in AIP GEN that are relevant to flight in accordance with VFR.

2. Licence privileges and limitations

2.1 State the privileges and limitations of the PPL gyroplane.

2.2 For the PPL with gyroplane category rating, describe:

(a) recent experience requirements;

(b) classification of operations.

3. Flight rules and conditions of flight

3.1 Describe which documents must be carried on board an aircraft during flight in Australian airspace.

3.2 Apply the relevant rules that relate to the following:

(a) carriage and discharge of firearms;

(b) aerodromes where operations are not restricted to runways;

(c) the conditions relating to flight in PRD areas;

(d) the conditions relating to flight in Designated Remote Areas.

3.3 Apply the relevant rules that relate to the following:

(a) aerodrome meteorological minima;

(b) flights over water;

(c) carriage of:

(i) cargo; and

(ii) sick and disabled persons; and

(iii) parachutists; and

(iv) dangerous goods; and

(v) animals; and

(vi) flotation and survival equipment; and

(vii) firearms.

3.4 State the requirements to test radio equipment before taxi and maintain a listening watch.

3.5 Extract the restrictions pertaining to the carriage of passengers on certain flights.

3.6 Recall the precautions pertaining to the security of safety harnesses and other equipment before solo flight in dual control aircraft.

4. Aerodromes

4.1 State a pilot's responsibilities relating to the use of aerodromes.

5. Airspace

5.1 Differentiate between the various classifications of airspace.

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5.2 With respect to the following terms, explain each term, identify any airspace boundaries on appropriate charts, and extract vertical limits of designated airspace from charts or ERSA:

(a) flight information service FIR, FIA, OCTA;

(b) ATC service CTA, CTR;

(c) radio ‘reports’ and ‘broadcasts’;

(d) VFR route and lanes of entry;

(e) PRD areas;

(f) CTAF areas;

(g) controlled aerodromes.

6. Altimetry

6.1 Recall the datum from which an altimeter indicates height when the following are set on the subscale:

(a) area QNH;

(b) local QNH;

(c) QFE;

(d) standard pressure setting.

6.2 Recall the procedures that are carried out with the altimeter at the transition altitude and the transition layer on climb and descent.

6.3 Derive from AIP the transition layer for any given area QNH.

6.4 Recall the method of using an altimeter to derive local QNH.

6.5 Recall the meaning of the following:

(a) height;

(b) altitude;

(c) flight level.

6.6 Recall the following parameters from the ICAO standard atmosphere:

(a) MSL temperature;

(b) pressure lapse rate.

7. Security

7.1 Explain the term ADIZ and extract from the AIP:

(a) the general requirements for operations in this zone; and

(b) the action by the pilot of the intercepted aircraft.

7.2 State the powers vested in a pilot in command.

8. Emergencies and SAR

8.1 Describe what the intermittent use of navigation and landing lights by an aircraft are used to indicate.

8.2 State the difference between an incident and an accident.

8.3 Reserved.

8.4 Explain the term SARTIME and how it might be used.

8.5 State the document that contains emergency procedures.

8.6 Extract from the AIP and ERSA the responsibilities of a pilot regarding.

(a) the notification of accidents and incidents; and

(b) emergency procedures.

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8.7 Describe examples of “hazards to navigation” that must be reported by pilots.

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Unit 1.5.6 PFRP: PPL flight rules and air law – powered-lift – ***Reserved***

Unit 1.5.7 PFRS: PPL flight rules and air law – airship – ***Reserved***

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Unit 1.5.8 CFRC: CPL flight rules and air law – all aircraft categories

1. Reserved

2. Elements

2.1 Documentation

2.1.1 Explain the reason for recording flight time in a logbook and state what other information that must be recorded.

2.1.2 Describe the method of obtaining publications and know why it is important to update these documents.

2.1.3 Given an item of operational significance:

(a) select the appropriate reference document – CASR, CAR, CAO, AIP (Book), CAAP; and

(b) extract relevant and current information from these documents.

2.1.4 Decode information contained in ERSA, NOTAM and AIP supplements.

2.1.5 Understand the terms and abbreviations in AIP GEN that are relevant to flight in accordance with VFR.

2.2 Pilot licences, privileges and limitations (CPL)

2.2.1 For the CPL, describe the following:

(a) privileges and limitations of the licence;

(b) recent experience requirements.

2.2.2 Apply the rules pertaining to flight and duty time limitations for CPL licence holders.

2.3 Flight rules and conditions of flight

2.3.1 Describe which documents must be carried on board an aircraft during flight in Australian airspace.

2.3.2 Apply the relevant rules that relate to the following:

(a) carriage and discharge of firearms;

(b) aerodromes where operations are not restricted to runways;

(c) the conditions relating to flight in PRD areas.

2.3.3 Describe the following:

(a) rules of the air;

(b) the requirements relating to the operation of aircraft on, and in the vicinity of, an aerodrome and the conditions relating to turns after take-off;

(c) separation minima between aircraft for take-off and landing at a controlled aerodromes;

(d) visual meteorology conditions for operations below 10,000 ft and below 700 ft;

(e) restrictions on smoking in aircraft during take-off, landing and refuelling;

(f) altimetry procedures for flight below 10,000 ft.

2.3.4 Apply the rules relating to the following:

(a) the use of drugs and alcohol and recall the minimum period between alcohol consumption and flight departure;

(b) temporary medical unfitness.

2.3.5 Recall the requirements relating to the minimum heights for flights over the following:

(a) populated areas;

(b) other areas.

2.3.6 Recall the meaning of the following light signals directed at an aircraft:

(a) steady ‘green’ and steady ‘red’;

(b) ‘green’, ‘red’, and ‘white’ flashes.

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2.3.7 Apply the limitations imposed on the following:

(a) aerobaitc flight;

(b) flights over public gatherings.

2.3.8 Recall the requirement to plan to and prior to the end of daylight.

2.4 Air service operations

2.4.1 Apply the relevant rules that relate to the following:

(a) a pilot's responsibilities before flight;

(b) aerodrome meteorological minima;

(c) flights over water;

(d) carriage of:

(i) cargo;

(ii) sick and handicapped persons;

(iii) parachutists;

(iv) dangerous goods;

(v) animals;

(vi) flotation and survival equipment.

2.4.2 State the requirements to test radio equipment prior to taxi and maintain a listening watch.

2.4.3 Extract the restrictions pertaining to the carriage of passengers on certain flights.

2.4.4 Apply the following rules relating to the responsibility of a pilot in command:

(a) before flight:

(i) requirements of the following:

(A) fuel and oil;

(B) fuelling aircraft;

(C) starting and ground operations of engines;

(ii) appropriate passenger briefing;

(b) during flight, requirements regarding the operation and safety of the aircraft and the authority of the pilot in command.

2.4.5 Recall the following requirements:

(a) before flight:

(i) the conditions regarding the following:

(A) removal of locking devices;

(B) security doors, hatches, tank caps;

(C) testing of flight controls;

(D) removal of frost and ice;

(E) instrument checks;

(ii) fuel system inspections, including when inspections are required and how they are performed;

(iii) carriage of passengers in a control seat;

(iv) carriage of infants and children;

(b) during flight:

(i) seat occupation and seat belt requirements:

(A) occupation of seats;

(B) wearing of seat belts;

(C) adjustment of seat belts;

(ii) manipulation of aircraft controls:

(A) by pilots;

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(B) not permitted by unauthorised persons.

2.4.6 Recall the precautions pertaining to the security of safety harnesses and other equipment prior to solo flight in dual control aircraft.

2.5 Aerodromes

2.5.1 State a pilot's responsibilities with regard to the use of aerodromes.

2.6 Airspace

2.6.1 Differentiate between the various classifications of airspace.

2.6.2 With respect to the following terms listed in (a) to (g), explain each term and, if applicable, identify airspace boundaries on appropriate charts, and extract vertical limits of designated airspace from charts or ERSA:

(a) flight information service FIR, FIA, OCTA;

(b) ATC service CTA, CTR, controlled airspace;

(c) radio 'reports' and 'broadcasts';

(d) VFR route and lanes of entry;

(e) PRD areas;

(f) CTAF areas;

(g) controlled aerodromes.

2.6.3 Apply permitted tracking tolerances for VFR aircraft to avoid controlled airspace.

2.6.4 Describe the requirements for obtaining clearances, making reports and broadcasts, and describe the procedures for requesting clearances, making reports and broadcasts, and the pilot actions to be taken on receiving an instruction from ATC to be adopted when operating in the following:

(a) in any class of airspace;

(b) from or into:

(i) a certified or registered aerodrome;

(ii) an uncertified aerodrome.

2.7 Altimetry

2.7.1 Recall the datum from which an altimeter indicates height when the following are set on the subscale:

(a) area QNH;

(b) local QNH;

(c) QFE;

(d) standard pressure setting.

2.7.2 Recall the procedures that are carried out with the altimeter at the transition altitude and the transition layer on climb and descent.

2.7.3 Derive from AIP the transition layer for any given area QNH.

2.7.4 Recall the method of using an altimeter to derive Local QNH.

2.7.5 Calculate height error caused by setting the altimeter subscale incorrectly.

2.7.6 Recall the meaning of the following:

(a) height;

(b) altitude;

(c) flight level.

2.7.7 Recall the following parameters from the ICAO standard atmosphere:

(a) MSL temperature;

(b) pressure lapse rate.

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2.8 Emergencies, accidents, incidents

2.8.1 State the conditions under which a pilot may declare a mercy flight and select occasions when a mercy flight must not be undertaken.

2.8.2 Extract from AIP the responsibilities of a pilot regarding the notification of accidents and incidents.

2.8.3 Describe examples of ‘hazards to navigation’ that must be reported by pilots.

2.9 Security

2.9.1 Explain the term ADIZ and extract:

(a) the general requirements for operations in this zone; and

(b) the action by the pilot of the intercepted aircraft.

2.9.2 State the powers vested in a pilot in command.

2.10 Airworthiness and equipment

2.10.1 State the purpose of certificates of airworthiness and registration.

2.10.2 Given a typical scenario, extract from regulations, orders and instructions the communication and normal and emergency equipment required to be on board an aircraft.

2.10.3 State the responsibilities of a pilot in command with regard to:

(a) daily inspections; and

(b) recording and reporting aircraft defects.

2.10.4 Describe the types of maintenance that may be carried out by the holder of a CPL.

2.10.5 Given a copy of a maintenance release:

(a) determine its validity; and

(b) describe the types of operations authorised in the aircraft; and

(c) list outstanding defects/endorsements and decide whether these affect the airworthiness of the aircraft.

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Unit 1.5.9 CFRA: CPL flight rules and air law – aeroplane

1. Reserved

2. Elements

2.1 Flight crew licensing

2.1.1 Describe the requirements for holding flight crew licences, ratings and endorsements that apply to aeroplane operations.

2.1.2 Describe the obligations aeroplane pilots must comply with in relation to general competency, flight reviews and proficiency checks.

2.2 Air operations

2.2.1 Describe circuit procedures for aeroplane operations.

2.2.2 Describe the requirements for operating in Class C and D airspace and special VFR clearance provisions.

2.2.3 State the minimum flight instruments required to operate an aeroplane under VFR.

2.2.4 State the rules for placarding unserviceable instruments.

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Unit 1.5.10 CFRH: CPL flight rules and air law – helicopter

1. Reserved

2. Elements

2.1 Flight crew licensing

2.1.1 Describe the requirements for holding flight crew licences, ratings and endorsements that apply to helicopter operations.

2.1.2 Describe the obligations helicopter pilots must comply with in relation to general competency, flight reviews and proficiency checks.

2.2 Air operations

2.2.1 Describe circuit procedures for helicopter operations.

2.2.2 Describe the requirements for operating in Class C and D airspace and special VFR clearance provisions.

2.2.3 State the minimum flight instruments required to operate a helicopter under VFR.

2.2.4 Describe the minimum VMC requirements for operating in Class G airspace.

2.2.5 State the conditions under which hot refuelling may be conducted.

2.2.6 State the floatation system requirements for helicopters.

2.2.7 State the rules for placarding unserviceable instruments.

2.3 Helicopter landing sites (HLS)

2.3.1 Describe the requirements for operating to and from HLS.

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Unit 1.5.11 CFRG: CPL flight rules and air law – gyroplane

1. Limitations

1.1 Describe the requirements for holding flight crew licences, ratings and endorsements that apply to gyroplane operations.

1.2 Describe the obligations gyroplane pilots must comply with in relation to general competency, flight reviews and proficiency checks.

1.3 Describe the rules pertaining to flight and duty time limitations for CPL licence holders.

2. Air operations

2.1 Describe circuit procedures for gyroplane operations.

2.2 Describe the requirements for operating in Classes C and D airspace and special VFR clearance provisions.

2.3 State the minimum flight instruments required to operate a gyroplane under VFR.

2.4 State the rules for placarding unserviceable instruments.

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Unit 1.5.12 CFRP: CPL flight rules and air law – powered-lift – *Reserved*

Unit 1.5.13 CFRS: CPL flight rules and air law – airship – *Reserved*

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Unit 1.5.14 AFRC: ATPL flight rules and air law – all aircraft categories

1. Reserved

2. Flight rules

2.1 Documentation

2.1.1 Airworthiness and equipment.

2.1.2 State the purpose of certificates of airworthiness and registration.

2.1.3 Given a typical scenario, extract from CASA regulations/orders/instructions the communication and normal and emergency equipment required to be on board an aircraft. State the responsibilities of a pilot in command with regard to:

(a) daily inspections; and

(b) recording/reporting aircraft defects.

2.1.4 As applicable, determine the types of maintenance that may be carried out by licence holder.

2.1.5 Given a copy of a maintenance release:

(a) determine its validity; and

(b) list the class(es) of operation applicable to the aircraft; and

(c) list outstanding defects/endorsements and decide whether these affect the airworthiness of the aircraft.

2.2 Aircraft nationality and registration

2.2.1 ICAO provisions (Annex).

2.2.2 General applicability – brief reference only.

2.2.3 Australian national legislation:

(a) requirement to register aircraft;

(b) registration of aircraft in Australia;

(c) transfer of interest and cancellation of registration.

2.3 Airworthiness of aircraft

2.3.1 ICAO Provisions (Annex 8):

(a) general applicability – brief reference only.

2.3.2 Australian national legislation:

(a) requirements for Certificates of Airworthiness;

(b) conditions relating to Certificates of Airworthiness;

(c) suspension or cancellation of Certificates of Airworthiness;

(d) permissible unserviceability:

(i) use of PUS;

(ii) MEL as an alternative to PUS;

(iii) use of an MEL;

(e) requirements for maintenance;

(f) pilot's responsibilities with respect to maintenance within Australia;

(g) pilot's responsibilities with respect to maintenance outside Australia;

(h) maintenance release requirements;

(i) suspension, cancellation of a maintenance release;

(j) cessation or recommencement of a maintenance release;

(k) pilot's responsibilities with respect to defects or damage;

(l) compliance and certification of Airworthiness Directives;

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(m) classes of controlled airspace.

2.4 Personnel licensing

2.4.1 ICAO Provisions (Annex 1):

(a) general applicability.

2.4.2 Australian national legislation:

(a) general provisions:

(i) licences;

(ii) ratings;

(b) ATPL:

(i) privileges;

(ii) limitations;

(iii) recency requirements;

(c) classification of operations;

(d) multi-crew aircraft:

(i) composition of crew;

(ii) flight and duty time limitations.

2.5 Rules of the air

2.5.1 ICAO Annex 2:

(a) general applicability.

2.5.2 Australian national legislation.

2.5.3 Rules of the Air Review (CAR Part XII).

2.5.4 Conditions of flight (CAR PART XI):

(a) flight manuals;

(b) documents required for flight;

(c) carriage and discharge of firearms;

(d) drunkenness and violence on board an aircraft;

(e) dropping of articles;

(f) flight over public gatherings;

(g) low flying.

2.6 Procedures for air navigation

2.6.1 ICAO Doc 8168 – OPS/611:

(a) general provisions – brief reference only.

2.6.2 Australian national legislation Review AIP (DAP):

(a) general requirements;

(b) alternate planning requirements.

2.7 Air traffic services

2.7.1 ICAO Annex II and Doc 4444:

(a) general provisions – brief reference only.

2.7.2 Australian national legislation.

2.7.3 General provisions:

(a) objectives of ATS;

(b) division of ATS;

(c) designation of the portions of the airspace and controlled aerodromes where ATS will be provided;

(d) establishment and designation of the units providing ATS;

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(e) specifications:
  (i) flight information regions;
  (ii) control areas;
  (iii) control zones;
(f) minimum flight attitudes;
(g) priority for aircraft in emergency;
(h) inflight contingencies in ATS.

2.7.4 ATC service:
(a) function and purpose of ATC;
(b) provision of ATC service;
(c) operation of ATC service;
(d) separation minima;
(e) contents of clearances;
(f) coordination of clearances;
(g) control of persons and vehicles at aerodromes.

2.7.5 Flight information service:
(a) application and scope of flight information service:
  (i) VFR traffic;
(b) operational flight information service broadcasts.

2.7.6 Alerting service:
(a) function/purpose;
(b) phases of alert: INCERFA, ALERFA, DISTRESFA;
(c) notification of rescue coordination centre;
(d) information to aircraft in a state of emergency.

2.7.7 Principles governing the identification of ATS routes other than standard departure and arrival routes.

2.8 Rules of the air and air traffic services

2.8.1 ICAO Doc 444 and RAC501/11:
(a) general provisions – brief reference only.

2.8.2 Australian national legislation.

2.8.3 General provisions:
(a) general air traffic services operating practices:
  (i) submission of a flight plan;
  (ii) flight clearances and information;
  (iii) control of air traffic flow;
  (iv) altimeter setting procedures;
  (v) position reporting requirements;
  (vi) requirements and format for AIREP.

2.8.4 Area control service:
(a) vertical separation:
  (i) requirements;
  (ii) vertical separation minima;
  (iii) minimum cruising level;
  (iv) assignment of cruising level;
  (v) vertical separation during climb or descent;

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(b) horizontal separation (subsonic aircraft only):
  (i) requirements;
  (ii) geographical separation;
  (iii) track separation for aircraft using the same navaid;
  (iv) longitudinal separation;
(c) reduction in separation minima;
(d) ATC clearances:
  (i) requirement for clearance;
  (ii) function of clearance;
  (iii) contents of clearance;
  (iv) maintaining own separation while in VMC;
  (v) essential traffic information while in VMC;
  (vi) essential traffic information;
  (vii) clearance of a requested change in flight plan;
(e) emergency:
  (i) general, priority, emergency descent only (action by pilot in command only);
(f) communication failure:
  (i) air-ground communication failure (actions by pilot in command only);
(g) interception of civil aircraft.

2.8.5 Approach control service

(a) departing aircraft:
  (i) general procedures for departing aircraft;
  (ii) information for departing aircraft;
  (iii) clearances to climb maintaining own separation while in VMC;
  (iv) wake turbulence separation;
(b) arriving aircraft:
  (i) general procedures for arriving aircraft;
  (ii) clearance to descend maintaining own separation while in VMC;
  (iii) visual approach;
  (iv) instrument approach;
  (v) holding;
  (vi) approach sequence;
  (vii) expected approach;
  (viii) time information for arriving aircraft.

2.8.6 Aerodrome control service:

(a) functions of aerodrome control towers:
  (i) general functions;
  (ii) alerting service;
  (iii) suspension of VFR operations;
(b) control of traffic:
  (i) traffic circuit(s);
  (ii) start-up;
  (iii) taxiing traffic;
  (iv) vehicular traffic;
  (v) coordination of take-off and landings;
  (vi) order of priority for arriving and departing aircraft;
  (vii) control of departing and arriving aircraft;

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(c) information provided to aircraft:
(i) operation of the aircraft;
(ii) aerodrome conditions.

2.8.7 Flight Information service and alerting service
(a) air traffic advisory service;
(b) alerting service.

2.8.8 Use of radar in air traffic services:
(a) limitations in the use of radar;
(b) functions of radar service:
(i) identification procedure (establishment of radar identity only);
(ii) position information;
(iii) radar vectoring;
(iv) speed control;
(c) use of radar in the ATC service;
(d) descent below MSA under radar control.

2.9 Aeronautical information service

2.9.1 ICAO Annex 15:
(a) general provisions – brief reference only.

2.9.2 Australian documentation:
(a) availability and procurement of AIP, NOTAM, AIC.

2.10 Aerodromes

2.10.1 ICAO Annex 14:
(a) general provisions – brief reference only.

2.10.2 Australian national legislation:
(a) AIP AD requirements:
(i) aerodrome markers and markings;
(ii) aerodrome lighting;
(iii) visual aids;
(iv) domestic aerodrome directory (ERSA);
(v) pavement strength limitations.

2.11 Facilitation

2.11.1 ICAO Annex 9:
(a) general provisions – brief reference only.

2.11.2 Australian national legislation.

2.11.3 AIP GEN requirements:
(a) responsibility of DIT;
(b) differences to international standards and practices: 9 Annex 9;
(c) entry and departure of international aircraft:
(i) documents required;
(ii) description, purpose and use;
(d) entry and departure of persons and baggage:
(i) normal requirements;
(ii) procedures for flight crew and similar personnel;
(e) identification of designated international airports.

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2.12 Search and Rescue

2.12.1 ICAO Annex 12:

(a) general provisions – brief reference only.

2.12.2 Australian national legislation

(a) SAR organisation:

(i) establishment of SAR regions;

(ii) establishment and designation of SAR services units;

(b) operating procedures:

(i) SAR phases;

(ii) distress and urgency signals;

(iii) use of SSR transponder;

(iv) procedures for pilots in command at the scene of an accident;

(v) procedures for pilots in command intercepting;

(vi) distress transmissions;

(vii) participation in searches.

2.13 Security

2.13.1 ICAO Annex 17:

(a) general provisions – brief reference only.

2.13.2 Air Defence identification zones (ADIZ):

(a) Pilot's responsibilities for flight within the zone;

(b) exemptions;

(c) non-compliance;

(d) action in the event of interception;

(e) interpretation of visual signals;

(f) powers of pilot in command.

2.14 Aircraft accidents and incidents

2.14.1 Terminology:

(a) definition of accident;

(b) definition of incident.

2.14.2 Responsibilities of pilot in command regarding notification.

2.15 Air service operations

(a) route qualifications;

(b) admission to crew compartment;

(c) carriage of approved persons:

(i) in crew compartment;

(ii) in cabin;

(d) operational procedures in relation to computers;

(e) fuel quantity measurement: (requirements for aircraft above 5,700 kg);

(f) hand signals;

(g) oxygen and protective breathing equipment;

(h) engine failure in multi-engine aircraft;

(i) carriage and use of radio;

(j) precautions in refuelling, engine and radar ground operations;

(k) emergency equipment;

(l) loading general;

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(m) carriage of cargo;

(n) carriage of persons;

(o) aircraft equipment:

(i) basic operational requirements;

(p) dangerous goods handling.

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Unit 1.5.15 AFRA: ATPL flight rules and air law – aeroplane

1. Reserved

2. Flight rules

2.1 Air traffic services

2.1.1 Flight information service:

(a) application and scope of flight information service:

(i) IFR traffic.

3. Procedures for air navigation

3.1 Australian national legislation

3.1.1 Review AIP (DAP):

(a) approach procedures:

(i) altimeter checks;

(b) entry and holding procedures;

(c) instrument landing system:

(i) failures;

(d) meteorological minima:

(i) take-off;

(ii) landing;

(iii) alternate;

(e) category 1 and 2 minima;

(f) SIDs, STARs and NAPs;

(g) DME and GNSSGNSS arrival procedures;

(h) GNSSGNSS as a route navigation and approach aid;

(i) RNP and PBN:

(i) aircraft requirements;

(ii) application.

4. Rules of the air and air traffic services

4.1 Australian national legislation

4.1.1 General provisions:

(a) general air traffic services operating practices:

(i) change from IFR to VFR.

5. Air service operations

(a) fuel jettison:

(i) legislation;

(b) ferry flights with 1 engine inoperative.

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Unit 1.5.16 AFRH: ATPL flight rules and air law – helicopter

1. Reserved

2. Flight rules

2.1 AERODROMES

2.1.1 ICAO Annex 14:

(a) helicopter landing sites and off shore HLS.

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Unit 1.5.17 AFRP: ATPL Flight rules and air law – powered-lift – *Reserved*

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Unit 1.5.18 FFRC: FE flight rules and air law – all aircraft categories

1. Reserved

2. Flight rules

2.1 Documentation

2.1.1 Airworthiness and equipment.

2.1.2 State the purpose of certificates of airworthiness and registration.

2.1.3 Given a typical scenario, extract from CASA regulations/orders/instructions the communication and normal and emergency equipment required to be on board an aircraft. State the responsibilities of a pilot in command with regard to:

(a) daily inspections; and

(b) recording/reporting aircraft defects.

2.1.4 As applicable, determine the types of maintenance that may be carried out by licence holder.

2.1.5 Given a copy of a maintenance release:

(a) determine its validity; and

(b) list the class(es) of operation applicable to the aircraft; and

(c) list outstanding defects/endorsements and decide whether these affect the airworthiness of the aircraft.

2.2 Aircraft nationality and registration

2.2.1 ICAO provisions (Annex).

2.2.2 General applicability – brief reference only.

2.2.3 Australian national legislation:

(a) requirement to register aircraft;

(b) registration of aircraft in Australia;

(c) transfer of interest and cancellation of registration.

2.3 Airworthiness of aircraft

2.3.1 ICAO Provisions (Annex 8):

(a) General applicability – brief reference only.

2.3.2 Australian national legislation:

(a) requirements for Certificates of Airworthiness;

(b) conditions relating to Certificates of Airworthiness;

(c) suspension or cancellation of Certificates of Airworthiness;

(d) permissible unserviceability:

(i) use of PUS;

(ii) MEL as an alternative to PUS;

(iii) use of an MEL;

(e) requirements for maintenance;

(f) flight engineer's responsibilities with respect to maintenance within Australia;

(g) flight engineer's responsibilities with respect to maintenance outside Australia;

(h) maintenance release requirements;

(i) suspension, cancellation of a maintenance release;

(j) cessation or re-commencement of a maintenance release;

(k) flight engineer's responsibilities with respect to defects or damage;

(l) compliance and certification of Airworthiness Directives;

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2.4 Personnel licensing

2.4.1 ICAO provisions (Annex 1):

(a) general applicability.

2.4.2 Australian national legislation:

(a) general provisions:

(i) licences;

(ii) ratings;

(b) flight engineer licence:

(i) privileges;

(ii) limitations;

(iii) recency requirements;

(c) multi-crew aircraft:

(i) composition of crew;

(ii) flight and duty time limitations.

2.5 Rules of the air

2.5.1 ICAO Annex 2:

(a) general applicability.

2.5.2 Australian national legislation.

2.5.3 Rules of the air review (CAR Part XI).

2.5.4 Conditions of flight (CAR PART X):

(a) flight manuals;

(b) documents required for flight;

(c) drunkenness and violence on board an aircraft;

2.6 Procedures for air navigation

2.6.1 ICAO Doc 8168 – OPS/611:

(a) general provisions – brief reference only.

2.7 Air traffic services

2.7.1 ICAO Annex I I and Doc 4444:

(a) general provisions – brief reference only.

2.7.2 Australian national legislation.

2.7.3 General provisions

(a) objectives of ATS;

(b) specifications:

(i) flight information regions;

(ii) control areas;

(iii) control zones;

(c) priority for aircraft in emergency;

(d) inflight contingencies in ATS.

2.7.4 ATC service:

(a) function and purpose of ATC.

2.7.5 Flight information service:

(a) application and scope of flight information service:

(i) VFR traffic;

(b) operational flight information service broadcasts.

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2.7.6 Alerting service:

(a) function/purpose;

(b) phases of alert: INCERFA, ALERFA, DISTRESFA;

(c) notification of rescue coordination centre;

(d) information to aircraft in a state of emergency.

2.7.7 Flight information service and alerting service

(a) air traffic advisory service;

(b) alerting service.

2.7.8 Use of radar in air traffic services

(a) limitations in the use of radar;

(b) functions of radar service:

(i) identification procedure (establishment of radar identity only);

(ii) position information;

(iii) radar vectoring;

(iv) speed control;

(c) use of radar in the ATC service;

(d) descent below MSA under radar control.

2.8 Aeronautical information service

2.8.1 ICAO Annex 15:

(a) general provisions – brief reference only.

2.8.2 Australian documentation:

(a) availability and procurement of AIP, NOTAM, AIC.

2.9 Aerodromes

2.9.1 ICAO Annex 14:

(a) general provisions – brief reference only.

2.9.2 Australian national legislation:

(a) AIP AD requirements:

(i) aerodrome markers and markings;

(ii) aerodrome lighting;

(iii) visual aids;

(iv) domestic aerodrome directory (ERSA);

(v) pavement strength limitations.

2.10 Facilitation

2.10.1 ICAO Annex 9:

(a) general provisions – brief reference only.

2.10.2 Australian national legislation.

2.10.3 AIP GEN requirements:

(a) responsibility of DIT;

(b) differences to international standards and practices: 9 Annex 9;

(c) entry and departure of international aircraft:

(i) documents required;

(ii) description, purpose and use;

(d) entry and departure of persons and baggage:

(i) normal requirements;

(ii) procedures for flight crew and similar personnel;

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(e) identification of designated international airports.

2.11 Search and rescue

2.11.1 ICAO Annex 12:

(a) general provisions – brief reference only.

2.11.2 Australian national legislation:

(a) SAR organisation;

(b) operating procedures:

(i) SAR phases;

(ii) distress and urgency signals;

(iii) use of SSR transponder;

(iv) distress transmissions;

(v) participation in searches.

2.12 Security

2.12.1 ICAO Annex 17:

(a) general provisions – brief reference only.

2.12.2 Air Defence identification zones (ADIZ)

(a) action in the event of interception;

(b) interpretation of visual signals.

2.13 Aircraft accidents and incidents

2.13.1 Terminology:

(a) definition of accident;

(b) definition of incident.

2.14 Air service operations

(a) admission to crew compartment;

(b) carriage of approved persons:

(i) in crew compartment;

(ii) in cabin;

(c) operational procedures in relation to computers;

(d) fuel quantity measurement (requirements for aircraft above 5,700 kg);

(e) hand signals;

(f) oxygen and protective breathing equipment;

(g) engine failure in multi-engine aircraft;

(h) carriage and use of radio;

(i) precautions in refuelling, engine and radar ground operations;

(j) emergency equipment;

(k) aircraft equipment:

(i) basic operational requirements.

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SECTION 1.6 HUMAN FACTORS PRINCIPES (HF)

Unit 1.6.1 PHFC: PPL human factors – all categories

1. Reserved

2. Fitness for flight

2.1 Basic health

2.1.1 Relate the effect on pilot performance of the following factors:

(a) diet, exercise;

(b) coronary risk factors – smoking, cholesterol, obesity, hereditary factors;

(c) upper respiratory tract infection, for example, colds, hay fever, congestion of air passages and sinuses;

(d) food poisoning and other digestive problems;

(e) headaches and migraines;

(f) pregnancy:

(i) when to stop flying;

(ii) impact on cockpit ergonomics;

(g) injuries;

(h) ageing;

(i) alcohol and smoking;

(j) blood donations;

(k) dehydration;

(l) emotional:

(i) anxiety;

(ii) depression;

(iii) fears.

2.1.2 Recall pilot obligations for a medical clearance from a DME when on any medication.

2.1.3 Enumerate the responsibilities of pilots with regard to being medically fit for flight.

2.2 Health and fitness

2.2.1 Medical standards

(a) state the reasons for and frequency of physical examinations and how to locate DAMEs;

(b) describe the process of obtaining a medical examination;

(c) state the role of the CASA with regard to medical fitness and that only those conditions which present a flight safety hazard are disqualifying.

2.2.2 Alcohol:

(a) recall how alcohol is absorbed and excreted;

(b) outline what a ‘hangover’ is;

(c) explain the effect a ‘hangover’ may have on flying performance;

(d) explain the relationship between a ‘hangover’ and level of blood alcohol in a person;

(e) recall the relationship between the level of blood alcohol and the recovery period from a ‘hangover’;

(f) state the factors that affect the elimination of alcohol from the body and describe the effects of illicit drugs and alcohol on judgment, comprehension, attention to detail the senses, coordination and reaction times;

(g) describe the symptoms of dehydration;

(h) list fluids suitable for rehydration, and explain why.

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2.2.3 Drugs:

(a) describe why drug abuse is a behavioural problem and is independent of:

(i) dependence (addiction);

(ii) frequent use;

(b) define illicit or non-illicit psychoactive substances;

(c) state the adverse effects of illicit or non-illicit psychoactive substances;

(d) recall the effects and duration of such effects on human performance related to perception, speed of processing information, and reaction time of such drugs as:

(i) cannabis-based substances, for example, marijuana, ganja;

(ii) amphetamine-based substances, for example, ecstasy;

(iii) opium-based substances, for example, codeine, heroin;

(e) state the undesirable effects of over-the-counter and prescription drugs. In particular, the side effects of:

(i) aspirin, antihistamines, nasal decongestants;

(ii) amphetamines, tranquillisers, sedatives, antibiotics.

2.2.4 Blood donations:

(a) state the effect on flying after giving a blood donation;

(b) state the recommended period between giving blood and the next flight and how this period can vary between individuals.

2.3 Hyperventilation

2.3.1 Recognise and state how to combat hyperventilation.

2.3.2 Define hyperventilation and recall its causes.

2.4 Atmospheric pressure changes

2.4.1 Trapped gases:

(a) recall the effect of changes in pressure on gases trapped in the body cavities;

(b) state the effect on normal bodily function;

(c) list measures for prevention and treatment.

2.4.2 Recall the effects of flying after a period of underwater diving and state the precautions to be taken if intending to fly after underwater diving.

2.5 Basic knowledge of the anatomy of the ear

2.5.1 Outline the basic operation.

2.5.2 Explain the purpose of the eustachian tube and effects of atmospheric/cabin pressure changes.

2.5.3 State the effects of noise exposure on:

(a) hearing loss: long- and short-term;

(b) speech intelligibility;

(c) fatigue.

2.6 State recommended methods of hearing protection

2.7 Vision, spatial disorientation, illusions

2.7.1 Outline the anatomy of the eye and its functioning during the day and at night.

2.7.2 State the factors that affect night vision and identify methods of ‘dark adaptation’.

2.7.3 Recall the limitations of the eye in discerning objects at night and the ‘off-centre’ method of identifying objects at night.

2.7.4 Recall the limitations of the eye with respect to:

(a) the ability to discern objects during flight, for example, other aircraft, transmission lines etc.;

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(b) empty field myopia;

(c) glare;

(d) colour vision in aviation;

(e) common visual problems, viz:

(i) myopia, hyperopia, astigmatism, presbyopia;

(f) flicker vertigo.

2.7.5 Outline the importance of:

(a) updating spectacle prescriptions;

(b) selecting suitable sunglasses.

2.7.6 Recall the factors which are conducive to mid-air collisions and describe techniques for visual ‘scanning’.

2.7.7 Define the term ‘disorientation’.

2.7.8 Recall the sensory systems involved in maintaining body equilibrium i.e. equilibrium is normally maintained by use of the eyes, inner ear and proprioceptive system (‘seat of pants’).

2.7.9 Recall that these mechanisms do not provide reliable information under all conditions of flight.

2.7.10 Describe illusion(s) that may be associated with the factors listed below:

(a) ‘leans’;

(b) linear and angular accelerations;

(c) unperceived changes in the pitch; roll; yaw;

(d) autokinetic illusions;

(e) ‘graveyard spin’ illusion.

(f) somatogravic illusion.

2.7.11 Explain:

(a) the conditions under which illusions may occur;

(b) the conflict in perception of an artificial reference system and a pilot's senses when illusions are experienced;

(c) the factors that may make a person more susceptible to disorientation;

(d) how to overcome sensory illusions.

2.7.12 Recall the illusions that may result from the following:

(a) false horizontal clues, for example, sloping cloud formations and sloping terrain;

(b) depth perception, for example, flying over water, snow, desert and other featureless terrain effect of fog; haze; dust;

(c) optical characteristics of windscreens;

(d) landing illusions:

(i) approach angles – steep; shallow;

(ii) width and slope of runway;

(iii) slope of (approach);

(iv) terrain approaches over water;

(e) relative motion between objects.

2.8 Motion sickness

2.8.1 State the basic cause of motion sickness.

2.8.2 List factors that may aggravate motion sickness.

2.8.3 List methods of combating motion sickness in flight.

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2.9 Acceleration ‘g’ effects

2.9.1 Describe the effects of positive and negative accelerations on:

(a) the cardiovascular systems; and

(b) vision; and

(c) consciousness.

2.10 Toxic hazards

2.10.1 State the sources, symptoms, effects and treatment of carbon monoxide poisoning.

2.10.2 Recall the effect of breathing air contaminated by fuel and other noxious or toxic aviation products.

2.11 The atmosphere and associated problems

2.11.1 State the chemical composition of the atmosphere and recall the variation of temperature and pressure with altitude.

2.11.2 Outline how the circulatory and respiratory systems distribute oxygen and excrete carbon dioxide.

2.11.3 State what is meant by the partial pressure of oxygen.

2.12 Hypoxia

2.12.1 List the causes of hypoxia and describe:

(a) its effect on night vision;

(b) the dangers of behavioural changes, for example, lack of self-criticism, over-confidence and a false sense of security;

(c) state the symptoms and their development as altitude is increased;

(d) list factors which may increase a person's susceptibility to hypoxia;

(e) list methods of combating various forms of hypoxia.

2.13 Human factors considerations

2.13.1 List the basic concepts of information processing and decision making, including:

(a) how sensory information is used to form mental images;

(b) the influence of the following factors on the decision-making process:

(i) personality traits, for example, introvert/extrovert;

(ii) pride, peer pressure;

(iii) the desire to get the flight flown;

(iv) anxiety, overconfidence, boredom, complacency;

(v) types of memory – long- and short-term;

(vi) memory limitations;

(vii) aides memoire, rules of thumb;

(viii) work load/overload;

(ix) skill, experience, currency.

2.13.2 Recall the general concepts behind decision-making and list the methods of enhancing decision-making skills.

2.13.3 Concepts of stress:

(a) recall the interaction between stress and arousal and the effects of short- and long-term stress on pilot performance and health;

(b) recall the symptoms, causes and effects of environmental stress:

(i) working in an excessively hot, cold, vibrating or noisy environment;

(c) state the effects of stress on performance;

(d) describe the effect of stress on human performance;

(e) apply the basic principles of stress management.

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2.13.4 Concepts of fatigue:

(a) identify causes of fatigue and describe its effects on pilot performance;

(b) relate coping strategies, for example:

(i) sleep management;

(ii) relaxation;

(iii) fitness and diet;

(c) describe the differences between acute and chronic fatigue.

2.14 Principles of first aid and survival

2.14.1 Recall first aid and survival information contained in ERSA.

2.15 Threat and error management

2.15.1 Describe the basic principles of TEM.

2.15.2 Explain the principles of TEM and detail a process to identify and manage threats and errors during single-pilot operations.

2.15.3 Define ‘threat’ and give examples of threats.

2.15.4 Give an example of a committed error and how action could be taken to ensure safe flight.

2.15.5 Explain how the use of checklists and standard operating procedures can prevent errors.

2.15.6 Give examples of how an undesired aircraft state can develop from an unmanaged threat or error.

2.15.7 Explain what resources a pilot could identify and use to avoid or manage an undesired aircraft, state such as being lost or entering adverse weather.

2.15.8 Explain the importance of ensuring that tasks are prioritised to manage an undesired aircraft state.

2.15.9 Give examples of how establishing and maintaining interpersonal relationships can promote safe flight.

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Unit 1.6.2 CHFC: CPL Human factors

1. Reserved

2. Fitness for flight

2.1 Basic health

2.1.1 Explain the effect and importance on pilot performance of the following factors:

(a) diet, exercise;

(b) coronary risk factors – smoking, cholesterol, obesity, hereditary factors;

(c) upper respiratory tract infection, for example, colds, hay fever, congestion of air passages and sinuses;

(d) food poisoning and other digestive problems;

(e) headaches and migraines;

(f) pregnancy:

(i) when to stop flying; and

(ii) impact on cockpit ergonomics;

(g) injuries;

(h) ageing;

(i) alcohol and smoking;

(j) blood donations;

(k) dehydration;

(l) emotional – anxiety, depression, fear.

2.1.2 Explain why a pilot is not to fly when on any medication unless a medical clearance from a DAME has been obtained.

2.2 Health and fitness

2.2.1 Explain the reasons for, and frequency of, physical examinations and that a CASA network of DAMEs exists.

2.2.2 Explain the role of the CASA with regard to medical fitness and that only those conditions which present a flight safety hazard are disqualifying.

2.3 Alcohol

(a) explain how alcohol is absorbed and excreted;

(b) state and explain what a ‘hangover’ is;

(c) explain the effect a ‘hangover’ may have on flying performance;

(d) explain the relationship between a ‘hangover’ and level of blood alcohol in a person;

(e) explain the relationship between the level of blood alcohol and the recovery period from a ‘hangover’;

(f) state the factors that affect the elimination of alcohol from the body and describe the effects of illicit drugs and alcohol on proficiency, for example:

(i) judgment, comprehension, attention to detail; and

(ii) the senses, coordination and reaction times.

2.4 Drugs

2.4.1 Explain that drug abuse is a behavioural problem and is independent of:

(a) dependence (addiction); and

(b) frequent use.

2.4.2 Define illicit or non-illicit psychoactive substances.

2.4.3 Explain the adverse effects of illicit or non-illicit psychoactive substances.

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2.4.4 Explain the effects and duration of such effects on human performance related to perception, speed of processing information, and reaction time of such drugs as:

(a) cannabis-based substances, for example, marijuana, ganja; and

(b) amphetamine-based substances, for example, ecstasy; and

(c) opium-based substances, for example, codeine, heroin.

2.5 Blood donations

2.5.1 Explain the effect on flying after giving a blood donation.

2.6 Hyperventilation

2.6.1 Describe the effects of hyperventilation on the human body.

2.7 Atmospheric pressure changes

2.7.1 Trapped gases

(a) describe the effect of changes in pressure on gases trapped in the body cavities; and

(b) describe the effect on normal bodily function; and

(c) state/list measures for prevention/treatment.

2.8 Vision, spatial disorientation, illusions

2.8.1 Describe the limitations of the eye in discerning objects at night and the 'off-centre' method of identifying objects at night.

2.8.2 Explain the limitations of the eye with respect to:

(a) the ability to discern objects during flight, for example, other aircraft, transmission lines etc; and

(b) empty field myopia; and

(c) glare; and

(d) colour vision in aviation; and

(e) common visual problems, viz myopia, hyperopia, astigmatism, presbyopia; and

(f) rotor flicker and its effects (helicopters only).

2.8.3 Know of the factors which are conducive to mid-air collisions and describe/practice techniques for visual 'scanning'.

2.8.4 Describe the sensory systems involved in maintaining body equilibrium i.e. that equilibrium is normally maintained by use of the eyes, inner ear and proprioceptive system ('seat of pants').

2.8.5 Describe illusion(s) that may be associated with the factors listed below:

(a) 'leans'; and

(b) linear and angular accelerations; and

(c) unperceived changes in the pitch roll yaw; and

(d) autokinetic illusions; and

(e) 'graveyard spin' illusion; and

(f) somatogravic illusion.

2.8.6 Explain:

(a) that sensory illusions usually occur when external visual clues are poor or ambiguous and that they are predictable; and

(b) the importance of an artificial visual reference system and a pilot's ability to use the system; and

(c) the factors that may make a person more susceptible to disorientation; and

(d) how to overcome sensory illusions.

2.9 Motion sickness

2.9.1 Describe the cause of motion sickness.

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2.9.2 Explain the factors which may aggravate motion sickness.

2.10 Acceleration 'g' effects

2.10.1 Describe the effects of positive and negative accelerations on the human body, include:

(a) on the cardiovascular systems; and

(b) vision; and

(c) consciousness.

2.11 Toxic hazards

2.11.1 Describe the sources, symptoms, effects and treatment of carbon monoxide poisoning.

2.11.2 Explain the effect of breathing air contaminated by fuel and other noxious or toxic aviation products.

2.12 The atmosphere and associated problems

2.12.1 Describe the chemical composition of the atmosphere and recall the variation of temperature and pressure with altitude.

2.12.2 Describe the circumstances where there is a risk of a pilot suffering symptoms associated with the 'bends' (release of nitrogen in the bloodstream), for example, rapid rate of climb in unpressurised aircraft to altitudes in excess of FL180 or continued flight at altitude following failure of the aircraft pressurisation system.

2.12.3 Describe what is meant by the partial pressure of oxygen.

2.13 Hypoxia

2.13.1 Describe the causes of hypoxia and recognise the symptoms of hypoxia particularly:

(a) its effect on night vision; and

(b) the dangers of behavioural changes, for example, lack of self-criticism, overconfidence and a false sense of security; and

(c) know that symptoms are difficult to detect in healthy individuals and can develop much faster at higher altitudes, for example, 14,000 ft; and

(d) list factors which may increase a person's susceptibility to hypoxia; and

(e) state the approximate time of useful consciousness (effective performance time: EPT) at 20,000, 25,000 and 30,000 ft and list factors which affect EPT; and

(f) list methods of combating various forms of hypoxia.

2.14 Human factors considerations

2.14.1 Know the basic concepts of information processing and decision making, including:

(a) how sensory information is used to form mental images; and

(b) the influence of the following factors on the decision-making process:

(i) personality traits, for example, introvert/extrovert;

(ii) pride, peer pressure, employer pressure;

(iii) the desire to get the task done;

(iv) anxiety, overconfidence, boredom, complacency;

(v) types of memory – long- and short-term;

(vi) memory limitations;

(vii) aides memoire, rules of thumb;

(viii) work load/overload;

(ix) skill, experience, currency.

2.14.2 Discuss the general concepts behind decision making and the methods of enhancing decision-making skills.

2.14.3 Concepts of stress:

(a) know the interaction between stress and arousal and the effects of short- and long-term stress on pilot performance and health; and

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(b) know the symptoms, causes and effects of environmental stress working in an excessively hot, cold, vibrating or noisy environment; and

(c) know the symptoms and effects of domestic and work-related stress; and

(d) know the effects of stress on performance; and

(e) know the principles of stress management, for example:

(i) cognitive and behavioural techniques; and

(ii) relaxation; and

(iii) time management.

2.14.4 Concepts of fatigue:

(a) identify causes of fatigue and describe its effects on pilot performance; and

(b) differentiate between acute and chronic fatigue; and

(c) discuss coping strategies, for example:

(i) sleep management; and

(ii) relaxation; and

(iii) fitness and diet.

2.14.5 Basic ergonomics:

(a) discuss principles of control design and the design features of conventional and modern displays; and

(b) discuss problems associated with:

(i) poorly designed controls/positioning of controls; and

(ii) interpreting instrument presentations; and

(c) know the following information regarding safety harnesses:

(i) types, how to assess their maintenance; and

(ii) inertia reels, how to assess their maintenance.

2.15 Threat and error management (TEM)

2.15.1 Explain the principles of TEM and detail a process to identify and manage threats and errors during single-pilot operations.

2.15.2 Explain the meaning of ‘threat’ and give examples of threats:

(a) give an example of a committed error and how action could be taken to ensure safe flight;

(b) explain how the use of checklists and standard operating procedures can prevent errors;

(c) describe how an undesired aircraft state can develop from an unmanaged threat or error;

(d) explain what resources a pilot could identify and use to avoid or manage an undesired aircraft, state such as being lost or entering adverse weather;

(e) explain the importance of ensuring that tasks are prioritised to manage an undesired aircraft state;

(f) describe how establishing and maintaining interpersonal relationships can promote safe flight.

2.16 Crew coordination

2.16.1 Explain the basic principles of crew coordination and discuss factors which:

(a) influence verbal and non-verbal communication between flight deck crews;

(b) barriers to communication;

(c) listening skills;

(d) assertion skills.

2.16.2 Discuss factors which affect the decision-making process:

(a) communication – attitude;

(b) personality;

(c) judgment;

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(d) leadership style.

2.16.3 Discuss ideal leadership qualities.

2.16.4 Review aircraft accidents which resulted from poor crew coordination.

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Unit 1.6.3 AHFC: ATPL human factors

1. Reserved

2. Aviation medicine

2.1 Basic concepts

2.1.1 Metabolism.

2.1.2 Oxygen requirement of tissues.

2.1.3 Composition of the atmosphere.

2.1.4 The gas laws.

2.2 The respiratory system and circulation of the blood

2.2.1 Interrelationship of respiration and circulation.

2.2.2 Composition and function of the blood.

2.2.3 Blood pressure:

(a) control of blood pressure;

(b) hypotension and hypertension;

(c) hemodynamic effects of acceleration.

2.2.4 Functional anatomy of the respiratory system.

2.2.5 Ventilation of the alveolar space, respiratory control.

2.2.6 Hypoxia:

(a) definition and causes of hypoxia;

(b) symptoms of oxygen deficiency and treatment;

(c) time of useful consciousness.

2.2.7 Hyperventilation:

(a) definition and causes of hyperventilation;

(b) symptoms and treatment.

2.3 The pressure cabin

2.3.1 Rapid decompression, effects and counter measures.

2.3.2 Entrapped gases, barotrauma.

3. Human information processing

3.1 The general system

3.1.1 Central and peripheral nervous system.

3.1.2 Sensory threshold, sensitivity, adaptation, habituation.

3.1.3 Reflexes and biological control systems.

3.1.4 Information processing by the central nervous system:

(a) mental set, attention (selective, divided, failure);

(b) channel capacity, filtering;

(c) mechanisms of perception, constancies, selective perception.

3.2 The senses

3.2.1 Vision:

(a) functional anatomy of the eye;

(b) physiology of the visual system;

(c) visual acuity, refraction and refractive errors, presbyopia;

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(d) the visual field, scanning of the environment;
(e) binocular vision;
(f) the intraocular pressure, glaucoma;
(g) hypoxia and vision;
(h) night vision (dark adaptation);
(i) defective colour vision.

3.2.2 Hearing:
(a) functional anatomy of the ear;
(b) physiology of hearing;
(c) hearing loss (perceptive, conductive);
(d) flight-related hazards to hearing: noise-related hearing loss, barotrauma.

3.2.3 Equilibrium:
(a) functional anatomy and physiology;
(b) detection of rotary and linear acceleration;
(c) the subjective vertical;
(d) motion sickness.

3.3 Integration of sensory inputs: spatial disorientation and illusions

3.3.1 Basic concepts and definitions.

3.3.2 Categories of disorientation:
(a) flight circumstances;
(b) vertigo coriolis effect, pressure, vertigo, flicker vertigo;
(c) visual illusions (the leans, approach and landing problems);
(d) prevention and handling of disorientation.

3.4 Memory

3.4.1 Functional description.

3.4.2 Information storage and recall:
(a) short-term memory;
(b) long-term memory;
(c) motor memory;
(d) effects of stress and time of day.

4. Human behaviour

4.1 General Concepts

4.1.1 Personality:
(a) characteristics;
(b) individual differences in personality;
(c) self concept;
(d) attitude development;
(e) cognitive dissonance.

4.1.2 Behaviour and skills:
(a) drives;
(b) learning;
(c) motivation and performance.

4.1.3 Human error and reliability:
(a) human error model;

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(b) types of errors;
(c) prevention and counter measures;
(d) reliability of human behaviour;
(e) errors induced by external factors (ergonomics, organisations).

4.1.4 Working in an automated cockpit:
(a) advantages;
(b) disadvantages;
(c) coping behaviour.

4.2 Cockpit management

4.2.1 Crew coordination:
(a) distribution of responsibilities;
(b) working with a crew concept.

4.2.2 Crew cooperation:
(a) small group dynamics (norms, atmosphere, pressure, communication, structure);
(b) conflict management.

4.2.3 Leadership, style of management:
(a) concern for performance;
(b) concern for people;
(c) democratic vs autocratic style;
(d) encouraging inputs and feedback;
(e) optimising of crew performance in flight;
(f) correcting crew coordination deficiencies.

4.2.4 Communication:
(a) verbal and non-verbal communication;
(b) one and two-way communication;
(c) effects of different communication styles;
(d) miscommunication (including cultural differences).

4.3 Judgment and decision-making

4.3.1 Pilot judgment concepts:
(a) types of judgment;
(b) motor skills and human factors.

4.3.2 Aeronautical decision-making:
(a) decision-making concepts;
(b) pilot responsibilities;
(c) behavioural aspects.

4.3.3 Identification of hazardous attitudes:
(a) physical factors;
(b) psychological factors;
(c) social influences and interface between people.

4.3.4 Pilot judgment awareness:
(a) risk assessment;
(b) cockpit stress management.

4.3.5 Applying decision-making concepts:
(a) practical application;
(b) managing resources;

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(c) safety awareness.

5. Flying and health

5.1 The high-altitude environment (ozone, radiation, humidity)

5.2 Physiological and mental fitness

5.3 Incapacitation

5.3.1 Causes and symptoms:

(a) gastro intestinal;

(b) cardiovascular;

(c) side effects of drug and medication;

(d) migraine;

(e) epilepsy;

(f) brain disorders.

5.3.2 Recognition: insidious and sudden incapacitation.

5.3.3 Procedures for dealing with incapacitation.

5.4 Intoxication

5.4.1 Tobacco.

5.4.2 Alcohol.

5.4.3 Drugs and self-medication.

5.4.4 Various toxic materials.

5.5 Body rhythm disturbances

5.5.1 The biological clock.

5.5.2 Disturbances of circadian rhythms:

(a) causes (shift work, time-zone crossing);

(b) symptoms;

(c) treatment.

5.5.3 Sleep

(a) functions;

(b) patterns;

(c) effects of disturbances and treatment.

5.6 Fatigue

5.6.1 Definition.

5.6.2 Causes.

5.6.3 Types and symptoms.

5.6.4 Prevention and treatment.

5.7 Stress and anxiety

5.7.1 Definition of stress.

5.7.2 Stress components.

5.7.3 Causes, stressors.

5.7.4 Coping behaviour:

(a) identifying and reducing stress;

(b) life stress management.

5.7.5 Effects on performance.

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5.7.6 Anxiety.

5.7.7 Defence mechanisms.

5.7.8 Effects of anxiety and defence mechanism.

5.8 General health aspects

5.8.1 Common minor ailments (colds, influenza, gastro-intestinal upsets).

5.8.2 Tropical climates: risk, regulatory aspects.

5.8.3 Personal hygiene: oral, external, internal hygiene.

5.8.4 Diabetes.

5.8.5 Hypotension and hypertension.

5.8.6 Obesitas, lack of exercise.

5.8.7 Epidermic diseases.

6. Threat and error management

6.1 Threat and error management model (TEM)

6.1.1 Explain what is TEM.

6.2 Basic principles of TEM

6.2.1 Explain the principles of TEM.

6.2.2 Explain the components of TEM.

6.3 Threat

6.3.1 Define and explain 'threat'.

6.3.2 Explain types of 'threats' such as 'expected', 'unexpected' and 'latent' threats – recognise and give examples.

6.3.3 Explain categories of 'threats' such as 'environmental' and 'organisational' threats – give examples of these 'threat(s) and recognise the 'threat(s)' in a given scenario.

6.4 Error

6.4.1 Define and explain 'error'.

6.4.2 Explain types of 'errors', such as those independent of 'threat(s)', induced by 'threat(s)' and with the potential to escalate other 'errors' (chain of errors) – recognise and give examples.

6.4.3 Explain categories of 'errors' such as those due to aircraft handling, flight management, procedures and communication – give examples of these 'error(s) and recognise the 'error(s)' in a given scenario.

6.4.4 Describe some measures or practices (for example, use of checklist, SOPs) to prevent occurrence of 'errors'.

6.4.5 Analyse scenarios of crew facing 'error(s)', and how crew may recognise and prevent 'errors' to ensure safe flight.

6.5 Undesired aircraft states (UAS)

6.5.1 Define and explain UAS.

6.5.2 Explain categories of UAS such as those arising from ineffective 'threat' and/or 'error' management, and those spontaneously and directly from a 'threat' – recognise and give examples.

6.5.3 Explain categories of UAS such as those due to aircraft handling, ground navigation and incorrect aircraft configuration – give examples of these UAS and recognise the UAS in a given scenario.

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6.5.4 Explain the primacy of UAS management over 'error' or 'threat' management – recognise and give examples of the importance of ensuring that tasks are prioritised to manage a UAS.

6.5.5 Explain what resources an aircraft cockpit crew could identify and use to avoid or manage a UAS.

6.5.6 Analyse scenarios of crew facing UAS, and what should be the recovery action, and what would be the end states (outcomes) if recovery action is not taken.

6.6 Countermeasures

6.6.1 Define and explain 'countermeasures'.

6.6.2 Describe and give examples of types of 'countermeasures' such as systemic-based, individual and team 'countermeasures'.

6.6.3 Describe and give examples of 'countermeasures'.

6.7 TEM in multi-crew operations

6.7.1 Detail a process to identify and manage threats and errors during multi-crew operations, such as data gathering, threat analysis, decision making.

6.7.2 Analyse scenarios of multi-crew operations with regards to TEM.

6.7.3 Give examples of how establishing and maintaining interpersonal relationships in multi-crew operations can promote safe flight.

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SECTION 1.7 NAVIGATION (NV)

Unit 1.7.1 PNVC: PPL navigation – all aircraft categories

1. Reserved

2. General navigation

2.1 Form of the earth

2.1.1 Describe:

(a) the shape and rotation of the earth;

(b) latitude, longitude;

(c) the difference between true and magnetic north;

(d) how distance and direction are measured and applied to navigation;

(e) magnetic variation and compass deviation;

(f) the relationship between magnetic heading, relative heading and magnetic bearing.

2.2 Time

2.2.1 Explain the terms UTC, local mean time, local (standard) time, local summer time.

2.2.2 Determine within +/- 5 min the beginning and end of civil twilight from AIP daylight and darkness graphs.

2.2.3 Complete conversions between LMT, UTC, local (standard) times, including local summer time.

2.2.4 List factors which may cause daylight to end earlier than the time extracted from AIP darkness graphs.

2.3 Basics – Extract information from documents

2.3.1 On a WAC and AIP 'visual' charts (if applicable) which cover the local area of operation:

(a) identify, without reference to the chart legend:

(i) major features to assist in map reading, for example, roads, rivers, lakes;

(ii) obstacles and spot heights, including elevation or height above terrain;

(iii) CTA, PRDs, and aerodrome data on VTC/ERC (if applicable);

(b) decode other symbols with reference to the chart legend;

(c) assess the general height of the terrain from hypsometric tints and contours;

(d) estimate track and distance;

(e) demonstrate and explain the reason for chart orientation in flight.

2.3.2 On visual AIP charts identify airspace boundaries and symbols with reference to the chart legend.

2.3.3 Use ERSA to extract:

(a) runway data;

(b) data pertaining to prohibited, restricted and danger areas.

2.4 Computation techniques

2.4.1 Use mental rules of thumb to estimate:

(a) time interval using estimated GS and distance, for example, 120 kt = 2 nm/min;

(b) endurance given fuel flow and fuel available (excluding reserve fuel).

2.4.2 Apply magnetic variation to obtain magnetic direction.

2.4.3 Carry out conversions between:

(a) feet/metres;

(b) nm/km;

(c) lbs/kg;

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(d) US gal/litres/kg of avgas.

2.4.4 Calculate headwind, tailwind and cross-wind components given W/V and HDG using:

(a) a navigation computer; and

(b) conversion and wind component tables in ERSA.

2.4.5 Calculate the following:

(a) CAS and TAS given air temperature and pressure height;

(b) HDG, GS and drift given TAS, W/V, TR;

(c) TR given HDG, TAS, W/V;

(d) climb and decent rates and gradients;

(e) TOPC and TOPD positions using average airspeed, W/V and rates of climb and descent.

2.5 Pilot navigation

2.5.1 Principles of map reading:

(a) describe the method of chart orientation; and

(b) list situations when a pilot should read:

(i) from map to ground; and

(ii) from ground to map; and

(c) select appropriate position lines to establish:

(i) ground speed; and

(ii) track error; and

(iii) a fix; and

(d) select appropriate ground features to establish position when flying:

(i) at low level (500 ft AGL); and

(ii) between (approximately) 2,000 and 10,000 ft; and

(iii) over mountainous terrain, coastal areas, densely populated and sparsely populated areas.

2.5.2 Chart preparation and selection (practice):

(a) draw tracks, track error lines, time/distance markings; and

(b) given a route – select WAC(s) and appropriate AIP ‘visual charts’.

2.5.3 With reference to a planned or given track and given appropriate data:

(a) determine track made good (TMG); and

(b) calculate drift; and

(c) determine alteration of heading or HDG(M) to:

(i) parallel track; and

(ii) intercept track at a nominated point; and

(iii) maintain track once track is intercepted; and

(d) revise/confirm estimates or ETA using latest ground speed or time/distance proportion; and

(e) establish a DR position using latest TR and GS; and

(f) using a map plotter, employ mental dead reckoning and proportional techniques to solve inflight navigational problems, including:

(i) mentally apply the 1 in 60 rule; and

(ii) mentally revise estimates/ETA’s; and

(iii) estimate TR and ETI to a selected diversion point.

2.6 Radio navigation aids

2.6.1 Extract NDB and VOR information from ERSA or ERC and state the rated coverage of a VOR up to 10,000 ft.

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2.7 Area navigation systems

2.7.1 Types of systems:

(a) external sensor systems:

(i) VOR/DME;

(ii) GNSS.

2.7.2 General principles:

(a) inputs required:

(i) air data inputs;

(ii) other inputs;

(b) outputs generated:

(i) types of outputs;

(ii) uses.

2.7.3 RNAV systems:

(a) principle of VOR/DME area navigation (RNAV);

(b) advantages and disadvantages;

(c) limitations and restrictions:

(i) errors, accuracy, reliability;

(ii) coverage;

(iii) range.

(d) typical control panel.

2.7.4 Reserved:

2.7.5 Satellite navigation systems:

(a) principle of GNSS navigation:

(i) elements of GNSS (for example, GPS, GLONASS);

(b) advantages and disadvantages;

(c) limitations and restrictions:

(i) errors, accuracy, reliability;

(ii) coverage;

(iii) range;

(d) typical control panel;

(e) approvals for IFR Navigation;

(f) GNSS system enhancements (for example, DGNSS, GLS, WAAS).

2.7.6 Updating area navigation systems:

(a) need for updating position;

(b) requirements for updating:

(i) manual inserting;

(ii) automatic updating;

(iii) inhibiting updating;

(c) common indications when system updates position.

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Unit 1.7.2 CNVC: CPL navigation – all aircraft categories

1. Reserved

2. Navigation

2.1 Form of the earth

2.1.1 Explain the following terms listed in (a) to (g):

(a) the shape and rotation of the earth; and

(b) latitude, longitude; and

(c) equator, Greenwich meridian; and

(d) great circles, small circles, rhumb lines; and

(e) difference between true and magnetic north; and

(f) terrestrial magnetism, magnetic variation and the change in variation with time; and

(g) distance on the earth i.e. relationship between a minute of latitude and a nautical mile; and, if applicable, their effect on:

(i) position on the earth; and

(ii) time differences; and

(iii) distance and direction.

2.2 Time

2.2.1 Explain the terms UTC, local mean time, local (standard) time, local summer time.

2.2.2 Determine within +/- 5 min the beginning and end of civil twilight from AIP daylight and darkness graphs.

2.2.3 Complete conversions between:

(a) LMT, UTC, local (standard) times, including local summer time.

2.2.4 List factors which may cause daylight to end earlier than the time extracted from AIP darkness graphs.

2.2.5 Describe the effect of the earth's rotation and revolution around the sun on the:

(a) beginning and end of daylight;

(b) period of daylight.

2.2.6 Describe the effect of changes in longitude on Local Mean Time.

2.3 Charts and publications

2.3.1 From:

(a) AIP visual charts, that is ERC, VTC and AUS PCA, including any subsequent changes to charts required for flight under VFR; and

(b) ERSA;

select the chart(s) or document(s) which contain information about a given item of operational significance.

2.3.2 Decode symbols and apply information displayed on AIP visual charts.

2.3.3 Interpret topographic detail and decode symbols displayed on a WAC and VTC.

2.3.4 On WAC and AIP visual charts using chart and latitude scale:

(a) estimate tracks and distances; and

(b) measure rhumb line track; and

(c) measure distance; and

(d) plot a position given:

(i) latitude and longitude; and

(ii) bearing and distance.

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2.3.5 Describe the different kinds of map projections used in aviation and:

(a) identify the following properties of a Lamberts Conformal:

(i) appearance of rhumb lines, great circles, meridians and the graticule;

(ii) distortion of shapes and areas;

(iii) scale variation;

(b) describe the methods of representing scale.

2.4 Computations

2.4.1 Review computations and conversions and:

(a) solve GS, distance, fuel used, fuel required, fuel remaining and fuel consumption problems, given appropriate combinations of these factors; and

(b) solve CAS/TAS problems given air temperature and pressure height; and

(c) determine HDG, GS and drift given TAS, W/V, TR; and

(d) determine TR given HDG, TAS, W/V; and

(e) solve problems relating to rates/gradients of climb and descent; and

(f) determine TOPC and TOPD position using average airspeed, W/V, and rates of climb/descent.

2.5 Pilot navigation

2.5.1 Principles of map reading:

(a) describe the method of chart orientation; and

(b) list situations when a pilot should read:

(i) from map to ground; and

(ii) from ground to map; and

(c) select appropriate position lines to establish:

(i) ground speed; and

(ii) track error; and

(iii) a fix; and

(d) select appropriate ground features to establish position when flying:

(i) at low level (500 ft AGL); and

(ii) between (approximately) 2,000 and 10,000 ft; and

(iii) over mountainous terrain, coastal areas, densely populated and sparsely populated areas.

2.5.2 Chart preparation and selection (practice):

(a) draw tracks, track error lines, time/distance markings; and

(b) given a route – select WAC(s) and appropriate AIP ‘visual charts’.

2.5.3 With reference to a planned or given track and given appropriate data:

(a) determine track made good (TMG); and

(b) calculate drift; and

(c) determine alteration of heading or HDG(M) to:

(i) parallel track; and

(ii) intercept track at a nominated point; and

(iii) maintain track once track is intercepted; and

(d) revise/confirm estimates or ETA using latest ground speed or time/distance proportion; and

(e) establish a DR position using latest TR and GS; and

(f) using a map plotter, employ mental dead reckoning and proportional techniques to solve inflight navigational problems, including:

(i) mentally apply the 1 in 60 rule; and

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(ii) mentally revise estimates/ETA's; and

(iii) estimate TR and ETI to a selected diversion point.

2.6 Radio navigation aids

2.6.1 Describe how to identify an aid and state the frequency of a nominated NDB or VOR.

2.6.2 Extract NDB and VOR information from ERSA or ERC and state the rated coverage of a VOR up to 10,000 ft.

2.6.3 State the effect (in Australia) of the following errors on the reliability of ADF cockpit indications:

(a) co-channel interference;

(b) mountain effect;

(c) effect of thunderstorms;

(d) coastal refraction.

2.6.4 Explain why information pertaining to broadcasting stations is included in ERSA.

2.6.5 Recall the 'aggregate' error of a VOR and explain what is meant by 'scalloping'.

2.6.6 Establish a position line given:

(a) HDG and ADF data; and

(b) VOR indications.

2.6.7 Describe how to use the VOR to determine TR to or from a station.

2.6.8 Describe how to use an ADF or VOR to home to a station, and recognise instrument indications that signify station passage.

2.6.9 Establish fixes and use these fixes to make off-track corrections using a DME distance and the following:

(a) HDG and ADF data; or

(b) VOR indications.

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Unit 1.7.3 ANVC: ATPL navigation – all aircraft categories

1. Reserved

2. Advanced navigation

2.1 Navigation charts

2.1.1 Lambert Conformal Conic Projection:

(a) review properties:

(i) great circles, rhumb lines, rules lines;

(ii) scales, chart convergence;

(b) brief comparison with properties of other projections:

(i) Mercator;

(ii) Polar sterographic.

2.1.2 Use of AIP (MAP) charts.

2.2 Time zones

(a) brief review:

(i) time zones, date line;

(ii) LMT, LST, UTC;

(iii) conversion from LMT/LST to UTC and vice versa;

(b) practical examples of LST arrival/departure calculations for flights across time zones:

(i) with and without date line involvement.

2.3 Flight instruments

2.3.1 Air data instruments:

(a) review of altimeter, ASI, VSI, IVSI and Machmeter:

(i) principles of operation;

(ii) errors;

(iii) relationship between IAS, CAS, EAS, TAS and TMN;

(b) modern instrumentation:

(i) integrated displays;

(ii) EFIS;

(iii) standby instruments.

2.3.2 Air data computer (ADC):

(a) principles of operation;

(b) input and output data;

(c) uses of output data.

2.3.3 Gyroscopic principles:

(a) rigidity, precession:

(i) real and apparent precession;

(ii) correcting for precession;

(b) types of gyros in common use:

(i) mechanical;

(ii) laser gyros;

(c) gyro platforms:

(i) two- and three-dimensional stability;

(d) introduce concept of self-contained instruments versus gyro-platform output displays.

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2.4 Compasses

2.4.1 Direct reading compass:

(a) principle of operation and errors;

(b) advantages and disadvantages.

2.4.2 Slaved gyro-stabilised compass:

(a) principles of operation;

(b) errors;

(c) advantages and disadvantages;

(d) uses of output data.

2.4.3 Inertial heading:

(a) use of a gyro platform to compute true heading:

(i) principles;

(ii) significance of initial positions insert;

(b) magnetic heading as a modification of true heading.

2.5 Radiowave propagation

2.5.1 Terminology:

(a) understand general principles of radio propagation;

(b) understand and be able to use in correct sense:

(i) wavelength;

(ii) amplitude;

(iii) frequency;

(iv) phase angle;

(v) frequency bands;

(vi) the following sidebands:

(A) SSB;

(B) LSB;

(C) USB;

(vii) carrier;

(viii) modulation, including the following:

(A) amplitude;

(B) frequency;

(C) pulse;

(D) multiplex;

(ix) demodulation.

2.5.2 Wave propagation:

(a) groundwaves, space (direct) waves, skywaves;

(b) propagation within the frequency bands;

(c) factors affecting reception:

(i) fading;

(ii) static;

(d) use of HF for communications:

(i) frequency prognosis;

(ii) SELCAL.

2.5.3 Antennas:

(a) function/purpose of antennas;

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(b) types of antennas in common use for aircraft:
(i) uses;
(ii) characteristics (outline only):
(A) directionality;
(B) polarisation.

2.6 Radio NavAids

2.6.1 ADF (including NDBs and use of RMI):
(a) application for navigation;
(b) principles;
(c) presentation and interpretation;
(d) coverage;
(e) range;
(f) errors and accuracy;
(g) factors affecting range and accuracy.

2.6.2 VOR and Doppler-VOR (including use of RMI):
(a) application for navigation;
(b) principles;
(c) presentation and interpretation;
(d) coverage;
(e) range;
(f) errors and accuracy;
(g) factors affecting range and accuracy.

2.6.3 DME (distance measurement equipment):
(a) application for navigation;
(b) principles;
(c) presentation and interpretation;
(d) range;
(e) errors and accuracy;
(f) factors affecting range and accuracy.

2.6.4 ILS (instrument landing system):
(a) application for navigation;
(b) principles;
(c) presentation and interpretation;
(d) coverage;
(e) range;
(f) errors and accuracy;
(g) factors affecting range and accuracy.

2.6.5 MLS (microwave landing system):
(a) application for navigation;
(b) principles;
(c) presentation and interpretation;
(d) coverage;
(e) range;
(f) errors and accuracy;
(g) factors affecting range and accuracy.

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2.7 Route navigation

2.7.1 Route selection:

(a) great circle tracks;

(b) choice of speed and flight level;

(c) ETOPS considerations.

2.7.2 Navigation on climb and descent:

(a) wind and temperature variations:

(i) desirability of allowing for variations;

(ii) availability of data in actual situations.

(b) weather/traffic avoidance:

(i) concept of track miles.

(c) allowance for use of anti-ice equipment:

(i) reduced rate of climb;

(ii) reduced rate of descent.

2.7.3 Use of radio NavAids:

(a) requirement for regular position fixing;

(b) use of navaid position lines to establish position:

(i) along track;

(ii) across track;

(iii) desired/preferred form of P/L intersections;

(c) computer-controlled navaid receivers:

(i) auto-tuning;

(ii) manual selection;

(iii) precautions.

2.7.4 Calculation of track and groundspeed:

(a) review basic track and groundspeed calculations:

(i) plotted positions, IAS/TAS/GS, HDG/TRK;

(ii) determination of wind velocity (track and groundspeed methods only);

(iii) calculation of ETAs, EETs;

(b) review ETP and PNR calculations;

(c) inflight diversion to fixed point:

(i) last PSD;

(ii) time and fuel required.

2.8 Basic radar principles

2.8.1 Pulse techniques and associated terminology.

2.8.2 Ground radar:

(a) coverage of ATC radars, factors affecting range and accuracy;

(b) facilities provided by Met radars for storm warning and avoidance.

2.8.3 Airborne weather radar:

(a) principles;

(b) types;

(c) presentation and interpretation;

(d) factors affecting range and accuracy.

2.8.4 SSR (secondary surveillance radar) and transponder:

(a) principles;

(b) application for traffic control;

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(c) presentation and interpretation;

(d) advantages compared to primary radar for traffic control.

2.8.5 Radio altimeter:

(a) principle of operation;

(b) display;

(c) accuracy, errors.

2.9 Area navigation systems

2.9.1 Type of systems

(a) Self-contained on-board systems including the following;

(i) INS;

(ii) DOPPLER;

(b) External sensor systems including the following:

(i) VOR and DME;

(ii) GNSS.

2.9.2 General principles:

(a) inputs required:

(i) air data inputs;

(ii) other inputs;

(b) outputs generated:

(i) types of outputs;

(ii) uses.

2.9.3 RNAV systems:

(a) principle of VOR/DME area navigation (RNAV);

(b) advantages and disadvantages;

(c) limitations and restrictions:

(i) errors, accuracy, reliability;

(ii) coverage;

(iii) range.

(d) typical control panel.

2.9.4 Reserved:

2.9.5 Satellite navigation systems:

(a) principle of GNSS navigation:

(i) elements of GNSS (for example, GPS, GLONASS);

(b) advantages and disadvantages;

(c) limitations and restrictions:

(i) errors, accuracy, reliability;

(ii) coverage;

(iii) range;

(d) typical control panel;

(e) approvals for IFR Navigation;

(f) GNSS system enhancements (for example, DGNSS, GLS, WAAS).

2.9.6 Updating area navigation systems:

(a) need for updating position;

(b) requirements for updating:

(i) manual inserting;

(ii) automatic updating;

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(iii) inhibiting updating;

(a) common indications when system updates position.

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Unit 1.7.4 ANVA: ATPL navigation – aeroplane – *Reserved*

Unit 1.7.5 ANVH: ATPL navigation – helicopter – *Reserved*

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SECTION 1.8 METEOROLOGY (MT)

Unit 1.8.1 RMTC: RPL meteorology – all aircraft categories

1. Reserved

2. Basic meteorology

2.1 Knowledge of local weather

2.1.1 Demonstrate a basic knowledge of local weather, in particular the likely occurrence of the following phenomena and how they may affect the safety of a flight:

(a) thunderstorms;

(b) low cloud;

(c) poor visibility;

(d) turbulence.

2.2 Knowledge of forecasts and reports

2.2.1 Demonstrate an understanding of weather forecasts, reports and broadcasts that are pertinent to the area of operation.

2.3 Understand significance of observations

2.3.1 Recognise signs, including forecast condition and pilot observations, which may indicate the presence of:

(a) turbulence, thermals, dust devils; and

(b) wind gradient, wind shear and describe the effect of these phenomena on flight characteristics.

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Unit 1.8.2 PMTC: PPL meteorology – all aircraft categories

1. Reserved

2. General meteorology

2.1 Composition of the atmosphere

2.1.1 Describe the International Standard Atmosphere (ISA) sea level temperature and pressure.

2.1.2 State the ISA temperature and pressure lapse rates in the troposphere.

2.1.3 Describe the vertical division of the atmosphere:

(a) troposphere;

(b) tropopause;

(c) stratosphere.

2.1.4 Explain why most weather effects occur below the stratosphere.

2.2 Heat, temperature pressure and humidity

2.2.1 State the method of measuring surface air temperature, and relate that to actual temperatures above the runway.

2.2.2 Explain the meaning of the following terms:

(a) temperature inversion;

(b) saturated air, relative humidity, dew point;

(c) evaporation, condensation, freezing.

2.2.3 List the effect of changes in temperature, pressure and humidity on air density.

2.2.4 Calculate ISA temperature and pressure height.

2.2.5 Explain the meaning of the following terms:

(a) height;

(b) elevation;

(c) altitude;

(d) QNH;

(e) QFE.

2.3 Clouds and precipitation

2.3.1 Identify and classify clouds according to height and the 10 genera forms.

2.3.2 Recall the standard abbreviation for each cloud type, and the method used to report cloud amount.

2.3.3 Describe the weather associated with each cloud type.

2.4 Visibility

2.4.1 Determine visibility from either visual sighting or met forecast.

2.4.2 List meteorological factors that will reduce inflight visibility.

2.5 Winds – general

2.5.1 Describe the relationship between pressure and wind and apply Buys Ballot's law to assess the approximate location of high and low pressure systems.

2.5.2 Differentiate between:

(a) squalls and gusts; and

(b) backing and veering.

2.5.3 Compare surface and gradient winds in terms of direction and strength.

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2.5.4 List the ‘factors’ that effect the diurnal variation of wind and describe typical ‘variations’ in surface wind strength during a 24-hour period.

2.6 Air masses and fronts

2.6.1 Describe typical ‘flying weather’ associated with the following using the factors described in subclause 2.6.2:

(a) cold fronts;

(b) warm fronts;

(c) wave depressions;

(d) occluded fronts;

(e) tropical cyclones;

(f) the equatorial trough.

2.6.2 For subclause 2.6.1, ‘flying weather’ embraces the following:

(a) temperature (warmer/colder);

(b) wind changes (back/veer, stronger/weaker);

(c) stability and turbulence;

(d) cloud type and approximate amount, precipitation.

2.7 Flight considerations

2.7.1 With respect to the phenomena listed below (i) – (vi):

(a) state the conditions favourable to their development and, where applicable, their dispersal;

(b) recognise signs which may indicate their presence;

(c) describe their effect on flight characteristics where applicable, state the pilot actions required to minimise their effect on an aircraft in flight:

(i) turbulence;

(ii) windshear;

(iii) mountain waves;

(iv) land and sea breezes;

(v) thunderstorms;

(vi) downdrafts associated with terrain and cloud.

2.7.2 State/select the conditions under which it is mandatory to obtain a forecast.

2.7.3 For information contained in an ARFOR, TAF, TTF, METAR, SPECI, AIRMET or SIGMET, do the following:

(a) explain the coded information in plain language;

(b) decide whether a particular forecast is valid for a flight;

(c) apply the information to planning and conducting a flight.

2.7.4 List the conditions that require a pilot to submit a short AIREP.

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Unit 1.8.3 CMTC: CPL meteorology – all aircraft categories

1. Reserved

2. Meteorology

2.1 Composition of the atmosphere

2.1.1 Describe the process of incoming solar radiation and outgoing terrestrial radiation and the factors that affect them.

2.1.2 Explain the processes by which the sun's energy is redistributed within the atmosphere and explain:

(a) conduction;

(b) advection;

(c) convection;

(d) latent heat;

(e) radiation.

2.2 Heat, temperature, pressure and humidity

2.2.1 A student should:

(a) describe the method of measuring surface air temperature and know that actual temperatures may be much higher, for example, above a runway; and

(b) know the meaning of the following terms:

(i) isotherm;

(ii) radiation, advection, convection, conduction;

(iii) isobar, horizontal pressure gradient;

(iv) saturated air, relative humidity, dew point;

(v) evaporation, condensation, freezing.

2.2.2 List the effect of changes in temperature, pressure and humidity on air density.

2.2.3 List factors that influence the diurnal variation of surface air temperature and explain the temperature gradient between land and sea surfaces.

2.3 Atmospheric stability

2.3.1 Differentiate between stable, unstable and conditionally atmospheric conditions.

2.3.2 Understanding of adiabatic process and the parcel method of assessing stability.

2.4 Clouds and precipitation

2.4.1 Identify and classify cloud 'types':

(a) classifications required are:

(i) high, medium, low; and

(ii) cumuliform, stratiform:

(A) examples of 'type' are Cu, Ci etc.

2.4.2 State the standard abbreviation for each cloud type, and the method used to report cloud amount.

2.4.3 Describe the weather associated with each cloud type.

2.4.4 Differentiate between drizzle, rain, showers and virga.

2.4.5 Select statements that describe the conditions necessary for the formation/dispersal of various types of cloud.

2.5 Visibility

2.5.1 Know the method used in meteorological forecasts and reports to determine visibility.

2.5.2 Describe the term 'runway visual range'.

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2.5.3 Give reasons for differences between ‘inflight’ and ‘reported’ visibility.

2.5.4 List meteorological factors that will reduce inflight visibility.

2.6 Winds – general

2.6.1 Describe the relationship between pressure and wind and apply Buys Ballot’s law to assess the approximate location of high and low pressure systems.

2.6.2 Differentiate between:

(a) squalls and gusts; and

(b) backing and veering.

2.6.3 Compare surface and gradient winds in terms of direction and strength.

2.6.4 List the ‘factors’ that effect the diurnal variation of wind and describe typical ‘variations’ in surface wind strength during a 24-hour period.

2.7 Air masses and fronts

2.7.1 Describe typical ‘flying weather’ associated with the following:

(a) cold fronts;

(b) warm fronts;

(c) wave depressions;

(d) occluded fronts;

(e) tropical cyclones;

(f) the equatorial trough.

2.7.2 For subsection 2.7.1 above, ‘flying weather’ embraces the following:

(a) temperature (warmer/colder);

(b) wind changes (back/veer, stronger/weaker);

(c) stability and turbulence;

(d) cloud type and approximate amount, precipitation.

2.8 Flight considerations

2.8.1 With respect to the phenomena listed below in subclause 2.8.2, do the following:

(a) state the conditions that are favourable to the development of the phenomenon and, where applicable, its dispersal;

(b) recognise signs which may indicate the presence of each phenomenon;

(c) describe the effect of the phenomenon on flight characteristics;

(d) where applicable, state the pilot actions required to minimise the effect of the phenomenon on an aircraft in flight.

2.8.2 The following is a list of meteorological phenomena that is for the purposes of subclause 2.8.1:

(i) thermals, turbulence;

(ii) dust devils and dust storms;

(iii) wind gradient, wind shear and low-level jetstreams;

(iv) anabatic and katabatic winds;

(v) mountain waves and fohn winds;

(vi) land and sea breezes;

(vii) inversions and fog;

(viii) thunderstorms and microbursts;

(ix) downdrafts associated with terrain/cloud;

(x) atmospheric stability and instability;

(xi) hoar frost, rime, and clear airframe ice;

(xii) tropical cyclones, tornadoes.

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2.9 Synoptic meteorology

2.9.1 Given a MSL analysis chart, identify:

(a) high and low pressure systems; and

(b) a trough, a ridge, a col; and

(c) warm, cold and occluded fronts; and

(d) a tropical cyclone; and

(e) approximate wind direction.

2.9.2 Describe typical weather characteristics associated with the items listed in 2.9.1 (a) and (b) above in the following terms:

(a) approximate wind direction;

(b) moisture content (dry or humid);

(c) cloud: stratiform and cumuliform;

(d) clear skies;

(e) turbulent or smooth air;

(f) good or poor visibility.

2.10 Weather services

2.10.1 For given locations, determine from CASA documents the availability of aviation forecasts, meteorological reports and weather briefing and state the method of obtaining this information.

2.10.2 State/select the conditions under which it is mandatory to obtain a forecast.

2.10.3 For information contained in an ARFOR, TAF, TTF, METAR, SPECI, AIRMET or SIGMET, do the following:

(a) explain the coded information in plain language;

(b) decide whether a particular forecast is valid for a flight;

(c) apply the information to planning and conducting a flight.

2.10.4 Given a typical weather briefing, evaluate weather information applicable to a flight, and:

(a) assess likely changes (both improving and deteriorating) in weather during the flight; and

(b) list phenomena which may adversely affect the flight.

2.10.5 List the conditions that require a pilot to submit a short AIREP.

2.10.6 State the purpose of VOLMET and ATIS broadcasts indicate how this information is obtained and apply this information to practical scenarios.

2.10.7 State what is meant by a Hazard Alert service.

2.11 Climatology

2.11.1 Describe typical seasonal weather conditions in different regions of Australia with reference to:

(a) visibility (good/poor); and

(b) prevailing winds; and

(c) typical cloud patterns and precipitation; and

(d) seasonal pressure and frontal systems, including the ITCZ and equatorial trough; and

(e) tropical cyclones.

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Unit 1.8.4 AMTC: ATPL meteorology – all aircraft categories

1. Reserved

2. Advanced meteorology

2.1 Composition of the atmosphere

2.1.1 Student should know the following vertical divisions in the atmosphere:

(a) troposphere, tropopause, stratosphere;

(b) that most weather effects occur below the stratosphere.

2.2 Heat, temperature, pressure and humidity

2.2.1 Describe the method of measuring surface air temperature, and explain how the actual temperatures may be much higher, for example, above a runway.

2.2.2 Describe the meaning of the following terms:

(a) isotherm, temperature inversion;

(b) radiation, advection, convection, conduction;

(c) isobar, horizontal pressure gradient;

(d) saturated air, relative humidity, dew point;

(e) evaporation, condensation, freezing.

2.2.3 Describe the effect of changes in temperature, pressure and humidity on air density.

2.2.4 Explain the factors that influence the diurnal variation of surface air temperature and explain the temperature gradient between land and sea surfaces.

2.3 Atmospheric stability

2.3.1 Differentiate between stable, unstable and conditionally atmospheric conditions.

2.3.2 Describe the adiabatic process and the parcel method of assessing stability.

2.4 Clouds and precipitation

2.4.1 Identify and classify cloud ‘types’ as cumuliform or stratform for the following:

(a) high level;

(b) medium level;

(c) low level.

2.4.2 State the standard abbreviation for each cloud type, and the method used to report cloud amount.

2.4.3 Describe the weather associated with each cloud type.

2.4.4 Differentiate between drizzle, rain, showers and virga, however, actual droplet size is NOT required.

2.4.5 Select statements that describe the conditions necessary for the formation/dispersal of various types of cloud.

2.5 Visibility

2.5.1 Know the method used in meteorological forecasts and reports to determine visibility.

2.5.2 Describe the term ‘runway visual range’.

2.5.3 Give reasons for differences between ‘inflight’ and ‘reported’ visibility.

2.5.4 List meteorological factors that will reduce inflight visibility.

2.6 Winds – general

2.6.1 Describe the relationship between pressure and wind and apply Buys Ballot’s law to assess the approximate location of high and low pressure systems.

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2.6.2 Differentiate between:

(a) squalls and gusts; and

(b) backing and veering.

2.6.3 Compare surface and gradient winds in terms of direction and strength.

2.6.4 List the ‘factors’ that effect the diurnal variation of wind and describe typical ‘variations’ in surface wind strength during a 24-hour period.

2.7 Air masses and fronts

2.7.1 Describe typical ‘flying weather’ associated with the following, with reference to the parameters mentioned in subsection 2.7.2:

(a) cold fronts; and

(b) warm fronts; and

(c) wave depressions; and

(d) occluded fronts; and

(e) tropical cyclones; and

(f) the equatorial trough.

2.7.2 For subsection 2.7.1, the following are the parameters:

(a) temperature (warmer/colder);

(b) wind changes (back/veer, stronger/weaker);

(c) stability and turbulence;

(d) cloud type and approximate amount, precipitation.

2.8 Flight considerations

2.8.1 With respect to the phenomena listed below from (i) to (xii)

(a) state the conditions favourable to their development and, where applicable, their dispersal;

(b) recognise signs which may indicate their presence;

(c) describe their effect on flight characteristics;

(d) where applicable, state the pilot actions required to minimise their effect on an aircraft in flight:

(i) thermals, turbulence; and

(ii) dust devils and dust storms; and

(iii) wind gradient, wind shear and low-level jetstreams; and

(iv) anabatic and katabatic winds; and

(v) mountain waves and fohn winds; and

(vi) land and sea breezes; and

(vii) inversions and fog; and

(viii) thunderstorms and microbursts; and

(ix) downdrafts associated with terrain/cloud; and

(x) atmospheric stability and instability; and

(xi) hoar frost, rime, and clear airframe ice; and

(xii) tropical cyclones, tornadoes.

2.9 Synoptic meteorology

2.9.1 Given a MSL analysis chart, identify:

(a) high and low pressure systems; and

(b) a trough, a ridge, a col; and

(c) warm, cold and occluded fronts; and

(d) a tropical cyclone; and

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(e) approximate wind direction.

2.9.2 Describe typical weather characteristics associated with the items listed in 2.9.1 (a) and (b) above.

2.9.3 For subclause 2.9.2, weather characteristics means the following:

(a) approx wind direction;

(b) moisture content (dry/humid);

(c) cloud: stratiform and cumuliform;

(d) clear skies;

(e) turbulent or smooth air;

(f) good or poor visibility.

2.10 Weather services

2.10.1 For given locations, determine from CASA documents the availability of aviation forecasts, meteorological reports and weather briefing and state the method of obtaining this information.

2.10.2 State/select the conditions under which it is mandatory to obtain a forecast.

2.10.3 For information contained in an ARFOR, TAF, TTF, METAR, SPECI, AIRMET or SIGMET, do the following:

(a) explain the coded information in plain language;

(b) decide whether a particular forecast is valid for a flight;

(c) apply the information to planning for and conducting a flight.

2.10.4 Given typical weather briefing, evaluate weather information applicable to a flight, and:

(a) assess likely changes in weather during the flight (both improving and deteriorating); and

(b) list phenomena which may adversely affect the flight.

2.10.5 List the conditions that require a pilot to submit a short AIREP.

2.10.6 State the purpose of VOLMET and ATIS broadcasts indicate how this information is obtained and apply this information to practical scenarios.

2.10.7 State what is meant by a Hazard Alert service.

2.11 Climatology

2.11.1 Explain typical seasonal weather conditions in different regions of Australia with reference to:

(a) visibility (good/poor); and

(b) prevailing winds; and

(c) typical cloud patterns and precipitation; and

(d) seasonal pressure and frontal systems, including the ITCZ and equatorial trough; and

(e) tropical cyclones.

2.12 Met observations

2.12.1 Standard observation methods:

(a) knowledge of the standard methods of measuring the following (however, knowledge of the mechanics of the various instruments used is not required):

(i) visibility;

(ii) cloud height;

(iii) pressure;

(iv) temperature;

(v) humidity;

(vi) surface wind;

(vii) upper winds.

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2.12.2 Q codes:

(a) understand the code groups QFE and QNH, and understand the meaning of area QNH.

2.12.3 Inflight observations:

(a) requirement for inflight observations by crew members;

(b) reporting criteria;

(c) form and circumstances in which observations are made and reported:

(i) refer AIP for full position report format.

2.12.4 Satellite observations:

(a) use of satellite photographs (visual and infra-red) to recognise and describe weather systems and air masses.

2.12.5 Australian flight weather documentation:

(a) comprehension and interpretation of all weather forecasts or reports in common use in Australia for aviation purposes;

(b) decoding of TAF, METAR and SIGMET messages;

(c) understand the function of TREND type forecasts and the criteria for their use.

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Unit 1.8.5 AMTA: ATPL meteorology – aeroplane

1. Reserved

2. Advanced meteorology

2.1 The atmosphere

2.1.1 Structure of the atmosphere:

(a) composition and extent;

(b) vertical division (to lower stratosphere only).

2.1.2 Pressure, temperature and density:

(a) interrelationship of pressure, temperature and density;

(b) barometric pressure, isobars;

(c) pressure, temperature and density variation with height;

(d) temperature near earth's surface:

(i) lapse rate;

(ii) surface effects;

(iii) diurnal variation;

(iv) effect of clouds;

(e) adiabatic processes:

(i) meaning of adiabatic;

(ii) dry air;

(iii) evaporation;

(iv) condensation;

(v) latent heat;

(vi) saturated air;

(f) temperature inversions:

(i) development;

(ii) types;

(iii) influence on the weather;

(g) stability and instability:

(i) DALR, SALR, ELR;

(ii) stable and unstable conditions;

(iii) conditional instability;

(iv) stability changes caused by:

(A) radiation;

(B) turbulence;

(C) convection;

(D) advection;

(E) subsidence;

(F) convergence;

(G) divergence;

(H) precipitation.

2.1.3 Humidity:

(a) water vapour in the atmosphere;

(b) vapour pressure, effect on density;

(c) dry/wet bulb temperature:

(i) dewpoint;

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(ii) relative humidity.

2.2 Clouds and precipitation

2.2.1 Cloud:

(a) types of cloud and level at which found:

(i) stratus;

(ii) cumulus;

(iii) cirrus;

(b) variations of basic types:

(i) strato-;

(ii) cumulo-;

(iii) nimbo-;

(iv) alto-;

(c) hazards (if any) presented by different types.

2.2.2 Formation of cloud:

(a) methods/mechanisms by which clouds form;

(b) conditions favourable to formation:

(i) atmospheric;

(ii) topographic.

2.2.3 Precipitation:

(a) cause of precipitation;

(b) types:

(i) drizzle, rain, snow, hail;

(ii) distinction between showers and rain;

(c) characteristics of precipitation:

(i) orographic;

(ii) frontal;

(iii) showers;

(d) hazards presented by precipitation:

(i) reduced visibility (for example, landing);

(ii) icing;

(iii) radar masking (water layer on radome);

(iv) weight and impact (severe rain on large aircraft).

2.2.4 Thunderstorms:

(a) development of a single cell:

(i) prerequisite conditions;

(ii) stages of development;

(iii) structure of mature cell;

(b) hazards presented by a thunderstorm:

(i) down-draught (near ground);

(ii) turbulence;

(iii) icing;

(iv) lightning;

(c) flight in or near thunderstorms:

(i) hazards in flight close to thunderstorms:

(ii) optimum flight paths/flight levels if penetration of a thunderstorm is necessary.

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2.3 Motion of the atmosphere

2.3.1 Wind and pressure:

(a) relationship between isobars and wind:

(i) Buys Ballot's Law;

(b) primary cause of wind:

(i) pressure gradient;

(ii) coriolis force;

(iii) gradient wind;

(iv) convergence and divergence;

(c) diurnal variation of wind;

(d) turbulence and gustiness:

(i) factors affecting turbulence;

(ii) effect of turbulence on lapse rate.

2.3.2 Local winds:

(a) land and sea breezes;

(b) anabatic, katabatic and fohn winds;

(c) low-level jet.

2.3.3 Mountain effects:

(a) standing waves, rotors;

(b) conditions favourable to development;

(c) hazards presented by mountain effects.

2.3.4 Microbursts:

(a) structure of a microburst;

(b) meteorological conditions conducive to microburst formation;

(c) visual identifying features;

(d) hazards presented by microbursts:

(i) windshear;

(ii) effect on IAS and groundspeed;

(iii) sink rate;

(iv) turbulence;

(e) windshear reporting procedures.

2.3.5 Variation of wind with height:

(a) general/common characteristics:

(i) loss of mechanical turbulence;

(ii) tends to increase speed;

(iii) tends westerly;

(b) elementary knowledge of contour charts.

2.4 Visibility

2.4.1 Measurement of visibility:

(a) brief outline of difficulties:

(i) practical measurement of visibility;

(ii) visibility versus RVR;

(iii) visibility at night;

(b) reduced visibility:

(i) distinction between fog, mist and haze;

(c) hazards presented by reduced visibility:

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(i) in flight;
(ii) on take-off or landing;
(iii) unseen obstacles on runway;
(iv) directional control, especially asymmetric roll control;
(v) obstacle avoidance if direction deviates;

(d) difference between horizontal and vertical visibility;

(e) effects of vertical visibility being greater than horizontal visibility on final approach:
(i) impression of greater visibility below aircraft's present height;
(ii) tendency to duck under glide path;
(iii) tendency to allow sink rate to increase;
(iv) reduction of visibility after flaring.

2.4.2 Fog:

(a) formation of fog:
(i) mechanism;
(ii) prerequisite conditions;

(b) synoptic conditions favourable to the formation and clearing of:
(i) radiation fog;
(ii) advection fog;
(iii) steam fog;
(iv) frontal fog.

2.4.3 Other causes of reduced visibility:

(a) effects of mist, smoke, dust, sand and sea spray;

(b) conditions favourable for such effects to develop.

2.5 Ice accretion

2.5.1 Airframe icing

(a) mechanism by which airframe ice is formed:

(b) types of icing:
(i) atmospheric conditions associated with each type;

(c) airframe areas most susceptible to icing:
(i) factors affecting type, rate and severity of icing;

(d) hazards presented by airframe icing;

(e) environmental conditions presenting an icing hazard:
(i) concept of visible moisture;
(ii) maximum and minimum air temperatures.

2.5.2 Engine icing (turbine engines only):

(a) conditions conducive to engine icing:
(i) atmospheric conditions;
(ii) aircraft conditions;

(b) sections of engine most susceptible to icing:
(i) factors affecting type, rate and severity of icing;

(c) hazards presented by engine icing.

2.5.3 Reports of icing:

(a) requirement to report;

(b) classification of degree of icing.

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2.6 Air masses and fronts

2.6.1 Properties of an air mass:

(a) concept of an air mass;

(b) factors affecting the properties of an air mass:

(i) description of an air mass.

2.6.2 Classification of air masses:

(a) classification on basis of area of origin;

(b) modifications due to advection.

2.6.3 Basic synoptic analysis:

(a) high and low pressure areas:

(i) relationship with air masses;

(b) boundaries between air masses:

(i) non-frontal boundaries;

(ii) general/common situations;

(iii) ridges;

(iv) cols.

2.6.4 Fronts:

(a) warm fronts:

(i) formation/mechanism of warm front;

(ii) associated clouds and weather;

(iii) hazards presented by warm fronts;

(b) cold fronts:

(i) formation/mechanism of cold front;

(ii) associated clouds and weather;

(iii) hazards presented by cold fronts;

(c) occluded fronts:

(i) formation/mechanism of occluded front;

(ii) associated clouds and weather;

(iii) hazards presented by occluded fronts;

(d) quasi-stationary fronts:

(i) formation/mechanism of quasi-stationary front;

(ii) associated clouds and weather;

(iii) hazards presented by quasi-stationary fronts.

2.7 Air masses and frontal analysis

2.7.1 Frontal depressions:

(a) formation of frontal depressions;

(b) warm and cold fronts:

(i) occlusion process;

(c) distribution of weather;

(d) depression families and troughs;

(e) flight conditions in and over depressions.

2.7.2 Non-frontal depressions:

(a) associated weather and flying conditions;

(b) thermal, orographic and secondary depressions.

2.7.3 Anticyclones:

(a) general properties of anticyclones;

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(b) cold and warm anticyclones.

2.7.4 Stream weather:

(a) general properties of streams;

(b) weather to be expected in typical stream situations.

2.8 Synoptic charts

2.8.1 Presentation of synoptic charts:

(a) common symbology and presentation of data;

(b) interpretation of data.

2.8.2 Basic analysis and prognostic rules:

(a) movement of pressure systems and development of pressure systems in the Australian region;

(b) movement of fronts and development of fronts;

(c) general prognosis of situations represented on synoptic charts:

(i) in the next 1 to 2 hours;

(ii) in the next 24 hours.

2.8.3 Aviation significance of synoptic chart:

(a) apply data from a synoptic chart to the selection of a route and destination/alternate;

(b) interpret data from a synoptic chart to estimate the surface weather expected at a selected point, at the time represented by the chart or at a time shortly later:

(i) surface wind;

(ii) type, amount and base of lowest cloud;

(iii) probability of rain;

(iv) probability of other features significant to aviation (for example, dust, fog, etc.).

2.9 Upper level weather

2.9.1 The tropopause:

(a) atmospheric division represented by the tropopause:

(i) temperature profile below and above the tropopause;

(b) variation in height of tropopause:

(i) at different latitudes;

(ii) in different seasons;

(c) variation in wind in the vicinity of the tropopause;

(d) temperature profile above the tropical and polar tropopause.

2.9.2 Upper level jet streams and CAT:

(a) recognise statements which define a jet stream;

(b) compare the strengths of typical tropical and polar jets;

(c) state conditions which may affect the strength and location of jet streams;

(d) recall that wind shear is usually greater on the polar side of the jet than on the equatorial side;

(e) list/identify signs which would suggest the presence of a jet stream and/or CAT;

(f) state pilot actions which would minimise the effect of CAT whilst flying:

(i) in the vicinity of a jet core;

(ii) in CAT not associated with a jet stream.

2.9.3 Flight conditions associated with:

(a) dense jet stream cirrus and cirrus haze;

(b) flight at high level in the vicinity of well-developed thunderstorm tops.

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2.10 Upper level weather charts

2.10.1 Presentation of charts:

(a) types of charts:

(i) upper level prognostic charts (brief general discussion only);

(ii) SIGWX charts;

(iii) gridpoint wind and temperature forecasts;

(b) presentation of data and symbology used in the different charts;

(c) altitudes/mb levels commonly charted.

2.10.2 Application of upper level charts:

(a) apply data from an upper level chart to the selection of a route and destination/alternate;

(b) interpret data from an upper level chart in terms of its aviation significance;

2.11 Climatology

2.11.1 Global pressure distribution:

(a) average surface pressure and temperature distribution over the world;

(b) global circulation:

(i) average circulation patterns in the troposphere and low stratosphere and their seasonal variation;

(ii) upper winds, stream lines and seasonal variation;

(c) ITCZ and its associated weather in different areas.

2.11.2 Monsoonal weather:

(a) wet and dry seasons;

(b) typical wet and dry weather conditions;

(c) hazards presented by monsoonal weather;

(d) application of monsoonal conditions to Australia and near neighbours.

2.11.3 Tropical storms:

(a) prerequisites for development:

(i) climatic;

(ii) equatorial latitudes;

(b) global breeding grounds:

(i) understand that different areas have different local names for the same phenomenon;

(c) typical life history of storm;

(d) hazards presented by tropical storms:

(i) location of severest weather in relation to storm centre;

(e) application of tropical storms to Australia and near neighbours.

2.12 Met observations

2.12.1 Standard observation methods:

(a) knowledge of standard methods of measuring, not including knowledge of the mechanics of the various instruments:

(i) visibility;

(ii) cloud height;

(iii) pressure;

(iv) temperature;

(v) humidity;

(vi) surface wind;

(vii) upper winds.

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2.12.2 Q Codes:

(a) understand the code groups QFE and QNH and understand the meaning of ‘area QNH’;:

2.12.3 Inflight observations:

(a) requirement for inflight observations by crew members;

(b) reporting criteria;

(c) form and circumstances in which observations are made and reported:

(i) AIP format for full position report.

2.12.4 Satellite observations:

(a) use of satellite photographs (visual and infra-red) to recognise and describe weather systems and air masses.

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SECTION 1.9 OPERATIONS, PERFORMANCE AND PLANNING (OP)

Unit 1.9.1 POPC: PPL operations, performance and planning – all aircraft categories

1. Reserved

2. General flight planning and performance

2.1 Loading

2.1.1 Describe the following terms:

(a) arm, moment, datum, station, index unit;

(b) centre of gravity (CG) and CG limits;

(c) empty weight, zero fuel weight (ZFW), ramp weight;

(d) maximum take-off and maximum landing weights;

(e) floor loading limits.

2.2 Speed limitations

2.2.1 Explain the following terms/abbreviations:

(a) normal operating speed (V_{no});

(b) never exceed speed (V_{NE});

(c) maximum manoeuvre speed (V_A);

(d) turbulence penetration speed (V_B);

(e) limit and design load factors;

(f) flap operating speed (V_{FO}) and flap extended speed (V_{FE}).

2.2.2 Describe situations which may result in an aircraft exceeding speed limits and load factor limits.

2.3 ERSA

2.3.1 Apply all items of information contained in ERSA which are relevant to VFR (day) operations.

2.4 Flight plan preparation

2.4.1 Apply the responsibilities of a pilot in command with regard to weather and operational briefing prior to planning a VFR flight.

2.4.2 Given a route:

(a) select appropriate visual charts for the flight;

(b) list the operations for which it is mandatory to obtain meteorological and operational briefing;

(c) list the weather services available, and nominate the sources and methods of obtaining this information;

(d) apply CASA requirements/instructions for flight notification of VFR flights and state the preferred methods of submitting this notification;

2.4.3 Given an aerodrome forecast, determine whether holding or alternate requirements apply and if so:

(a) nominate an appropriate alternate aerodrome;

(b) determine the quantity of additional fuel required for holding or flight to the alternate.

2.5 PPL – completion standard

2.5.1 Given:

(a) a departure place and 2 landing points;

(b) weather and operational briefing;

(c) passenger and/or baggage requirements;

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(d) appropriate performance data.

2.5.2 Complete a flight plan form after considering the following aspects:

(a) selection of safe route(s) and cruise levels to comply with VFR;

(b) selection of cruise levels in accordance with the table of cruising levels;

(c) fuel for the flight, holding fuel, fuel to an alternate aerodrome, and specified reserves;

(d) weight limitation and aeroplane balance requirements;

(e) latest departure time.

2.6 Equi-time point (ETP), point of no return (PNR), diversions

2.6.1 Describe/recognise situations that may require the calculations of an ETP or PNR.

2.6.2 Assuming a constant cruise altitude and TAS, indicate the position of an ETP between 2 points in still air.

2.6.3 Given fuel on board, use planned/given ground speed to decide which of the following courses of action would require the least fuel (including reserves):

(a) proceed to destination;

(b) return to the departure aerodrome;

(c) proceed to a suitable alternate.

2.7 Airworthiness and equipment

2.7.1 State the purpose of certificates of airworthiness and registration.

2.7.2 Given a typical scenario, extract the communication and normal and emergency equipment required to be on board an aircraft.

2.7.3 State the responsibilities of a pilot in command with regard to:

(a) daily inspections;

(b) recording/reporting aircraft defects;

(c) know the types of maintenance that may be carried out by a PPL or CPL holder, as appropriate;

(d) given a copy of a maintenance release:

(i) determine its validity;

(ii) list the class(es) of operation applicable to the aircraft;

(iii) list outstanding defects/endorsements and decide whether these affect the airworthiness of the aircraft.

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Unit 1.9.2 POPA: PPL operations, performance and planning – aeroplane

1. Reserved

2. General flight planning and performance

2.1 Aerodromes and aeroplane landing areas (ALAs)

2.1.1 Explain/apply the following terms used in CASA publications and documents:

(a) take-off safety speed;

(b) take-off distance available (TODA);

(c) take-off distance required (TODR);

(d) landing distance available (LDA);

(e) landing distance required (LDR).

2.1.2 Determine whether a given ALA is suitable for an aeroplane to take-off and land safety in accordance with guidelines contained in CAAP 92.1.

2.2 Take-off and landing performance

2.2.1 State the effect (increase/decrease) of the following factors on take-off, landing, and take-off climb performance:

(a) strength of headwind/tailwind component;

(b) air temperature;

(c) QNH;

(d) density height (non-standard conditions);

(e) airfield elevation;

(f) runway slope and surface, including wet and slushy runways;

(g) ground effect and windshear;

(h) frost on an aircraft.

2.2.2 Differentiate between pressure height and density height.

2.2.3 Describe how to use an altimeter to obtain:

(a) local QNH at an aerodrome; and

(b) pressure height of an aerodrome; and

(c) elevation of an aerodrome.

2.2.4 Explain the terms:

(a) maximum structural take-off and landing weight; and

(b) climb weight limit.

2.2.5 State the likely results of exceeding aircraft weight limits.

2.3 Density height

2.3.1 Using the methods under subsection 2.3.2, determine density height, given the following:

(a) OAT and pressure height;

(b) using cockpit temperature and an altimeter setting of 1013.2 hPa.

2.3.2 For subsection 2.3.1, the methods are the following:

(a) density altitude charts;

(b) manual computer;

(c) flight manual charts;

(d) mathematics.

2.4 Take-off and landing performance

2.4.1 Use the flight manual to extract maximum structural take-off and landing weights.

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2.4.2 Given a typical flight scenario, use performance charts to extract:

(a) maximum take-off weight A;

(b) maximum landing weight A;

(c) take-off distance required (TODR) B;

(d) landing distance required (LDR) B;

(e) climb weight limit;

(f) take-off parameters:

(i) power;

(ii) flap setting;

(iii) take-off safety speed;

(g) landing parameters:

(i) flap;

(ii) threshold speed;

(h) State the conditions on which the parameters listed in paragraphs (f) and (g) are based.

2.5 Climb, cruise and descent performance

2.5.1 From typical charts or tables extract/determine the following data for climb, cruise and descent:

(a) time, speed, distance, fuel flow/quantity;

(b) appropriate engine settings;

(c) rates of climb/descent;

(d) the conditions under which an aeroplane will achieve maximum range and endurance.

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Unit 1.9.3 POPH: PPL operations, performance and planning – helicopter

1. Reserved

2. General flight planning and performance

2.1 Helicopter limitations

2.1.1 Describe the reason for the following limitations on helicopter performance:

(a) maximum rotor RPM – power on;

(b) maximum rotor RPM – power off;

(c) minimum rotor RPM – power on;

(d) minimum rotor RPM – power off;

(e) never exceed speed – power on;

(f) never exceed speed – power off;

(g) maximum sideways speed;

(h) maximum rearward speed;

(i) maximum take-off weight;

(j) maximum all up weight;

(k) minimum operating weight;

(l) maximum positive and negative flight load factors.

2.2 Flight manual

2.2.1 Select from a list, the information which may be obtained from a flight manual.

2.3 Density altitude

2.3.1 Match each of the following terms with an appropriately worded definition:

(a) pressure altitude;

(b) density altitude;

(c) ambient conditions;

(d) forecast conditions.

2.3.2 Calculate density altitude given pressure altitude (or elevation and QNH) and temperature.

2.4 Helicopter landing sites (HLS)

2.4.1 Recall the requirements of basic and secondary HLS in respect to:

(a) physical specifications;

(b) operational requirements;

(c) general conditions for use.

2.5 Take-off and landing weight

2.5.1 Select from a list the statement which best describes:

(a) the effect of the following variables on the take-off and/or landing performance of a helicopter:

(i) weight;

(ii) power;

(iii) ground effect;

(iv) density altitude;

(v) ambient wind component;

(b) the easiest way of determining pressure altitude from a sensitive altimeter.

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2.5.2 Determine hover performance in and out of ground effect given the following:

(a) gross weight;

(b) pressure altitude;

(c) temperature;

(d) flight manual performance charts.

2.6 Forward climb performance

2.6.1 Given graphical or tabular information typical of that provided in a flight manual for a single-engine helicopter extract:

(a) the best rate of climb for various conditions of pressure altitude, temperature and weight;

(b) the service ceiling for various conditions of pressure altitude, temperature and weight.

2.7 Cruise performance

2.7.1 Given graphical or tabular information typical of that provided in a flight manual for a single-engine helicopter, calculate:

(a) maximum payload which may be carried after determining the fuel requirements and the nature of the operation;

(b) endurance for holding or search for various combinations of helicopter weight and fuel;

(c) the maximum range, given weight, fuel carried and cruising altitude.

2.8 Weight and balance

2.8.1 Recall the meaning of the following terms used in the computation of weight and balance data:

(a) datum;

(b) arm;

(c) moment;

(d) station;

(e) centre of gravity range;

(f) lateral centre of gravity range;

(g) empty weight;

(h) operating weight;

(i) maximum take-off weight (MTOW).

2.8.2 Given a typical manual for a single-engine helicopter:

(a) extract the following weight and balance information:

(i) MTOW;

(ii) capacity and arm of the baggage lockers;

(iii) capacity, arm, grade and specific gravity of the fuel;

(iv) location and arms of the seating;

(b) determine the forward, aft and lateral limits of the CG for a given weight in the case of the above helicopter;

(c) determine whether the helicopter is safely loaded for flight given various combinations of weight and balance data using arithmetical methods or the specified loading system for the helicopter;

(d) calculate the adjustment of load required to achieve a CG within specified limits if previously determined to be outside limits;

(e) calculate where to position additional load items so that the CG is retained within the specific limits.

2.9 Flight plan preparation

2.9.1 Apply the responsibilities of a pilot in command with regard to weather and operational briefing prior to planning a VFR flight.

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2.9.2 Given a route, select appropriate charts for the flight and list the operations for which it is mandatory to obtain a weather briefing.

2.9.3 List the weather services available, and nominate the sources and methods of obtaining this information.

2.9.4 State the minimum flight notification required, the method(s) of submitting this notification, and identify flight plan details that must be submitted.

2.9.5 Given an aerodrome forecast, decide whether it is necessary to:

(a) nominate an alternate aerodrome; or

(b) carry additional fuel for holding, and if so determine the following:

(i) requirement to nominate an appropriate alternate aerodrome;

(ii) determine the quantity of additional fuel required for holding or flight to the alternate.

2.9.6 Given a typical flight scenario, including:

(a) departure and landing points within and outside controlled airspace;

(b) weather and operational briefing;

(c) appropriate performance data;

(d) select safe route/cruise levels to comply with VFR;

(e) select cruise levels for the following:

(i) to comply with VFR and the table of cruising levels;

(ii) which meets passenger and fuel economy requirements;

(f) determine, for the following:

(i) the minimum fuel required;

(ii) the maximum payload (passengers/cargo and fuel) that may be carried whilst meeting the appropriate requirements;

(iii) whether intermediate refuelling is necessary;

(iv) ETD/ETA after considering VFR (day) requirements and flight/duty time limitations;

(g) complete a flight plan and a loading system.

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Unit 1.9.4 POPG: PPL operations, performance and planning – gyroplane

1. General flight planning and performance

1.1 Determine whether a given ALA is suitable for a gyroplane to take off and land safely in accordance with guidelines contained in CASA guidance material.

2. Take-off and landing performance

2.1 State the effect (increase/decrease) of the following factors on take-off, landing, and take-off climb performance:

(a) strength of headwind/tailwind component;

(b) air temperature;

(c) QNH;

(d) density height (non-standard conditions);

(e) airfield elevation;

(f) runway slope and surface, including wet and slushy runways;

(g) ground effect and windshear;

(h) frost on an aircraft.

2.2 Differentiate between pressure height and density height.

2.3 Explain the terms:

(a) maximum structural take-off and landing weight; and

(b) climb weight limit.

2.4 State the likely results of exceeding gyroplane weight limits.

3. Density height

3.1 Using the methods under subsection 3.2, determine density height, given the following:

(a) OAT and pressure height;

(b) using cockpit temperature and an altimeter setting of 1013.2 hPa.

3.2 For subsection 3.1, the methods are the following:

(a) density altitude charts;

(b) manual computer;

(c) aircraft flight manual charts;

(d) mathematics.

4. Take-off and landing performance

4.1 Use the aircraft flight manual to extract maximum structural take-off and landing weights.

4.2 Given a typical flight scenario, use performance charts to extract:

(a) maximum take-off weight A;

(b) maximum landing weight A;

(c) take-off distance required (TODR) B;

(d) landing distance required (LDR) B;

(e) climb weight limit.

5. Climb, cruise and descent performance

5.1 From typical charts or tables extract/determine the following data for climb, cruise and descent:

(a) time, speed, distance, fuel flow/quantity;

(b) appropriate engine settings;

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(c) rates of climb/descent;

(d) the conditions under which a gyroplane will achieve maximum range and endurance.

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Unit 1.9.5 COPC: CPL operations, performance and planning – all aircraft categories

1. Reserved

2. Flight planning and performance

2.1 Density height

2.1.1 Using the methods under subsection 2.1.2, determine density height, given the following:

(a) OAT and pressure height;

(b) using cockpit temperature and an altimeter setting of 1013.2 hPa.

2.1.2 For subsection 2.1.1, the methods are the following:

(a) density altitude charts;

(b) manual computer;

(c) flight manual charts;

(d) mathematics.

2.2 Take-off and landing

2.2.1 Use the flight manual to extract maximum structural take-off and landing weights mentioned in subsection 2.2.2 according to the requirements mentioned in subsection 2.2.3.

2.2.2 Given a typical flight scenario, for the items mentioned in subsection 2.2.3, use performance charts to extract the following:

(a) maximum take-off weight;

(b) maximum landing weight;

(c) take-off distance required (TODR);

(d) landing distance required (LDR);

(e) climb weight limit;

(f) take-off parameters – power, flap setting, take-off safety speed;

(g) landing parameters – flap, threshold speed and state the conditions on which the parameters listed in (f) and (g) are based.

2.2.3 For subsection 2.2, the following requirements apply:

(a) apply information extracted from ERSA;

(b) determine TODA and LDA at a ground ALA;

(c) apply the CASA regulatory requirements/orders as applicable to single-engine aeroplanes;

(d) extract/derive entry parameters for take-off and landing charts viz:

(i) temperature and pressure;

(ii) take-off and landing weights;

(e) extract structural weight limits from a flight manual.

3. Climb, cruise and descent performance

3.1.1 From typical charts or tables, determine the following data for climb, cruise and descent:

(a) time, speed, distance, fuel flow/quantity;

(b) appropriate engine settings;

(c) rates of climb/descent;

(d) the conditions under which an aeroplane will achieve maximum range and endurance.

3.1.2 Determine the following, using the fuel units of US gal, kg, litres:

(a) best air and ground nm/unit of fuel;

(b) least fuel/air or ground nm.

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4. Weight and balance

4.1 Weight calculations

4.1.1 Calculate the following:

(a) mid-zone weight;

(b) landing weight;

(c) take-off weight at an intermediate landing point.

4.2 Loading

4.2.1 Explain the following terms:

(a) arm, moment, datum, station, index unit;

(b) CG and CG limits;

(c) mean aerodynamic chord (MAC);

(d) empty weight, ZFW, ramp weight;

(e) maximum take-off and maximum landing weights;

(f) floor loading limits.

4.2.2 Demonstrate the ability to:

(a) express CG as a % of MAC;

(b) determine CG position relative to the datum;

(c) determine movement of CG with changes in load distribution and mass.

4.2.3 Given appropriate data use a typical loading system or a load sheet to distribute load to maintain CG within limits throughout a flight. This objective requires the ability to perform 1 or more of the following tasks:

(a) extract the following weight limits from a flight manual:

(i) empty weight ZFW;

(ii) maximum structural take-off and landing weight.

(b) determine the following:

(i) maximum payload;

(ii) maximum load per station;

(iii) maximum floor loading capacities;

(iv) fore and aft CG limits for a given/derived weight;

(v) weight of fuel/ballast to be carried;

(c) determine the following:

(i) the maximum payload/fuel that may be carried;

(ii) ballast requirements, if any;

(iii) the position of the CG under different load configurations.

5. Flight plan preparation

5.1.1 Apply the responsibilities of a pilot in command with regard to weather and operational briefing prior to planning a VFR flight.

5.1.2 Given a route applicable to the level of licence and type of operation viz. OCTA/CTA, do the following:

(a) select appropriate visual charts for the flight;

(b) list the operations for which it is mandatory to obtain meteorological and operational briefing;

(c) list the weather services available, and nominate the sources and methods of obtaining this information;

(d) apply CASA requirements/instructions for flight notification of VFR flights and state the preferred methods of submitting this notification.

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5.1.3 Given an aerodrome forecast determine whether holding or alternate requirements apply and if so, for the following:

(a) nominate an appropriate alternate aerodrome;

(b) determine the quantity of additional fuel required for holding or flight to the alternate.

5.2 Flight planning

5.2.1 Reserved

5.2.2 For a domestic flight plan form:

(a) given the following:

(i) a typical training navigation route (OCTA/CTA), as applicable;

(ii) appropriate weather and operational briefing;

(iii) aircraft (type) planning data and fuel at start up; and

(b) apply the fuel policy described in CAAP 234-1(0); and

(c) select correct (safe) cruise levels; and

(d) enter information correctly in the flight plan form; and

(e) submit appropriate flight notification details; and

(f) determine minimum (safe) fuel and endurance; and

(g) demonstrate accuracy in computations:

(i) HDG +/- 5°, ETI +/- 2 mins; and

(ii) fuel and endurance +5%.

5.2.3 Given the following:

(a) a departure place and 2 landing points;

(b) weather and operational briefing;

(c) passenger and/or baggage requirements;

(d) appropriate performance data;

then complete a flight plan form after considering the following aspects:

(e) selection of safe route(s) and cruise levels to comply with VFR;

(f) selection of cruise levels in accordance with the table of cruising levels;

(g) fuel for the flight, holding fuel, fuel to an alternate aerodrome, and specified reserves;

(h) weight limitation and aeroplane balance requirements;

(i) latest departure time.

5.2.4 Given a typical commercial task, including the following, do the things mentioned in paragraphs (d), (e), (f) and (g):

(a) departure and landing points within and/or outside controlled airspace;

(b) weather and operational briefing;

(c) appropriate performance data;

then:

(d) select safe routes to comply to VFR;

(e) select cruise levels as follows:

(i) to comply with VFR and the table of cruising levels;

(ii) which meet passenger and fuel economy requirements;

(f) determine the following:

(iii) the minimum (safe) fuel required;

(iv) the maximum payload (passengers/cargo and fuel) that may be carried;

(v) whether intermediate refuelling is necessary;

(vi) ETD and ETA after considering day VFR requirements, flight/duty time limitations and commercial considerations;

(g) complete a flight plan form and a loading system.

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5.3 Equi-time point (ETP), point of no return (PNR), diversions

5.3.1 Given fuel on board, use planned/given ground speed to decide which of the following courses of action would require the least fuel (including reserves):

(a) proceed to destination;

(b) return to the departure aerodrome;

(c) proceed to a suitable alternate.

5.3.2 Calculate time and distance to an ETP or PNR between 2 points, using planned or given data.

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Unit 1.9.6 COPA: CPL operations, performance and planning – aeroplane

1. Reserved

2. Operational knowledge

2.1 Aerodromes and aeroplane landing areas (ALAs)

2.1.1 ALAs are included as a topic in this syllabus pursuant to a pilot's responsibilities in accordance with CASA regulations.

2.1.2 Explain and apply the following terms used in CASA publications and documents:

(a) take-off safety speed;

(b) take-off distance available (TODA);

(c) take-off distance required (TODR);

(d) landing distance available (LDA);

(e) landing distance required (LDR).

2.1.3 Determine whether a given aerodrome or ALA is suitable for an aeroplane to take-off and land safety in accordance with guidelines contained in CASA guidance material.

2.2 Climb, cruise and descent performance

2.2.1 From typical charts or tables extract/determine the following data for climb, cruise and descent:

(a) time, speed, distance, fuel flow/quantity;

(b) appropriate engine settings;

(c) rates of climb/descent;

(d) the conditions under which an aeroplane will achieve maximum range and endurance.

2.2.2 Determine the:

(a) best air and ground nm/unit of fuel (for example, 2.5 nm/kg);

(b) least fuel/air or ground nm (for example, 0.4 kg/nm).

3. Fuel units

3.1.1 Using US Gal, kg and litres, estimate:

(a) mid-zone weight;

(b) landing weight;

(c) take-off weight at an intermediate landing point.

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Unit 1.9.7 COPH: CPL operations, performance and planning – helicopter

1 Reserved

1. Operational knowledge

1.1 Helicopter limitations

1.1.1 Describe the reason for following operational limitation on helicopter performance:

(a) maximum rotor RPM – power on;

(b) maximum rotor RPM – power off;

(c) minimum rotor RPM – power on;

(d) minimum rotor RPM – power off;

(e) never exceed speed – power on;

(f) never exceed speed – power off;

(g) maximum sideways speed;

(h) maximum rearward speed;

(i) maximum take-off weight;

(j) maximum all up weight;

(k) minimum operating weight;

(l) maximum positive and negative flight load factors.

1.2 Helicopter landing sites (HLS)

1.2.1 Recall the requirements of basic and secondary HLS in respect to:

(a) physical specifications;

(b) operational requirements;

(c) general conditions for use.

1.3 Take-off and landing weight

1.3.1 Select from a list the statement which best describes:

(a) the effect of the following variables on the take-off and/or landing performance of a helicopter:

(i) weight;

(ii) power;

(iii) ground effect;

(iv) density altitude;

(v) ambient wind component;

(b) the easiest way of determining pressure altitude from a sensitive altimeter.

1.3.2 Determine hover performance in and out of ground effect given the following:

(a) gross weight;

(b) pressure altitude;

(c) temperature;

(d) flight manual performance charts.

1.4 Forward climb performance

1.4.1 Given graphical or tabular information typical of that provided in a flight manual for a single-engine helicopter extract:

(a) the best rate of climb for various conditions of pressure altitude, temperature and weight;

(b) the service ceiling for various conditions of pressure altitude, temperature and weight.

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1.5 Cruise performance

1.5.1 Given graphical or tabular information typical of that provided in a flight manual for a single-engine helicopter, calculate:

(a) maximum payload which may be carried after determining the fuel requirements and the nature of the operation;

(b) endurance for holding or search for various combinations of helicopter weight and fuel;

(c) the maximum range, given weight, fuel carried and cruising altitude.

1.6 Weight and balance

1.6.1 Recall the meaning of the following terms used in the computation of weight and balance data:

(a) datum;

(b) arm;

(c) moment;

(d) station;

(e) centre of gravity range;

(f) lateral centre of gravity range;

(g) empty weight;

(h) operating weight;

(i) maximum take-off weight (MTOW).

1.6.2 Given a typical manual for a single-engine helicopter:

(a) extract the following weight and balance information:

(i) MTOW;

(ii) capacity and arm of the baggage lockers;

(iii) capacity, arm, grade and specific gravity of the fuel;

(iv) location and arms of the seating;

(b) determine the forward, aft and lateral limits of the CG for a given weight in the case of the above helicopter;

(c) determine whether the helicopter is safely loaded for flight given various combinations of weight and balance data using arithmetical methods or the specified loading system for the helicopter;

(d) calculate the adjustment of load required to achieve a CG within specified limits if previously determined to be outside limits;

(e) calculate where to position additional load items so that the CG is retained within the specific limits.

1.7 Flight plan preparation

1.7.1 Apply the responsibilities of a pilot in command with regard to weather and operational briefing prior to planning a VFR flight.

1.7.2 Given a route, select appropriate charts for the flight and list the operations for which it is mandatory to obtain a weather briefing.

1.7.3 List the weather services available, and nominate the sources and methods of obtaining this information.

1.7.4 State the minimum flight notification required, the method(s) of submitting this notification, and identify the flight plan details that must be submitted.

1.7.5 Given an aerodrome forecast, decide whether it is necessary to the following:

(a) nominate an alternate aerodrome;

(b) carry additional fuel for holding and if so:

(i) nominate an appropriate alternate aerodrome;

(ii) determine the quantity of additional fuel required for holding or flight to the alternate.

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1.7.6 Given a typical flight scenario, including:

(a) departure and landing points within and outside controlled airspace;

(b) weather and operational briefing;

(c) appropriate performance data;

(d) select safe route/cruise levels to comply with VFR;

(e) select cruise levels for the following:

(i) to comply with VFR and the table of cruising levels;

(ii) which meets passenger and fuel economy requirements;

(f) determine for the following:

(i) the minimum fuel required;

(ii) the maximum payload (passengers/cargo and fuel) that may be carried whilst meeting the appropriate requirements;

(iii) whether intermediate refuelling is necessary;

(iv) ETD/ETA after considering VFR (day) requirements and flight/duty time limitations;

(g) complete a flight plan and a loading system.

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Unit 1.9.8 COPG: CPL operations, performance and planning – gyroplane

1. Operational knowledge

1.1 Aerodromes and gyroplane landing areas (ALAs)

1.1.1 ALAs are included as a topic in this syllabus for the purposes of a pilot's responsibilities in accordance with CAR and CASR.

1.1.2 Explain and apply the following terms used in CASA publications and documents:

(a) take-off distance available (TODA);

(b) take-off distance required (TODR);

(c) landing distance available (LDA);

(d) landing distance required (LDR).

1.1.3 Determine whether a given aerodrome or ALA is suitable for a gyroplane to take off and land safely in accordance with guidelines contained in CASA guidance material.

2. Climb, cruise and descent performance

2.1 From typical charts or tables extract/determine the following data for climb, cruise and descent:

(a) time, speed, distance, fuel flow/quantity;

(b) appropriate engine settings;

(c) rates of climb/descent;

(d) the conditions under which a gyroplane will achieve maximum range and endurance.

3. Forward climb performance

3.1 Given graphical or tabular information typical of that provided in an aircraft flight manual for a single-engine gyroplane, extract the following:

(a) the best rate of climb for various conditions of pressure altitude, temperature and weight;

(b) the service ceiling for various conditions of pressure altitude, temperature and weight.

4. Cruise performance

4.1 Given graphical or tabular information typical of that provided in an aircraft flight manual for a single-engine gyroplane, calculate the following:

(a) maximum payload which may be carried after determining the fuel requirements and the nature of the operation;

(b) endurance for holding or search for various combinations of gyroplane weight and fuel;

(c) maximum range, given weight, fuel carried and cruising altitude.

5. Weight and balance

5.1 Given a typical aircraft flight manual for a single-engine gyroplane:

(a) extract the following weight and balance information:

(i) MTOW;

(ii) capacity and arm of the baggage lockers;

(iii) capacity, arm, grade and specific gravity of the fuel;

(iv) location and arms of the seating;

(b) determine the forward, aft and lateral limits of the CG for a given weight in the case of the above gyroplane;

(c) determine whether the gyroplane is safely loaded for flight given various combinations of weight and balance data using arithmetical methods or the specified loading system for the gyroplane;

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(d) calculate the adjustment of load required to achieve a CG within specified limits if previously determined to be outside limits;

(e) calculate where to position additional load items so that the CG is retained within the specific limits.

6. Flight plan preparation

6.1 Apply the responsibilities of a pilot in command in relation to weather and operational briefing before planning a VFR flight.

6.2 Given a route, select appropriate charts for the flight and list the operations for which it is mandatory to obtain a weather briefing.

6.3 List the weather services available, and nominate the sources and methods of obtaining this information.

6.4 State the minimum flight notification required, the methods of submitting this notification, and identify the flight plan details that must be submitted.

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Unit 1.9.9 **COPP: CPL operations, performance and planning – powered-lift – Reserved**

Unit 1.9.10 **COPS: CPL operations, performance and planning – airship – Reserved**

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SECTION 1.10 FLIGHT PLANNING (FP)

Unit 1.10.1 AFPC: ATPL flight planning – all aircraft categories – *Reserved*

Unit 1.10.2 AFPA: ATPL flight planning – aeroplane

1. Reserved

2. Flight planning and flight monitoring

2.1 Practical considerations

2.1.1 Complete a practical flight planning exercise using specified initial conditions and operations manual data. Other conditions may be inserted or varied en route for test purposes. The exercise is intended as a consolidated test of a candidate's ability to apply flight planning, performance and navigational principles, and will include:

(a) determine take-off limits with consideration of the following as applicable:
- (i) selection of runway;
- (ii) payload/fuel uplift capability;
- (iii) MTOW, including limits imposed by cruise or landing factors;
- (iv) calculation of V-speeds and take-off distances;

(b) preparation of a weight and balance proforma:
- (i) adjustment of load/fuel if required;

(c) selection of route and altitude:
- (i) allowing for wind and temperature;
- (ii) based on (given) forecast or actual conditions:
  - (A) synoptic;
  - (B) SIGMET;
  - (C) upper winds;
  - (D) TAF/METARs;
- (iii) including departure, destination and alternate requirements;

(d) preparation of a fuel plan:
- (i) sector fuel burns;
- (ii) total fuel burn;
- (iii) alternate and reserve fuel;
- (iv) total fuel required;

(e) preparation of a navigation plan:
- (i) sector times, distances, tracks;
- (ii) headings and ground speeds;
- (iii) minimum en route altitudes;
- (iv) allowance for climb and descent;

(f) inflight computations, revisions or replanning:
- (i) fuel state, fuel requirements, fuel reserves;
- (ii) navigational progress:
  - (A) tracks, ETAs, en route wind;
- (iii) diversion from track;
- (iv) change of cruising level;
- (v) engine-out flight;
- (vi) holding;
- (vii) assisting in search;

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(g) interpretation of AIP maps and symbols;

(h) interpretation of (given) ATC requirements:

  (i) SID and/or STAR routings;

  (ii) DME descent steps;

(i) calculation of the following types of CP (ETP) and PNR:

  (i) normal;

  (ii) engine-out;

  (iii) depressurised.

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Unit 1.10.3 AFPH: ATPL flight planning – helicopter

1. Reserved

2. Flight planning

2.1 Practical considerations

2.1.1 Complete a practical fight planning exercise using specified initial conditions and operations manual data:

(a) determine take-off limits with consideration of the following as applicable:

(i) payload/fuel uplift capability;

(ii) MTOW, including limits imposed by cruise factors;

(b) prepare a weight and balance proforma:

(i) adjustment of load/fuel it required;

(c) selection of route and altitude:

(i) allowing for wind and temperature;

(ii) based on (given) forecast or actual conditions from the following meteorological reports/forecasts with consideration of departure, destination and alternate requirements;

(iii) synoptic;

(iv) SIGMET;

(v) winds;

(vi) TAF, TTF, METARs;

(d) preparation of a fuel plan:

(i) sector fuel burns;

(ii) mid-zone weight (MZW);

(iii) total fuel burn;

(iv) alternate and reserve fuel;

(v) total fuel required;

(e) preparation of a navigation plan:

(i) sector times, distances, tracks;

(ii) headings and ground speeds;

(iii) minimum en route altitudes;

(iv) allowance for climb and descent;

(v) lowest safe altitudes;

(f) inflight computations, revisions or replanning:

(i) fuel state, fuel requirements, fuel reserves;

(ii) navigational progress, including tracks, ETAs, en route wind;

(iii) diversion from track;

(iv) change of cruising level;

(v) engine-out flight;

(g) interpretation of AIP maps and symbols;

(h) interpretation of (given) ATC requirements;

(i) SID and/or STAR routings;

(ii) DME and GNSS descent steps;

(i) calculation of the following types of CP (ETP) and PNR:

(i) normal;

(ii) engine-out.

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2.2 Pre-flight considerations

2.2.1 Aircraft equipment fits.

2.2.2 General helicopter exemptions:

(a) performance of straight in approaches;

(b) turns before 500 ft after take-off;

(c) non-requirement to conduct flight control checks before take-off;

(d) refuelling requirements;

(e) crew seating requirements;

(f) hoisting, rappelling and sling loads.

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SECTION 1.11 ATPL PERFORMANCE AND LOADING (PL)

Unit 1.11.1 APLC: ATPL performance and loading – all aircraft categories – *Reserved*

Unit 1.11.2 APLA: ATPL performance and loading – aeroplane

1. Reserved

2. Take-off and landing performance

2.1 Terminology

2.1.1 Explain the following terms in the context of take-off and landing performance:

(a) speeds:
- (i) V_1, V_R, V_2;
- (ii) V_S and derivatives (for example, 1.3 V_S);
- (iii) maximum rate and maximum angle climb speed;
- (iv) V_{MCA}, V_{MCG};
- (v) flap retraction speed schedule;

(b) distances:
- (i) TORR/TORA, TODR/TODA, ASDR/ASDA, LDR/LDA;
- (ii) balanced field length;
- (iii) clearway, stopway;

(c) weights:
- (i) TOW/MTOW, LW/MLW, ZFW/MZFW;
- (ii) basic operating weight;
- (iii) useable fuel;
- (iv) payload;

(d) take-off segments:
- (i) first, second, third and fourth segments;

(e) pavement segments:
- (i) LCN, CAN, PCN;
- (ii) pavement concession;
- (iii) wheel loading.

2.2 Theory – take-off performance

2.2.1 Runway:

(a) derivation/basis of take-off distance;

(b) derivation/basis of accelerate-stop distance:
- (i) delay factors assumed;
- (ii) use of reverse thrust;

(c) derivation/basis of V_1;

(d) concept of balanced field length;

(e) clearways and stopways:
- (i) function;
- (ii) effect on V_1;
- (iii) effect on TOW when runway-limited;

(f) V_R and V_2:
- (i) interrelationship with V_1;
- (ii) range of acceptable values;

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(g) allowance for headwind/tailwind;

(h) allowance for abnormal runway surfaces:

(i) wet;

(ii) standing water/snow;

(iii) gravel.

2.2.2 Take-off climb:

(a) concept/purpose of take-off segments;

(b) composition of segments:

(i) first;

(ii) second;

(iii) third;

(iv) fourth;

(c) take-off climb gradients:

(i) distinction between gross and net gradient;

(ii) purpose of net gradient;

(d) gradients required in each segment:

(i) gross and net;

(ii) two-, three- and four-engine aircraft;

(e) obstacle clearance requirements:

(i) take-off area (IMC case only);

(ii) vertical clearance;

(f) curved departures:

(i) point at which turn may commence;

(ii) bank angle;

(iii) vertical clearance.

2.2.3 Take-off weight restrictions:

(a) factors affecting the maximum permissible take-off weight, including;

(i) structural limit;

(ii) TODA limit;

(iii) ASDA limit;

(iv) second-segment climb limit;

(v) effect of different flap settings:

(A) lift-off speed;

(B) lift-off distance;

(C) second segment performance;

(vi) effect of increased V_2 ('V_2 overspeed'):

(A) lift-off speed;

(B) lift-off distance;

(C) second segment climb performance;

(vii) typical penalties applied for non-standard take-off:

(A) line-up allowance;

(B) use of anti-ice;

(C) non-availability of reverse thrust;

(D) non-availability of anti-skid braking;

(E) non-availability of ground spoilers;

(F) abnormal runway surface.

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2.2.4 Effects of operating technique:

(a) explain the effects of early or late rotation speed:

(i) runway distance to lift-off;

(ii) vertical clearance at runway end;

(b) explain the effects of too-rapid or too-slow rotation rate:

(i) runway distance to lift-off;

(ii) obstacle clearance;

(c) possibility of tail-strike or stall with early or rapid rotation.

2.2.5 Take-off thrust de-rating:

(a) concept of de-rated thrust;

(b) typical restrictions/limitations on use of de-rate;

(c) typical de-rate values.

2.3 Practical application – take-off

(a) use typical operations manual data to determine either:

(i) MTOW on given runway; or

(ii) minimum runway length at given take-off weight incorporating any or all of the following variables:

(A) runway slope;

(B) wet runway;

(C) wind component;

(D) temperature;

(E) altitude;

(F) flap setting;

(G) engine type and/or power derate setting;

(H) obstacles of various heights at various distances;

(b) use typical operations manual data to determine V_1, V_R and V_2.

2.4 Theory – landing performance

2.4.1 Runway:

(a) derivation/basis of landing distance:

(i) certification landing technique;

(ii) factoring;

(b) normal/abnormal runway surfaces;

(c) allowance for wind.

2.4.2 Approach and touchdown:

(a) determination/basis of VREF:

(i) nominally 1.3 V_S;

(ii) typical additives for gust;

(b) nominal approach path:

(i) 3^o-degree slope;

(ii) runway aim point (1,000 ft from threshold);

(iii) threshold crossing height;

(iv) compare with certification landing technique;

(c) effect of different flap settings:

(i) approach speed;

(ii) visibility (cockpit cutoff angle);

(iii) low-speed stability;

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(iv) go-around capability.

2.4.3 Flight path gradients – landing:

(a) net path at 1,500 ft above airfield;

(b) missed approach climb:

(i) configuration;

(ii) required gradients for two-, three- and four-engine aircraft;

(c) landing climb:

(i) configuration;

(ii) required gradients for two-, three- and four-engine aircraft.

2.4.4 Landing weight restrictions:

(a) explain the factors affecting the maximum permissible landing weight, including:

(i) structural limit;

(ii) LDA limit;

(iii) missed approach climb limit;

(iv) landing climb limit;

(v) typical penalties applied for non-standard landing:

(A) non-availability of reverse thrust;

(B) non-availability of anti-skid;

(C) non-availability of ground spoilers;

(vi) abnormal runway surface.

2.4.5 Effects of operating technique:

(a) effect of excessive touchdown speed;

(b) effect of late touchdown such as prolonged flare and holding off;

(c) effect of delayed reverse thrust.

2.5 Practical application – landing

(a) using typical operations manual data, calculate each of the following:

(i) MLW on given runway; or

(ii) minimum runway length at given landing weight incorporating any or all of the following variables:

(A) runway slope;

(B) wet runway;

(C) wind component;

(D) temperature;

(E) altitude;

(F) flap setting;

(iii) Reference velocity (V_{REF}); and

(b) using typical operations manual data:

(i) calculate the MTOW and the MLW, taking into consideration the limiting factors that are applicable to the given circumstances, and then deciding which of those factors is the critically limiting one, being aware that the TOW might be limited by cruising level or landing factors; and

(ii) determine the limiting variable for a given take-off situation (for example, the limiting temperature at which a given take-off can be made).

3. Climb, cruise and descent performance

3.1 Terminology

3.1.1 Understand and be able to use terms in correct context:

(a) LRC;

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(b) specific range;
(c) PNR;
(d) point of safe diversion (PSD);
(e) ETP;
(f) ISA and temperature derivatives (for example, ISA+10°).

3.2 Theory

3.2.1 Basis of speed and thrust management:
(a) basic theory:
(i) drag (thrust) versus speed;
(ii) thrust/speed required for minimum drag;
(iii) thrust/speed required for minimum fuel consumption;
(iv) specific range;
(v) thrust available versus thrust required;
(vi) excess thrust;
(vii) climb speeds;
(viii) best rate of climb;
(ix) best angle of climb;
(x) graphical representations of the above.
(b) effect of altitude and temperature variations:
(i) fuel consumption;
(ii) range;
(iii) specific range;
(iv) rate of climb.

3.2.2 Effect of operational decisions:
(a) factors affecting choice of cruise speed (general discussion only):
(i) direct costs;
(ii) indirect costs;
(iii) scheduled departure/arrival times;
(iv) effect on connecting flights;
(v) effects of competition;
(vi) making up for delayed departure;
(b) selection of cruise schedules:
(i) economic cruise;
(ii) LRC;
(iii) use of high-speed cruise;
(iv) selection of cruise altitude;
(v) performance index for FMS input;
(c) selection of descent point:
(i) fuel used on descent;
(ii) fuel used at low level;
(iii) effect of early/late descent;
(d) engine-out considerations.

3.2.3 En route flight path gradients:
(a) en route climb gradient:
(i) two-engine aircraft;
(ii) three- and four-engine aircraft;

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(b) en route obstacle clearance (IMC case):

(i) horizontal distance from obstacles;

(ii) vertical clearance of obstacles;

(iii) net gradient required at minimum clearance;

(c) drift-down procedure:

(i) increased vertical clearance required.

3.3 Practical application

3.3.1 For the climb segment, given appropriate initial data, including variations from ISA, use typical operations manual information to determine each of the following:

(a) time/distance/fuel used to a given altitude;

(b) altitude reached after a given time or distance;

(c) fuel/distance/time requirements for intermediate level changes.

3.3.2 Cruise and descent:

(a) given appropriate initial data, including variations from ISA, use typical operations manual information to determine, under normal and engine-out conditions:

(i) maximum and optimum cruise levels;

(ii) TAS and fuel consumption at specified altitudes, adjusting for use of airconditioning packs, bleed air, etc. as required;

(iii) maximum weight or temperature at which specified performance and/or altitudes can be attained;

(iv) holding speeds and fuel consumption at specified and optimum altitudes;

(v) appropriate descent points and calculate time/fuel used on descent.

4. Weight and balance

4.1 Terminology

4.1.1 Explain, and be able to apply, the following terms and concepts in their correct context:

(a) CG;

(b) moment arm;

(c) CG index;

(d) CG envelope;

(e) loading zones;

(f) floor limits;

(g) basic weight;

(h) zero-fuel weight;

(i) average weights for passengers and baggage;

(j) approved load control system.

4.2 Theory

4.2.1 Basic weight and balance:

(a) explain the basic theory of CG and moments in respect to the following:

(i) CG index;

(ii) CG envelope;

(b) explain the following terminology for weights:

(i) basic weight;

(ii) operating weight;

(iii) zero-fuel weight;

(iv) fuel weight;

(v) payload;

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(c) explain the consequences of overloading on:

(i) take-off performance;

(ii) climb/cruise performance;

(iii) aircraft structure;

(d) understand requirement for passenger seal allocation and need to control seating changes in large aircraft.

4.2.2 Load control system:

(a) describe purpose/function of a load control system:

(i) weight control authority;

(b) describe requirements and responsibilities of approved load controllers (ALC);

(c) describe responsibilities of pilot in command;

(d) describe the requirements for load sheet and explain the contents.

4.3 Practical application

4.3.1 Use typical operations manual information to extract weight and balance data:

(a) given appropriate initial data, determine any or all of:

(i) CG at empty weight;

(ii) movement of CG with addition of fuel and payload;

(iii) movement of CG due to fuel consumption in flight;

(iv) effect on CG of raising/lowering undercarriage and/or flaps;

(b) determine CG limits for take-off, cruise and landing;

(c) determine adjustments (if any) required to fuel or payload to permit operations within the CG envelope;

(d) passenger load may be presented as block loads (for example, 24 adults in Zone A, 36 adults and 4 children in Zone B, etc.).

4.3.2 Given appropriate initial data, assess a completed weight and balance proforma and determine whether it is acceptable for flight.

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Unit 1.11.3 APLH: ATPL performance and loading – helicopter

1. Reserved

2. Take-off and landing performance

2.1 Terminology

2.1.1 Explain the following terms in the context of take-off and landing performance:

(a) speeds:

(i) V_{TOSS}, V_{YSE};

(ii) maximum rate and maximum angle climb speed;

(iii) CDP (speed/time), LDP;

(b) distance (a basic understanding is required at the ATPL level):

(i) TORR/TORA, TODR/TODA, ASDR/ASDA, LDR/LDA;

(ii) balanced field length;

(iii) clearway, stopway;

(c) weights:

(i) TOW/MTOW, LW/MLW, ZFW/MZFW;

(ii) basic operating weight;

(iii) useable fuel;

(iv) payload;

(d) pavement parameters:

(i) LCN, ACN, PCN;

(ii) pavement concession;

(iii) wheel loading.

2.2 Theory – take-off performance

2.2.1 For runways and helipads, explain the following:

(a) derivation of take-off distance;

(b) derivation of accelerate-stop distance with delay factors assumed;

(c) clearways and stopways and their function;

(d) allowance for headwind and tailwind.

2.2.2 For take-off performance, explain the following:

(a) concept and purpose of take-off segments;

(b) composition of the first, second, third and fourth segments:

(c) take-off climb gradients, including:

(i) distinction between gross and net gradient; and

(ii) purpose of net gradient;

(d) gradients required in each segment, including:

(i) gross and net obstacle clearance requirements take-off area (IMC case only); and

(ii) vertical clearance;

(e) for curved departures, the point at which turn may commence taking into account vertical clearance.

2.2.3 Take-off weight restrictions:

(a) describe the following factors that affect the maximum permissible take-off weight:

(i) structural limit;

(ii) en route accountability VFR;

(iii) en route accountability night/IFR;

(iv) second-segment climb limit;

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(v) landing weight;

(vi) en route climb requirement.

2.2.4 Explain power assessment.

2.3 Practical application – take-off

2.3.1 Use typical flight manual data to determine each of the following:

(a) MTOW for a given runway or helipad;

(b) minimum runway length at given take-off weight incorporating each of the following variables:

(i) wind component;

(ii) temperature;

(iii) altitude;

(iv) engine type and/or power setting.

2.4 Theory – landing performance

2.4.1 For runway landing performance, explain the derivation and basis of landing distance for the following:

(a) certification landing technique;

(b) factoring;

(c) allowance for wind.

2.4.2 For approach and touchdown performance, explain the determination of the nominal landing decision point (LDP):

2.4.3 For landing weight restrictions, explain the factors affecting the maximum permissible landing weight.

2.4.4 Describe effects of different operating techniques on landing performance.

2.5 Practical application-landing

2.5.1 Using typical flight manual data

(a) calculate each of the following:

(i) MLW for a given runway or helipad;

(ii) MTOW and MLW taking into considering the limitations applicable to the given circumstances, including deciding which of those factors is the critical limiting one, being aware that the TOW may be limited by cruising level or landing factors; and

(b) determine the limiting variable for a given take-off situation (for example, the limiting temperature at which a given take-off can be made).

3. Climb, cruise and descent performance

3.1 Terminology

3.1.1 Understand and be able to use terms in correct context:

(a) LRC;

(b) specific range;

(c) PNR;

(d) point of safe diversion (PSD);

(e) CP or ETP;

(f) ISA and temperature derivatives (for example, ISA+10^{o}).

3.2 Theory

3.2.1 Basis of speed management:

(a) effect of altitude and temperature variations:

(i) fuel consumption;

(ii) range;

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(iii) specific range;

(iv) rate of climb.

3.2.2 Effect of operational decisions:

(a) factors affecting choice of cruise speed;

(b) selection of descent point;

(c) engine-out considerations.

3.2.3 En route flight path gradients:

(a) en route climb gradient;

(b) en route obstacle clearance (IMC case):

(i) horizontal distance from obstacles;

(ii) vertical clearance of obstacles;

(iii) net gradient required at minimum clearance;

(c) drift down procedure:

(i) increased vertical clearance required.

3.3 Practical application

3.3.1 Climb:

(a) given appropriate initial data, including variations from ISA, use typical flight manual information to determine:

(i) time/distance/fuel used to a given altitude, or altitude reached after a given time or distance.

3.3.2 Cruise and descent:

(a) given appropriate initial data, including variations from ISA, use typical flight manual information to determine, under normal and engine-out conditions:

(i) maximum and optimum cruise levels;

(ii) TAS and fuel consumption at specified altitudes, adjusting for use of bleed air, etc., as required;

(iii) maximum weight or temperature at which specified performance and/or altitudes can be attained;

(iv) holding speeds and fuel consumption at specified and optimum altitudes;

(v) appropriate descent points and calculate time on descent.

4. Weight and balance

4.1 Terminology

4.1.1 Understand, and be able to apply, in correct context the following terms and concepts:

(a) CG;

(b) moment arm;

(c) CG index;

(d) CG envelope;

(e) loading zones;

(f) floor limits;

(g) basic weight;

(h) zero-fuel weight;

(i) average weights for passengers and baggage;

(j) approved load control system.

4.2 Theory

4.2.1 Basic weight and balance:

(a) review basic theory of CG and moments:

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(i) CG index and CG envelope;

(b) review standard terminology for weights:

(i) basic weight, operating weight, zero-fuel weight;

(ii) fuel weight, payload;

(c) understand the consequences of overloading on:

(i) take-off performance;

(ii) climb/cruise performance, aircraft structure;

(d) understand requirement for passenger seat allocation and need to control seating changes in large aircraft;

(e) effect of weight on autorotation and landing.

4.2.2 Load control system:

(a) purpose/function of a load control system:

(i) weight control authority;

(b) approved load controlled (ALC):

(i) responsibility of ALC;

(c) responsibilities of pilot in command:

(i) pilots may assume responsibilities of ALC;

(d) load sheet;

(i) requirements;

(ii) contents.

4.3 Practical application

4.3.1 Use typical flight manual information to extract weight and balance data:

(a) given appropriate initial data, determine any or all of:

(i) CG at empty weight;

(ii) movement of CG with addition of fuel and payload;

(iii) movement of CG due to fuel consumption in flight;

(iv) effect on CG of raising/lowering undercarriage;

(b) determine CG limits for take-off, cruise and landing;

(c) determine adjustments (if any) required to the payload to permit operations within the CG envelope.

4.3.2 Given appropriate initial data, assess a completed weight and balance proforma and determine whether it is acceptable for flight.

4.3.3 Sling load/hoist:

(a) effects on CG.

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Unit 1.11.4 APLP: ATPL performance and loading – powered-lift – *Reserved*

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APPENDIX 2. OPERATIONAL RATINGS

SECTION 2.1 INSTRUMENT RATING

Unit 2.1.1 IREX: Instrument rating

1. Reserved

2. General operational knowledge

2.1 Privileges and limitations conferred by an instrument rating

2.1.1 Describe the privileges of an instrument rating.

2.1.2 State the limitations of an instrument rating, including proficiency checks and recent experience requirements.

2.1.3 State limitations for the conduct of a flight under the IFR in a type rated aircraft.

2.2 Documents

2.2.1 List the documents that must be carried on an IFR flight.

2.3 Procedures, radiotelephony and charts

2.3.1 Operation and limitations of flight instruments required to conduct a flight under the IFR.

2.3.2 Standard radio communication phraseology used to conduct IFR operations in accordance with AIP.

2.3.3 Procedure to be followed in the event of loss of radio communications in different phases of flight.

2.3.4 Requirements for notifying ATC of changes in estimated time of arrival at waypoint in flight.

2.3.5 Symbology and interpretation of information published on charts used to conduct operations under the IFR.

2.3.6 Reporting requirements for a descent, approach and landing at an aerodrome outside controlled airspace.

2.3.7 Differences between 2D and 3D instrument approach operations.

2.3.8 Difference between the minimum altitude MDA and DA when published on an instrument approach chart and the pilot responsibilities.

2.3.9 How variations in temperature above and below ISA affect altimeter accuracy.

2.3.10 Pilot responsibilities when conducting 3D instrument approach operations in temperatures below ISA.

2.3.11 Validity period of flight plans submitted to ATC.

2.3.12 Pilot obligations for cancellation of SAR.

2.3.13 The circumstances in which a missed approach must be conducted.

2.3.14 The criteria for determining the published alternate aerodrome weather minimum specified for an aerodrome and its use in planning.

2.3.15 Aircraft separation standards from other IFR and VFR aircraft.

2.3.16 Procedure/s for operating PAL systems.

2.3.17 The principles of operation and limitations of runway visual approach slope lighting systems used in Australia.

2.3.18 Pilot responsibilities for compliance with the following procedures:

(a) SID;

(b) STAR;

(c) Noise abatement;

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(d) Missed approach;

(e) Holding pattern and entry.

2.3.19 Operation of aircraft transponders.

2.3.20 Limitations on use of radar when on the ground.

3. Meteorology

3.1 Weather phenomena

3.1.1 Seasonal variations in the location and frequency of the following phenomena and their impact on IFR operations:

(a) frontal weather;

(b) tropical cyclones;

(c) dust devils;

(d) thunderstorms;

(e) jetstreams;

(f) fog.

3.2 Meteorological information

3.2.1 Requirements for obtaining meteorological information to conduct a flight under the IFR.

3.2.2 Interpret meteorological forecasts required to conduct an IFR flight to determine the operational requirements that apply in accordance with AIP.

3.2.3 Given air temperature in clear air or in cloud, determine approximate height of freezing level, using a temperature lapse rate of 3°C per 1,000 ft in clear air and 1.5°C in cloud.

3.2.4 Given pilot observations, either in clear air or in cloud, of any 1 or more of the following phenomena — turbulence, precipitation, temperature, cloud type predict the probability and likely duration of the following:

(a) airframe icing;

(b) hail;

(c) micro bursts and wind shear;

(d) turbulence (including CAT).

3.2.5 Interpret meteorological information required to conduct a flight under the IFR to determine the possibility of turbulence for the planned route.

3.2.6 Sources for obtaining updates to weather information in flight, including the Volmet service as detailed in AIP.

3.2.7 Obligations for reporting variations to forecast meteorological conditions.

3.3 Sources of altimeter QNH required to conduct operations under the IFR

3.4 Meteorological minima

3.4.1 State the minimum meteorological conditions required for take-off.

4. Operational planning requirements

4.1 Flight plan

4.1.1 Plan an IFR flight between aerodromes in Australia in accordance with the requirements specified in AIP and considering the following:

(a) route limitations;

(b) aircraft performance and forecast freezing level;

(c) table of cruising altitudes/levels.

4.1.2 Determine RNP requirements applicable to an IFR flight.

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4.2 Alternate requirements

4.2.1 Describe the alternate aerodrome requirements for the following:

(a) weather;

(b) navigation aids or approach procedures;

(c) aerodrome lighting (including personnel in attendance requirements);

(d) availability of weather reports;

(e) divert time.

4.2.2 Determine holding fuel requirements for:

(a) weather; and

(b) traffic;

4.2.3 When NGT VFR operations are planned on last route segment, determine the following:

(a) pilot night recency requirements;

(b) alternate requirements;

(c) airways clearance requirements.

4.2.4 Requirements when weather conditions at the planned destination deteriorate below conditions prescribed for alternate or landing minima after the flight commences.

4.2.5 The implications of each type of RAIM prediction on operational requirements.

4.3 Lowest safe altitude

4.3.1 Calculate LSALT for a route not specified in AIP charts.

4.3.2 The minimum obstacle clearance criteria for a missed approach as specified in IAL.

4.3.3 The minimum obstacle clearance provided by the minimum circling altitude for different performance category IFR aircraft as defined in IAL, both day and night.

4.3.4 The requirements for establishing the aircraft on track after take-off.

4.3.5 Describe the requirements to establish the aircraft above the LSALT after take-off.

4.3.6 The requirements that must be satisfied for descent below LSALT or minimum safety altitude by day and night under the IFR and night VFR.

4.4 Navigation requirements

4.4.1 Requirements for position fixing in accordance with the AIP.

4.4.2 The determination of aircraft performance category and the implications for operations under the IFR.

4.4.3 The requirements associated with the following waypoints and the symbology used on an instrument approach chart to define each point for the following:

(a) initial approach fix;

(b) final approach fix.

4.4.4 The requirements to conduct visual circling by day or night.

4.4.5 The use of PEC when applied to a DA to determine AOM.

4.4.6 The normal gradient applied in each segment when designing an instrument approach procedure.

4.4.7 Tracking tolerance requirements for the following:

(a) avoidance of CTA;

(b) utilising ground based navigation aids;

(c) when navaids are not available;

(d) notification requirements;

(e) order of precision of navigation aids/systems.

4.4.8 Speed limitations and restrictions in accordance with the AIP for the following:

(a) operations below 10 0000 ft AMSL;

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(b) during holding procedures;

(c) during approach procedures;

(d) issued by ATS and when speed restrictions are cancelled.

5. Ground and space-based navigation systems and infrastructure

5.1 Ground-based systems

5.1.1 For ground-based radio navigation aids:

(a) understand the principles of operation, indications and limitations of the ground-based navigation aids; and

(b) extract from AIP:

(i) the rated coverage of the radio navigation aids considering aircraft location, altitude and time of day; and

(ii) pilot navigation tolerances.

5.1.2 For lateral azimuth guidance provided by NDB, describe the following:

(a) the errors caused by coastal refraction;

(b) the effect thunderstorms may cause;

(c) the indications of loss of signal integrity;

(d) the potential for errors when turning;

(e) the indications of station passage.

5.1.3 Given heading and relative NDB azimuth bearings, for the following:

(a) calculate track to and from the NDB;

(b) fix position given relative bearings of 2 stations;

(c) calculate drift relative to planned track;

(d) calculate the relative bearing which will indicate the aircraft is abeam a station;

(e) calculate the relative bearing which will indicate that a desired track to or from an NDB has been intercepted, given the intercept heading;

(f) calculate the heading to steer to intercept desired inbound track before reaching the NDB.

5.1.4 For lateral guidance provided by VOR course deviation indicator (CDI), describe the following:

(a) the cockpit indications of scalloping;

(b) the indications of loss of signal integrity;

(c) the indications of station passage.

5.1.5 Given VOR lateral course deviation indications, determine the position of the aircraft with reference to the VOR ground station.

5.1.6 VOR OBS settings required to provide command indications when flying on given tracks both to and from the VOR.

5.1.7 Determine aircraft position given cockpit instrument indications utilising a VOR.

5.1.8 Instrument indications when the aircraft is abeam the VOR on a given track.

5.1.9 DME including the following:

(a) the use of DME and its limitations;

(b) effect of aircraft altitude (slant range);

(c) effect when not tracking direct to and from the aid;

(d) DME arrival procedures.

5.1.10 ILS and LOC including the following:

(a) components of the ILS including marker beacons;

(b) operational considerations;

(c) errors including G/S fluctuations and course reversal indications.

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5.2 GNSS

5.2.1 The GNSS system and its principles of operation, including the following:

(a) GNSS system components;

(b) space segment;

(c) GNSS satellite signal;

(d) pseudo random code (C/A course acquisition code);

(e) control segment;

(f) user segment (the GNSS receiver);

(g) pseudo ranging;

(h) principle of position fixing/minimum satellites required for navigation functions;

(i) TSO/Performance limitations of various equipment types;

(j) RAIM;

(k) masking function;

(l) receiver displays of system integrity;

(m) operating modes – navigation with and without RAIM, DR;

(n) explain why GNSS use the WGS84 coordinate system;

(o) effect of PDOP/GDOP.

5.2.2 The following terms in relation to a navigational system and recall to what extent the GNSS system meets the associated requirements:

(a) accuracy;

(b) integrity;

(c) means of providing GNSS integrity;

(d) RAIM, procedural, systems integration;

(e) availability;

(f) continuity of service.

5.2.3 Degradation of GNSS accuracy by the following GNSS errors:

(a) ephemeris;

(b) clock;

(c) receiver;

(d) atmospheric/ionospheric;

(e) multipath;

(f) selective availability (SA);

(g) typical total error associated with c/a code;

(h) interference.

5.2.4 Requirements for use of GNSS in the following IFR operations:

(a) en route;

(b) RNP instrument approach operations;

(c) alternates;

(d) RNP operations.

5.2.5 Pilots actions and implications for the following GNSS warnings and messages, including the following:

(a) loss of RAIM;

(b) 2D navigation;

(c) in dead reckoning mode;

(d) database out-of-date;

(e) database missing/failure;

(f) GNSS fail;

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(g) barometric input fail;

(h) power/battery fail;

(i) parallel offset on.

5.2.6 Parameters applicable to tracking tolerances, automatic waypoint sequencing, CDI sensitivity and RAIM availability in each of the following segments:

(a) en route;

(b) terminal;

(c) initial approach;

(d) intermediate approach;

(e) final approach;

(f) missed approach.

5.2.7 Indications requiring a missed approach to be initiated.

5.2.8 The effect of availability or otherwise of baro-aiding on RAIM availability and prediction.

5.2.9 Describe the effect of satellite unserviceability on the reliability of each type of prediction.

5.3 3D instrument approach operations

5.3.1 Pilot responsibilities when conducting a 3D instrument approach operation utilising vertical guidance (advisory) provided by the aircraft navigation system on a 2D instrument approach procedure.

5.3.2 The different kinds of 3D instrument approach procedures.

5.3.3 The components required for a GNSS landing system (GLS) instrument approach procedure.

5.3.4 The principles of operation of a GBAS or local area augmentation system.

5.3.5 The validity of GLS guidance information beyond the distance of the GBAS station defined as D-Max.

6. Performance based navigation (PBN)

6.1 Basic principles

6.1.1 The basic principles of PBN, including requirements for RNAV and RNP capability.

6.1.2 The core components that make up the PBN airspace concept, including the following:

(a) communications;

(b) navigation;

(c) surveillance (extended squitter ADS-B);

(d) air traffic management.

6.1.3 The navigation system performance requirements for PBN in respect to the following:

(a) accuracy;

(b) integrity;

(c) continuity;

(d) functionality;

(e) installation requirements.

6.1.4 The function of performance monitoring and alerting in a navigation system approved for PBN operations.

6.2 RNP specifications

6.2.1 RNP specifications and system requirements and their application for the following:

(a) RNP 2 (en route);

(b) RNP 1 (terminal);

(c) RNP APCH – LNAV and LNAV/Baro VNAV;

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(d) RNP APCH – LP and LPV (SBAS).

6.2.2 The meaning of the specified RNP value, for example, RNP 1, in terms of the navigational accuracy.

6.2.3 The following RNP navigation system errors:

(a) FTE (flight technical error);

(b) PDE (path definition error);

(c) TSE (total system error);

(d) NSE or PEE (navigation system error/position estimation error).

6.2.4 The meaning of the following RNP leg types:

(a) TF (track to a fix);

(b) RF (constant radius to a fix);

(c) IF (initial fix);

(d) HF (hold to fix);

(e) HM (hold for clearance);

(f) HA (hold to altitude);

(g) DF (direct to a fix);

(h) FA (fix to an altitude);

(i) CF (course to a fix).

6.2.5 The meaning of the following leg transitions and their use in RNP operations:

(a) fly-by;

(b) fly-over;

(c) fixed radius (airspace design limitations).

6.2.6 The basic requirements for an RNP navigation authorisation and use of the following:

(a) communications;

(b) navigation;

(c) surveillance;

(d) airworthiness;

(e) continued airworthiness;

(f) flight operations.

6.2.7 The GNSS receiver requirements to conduct a RNP APCH operation.

6.2.8 The requirements to conduct an RNP instrument approach operation to a published Barometric Vertical Navigation (Baro/VNAV) minimum altitude.

6.2.9 The requirements to conduct a RNP instrument approach operation to a published Localiser Precision (LP) or LPV minimum altitude.

6.2.10 The conditions and actions that allow the GNSS receiver to function in the appropriate mode for the successful conduct of a RNP approach.

6.2.11 The difference between augmented and non-augmented approaches.

6.2.12 Interpret IAP charts and extract the correct minima for a given approach and any relevant operational restrictions.

6.2.13 The requirement for using a valid and accurate local QNH when conducting RNP approaches.

6.2.14 Differentiate between the following RNP approaches that provide 3D vertical guidance:

(a) RNP APCH – LNAV/VNAV (Baro VNAV);

(b) RNP APCH – LPV (SBAS required).

6.2.15 The basic principles of operation of a space-based augmentation system (SBAS) and the kind of minimum published altitudes that can be used when a SBAS is available.

6.2.16 Explain SBAS and how it affects RNP approaches.

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6.2.17 Interpret APV Baro-VNAV instrument approach charts, including LNAV/VNAV minima, temperature limitations and vertical flight path angle.

6.2.18 Describe the difference between vertical guidance presented as linear deviation and angular deviation and the relevant operational considerations.

6.2.19 Demonstrate an understanding of the principles of Baro-VNAV vertical guidance, including path angle (VPA) construction and the effect of temperature variation from ISA on VPA.

7. Reduced Vertical Separation Minima (RVSM) operations

7.1.1 Range of flight levels in which RVSM requirements apply within Australian airspace.

7.1.2 Operational requirements to conduct operations in designated RVSM airspace.

7.1.3 Requirements to ensure accuracy of aircraft altimeters are within prescribed tolerances to conduct operations in RVSM airspace.

7.1.4 Vertical height tolerance applicable when levelling off at assigned flight level in RVSM airspace.

7.1.5 Procedures and standard communication phraseology used for operations in RVSM airspace, including procedure following failure of 1 or all primary altimetry systems.

8. Human factors

8.1.1 Physiological factors effecting human performance when conducting flight without visual reference, including the following:

(a) the part played by the vestibular systems, namely the semicircular canals and otiliths, in helping the pilot maintain orientation;

(b) the circumstances aggravate vestibular disorientation, and how to overcome this problem.

8.1.2 The circumstances that may aggravate vestibular disorientation such as somatogravic illusions and somatogyral illusions.

8.1.3 State conditions and causes under which visual illusions, such as 'false horizons', visual-cue illusions, relative motion illusions, 'flicker' effect, ‘black hole' illusion, and autokinesis may occur.

8.1.4 GNSS operating procedures which provide safeguards against navigational errors and loss of situational awareness because of the following:

(a) mode errors;

(b) data entry errors;

(c) data validation and checking, including independent cross-checking procedures;

(d) automation induced complacency;

(e) non-standardisation of the GNSS receiver units;

(f) human information processing and situational awareness.

8.1.5 When conducting an instrument approach operation describe the benefits of utilising a CDFA technique from a human performance limitations perspective.

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SECTION 2.2 PRIVATE IFR RATING

Unit 2.2.1 PIFR: Private IFR rating

1. Reserved

2. Pilot's fitness and qualifications

2.1 Pilot medical fitness for IFR flight

2.1.1 State requirements for pilot fitness to conduct an IFR flight.

2.1.2 Describe how a pilot determines whether they are fit to conduct an IFR flight.

2.1.3 State what qualifications a pilot must have to be authorised to conduct an IFR flight.

3. Aircraft instruments, radios and equipment

3.1.1 List the mandatory flight instruments that must be installed and serviceable for conducting an IFR flight.

3.1.2 List the mandatory electrical lighting equipment that must be installed and serviceable for conducting an IFR flight.

3.1.3 List the mandatory aircraft radio communications equipment that must be installed and serviceable for conducting an IFR flight.

3.1.4 List the mandatory radio navigation equipment that must be installed and serviceable for conducting an IFR flight.

3.1.5 Extract from an aircraft flight manual information about the limitations that are specified for operating a particular type of aircraft under the IFR.

4. IFR operations – general

4.1.1 State the IFR operations a single-engine aircraft is limited to.

4.1.2 State the requirements for submission of flight notification and SARWATCH for conducting an IFR operation.

4.1.3 State the speed restrictions an IFR flight must operate to.

4.1.4 State the requirements for inflight progress reports for IFR flights.

4.1.5 State the requirements and procedures for flight plan amendments and advising revised estimates.

5. Documentation for IFR flight

5.1.1 State the documents required to be carried on an IFR flight.

5.1.2 Extract relevant information from operational documents for an IFR flight.

5.1.3 Describe the meteorological forecasts required for conducting an IFR flight.

5.1.4 State sources of, and actions to obtain, meteorological forecasts for IFR flights.

5.1.5 Determine the validity of a meteorological forecast for an IFR flight.

5.1.6 State what meteorological broadcast services are available in Australia for the flight.

6. IFR navigation requirements

6.1.1 Describe the navigation requirements for an IFR flight using radio navigation systems.

6.1.2 State the navigation requirements for an IFR flight using self-contained or long-range navigation systems.

6.1.3 Describe the navigation requirements for an IFR flight using visual reference to ground and water.

6.1.4 State the navigation tolerance for an IFR flight avoiding CTA.

6.1.5 State the requirements for positive radio fixing.

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6.1.6 Determine the requirements for the most precise track guidance.

6.1.7 Apply the navigation requirements of IFR flight with respect to time interval between fixes, accuracy of time reference, accuracy and procedures in track keeping.

6.1.8 Apply the procedures of IFR flight in all classes of airspace when diverting from track due navigation or weather.

7. Selection of IFR routes

7.1.1 Select a route for IFR flight with respect to the following:

(a) forecast weather;

(b) controlled airspace;

(c) PRDs;

(d) engine out performance for multi-engine aircraft;

(e) specified route limitations;

(f) airways operational requirements;

(g) the availability of the following:

(i) published routes;

(ii) en route alternate aerodromes;

(iii) navigation aids;

(iv) rated coverage of navigation aids;

(v) radio communication.

1.1.1 Determine the compulsory reporting points for a route selected.

7.1.2 Determine whether the flight may proceed based on route, aircraft equipment and IFR navigation requirements.

8. LSALT and selection of IFR altitudes and levels

8.1 LSALT

8.1.1 Determine LSALT for an IFR flight for a route published on a chart.

8.1.2 Determine the dimensions of the significant safety sector when calculating LSALT for a route not published on a chart.

8.1.3 Determine methods of calculating LSALT for a route not published on a chart.

8.1.4 Calculate LSALT for non-published route.

8.1.5 State the requirements for descent below LSALT.

8.2 Select cruising altitude or level

8.2.1 Select an appropriate cruising altitude/level after assessing the following:

(a) LSALT;

(b) forecast freezing level;

(c) engine out performance for multi-engine aircraft;

(d) CTA and PRDs;

(e) table of IFR cruising levels;

(f) availability of published routes;

(g) availability of navigation aids;

(h) rated coverage of navigation aids;

(i) specified route limitations;

(j) airways operational requirements.

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8.3 Determining when flight may proceed – uncertain position

8.3.1 Determine whether a flight may proceed based on the following:

(a) altitude;

(b) aircraft equipment;

(c) IFR navigation requirements.

8.3.2 Determine an appropriate LSALT when uncertain of position.

9. IFR alternate aerodrome requirements

9.1.1 State the alternate aerodrome requirements for an IFR flight to a specified destination, given relevant information, including NOTAM.

9.1.2 Determine the suitability of a specified alternate aerodrome for an IFR flight given relevant information, including NOTAM.

9.1.3 Describe the holding requirements due to weather, traffic, traffic advisory, and procedures.

9.1.4 Calculate the minimum fuel required for an IFR flight in accordance with CASA fuel policy guidance material.

9.1.5 Determine whether a flight may proceed based on alternate or holding requirements and fuel capacity.

10. Operation of aircraft equipment

10.1.1 State the safety precautions that must be observed when operating aircraft radar equipment on the ground.

10.1.2 State the pre-flight altimeter accuracy check for an IFR flight.

10.1.3 Apply altimetry procedures to all stages of an IFR flight.

10.1.4 Describe the correct use of a transponder, and the associated radio phraseology, in all classes of airspace.

11. CTA operations

11.1.1 State airways clearance requirements for operating in all classes of airspace, including lead time required for flight plan submission, contents, 'clearance void time', and 'read back' requirement.

11.1.2 State airways clearance requirements for entering, operating in and departing CTA and CTR, including what details to provide to ATC, and what details to expect from ATC.

11.1.3 State what is 'controlled area protection'.

11.1.4 State ATC requirements for a change of level in CTA, including in an emergency situation.

11.1.5 State the procedures for the following components of a flight profile for day and night operations in CTA and CTR:

(a) departure;

(b) climb;

(c) transition to cruise (levelling out);

(d) cruise;

(e) change of levels;

(f) descent and visual approach.

11.2 Separation standards

11.2.1 State the provision of separation between IFR flights, and IFR and VFR flights in the various classes of CTA.

11.2.2 State the provision of separation between IFR flights, and IFR and VFR flights in Class D airspace.

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11.3 Radio procedures

11.3.1 Demonstrate knowledge of radio procedures in CTA and CTR.

11.3.2 Determine procedures for loss of radio communication in CTA and CTR.

11.3.3 Determine procedures for abnormal operations and/or emergencies in CTA and CTR.

12. Radar services

12.1.1 State what radar services are provided by ATC.

12.1.2 Demonstrate knowledge of radar vectoring procedures, including radio procedures and phraseologies.

12.1.3 State the permissible intervals between ATC transmissions during radar vectoring.

12.1.4 Demonstrate knowledge of radar emergency procedures, including loss of radio communication, radar failure, transponder emergency codes, and aircraft emergencies.

13. OCTA operations

13.1 Flight profile procedures – OCTA

13.1.1 State the procedures for the following components of a flight profile for day and night operations in Class G airspace and at non-controlled aerodromes:

(a) departure;

(b) climb;

(c) transition to cruise (levelling out);

(d) cruise;

(e) change of levels;

(f) descent, and arrival.

13.2 Visual approach procedures

13.2.1 State visual approach procedures, day and night, in Class G airspace and at non-controlled aerodromes, including the following:

(a) landing manoeuvres;

(b) cancellation of SARWATCH;

(c) operation of VHF aerodrome lighting (PAL).

13.3 Radio and abnormal procedures

13.3.1 Demonstrate knowledge of radio procedures in Class G airspace and at non-controlled aerodromes.

13.3.2 Determine procedures for loss of radio communication in Class G airspace and at non-controlled aerodromes.

13.3.3 Determine procedures for abnormal operations and/or emergencies Class G airspace and at non-controlled aerodromes.

14. Meteorology relevant to IFR operations:

14.1.1 Demonstrate knowledge of flying conditions likely to be associated with any phenomenon listed in AIP documents and the Bureau of Meteorology publication, Manual of Meteorology, Part 2.

14.1.2 Demonstrate knowledge of Australian climatology as enumerated in Manual of Meteorology Parts 1 and 2, with emphasis on the seasonal variations in the location and frequency of frontal weather, tropical cyclones, dust devils, thunderstorms, fog, and the associated penetration and/or avoidance techniques.

14.1.3 Predict probability and likely duration and extent of airframe icing, hail, microbursts, wind shear, turbulence en route, when experiencing and/or observing certain cloud types, precipitation, temperature and/or turbulence.

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15. Navigation systems

15.1 VOR

15.1.1 Describe the instrument indications that would indicate the following:

(a) scalloping;

(b) VOR station passage;

(c) abeam VOR station;

(d) VOR radial the aircraft is on;

(e) track error and/or drift experienced.

15.1.2 Determine off-track distance experienced from VOR and DME cockpit indications.

15.1.3 State VOR omni-bearing selector (OBS) settings required to provide command indications when flying on given tracks both to and from the VOR.

15.1.4 Calculate the heading to steer to intercept a new or original track to, or from, a VOR.

15.1.5 Fix position, given cockpit instrument indications utilising 2 VOR stations.

15.1.6 Fix position, given instrument indications utilising combinations of VOR, NDB and DME.

15.2 NDB

15.2.1 State how NDB indications or range may be affected by the following:

(a) coastal refraction;

(b) night error;

(c) thunderstorms;

(d) mountainous areas;

(e) types of terrain;

(f) altitude of aircraft.

15.2.2 State the method of using the most appropriate NDB for tracking during navigation.

15.2.3 Describe how the following are determined using an ADF relative bearing indication:

(a) NDB station passage;

(b) abeam NDB station;

(c) NDB bearing the aircraft is on;

(d) track error and/or drift experienced.

15.2.4 Calculate track to and from the NDB, given heading and relative bearings.

15.2.5 Calculate heading to steer to intercept a new or original track to or from an NDB.

15.2.6 Calculate heading to steer to intercept desired inbound track before reaching the NDB.

15.2.7 Calculate relative bearing which will indicate that a desired track to or from an NDB has been intercepted, given the intercept heading.

15.2.8 Fix position, given relative bearing indications utilising 2 NDB stations.

15.3 GNSS

15.3.1 GNSS system components and principle of operation:

(a) Describe the GNSS system and its principles of operation, including the following:

(i) GNSS system components;

(ii) space segment;

(iii) GNSS Satellite signal;

(iv) pseudo random code (C/A course acquisition code);

(v) control segment;

(vi) user segment (the GNSS receiver);

(vii) pseudo ranging;

(viii) principle of position fixing/minimum satellites required for navigation functions;

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(ix) TSO/performance limitations of various equipment types;

(x) RAIM;

(xi) masking function;

(xii) receiver displays of system integrity;

(xiii) operating modes – navigation with and without RAIM, DR.

(b) Explain why GNSS uses the WGS84 coordinate system.

15.3.2 GNSS errors.

15.3.3 Describe the cause and magnitude of typical GNSS errors:

(a) ephemeris;

(b) clock;

(c) receiver;

(d) atmospheric and ionospheric;

(e) multipath;

(f) SA;

(g) typical total error associated with C/A code;

(h) effect of PDOP/GDOP on position accuracy;

(i) susceptibility to interference;

(j) comparison of vertical and horizontal errors;

(k) tracking accuracy and collision avoidance.

16. Flight instrument errors

16.1.1 State how the compass is affected by turning error, acceleration and deceleration error.

16.1.2 State how the attitude indicator is affected by power source output, acceleration and deceleration error, and bank and pitch limits.

17. Human factors relevant to IFR operations

17.1.1 State the part played by the vestibular systems, namely the semicircular canals and otiliths, in helping the pilot maintain orientation.

17.1.2 State what circumstances aggravate vestibular disorientation, and how to overcome this problem.

17.1.3 State what causes, and may aggravate, vestibular disorientation such as somatogravic illusions, somatogyral illusions and 'graveyard spiral', coriolis effect, and 'leans'.

17.1.4 State conditions and causes under which visual illusions, such as 'false horizons', visual-cue illusions, relative motion illusions, 'flicker' effect', black hole' illusion, and autokinesis may occur.

17.1.5 Be aware of the human factors limitations associated with the use of GNSS equipment to provide safeguards against navigational errors and loss of situational awareness because of the following:

(a) mode errors;

(b) data entry errors;

(c) data validation and checking, including independent cross-checking procedures;

(d) automation induced complacency;

(e) non-standardisation of the GNSS receiver units;

(f) human information processing and situational awareness.

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SECTION 2.3 AERIAL APPLICATION RATING AND ENDORSEMENTS

Unit 2.3.1 AAGR: aerial application rating – all aircraft categories

1. Reserved

2. Flight rules

2.1 Legislation

2.1.1 Explain the privileges and limitations of an aerial application rating.

2.1.2 State the responsibilities for supervision of a pilot where required.

2.1.3 State the requirements for the conduct of aerial application operations below 500 ft AGL, including pilot responsibilities.

2.1.4 Explain pilot responsibilities for carrying out the following in relation to role equipment that is fitted to an aircraft:

(a) repairs;

(b) replacement;

(c) overhauls.

3. Operational planning

3.1 Pre-flight and after-flight inspection

3.1.1 Describe the areas of the aircraft that should be inspected to ensure the safety of aerial application operations.

3.1.2 Describe inspection and flight preparation of aircraft exposed to outside parking and harsh environmental conditions (for example, wing and control surfaces exposed to freezing conditions, engine, battery care, etc.).

3.1.3 Explain inspection requirements for aircraft role and equipment, including secure fittings of booms, spreader, hoses, pumps and operations of the dump equipment.

3.1.4 Explain fuelling procedures, including drum stowage, use and care of pumps, fuel testing, use of safety equipment/fire extinguishers, vehicle positioning and fuel quantity checks.

3.2 Operational inspections

3.2.1 Explain operating area inspection methods and purpose.

3.2.2 Explain limitations of ground inspections.

4. Flight between airstrip and operating area

4.1.1 Explain the low-flying restrictions, planning notice, precautions and procedures with respect to overflying or in close proximity to buildings during aerial application operations, including stating the required safety distances and minimum height from buildings.

5. Operations on, or in vicinity of, non-controlled and controlled aerodromes or airstrips

5.1.1 State restrictions and conditions on aerial application operations at aerodromes with movements of regular public transport aircraft.

5.1.2 Explain the circuit requirements at various types of aerodromes and ALA, including conditions applying to exemption from compliance with CASA notified procedures.

5.2 Aerial inspection

5.2.1 Explain the method and purpose (i.e. how and what are you looking for).

5.2.2 Explain key considerations for operations between airstrip and the treatment area and for general low-level navigation.

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5.2.3 Describe how to locate and plan for the management of obstructions and ground undulations from the air.

5.3 Weather

5.3.1 Describe the effects of inversion on aerial application.

5.3.2 Describe indicators of mechanical and thermal turbulence and shifting wind and explain implications for low-level aerial application.

5.3.3 Describe winds affecting low-level flying and associated flying conditions.

5.3.4 Describe the effect of mountainous influence on airflow and associated flying conditions.

5.3.5 Describe weather phenomena hazardous to low-flying operations.

5.3.6 Recall the terrain and weather conditions that may lead to disorientation during low-level flight (for example, flight into rising ground and toward low ground, false horizons, ridgeline and valley effects) and explain pilot corrective action.

5.3.7 Explain typical terrain and seasonal effects on local wind direction, strength and mechanical or thermal turbulence.

5.4 Planning and risk control

5.4.1 Describe the planning tools available to an aerial application pilot, including:

(a) describing the process of risk assessment, including the following:

(i) identifying potential hazards or risk;

(ii) describing what a risk assessment matrix is, and how to use it;

(iii) assessing risk — probability versus severity;

(iv) assigning priority to identified risk.

5.4.2 Describing risk management, including:

(a) using risk management hierarchy such as eliminating risk, substituting for a smaller risk, engineering and administering around risk.

5.4.3 Explaining what is an Aerial Application Management Plan (AMP), including:

(a) describing its key components and how it affects safety of the flight, the importance of monitoring an AMP, and the need for pilots to meet changing conditions;

(b) describing typical changing weather conditions that require monitoring, for example, wind direction and speed and estimating their magnitude and direction; inversions and changing atmospheric stability; position of the sun and the danger of its glare, and importance of maintaining a clean, clear and serviceable windscreen.

6. Flight – aerial application

6.1 Operational techniques

6.1.1 For the treatment area, describe methods of managing the following given factors (for main runs and clean up swaths):

(a) wind direction;

(b) sun glare;

(c) obstructions, particularly wires and powerlines.

6.1.2 Describe hazards associated with application, such as hilly terrain, downdraughts, turbulence, false horizon effect, high country and irregular areas.

6.1.3 Explain precautionary actions before starting a clean-up.

6.1.4 Explain how to identify wire runs, and minimise associated risks, with the following:

(a) preliminary inspection of treatment area;

(b) how to judge distance to the wire;

(c) the danger and forms of distraction;

(d) considerations for flying above or under the wire;

(e) considerations for crossing oblique wires;

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(f) visual cues of wire locations such as pole runs, type, numbers and attitude of;

(g) insulators, cross-stress and angle of cross-stress, supplementary or spur wires buildings;

(h) characteristics and dangers of high wires and guy wires;

(i) factors affecting misjudgment of wire clearance;

(j) how to maintain awareness of located wires;

(k) the hazards of mental overload.

6.1.5 Describe the operation of DGNSS for track guidance, including the importance of maintaining an active scan outside the cockpit while referencing the DGNSS.

6.1.6 Explain considerations for dumping a load.

6.2 Human factors

6.2.1 Demonstrate knowledge of the following human factors issues and their impact on the safety of an aerial application operation:

(a) dehydration and its impact on pilot cognitive function and reaction time;

(b) fatigue and its impact on pilot cognitive function and situational awareness;

(c) stress and its short-term and long-term impact;

(d) drugs (particularly OTC) impact on pilot cognitive function, reaction time and coordination;

(e) spatial disorientation and illusions.

6.2.2 Explain the use of mnemonics as an aide-mémoire to key operational planning issues (for example, ‘WISHSTANDE’).

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Unit 2.3.2 AAGA: aerial application rating – aeroplane endorsement

1. Reserved

2. General operational knowledge

2.1 Aircraft performance

2.1.1 Explain how loads and turn rate affect aircraft performance (stall speed, angle of attack, inertia).

2.1.2 Explain the effects of rolling 'G' on aircraft.

2.1.3 Explain ground effect and its impact on aircraft performance.

2.1.4 Explain possible aerodynamic and controllability effects associated with load dumping.

2.1.5 Explain how temperature, height above mean sea level (*AMSL*), pressure, humidity, weight, field surface and relative wind affect each of the following:

(a) lift-off distance;

(b) climb angle;

(c) rate of climb;

(d) landing stop distance.

2.1.6 Explain how temperature, pressure, height and humidity affect power available.

2.1.7 Calculate pressure and density height.

2.2 Flight and duty times

2.2.1 Explain the flight and duty time limitations for pilots conducting aerial application operations.

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Unit 2.3.3 AAGH: Aerial application rating – helicopter endorsement

1. Aircraft performance

1.1 Environmental effects

1.1.1 Explain how temperature, pressure, height AMSL, humidity, weight, ground surface and relative wind affect each of the following:

(a) hover performance;

(b) distance to achieve translational lift;

(c) climb angle;

(d) rate of climb.

1.1.2 Explain how temperature, pressure, altitude and humidity affect power available and power required.

1.1.3 Calculate pressure and density height.

1.2 Determine payload

1.2.1 Determine payload (under IGE and OGE conditions) and helicopter balance using performance charts, including the following:

(a) maximum payload and fuel that may be carried;

(b) calculation of CG under different load configurations;

(c) calculation of payload and fuel to retain CG within limits throughout the flight;

(d) arithmetic calculations to reposition internal equipment to adjust CG position;

(e) distribution of internal equipment in accordance with deck loading limits.

1.3 Helicopter landing sites (HLS)

1.3.1 Recall the standards recommended for “basic” and “secondary” helicopter landing sites (*HLS*).

1.4 Explain ground effect, Vne and retreating blade stall.

1.5 Rotor disc behaviour under reduced/negative “g”

1.5.1 Explain the relationship between cyclic input, disc attitude, rotor hub and shaft position and fuselage responsiveness on a teetering head helicopter system under 1 “g”, negative “g” and normal disc loading conditions.

1.6 Control power

1.6.1 Explain the term “control power” and how it relates to aircraft performance.

1.7 Dynamic rollover

1.7.1 Explain each of the following:

(a) what is dynamic rollover; and

(b) how to avoid dynamic rollover; and

(c) how to correct in a dynamic rollover situation.

1.8 Loss of tail rotor effectiveness (*LTE*)

1.8.1 Explain each of the following:

(a) the phenomenon of LTE; and

(b) factors that contribute to LTE (high density altitude, high gross weight, turning down wind at low airspeed i.e. below the speed for minimum powered level flight, exceeding manufacturer recommended relative wind and operating gross weight limits); and

(c) indications of LTE; and

(d) recovery from LTE.

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1.9 Height-velocity curve

1.9.1 Explain the implications of flying inside the helicopter height-velocity curve.

1.10 Blade contamination

1.10.1 Explain the degradation of performance with contamination on rotor blades (e.g. mud picked up by rotor wash during hovering operations).

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Unit 2.3.4 AAGG: aerial application rating – gyroplane endorsement

1. Aircraft performance

1.1 Environmental effects

1.1.1 Explain how loads and turn rate affect aircraft performance (airspeed, rotor RPM, disc angle of attack, inertia).

1.1.2 Explain ground effect and its impact on aircraft performance.

1.1.3 Explain possible aerodynamic and controllability effects associated with load dumping.

1.1.4 Explain how temperature, height above mean sea level (AMSL), pressure, humidity, weight, field surface and relative wind affect each of the following:

(a) lift-off distance;

(b) climb angle;

(c) rate of climb;

(d) landing stop distance.

1.1.5 Explain how temperature, height above mean sea level (AMSL), pressure, and humidity affect power available and power required.

1.2 Determine payload

Determine the following using information from the aircraft flight manual:

(a) the maximum payload and fuel that may be carried;

(b) calculation of CG under different load configurations.

1.3 Height-velocity diagram

1.3.1 Explain the implications of flying inside the gyroplane height-velocity diagram.

1.3.2 Explain the implications of allowing speed to decay behind the power curve.

1.4 Rotor disc behaviour

1.4.1 Explain rotor disc behaviour under negative ‘g’.

1.4.2 Explain the effect of rapid load reduction on the rotor disc and aircraft performance.

1.5 Rotor blade contamination

1.5.1 Explain the degradation of performance with contamination on rotor blades (e.g. mud picked up by rotor during operations).

2. Flight and duty times

2.1 Explain the flight and duty time limitations for pilots conducting aerial application operations.

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SECTION 2.4 INSTRUCTOR RATINGS

Unit 2.4.1 FIRC: Instructor rating – common

1. Reserved

2. Flight rules

2.1 Legislation

2.1.1 Describe the privileges and limitations of the instructor rating and associated training endorsements.

2.1.2 Describe the flight training that must be conducted under the authority of Part 141 or 142 of CASR 1998.

3. Principles and methods of instruction

3.1 Principles of learning

3.1.1 Describe the adult learning process.

3.1.2 Explain what is meant by perception.

3.1.3 Explain the relative importance of each of the physical senses in learning.

3.1.4 Explain how the defence mechanisms listed may hinder learning:

(a) rationalisation;

(b) flight;

(c) aggression;

(d) resignation.

3.1.5 Explain how the level of stress may affect learning.

3.1.6 Explain the relation between perception and understanding.

3.1.7 State how positive and negative motivation affects learning.

3.1.8 Explain the application of the levels of learning.

3.1.9 Explain how the rate of learning may vary with practice.

3.1.10 Explain the role of each of the memory systems in terms of the model of information processing:

(a) sensory register;

(b) short-term memory;

(c) long-term memory.

3.2 Principles of instruction

3.2.1 Explain how a flight instructor could assist the process of perception and understanding.

3.2.2 State examples of how rote learning, understanding of knowledge and correlation apply to flight training.

3.2.3 Identify the outcomes of aeronautical knowledge instruction associated with the 3 domains of learning:

(a) cognitive (knowledge);

(b) affective (attitudes, beliefs and values);

(c) psychomotor (physical skills).

3.2.4 State the factors that may hinder learning with respect to aeronautical knowledge training.

3.2.5 Explain the advantages and disadvantages of guided discussion in flight training and identify flight training activities for which this technique could be suitable.

3.2.6 Give examples of positive and negative transfer in aeronautical knowledge training.

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3.2.7 Explain the role of each factor listed in the communication process:
- (a) source;
- (b) symbols;
- (c) receiver.

3.2.8 Recall how these common barriers affect communication:
- (a) lack of common experience;
- (b) confusion;
- (c) abstractions.

3.2.9 Explain how an instructor may monitor, whether communication has been achieved.

3.2.10 Identify adult learning issues applicable to aeronautical knowledge training.

3.2.11 Explain each of the basic steps of the teaching process:
- (a) preparation;
- (b) presentation;
- (c) application;
- (d) review and evaluation.

3.2.12 State the purpose of behavioural (performance-based) outcomes in flight training.

3.2.13 Explain the following attributes of effective outcomes:
- (a) achievable;
- (b) observable;
- (c) measurable.

3.2.14 Explain how to develop the 3 essential elements of behavioural outcomes:
- (a) performance (what has to be done);
- (b) performance criteria;
- (c) conditions.

3.2.15 Explain the advantages and disadvantages of the teaching methods listed and give practical examples of situations best suited to each of these techniques in flight training:
- (a) lecture;
- (b) theory or skill lesson;
- (c) group learning;
- (d) guided discussion;
- (e) briefing.

3.2.16 Explain the role of the instructor in each of the 5 steps involved in providing skill practice to trainees:
- (a) explanation;
- (b) demonstration;
- (c) performance;
- (d) supervision;
- (e) evaluation.

3.2.17 Explain the difference between a training syllabus and competency-based standards.

3.3 Lesson planning and delivery

3.3.1 Explain the general purpose and content of each of the components of a typical aeronautical knowledge lesson plan:
- (a) aim/motivation/revision;
- (b) outcomes;
- (c) explanation of principles;
- (d) explanation/demonstration of technique;

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(e) threat and error management;

(f) practice;

(g) review.

3.3.2 State the reasons for limiting the duration of lessons and indicate the desirable duration of a typical lesson.

3.3.3 Explain the purpose and content of a training syllabus (or curriculum).

3.3.4 Explain the purpose and use of training aids.

3.3.5 Give examples of training aids particularly suited to aeronautical knowledge training.

3.3.6 Explain the role of the instructor in each of the following phases of review and evaluation:

(a) fault analysis (diagnosis);

(b) competency assessment;

(c) trainee self-assessment;

(d) training effectiveness.

3.4 Principles of questioning

3.4.1 Explain the reasons for questioning trainees.

3.4.2 Explain the characteristics of an effective or open question.

3.4.3 Give examples of good and poor questions.

3.4.4 Explain how oral questions can promote mental activity.

3.4.5 Explain why oral questions maintain student interest during a lesson.

3.4.6 Explain why is it essential that the instructor always confirm answers to questions.

3.4.7 Explain the purposes of oral questions.

3.4.8 Describe the desired qualities of good oral questions.

3.4.9 Describe the procedure to follow when asking a question.

3.4.10 Explain the key points to observe in the handling of student answers.

3.4.11 Explain the key points to observe in the handling of student questions.

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SECTION 2.5 LOW-LEVEL RATING

Unit 2.5.1 LLLR: Low-level rating – all aircraft categories

1. Reserved

2. Flight rules

2.1 Legislation

2.1.1 Explain the privileges and limitations of a low-level rating.

2.1.2 Recall the provisions of 157 of CAR 1988.

2.1.3 State the requirements for the conduct of flights below 500 ft AGL, including pilot responsibilities.

3. Operational planning

3.1 Pre-flight and after-flight inspection

3.1.1 Describe the areas of the aircraft that should be inspected to ensure the safety of low-level operations.

3.1.2 Describe inspection and flight preparation of aircraft exposed to outside parking and harsh environmental conditions (for example, wing and control surfaces exposed to freezing conditions, engine, battery care, etc.).

3.2 Operational inspections

3.2.1 Explain operating area inspection methods and purpose.

3.2.2 Explain limitations of ground inspections.

3.2.3 Explain the low-flying restrictions, planning notice, precautions and procedures with respect to overflying or in close proximity to buildings during aerial application operations, including stating the required safety distances and minimum height from buildings.

4. Operations on, or in vicinity of, non-controlled and controlled aerodromes or airstrips

4.1.1 State restrictions and conditions on low-level operations at aerodromes with movements of regular public transport aircraft.

4.1.2 Explain the circuit requirements at various types of aerodromes and ALA, including conditions applying to exemption from compliance with CASA published procedures.

4.2 Aerial inspection

4.2.1 Explain the method and purpose (i.e. how and what are you looking for?).

4.2.2 Describe how to locate and plan for the management of obstructions and ground undulations from the air.

4.3 Weather

4.3.1 Describe the effects of inversion on low-level operations.

4.3.2 Describe indicators of mechanical and thermal turbulence and shifting wind and explain implications for low-level operations.

4.3.3 Describe winds affecting low-level flying and associated flying conditions.

4.3.4 Describe the effect of mountainous influence on airflow and associated flying conditions.

4.3.5 Describe weather phenomena hazardous to low-level operations.

4.3.6 Recall the terrain and weather conditions that may lead to disorientation during low-level flight (for example, flight into rising ground and toward low ground, false horizons, ridgeline and valley effects) and explain pilot corrective action.

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4.3.7 Explain typical terrain and seasonal effects on local wind direction, strength and mechanical or thermal turbulence.

4.4 Planning and risk control

4.4.1 Describe the process of conducting a risk assessment, including the following:

(a) identifying potential hazards or risk;

(b) describing what a risk assessment matrix is, and how to use it;

(c) assessing risk — probability versus severity;

(d) assigning priority to identified risk.

4.4.2 Describing risk management, including:

(a) using risk management hierarchy such as eliminating risk, substituting for a smaller risk, engineering and administering around risk;

(b) consideration of typical changing weather conditions that require monitoring, for example, wind direction and speed and estimating their magnitude and direction, inversions and changing atmospheric stability; position of the sun and the danger of its glare, and importance of maintaining a clean, clear and serviceable windscreen.

5. Flight – low level

5.1 Operational techniques

5.1.1 For the area of operations, describe the methods of managing the following given factors:

(a) wind direction;

(b) sun glare;

(c) obstructions, particularly wires and powerlines.

5.1.2 Describe hazards associated with low-level operations, such as hilly terrain, downdraughts, turbulence, false horizon effect, high country and irregular areas.

5.1.3 Explain precautionary actions before starting a clean-up.

5.1.4 Explain how to identify wire runs, and minimise associated risks, with the following:

(a) preliminary inspection of treatment area;

(b) how to judge distance to the wire;

(c) the danger and forms of distraction;

(d) considerations for flying above or under the wire;

(e) considerations for crossing oblique wires;

(f) visual cues of wire locations such as pole runs, type, numbers and attitude of;

(g) insulators, cross-stress and angle of cross-stress, supplementary or spur wires buildings;

(h) characteristics and dangers of high wires and guy wires;

(i) factors affecting misjudgment of wire clearance;

(j) how to maintain awareness of located wires;

(k) the hazards of mental overload.

5.1.5 Describe the operation of DGNSS for track guidance, including the importance of maintaining an active scan outside the cockpit while referencing the DGNSS.

6. Human factors

6.1.1 Demonstrate knowledge of the following human factors issues and their impact on the safety of an aerial application operation.

6.1.2 Dehydration and its impact on pilot cognitive function and reaction time.

6.1.3 Fatigue and its impact on pilot cognitive function and situational awareness.

6.1.4 Stress and its short-term and long-term impact.

6.1.5 Drugs (particularly OTC) impact on pilot cognitive function, reaction time and coordination.

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6.1.6 Spatial disorientation and illusions.

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SECTION 2.6 NIGHT VISION IMAGING SYSTEMS (NVIS) RATING

Unit 2.6.1 NVIS: NVIS rating – all aircraft categories

1. Reserved

2. Human factors and physiological limitations

2.1.1 Explain the human factors and physiological limitations for operations using NVIS.

3. Flight rules

3.1 Legislation

3.1.1 Describe the privileges and limitations of an NVIS rating and endorsement.

3.1.2 Explain the requirements for the conduct of a flight using NVIS.

3.1.3 Describe the requirements for the conduct of a flight using NVIS below 500 ft AGL.

3.1.4 Describe minimum aircraft equipment requirements.

3.1.5 Explain how to determine if NVIS equipment meets minimum standards to be authorised for use.

4. Flight – night (non-visual)

4.1 Vision imaging equipment and systems

4.1.1 Describe the operation and limitations of NVIS equipment used, including meteorological conditions likely to effect the performance of the system.

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SECTION 2.7 NIGHT VFR RATING

Unit 2.7.1 NVFR: NVFR rating – all aircraft categories

1. Flight Rules

1.1 Describe the privileges and limitations of the rating.

1.2 Describe the minimum NVFR aircraft equipment requirements.

1.3 Describe the ALA dimension and lighting requirements as applicable.

1.4 Describe the flight planning requirements (including notification and weather forecast requirements).

1.5 Describe the requirements for determining LSALT.

1.6 Describe the requirements for descent below LSALT.

1.7 Explain the alternate aerodrome planning requirements (including night circuit training flights).

2. Flight at Night

2.1 Operations

2.1.1 Describe the principles of operations, limitations and errors for the radio navigation systems used.

2.1.2 Explain the requirements for departure and descent for clearance from terrain.

2.1.3 Describe the operation of PAL.

2.2 Human factors

2.2.1 Explain the human factors and physiological limitations for the conduct of operations at night as described in CASA guidance material for NVFR operations.

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SECTION 2.8 EXAMINER RATINGS

Unit 2.8.1 FERC: flight examiner rating – common – *Reserved*

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APPENDIX 3. AIRCRAFT RATINGS AND ENDORSEMENTS

SECTION 3.1 CLASS RATINGS

Unit 3.1.1 MECR: multi-engine aeroplane class rating – all aircraft categories

1. Reserved

2. General operational knowledge

2.1 Principles of asymmetric flight

2.1.1 Describe basic principles of asymmetric flight, changes in thrust and drag vectors and the effect on balanced flight.

2.1.2 State airspeed limitations necessary to ensure control of the aircraft.

2.1.3 Explain the effects on aircraft performance associated with engine failure.

2.1.4 Describe the effects of bank or sideslip on:

(a) vertical stabiliser (fin) and stall speed;

(b) rudder effectiveness;

(c) control load and aircraft trim.

2.1.5 Describe the factors effecting minimum control speeds or other speed specified to achieve optimum performance following the failure of an engine.

2.1.6 Describe the concept of 'commitment height' during approach and landing where applicable and the factors determining that height.

2.1.7 Knowledge of the aircraft certification performance requirements.

3. Aircraft systems

3.1 Aeroplane and engine systems

3.1.1 Describe the normal and non-normal operation of the following systems if installed in the aircraft:

(a) fuel;

(b) electrical;

(c) flight control (primary and secondary);

(d) hydraulic;

(e) flight instruments;

(f) avionics;

(g) braking;

(h) de-icing;

(i) oxygen;

(j) cabin airconditioning and pressurisation;

(k) other systems installed in the aircraft.

3.1.2 Describe the operation and limitations of following engine systems where installed:

(a) fuel;

(b) oil;

(c) starter (including air start for turbo-jets);

(d) ignition;

(e) propeller;

(f) mixture – piston engine only;

(g) turbochargers.

3.1.3 Knowledge of the aeroplane limitations specified in the aircraft flight manual.

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SECTION 3.2 TYPE RATINGS

Unit 3.2.1 TYPA: Pilot type rating – aeroplane

1. General note: for this unit

1.1.1 Applicants for a multi-crew certified aircraft type rating are required to satisfy the knowledge standards specified for the ATPL of the same aircraft category, that are relevant to the operation of the aircraft. The following knowledge standards may not be relevant for all aircraft type ratings and can be ignored if not applicable to an aircraft type.

2. Aeroplane limitations and documentation

2.1.1 Identify aircraft limitations and able to locate information contained in the AFM and POH.

2.1.2 Perform pre-flight inspection and determine serviceability of the aircraft for flight.

2.1.3 Apply MEL and CDL, where applicable.

2.1.4 Determine the effects of ADs, ASB/SB where pilot action may be required, as applicable to type.

2.1.5 Aware of licensing obligations for variants, where applicable.

3. Weight and balance

3.1.1 Calculate CG for aircraft and determine if within prescribed limits.

3.1.2 Determine trim settings and MAC, where applicable.

3.1.3 Describe the effects of fuel use and management on CG, if any.

3.1.4 Describe the effects of changes to CG on aircraft performance.

3.1.5 Awareness of aircraft weight limitations, loading limits, cargo hold limitations, and any load/weight limitations for operational equipment contained in the flight manual supplement

4. Meteorology and adverse weather operations

4.1.1 Interpret weather forecasts typically required to conduct a flight in the aeroplane.

4.1.2 State the requirements for low-visibility operations.

4.1.3 Describe the effect on aircraft operations for the following conditions:

(a) ice, slush or snow (as applicable);

(b) turbulence penetration;

(c) heavy rain or falling snow;

(d) windshear techniques during take-off, approach and landing (as applicable);

(e) cold weather operations (as applicable);

(f) low-visibility operations (as applicable).

5. Aerodynamics and performance

5.1.1 Describe basic aerodynamics and high speed aerodynamics for turbo-jet powered aircraft.

5.1.2 Describe the effect of changes in airspeed on longitudinal stability for swept-wing aeroplanes.

5.1.3 Describe the minimum climb gradient performance requirements for each segment for aeroplanes that are certified as a transport or commuter category aircraft.

5.1.4 Describe the effects on airflow over aerofoils and the aerodynamic effects of the following if installed on the aircraft:

(a) spoiler;

(b) speed brakes;

(c) flaps and slats.

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5.1.5 Determine the airspeeds to meet performance requirements for different configurations and phases of flight.

5.1.6 Describe stall characteristics and limits of normal operating envelope.

5.1.7 Discuss the meteorological performance limiting factors.

5.1.8 Discuss any unique operational characteristics, including runway requirements/limitations.

6. Fuel and engine oil systems

6.1.1 Describe the following in relation to the aircraft's fuel system:

(a) location of fuel tank/s and capacity;

(b) normal and non-normal fuel system operation and distribution;

(c) location and type of pumps used;

(d) vents system and location of vents and drains;

(e) system controls and indicators;

(f) minimum grades, colour and additives required, if any;

(g) minimum fuel temperature;

(h) indications of reduced or loss of fuel flow.

6.1.2 Determine level of engine oil.

6.1.3 Describe oil system indicators and grade of oil required.

6.1.4 Describe fuel and oil system limitations.

7. Engines

7.1.1 Describe type of engine/s installed, the main components, rated thrust or horsepower and indicators required for operation.

7.1.2 State engine start limits, as applicable.

7.1.3 Describe engine controls and their function.

7.1.4 Describe normal and non-normal engine operation.

7.1.5 Describe operation of the ignition system.

7.1.6 Describe the method of feathering and unfeathering the propeller/s, where applicable.

8. Electrical system

8.1.1 Describe core components of the aircraft's electrical system.

8.1.2 Describe the system design and operation, including use of AC or DC power, as applicable.

8.1.3 Explain the methods of power generation.

8.1.4 Describe the electrical system protections and locations of key components.

8.1.5 Explain the indications of normal and degraded system operation.

8.1.6 Describe the location of connections for external sources of power, if applicable.

8.1.7 Describe the use of the APU when used to provide a source of electrical power.

9. Hydraulic system

9.1.1 Describe core components of the aircraft hydraulic system/s and their method of operation, including alternative sources of operation.

9.1.2 Describe normal system operating pressure and system protections to prevent damage to components or system.

9.1.3 Explain method of determining sufficient system capacity, indicators and controls.

9.1.4 Describe systems operated by the hydraulic system/s.

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10. Undercarriage and brakes

10.1.1 Describe the undercarriage system components and safety systems.

10.1.2 Explain normal and alternative method of undercarriage operation.

10.1.3 Describe operation of the nosewheel steering system, if installed.

10.1.4 Describe the brake system components and normal and non-normal operation.

10.1.5 Explain operation of the anti-skid system and limitations.

10.1.6 Determine brake energy limits and brake cooling requirements.

11. Pneumatic system

11.1.1 Describe the aircraft pneumatic system components and methods of operation.

11.1.2 Describe system limitations and safety devices.

12. Environmental system

12.1.1 Explain the operation of aircraft heating, demisting, and airconditioning systems, normal and emergency modes of operation and limitations.

13. Flight controls

13.1.1 Describe primary and secondary flight controls and their method of operation.

13.1.2 Describe degraded modes of operation for aircraft fitted envelope protection systems, the effects on longitudinal stability with changes in aircraft speed.

13.1.3 Knowledge of limitations and safety features that prevent structural damage to the aircraft.

14. Ice and rain protection

14.1.1 Describe the aircraft ice protection system/s, detection systems and explain their operation.

14.1.2 Describe anti-ice system limitations.

15. Fire and overheat protection

15.1.1 Describe the fire and overheat protection system/s installed on the aircraft, including indicators and extinguishing agents used.

15.1.2 Can determine the serviceability of the system/s.

15.1.3 Describe the power sources required for system operation.

16. Flight instruments

16.1.1 Describe the system/s that provide data to the primary flight instruments.

16.1.2 Describe the power sources for the primary flight instruments/displays.

16.1.3 Describe the operation of the warning systems.

16.1.4 Knowledge of alternative sources of flight instrument operation.

16.1.5 Describe the operation of EFIS system and redundant modes of operation.

17. Navigation and radar systems

17.1.1 Knowledge of the operation of the aircraft navigation, communication and surveillance system/s.

17.1.2 Describe the operation of the aircraft navigation receivers and how to determine their operational status and integrity.

17.1.3 Knowledge of the aircraft's weather detection system/s and safety precautions.

17.1.4 Explain operation of the aircraft FMS and integration with other aircraft systems.

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17.1.5 Determine ANP for RNP operations.

17.1.6 Describe the operation of the aircraft windshear detection system.

18. Autoflight system

18.1.1 Explain the operation of the autopilot and autothrottle, if installed, in flight operation in all modes.

18.1.2 Describe failure annunciations, pilot actions and limitations.

18.1.3 Explain the integration of aircraft navigation systems with the autoflight system.

19. Communications

19.1.1 Can operate all the aircraft communication systems, voice and data when installed.

19.1.2 Describe operation of aircraft intercommunication systems.

19.1.3 Describe operation of the communications system in the event of changes in power source.

19.1.4 Explain operation of the CVR and FDR and requirements for operation.

20. Airframe

20.1.1 Describe airframe construction, fuselage sections, materials, cowling and firewalls, as applicable.

20.1.2 Describe aerodynamic surfaces of the airframe.

20.1.3 Describe operation of the doors, exits, windows and monitoring systems.

21. Miscellaneous systems

21.1.1 Describe other systems installed in the aircraft that are likely to be used by the flight crew to operate the aircraft.

21.1.2 Describe the location and operation of emergency equipment installed on the aircraft.

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Unit 3.2.2 TYPH: Pilot type rating – helicopter

1. Reserved

2. Helicopter limitations and documentation

2.1.1 State aircraft limitations and demonstrate ability to locate information contained in the RFM and POH, if applicable.

2.1.2 Perform pre-flight inspection and determine serviceability of the aircraft for flight.

2.1.3 Apply MEL and Configuration Deviation List (CDL), where applicable.

2.1.4 Determine the effects of ADs, ASB/SB where pilot action may be required, as applicable to type.

2.1.5 Awareness of licensing obligations for variants, where applicable.

3. Weight and balance

3.1.1 Calculate CG for aircraft and determine if within prescribed limits.

3.1.2 The effects of configuration changes on CG, if any.

3.1.3 The effects of fuel use and the management of the CG, if any.

3.1.4 The effects of changes to CG on aircraft performance.

3.1.5 Aircraft weight limitations, loading limits, cargo hold limitations, and any load/weight limitations for operational equipment contained in the flight manual supplement.

4. Meteorology and adverse weather operations

4.1.1 Interpret weather forecasts typically required to conduct a flight in the helicopter.

4.1.2 State the requirements for low-visibility operations.

4.1.3 Describe the effect on helicopter operations of the following:

(a) ice, slush or snow (contaminated runway);

(b) turbulence penetration;

(c) heavy rain or falling snow;

(d) windshear and localised environments (as applicable);

(e) cold weather operations (as applicable);

(f) low-visibility operations (as applicable).

5. Aerodynamics and performance

5.1.1 Describe basic aerodynamics for single main rotor, tandem rotor or coaxial system, as appropriate.

5.1.2 Describe the effect of changes in airspeed on drag and, therefore, performance.

5.1.3 Describe the minimum climb gradient performance requirements for each segment for helicopters that are certified as an air transport helicopter.

5.1.4 Describe the following aerodynamic effects as they apply to the particular helicopter:

(a) ground resonance;

(b) dynamic rollover;

(c) tail rotor drift and tail rotor roll;

(d) flapback and inflow roll;

(e) vortex ring;

(f) retreating blade stall;

(g) autorotation;

(h) loss of tail rotor effectiveness.

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5.1.5 Determine the airspeeds to meet performance requirements for different configurations and phases of flight.

5.1.6 Describe stall characteristics and limits of normal operating envelope.

5.1.7 Discuss the meteorological performance limiting factors.

5.1.8 Discuss any unique operational characteristics, including terrain and environment.

6. Fuel and engine oil systems

6.1.1 Describe the following in relation to the aircraft's fuel system:

(a) location of fuel tank/s and capacity;

(b) normal and non-normal fuel system operation and distribution;

(c) location and type of pumps used;

(d) vents system and location of vents and drains;

(e) system controls and indicators;

(f) minimum grades, colour and additives required, if any;

(g) minimum fuel temperature;

(h) indications of reduced or loss of fuel flow.

6.1.2 Minimum level of engine oil.

6.1.3 The aeroplane's oil system indicators and grade of oil required.

6.1.4 Fuel and oil system limitations for the aeroplane.

7. Engines

7.1.1 Describe type of engine/s installed, the main components, rated horsepower and indicators required for operation.

7.1.2 State engine start limits, as applicable.

7.1.3 Describe engine controls and their function.

7.1.4 Describe normal and non-normal engine operation.

7.1.5 Describe operation of the ignition system.

7.1.6 Describe the method of rotor engagement, as applicable.

8. Electrical system

8.1.1 Describe core components of the aircraft's electrical system.

8.1.2 Describe the system design and operation, including use of AC or DC power, as applicable.

8.1.3 Explain the methods of power generation.

8.1.4 Describe the electrical system protections and locations of key components.

8.1.5 Explain the indications of normal and degraded system operation.

8.1.6 Describe the location of connections for external sources of power, if applicable.

8.1.7 Describe the use of the APU when used to provide a source of electrical power.

9. Hydraulic system

9.1.1 Describe core components of the aircraft hydraulic system/s and their method of operation, including alternative sources of operation.

9.1.2 Describe normal system operating pressure and system protections to prevent damage to components or system.

9.1.3 Explain method of determining sufficient system capacity, indicators and controls.

9.1.4 Describe systems operated by the hydraulic system/s.

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10. Undercarriage and brakes

10.1.1 Describe the undercarriage system components and safety systems.

10.1.2 Explain normal and alternative method of undercarriage operation.

10.1.3 Describe operation of the nosewheel steering system, if installed.

10.1.4 Describe the brake system components and normal and non-normal operation.

10.1.5 Determine brake energy limits and brake cooling requirements.

11. Pneumatic system

11.1.1 Describe the aircraft pneumatic system components and methods of operation.

11.1.2 Describe system limitations and safety devices.

12. Environmental/pressurisation system

12.1.1 Explain the operation of aircraft heating, demisting, and airconditioning systems, if applicable, normal and emergency modes of operation and limitations.

13. Flight controls

13.1.1 Describe primary and secondary flight controls and their method of operation.

13.1.2 Knowledge of limitations and safety features that prevent structural damage to the aircraft.

14. Ice and rain protection

14.1.1 Describe the aircraft ice protection system/s, detection systems and explain their operation.

14.1.2 Describe anti-ice system limitations, if applicable.

15. Fire and overheat protection

15.1.1 Describe the fire and overheat protection system/s installed on the aircraft, including indicators and extinguishing agents used, if applicable.

15.1.2 Determine the serviceability of the fire and or overheat system/s, if applicable.

15.1.3 Describe the power sources required for system operation.

16. Flight instruments

16.1.1 Describe the system/s that provide data to the primary flight instruments.

16.1.2 Describe the power sources for the primary flight instruments/displays.

16.1.3 Describe the operation of the warning systems.

16.1.4 Knowledge of alternative sources of flight instrument operation.

16.1.5 Describe the operation of EFIS system and redundant modes of operation.

17. Navigation and radar systems

17.1.1 Knowledge of the operation of the aircraft navigation, communication and surveillance system/s, as applicable.

17.1.2 Describe the operation of the aircraft navigation receivers and how to determine their operational status and integrity.

17.1.3 Knowledge of the aircraft's weather detection system/s and safety precautions, if applicable.

17.1.4 Explain operation of the aircraft FMS and integration with other aircraft systems, if applicable.

17.1.5 Determine RNP capability.

17.1.6 Conduct RNP operations, as applicable.

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17.1.7 Describe the operation of the aircraft windshear detection system, if applicable.

18. Autoflight system

18.1.1 Describe the function and design of stability augmentation, autopilot and flight director systems in both the normal and degraded modes, if applicable.

18.1.2 Describe failure annunciations, pilot actions and limitations.

18.1.3 Explain the integration of aircraft navigation systems with the autoflight system.

19. Communications

19.1.1 Describe operation of all the aircraft communication systems, voice and data when installed.

19.1.2 Describe operation of aircraft intercommunication systems.

19.1.3 Describe operation of the communications system in the event of changes in power source.

19.1.4 Explain operation of the CVR and the FDR and requirements for operation, as applicable.

20. Airframe

20.1.1 Describe airframe construction, fuselage sections, materials, cowling and firewalls, as applicable.

20.1.2 Describe the operation and function of aerodynamic surfaces of the airframe.

20.1.3 Describe operation of the doors, exits, windows and monitoring systems.

21. Miscellaneous systems

21.1.1 Describe deign of role equipment and their use, the applicable procedures during normal and non-normal operations and limitations imposed on such equipment.

21.1.2 Describe other systems installed in the aircraft that are likely to be used by the flight crew to operate the aircraft.

21.1.3 Describe the location and operation of emergency equipment installed on the aircraft.

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Unit 3.2.3 TYPG: Pilot type rating – gyroplane

1. General note for this unit

The following knowledge standards may not be relevant for all aircraft type ratings and can be ignored if not applicable to an aircraft type.

2. Gyroplane limitations and documentation

2.1.1 Identify aircraft limitations and locate information contained in the aircraft flight manual.

2.1.2 Perform pre-flight inspection and determine serviceability of the gyroplane for flight.

2.1.3 Apply MEL and CDL, where applicable.

2.1.4 Determine the effects of ADs, ASB/SB where pilot action may be required, as applicable to type.

2.1.5 Aware of licensing obligations for variants, where applicable.

3. Weight and balance

3.1.1 Calculate CG for gyroplane and determine if within prescribed limits.

3.1.2 Determine trim settings, where applicable.

3.1.3 Describe the effects of fuel use and management on CG, if any.

3.1.4 Describe the effects of changes to CG on aircraft performance.

3.1.5 Awareness of aircraft weight limitations, loading limits, cargo hold limitations, and any load/weight limitations for operational equipment contained in the aircraft flight manual supplement.

4. Meteorology and adverse weather operations

4.1.1 Interpret weather forecasts typically required to conduct a flight in the gyroplane.

4.1.2 State the requirements for low-visibility operations.

4.1.3 Describe the effect on aircraft operations of the following conditions:

(a) ice, slush or snow (as applicable);

(b) turbulence penetration;

(c) heavy rain or falling snow;

(d) windshear techniques during take-off, approach and landing (as applicable);

(e) cold weather operations (as applicable);

(f) low-visibility operations (as applicable).

5. Aerodynamics and performance

5.1.1 Describe basic aerodynamics for single main rotor.

5.1.2 Describe the following aerodynamic effects as they apply to the particular gyroplane:

(a) rotor blade flap;

(b) retreating blade stall;

(c) effect of engine torque;

(d) ground resonance.

5.1.3 Determine the airspeeds to meet performance requirements for different configurations and phases of flight.

5.1.4 Describe limits of normal operating envelope.

5.1.5 Discuss the meteorological performance limiting factors.

5.1.6 Discuss any unique operational characteristics, including terrain and environment and runway requirements/limitations.

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5.1.7 Describe the operation and application of the following:

(a) trim devices;

(b) rotor RPM gauge;

(c) rotor brake;

(d) prerotator/spin-up control;

(e) height-velocity diagram;

(f) securing rotor blades.

5.1.8 Determine the airspeeds to meet performance requirements for different phases of flight.

5.1.9 Describe manoeuvring below minimum level speed and recovery.

6. Fuel and engine oil systems

6.1.1 Describe the following in relation to the gyroplane's fuel system:

(a) location of fuel tank/s and capacity;

(b) normal and abnormal fuel system operation and distribution;

(c) location and type of pumps used;

(d) vents system and location of vents and drains;

(e) system controls and indicators;

(f) minimum grades, colour and additives required, if any;

(g) minimum fuel temperature;

(h) indications of reduced or loss of fuel flow;

(i) determining level of engine oil;

(j) oil system indicators and grade of oil required;

(k) fuel and oil system limitations.

7. Engines

7.1.1 Describe type of engine/s installed, the main components, rated thrust or horsepower and indicators required for operation.

7.1.2 State engine start limits, as applicable.

7.1.3 Describe engine controls and their function.

7.1.4 Describe normal and abnormal engine operations.

7.1.5 Describe the operation of the ignition system.

7.1.6 Describe the method of feathering and unfeathering the propeller/s, where applicable.

8. Electrical system

8.1.1 Describe core components of the gyroplane's electrical system.

8.1.2 Describe the system design and operation, including use of AC or DC power, as applicable.

8.1.3 Explain the methods of power generation.

8.1.4 Describe the electrical system protections and locations of key components.

8.1.5 Explain the indications of normal and degraded system operation.

8.1.6 Describe the location of connections for external sources of power, if applicable.

8.1.7 Describe the use of the APU when used to provide a source of electrical power.

9. Hydraulic system

9.1.1 Describe core components of the gyroplane's hydraulic system/s and their method of operation, including alternative sources of operation.

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9.1.2 Describe normal system operating pressure and system protections to prevent damage to components or system.

9.1.3 Explain the method of determining sufficient system capacity, indicators and controls.

9.1.4 Describe systems operated by the hydraulic system/s.

10. Undercarriage and brakes

10.1.1 Describe the undercarriage system components and safety systems.

10.1.2 Explain normal and alternative method of undercarriage operations.

10.1.3 Describe the operation of the nosewheel steering system, if installed.

10.1.4 Describe the brake system components and normal and abnormal operations.

10.1.5 Explain the operation of the anti-skid system and limitations, if installed.

10.1.6 Determine brake energy limits and brake cooling requirements.

11. Pneumatic system

11.1.1 Describe the gyroplane's pneumatic system components and methods of operation.

11.1.2 Describe system limitations and safety devices.

12. Environmental system

12.1.1 Explain the operation of the gyroplane's heating, demisting and airconditioning systems and normal and emergency modes of operation and limitations.

13. Flight controls

13.1.1 Describe flight controls and their method of operation.

13.1.2 Describe limitations and safety features that prevent structural damage to the gyroplane.

14. Ice and rain protection

14.1.1 Describe the gyroplane's ice protection system/s, detection systems and explain their operation, if applicable.

14.1.2 Describe anti-ice system limitations, if applicable.

15. Fire and overheat protection

15.1.1 Describe the fire and overheat protection system/s installed on the gyroplane, including indicators and extinguishing agents used.

15.1.2 Determine the serviceability of the system/s.

15.1.3 Describe the power sources required for system operation.

16. Flight instruments

16.1.1 Describe the system/s that provides data to the primary flight instruments.

16.1.2 Describe the power sources for the primary flight instruments/displays.

16.1.3 Describe the operation of the warning systems.

16.1.4 Describe alternative sources of input or power for flight instrument operation.

16.1.5 Describe the operation of EFIS system and redundant modes of operation.

17. Navigation and radar systems (when installed)

17.1.1 Describe the operation of the gyroplane's navigation, communication and surveillance system/s.

17.1.2 Describe the operation of the gyroplane's navigation receivers and how to determine their operational status and integrity.

17.1.3 Describe the gyroplane's weather detection system/s and safety precautions.

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17.1.4 Explain the operation of the gyroplane's FMS and integration with other aircraft systems.

17.1.5 Determine ANP for RNP operations.

17.1.6 Describe the operation of the gyroplane's windshear detection system.

18. Autoflight system (when installed)

18.1.1 Explain the operation of the autopilot and autothrottle, if installed, in flight operation in all modes.

18.1.2 Describe failure annunciations, pilot actions and limitations.

18.1.3 Explain the integration of aircraft navigation systems with the autoflight system.

19. Communications

19.1.1 Can operate all the aircraft communication systems, voice and data when installed.

19.1.2 Describe the operation of aircraft intercommunication systems.

19.1.3 Describe the operation of the communications system in the event of changes in power source.

19.1.4 Explain the operation of the CVR and DFDR and requirements for operation.

20. Airframe

20.1.1 Describe airframe construction, materials, cowling and firewalls, as applicable.

20.1.2 Describe rotor system.

20.1.3 Describe the operation of the doors, exits, windows and monitoring systems.

21. Miscellaneous systems

21.1.1 Describe other systems installed in the gyroplane that are likely to be used by the flight crew to operate the gyroplane.

21.1.2 Describe the location and operation of emergency equipment installed on the aircraft.

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22. Reserved

23. General operational knowledge

23.1 Aircraft limitations and documentation

23.1.1 Recalls essential aircraft limitations.

23.1.2 Can locate information in the AFM.

23.1.3 General background knowledge on unique aircraft characteristics, similar models and variants, including knowledge required to confirm the serviceability of the aircraft before commencement of flight.

23.1.4 Knowledge of licensing obligations for variants, where applicable.

23.1.5 Use of MEL and configuration deviation list (CDL), where applicable.

23.2 Weight and balance

23.2.1 Describe the effects of fuel burn on the CG.

23.3 Adverse weather operations

23.3.1 Describe operational impact of icing conditions.

23.4 Aerodynamics and performance

23.4.1 General knowledge of airflow over aerofoils and the aerodynamic effects of the following if installed on the aircraft:

(a) spoiler;

(b) speed brakes;

(c) flaps and slats.

23.4.2 Able to calculate or extract relevant aircraft performance data for different phases of flight and the effects of non-normal operations on aircraft range and endurance.

23.4.3 Describe the meteorological performance limiting factors.

23.4.4 Discuss any unique operational characteristics.

23.5 Meteorology

23.5.1 Can interpret the weather forecasts typically required for the normal operation of the aircraft.

24. Aircraft systems

24.1 Fuel and oil systems

24.1.1 Can describe the following in relation to the aircraft's fuel system:

(a) location of fuel tank/s and capacity;

(b) normal and non-normal fuel system operation and distribution;

(c) location and type of pumps used;

(d) vents system and location of vents and drains;

(e) system controls and indicators;

(f) minimum grades, colour and additives required, if any.

24.1.2 Determine minimum level of engine oil.

24.1.3 Describe oil system indicators and grade of oil required.

24.1.4 Knowledge of fuel and oil system limitations.

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24.2 Engines

24.2.1 Describe type of engine/s installed, the main components, rated thrust or horsepower and indicators required for operation.

24.2.2 Describe engine controls, their function.

24.2.3 Describe normal and non-normal engine operation.

24.2.4 If installed, the type of propellers/s, indicators and method of control and the method of feathering and unfeathering the propeller.

24.2.5 For turbine engine aircraft, explain the operation of the engine ignition system.

24.3 Electrical system

24.3.1 Describe core components of aircraft's electrical system, including;

(a) method/s of power generation;

(b) system design and operation;

(c) system protections and locations of key components;

(d) indicators and normal and degrade system operation;

(e) APU operation and location of connections for other external sources of power, if applicable.

24.4 Hydraulic system

24.4.1 Describe core components of the aircraft hydraulic system and their method of operation.

24.4.2 Method of determining sufficient system capacity, indicators and controls.

24.4.3 Systems operated by the hydraulic system/s.

24.5 Undercarriage and brakes

24.5.1 Describe the undercarriage system components and safety systems.

24.5.2 Normal and alternative method of operation.

24.5.3 Nosewheel steering system, if installed.

24.5.4 Describe the brake system components and normal and non-normal operation.

24.6 Pneumatic system

24.6.1 Describe the aircraft pneumatic system components and methods of operation.

24.6.2 Describe system limitations and safety devices.

24.7 Environmental/pressurisation system

24.7.1 Describe aircraft pressurisation system components and methods of normal and non-normal operation.

24.7.2 Explain the aircraft pressurisation limitations and safety features.

24.7.3 Describe the differences between gradual and rapid depressurisation experienced by the occupants of the aircraft.

24.7.4 Describes the reason for pressurisation limitation for take-off and landing.

24.7.5 Explain why a pressurised aircraft is fitted with a cabin altimeter.

24.7.6 Describe how to determine that the pressurisation system is functioning correctly.

24.8 Flight controls

24.8.1 Describe primary and secondary flight controls and their method of operation.

24.8.2 Describe the operation of speed-sensing devices that limit or operate flight controls where installed.

24.8.3 Describe degraded modes of operation for aircraft fitted with fly-by-wire flight control systems, the degraded protection provided and the effects on longitudinal stability with changes in aircraft speed.

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24.8.4 Knowledge of limitations and safety features that prevent structural damage to the aircraft.

24.9 Ice and rain protection

24.9.1 Describe the aircraft ice protection system/s, detection systems and explain their operation.

24.9.2 Describe anti-ice system limitations.

24.10 Fire and overheat protection

24.10.1 Describe the fire and overheat protection system/s installed on the aircraft, including indicators and extinguishing agents used.

24.10.2 Can determine the serviceability of the system/s.

24.10.3 Describe the power sources necessary for system operation.

24.11 Flight instruments

24.11.1 Describe the system/s that provide data to the primary flight instruments.

24.11.2 Describe the power sources for the primary flight instruments/displays.

24.11.3 Describe the operation of the stall avoidance and/or warning systems.

24.11.4 Knowledge of alternative sources of operation.

24.12 Navigation

24.12.1 Knowledge of the operation of the aircraft navigation system/s, including transponder/s and flight director/s and limitations.

24.12.2 Describe the operation of the aircraft navigation receivers and how to determine their working status.

24.12.3 Knowledge of the aircraft's weather detection system/s and safety precautions.

24.12.4 Operation of the aircraft FMS and cane determine signals used to determine aircraft position.

24.12.5 Describe the operation of the aircraft TCAS system.

24.12.6 Understanding of the aircraft windshear detection system, if installed.

24.13 Autoflight

24.13.1 Knowledge of autopilot and autothrottle, if installed, in flight operation in all modes.

24.13.2 Describe failure annunciations and pilot actions.

24.13.3 Understanding of interface with aircraft navigation systems.

24.13.4 Describe autoflight limitations.

24.14 Communications

24.14.1 Can operate all the aircraft communication systems, voice and data when installed.

24.14.2 Describe operation of aircraft intercommunication systems.

24.14.3 Describe operation of the communications system in the event of depressurisation or use of emergency oxygen system.

24.14.4 Explain operation of the CVR and FDR.

24.15 Miscellaneous systems

24.15.1 Describe other systems installed in the aircraft that contribute to the safety of the aircraft operation or are likely to be used by the flight crew to operate the aircraft.

24.15.2 Describe the location and operation of emergency equipment installed on the aircraft.

24.15.3 Knowledge of the location and operation of all exits installed on the aircraft.

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APPENDIX 4. FOREIGN LICENCE CONVERSION

SECTION 4.1 CPL – *RESERVED*

SECTION 4.2 MPL/ATPL – *RESERVED*

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