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.