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;

(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.

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;

(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.

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;

(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;

(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.

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.

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.

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.

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.

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.

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;

(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.

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.

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;

(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').

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.

Unit 2.3.3 AAGH: Aerial application rating – helicopter endorsement

1 Reserved

1. Aircraft performance

1.1 Environment affects

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 Helicoper 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.

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).

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.

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;

(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.

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.

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.

6.1.6 Spatial disorientation and illusions.

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.

SECTION 2.7 NIGHT VFR RATING

Unit 2.7.1 NVFR: NVFR rating – all aircraft categories

1. Reserved

2. Flight rules

2.1 Legislation

2.1.1 Describe the privileges and limitations of the rating.

2.1.2 Describe the minimum NVFR aircraft equipment requirements.

2.1.3 Describe the ALA/HLS dimension and lighting requirements as applicable.

3. Flight at night

3.1 Operations

3.1.1 Describe the principles of operations, limitations and errors for the radio navigation systems used.

3.1.2 Describe the flight planning/notification; requirements, including LSALT, weather, fuel and lighting.

3.1.3 Explain the requirements for departure and descent for clearance from terrain.

3.1.4 Explain the alternate aerodrome planning requirements.

3.1.5 Describe the operation of PAL.

3.1.6 Describe the ATC procedures relevant to NVFR operations.

3.2 Human factors

3.2.1 Explain the human factors and physiological limitations for the conduct of operations at night as described in CASA guidance material for NVFR operations.

SECTION 2.8 EXAMINER RATINGS

Unit 2.8.1 FERC: flight examiner rating – common – *Reserved*