

Revision 12

5 October 2016

Pilot Licences and Ratings—Instrument Rating

General

Civil Aviation Authority advisory circulars contain guidance and information about standards, practices, and procedures that the Director has found to be an **acceptable means of compliance** with the associated rules and legislation.

However the information in the advisory circular does not replace the requirement for participants to comply with their own obligations under the Civil Aviation rules, the Civil Aviation Act 1990 and other legislation.

An advisory circular reflects the Director's view on the rules and legislation. It expresses CAA policy on the relevant matter. It is not intended to be definitive. Consideration will be given to other methods of compliance that may be presented to the Director. When new standards, practices, or procedures are found to be acceptable they will be added to the appropriate advisory circular. Should there be any inconsistency between this information and the rules or legislation, the rules and legislation take precedence.

An advisory circular may also include **guidance material** generally, including guidance on best practice as well as guidance to facilitate compliance with the rule requirements. However, guidance material must not be regarded as an acceptable means of compliance.

An advisory circular may also include **technical information** that is relevant to the standards or requirements.

Purpose

This advisory circular provides information on the flight time experience and on the examination syllabus content that is acceptable to the Director for meeting the Civil Aviation Rule requirements for the issue of an Instrument Rating.

Related Rules

This advisory circular relates specifically to Civil Aviation Rule Part 61 Subpart Q—Instrument Ratings.

Change Notice

Revision 12 introduces the requirement for Performance Based Navigation (PBN), and specifically RNP1, into the instrument rating and details transition arrangements.

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Rule 61.801 Eligibility Requirements

Flight time experience

Rule 61.801(a)(2) requires an applicant for an instrument rating to have flight time experience acceptable to the Director.

The following is acceptable to the Director:

EITHER

- (i) 50 hours of VFR cross-country navigation flight time as pilot-in-command, of which not less than 10 hours are in the appropriate category of aircraft; and
- (ii) 10 hours dual instrument cross-country flight time under an IFR flight plan; and
- (iii) 40 hours instrument time; and
- (iv) 20 hours instrument flight time in that category of aircraft, of which at least 10 hours are dual instruction as required by rule 61.801(a)(4).

OR

Where an applicant for an instrument rating is undertaking the instrument rating training course in conjunction with a 200 hour CPL (A) training course conducted in accordance with AC61-5 by a training organisation certificated under Part 141, where the certificate authorises the holder to conduct that training.

- (i) 50 hours cross-country flight time in aeroplanes, which is to include the 20 hours training in accordance with the CPL (A) cross-country navigation syllabus set out in Appendix II of AC61-5 and 10 hours dual instrument cross-country flight time under an IFR flight plan; and
- (ii) 40 hours instrument time; and
- (iii) 20 hours instrument flight time in that category of aircraft, of which at least 10 hours are dual instruction as required by rule 61.801(a)(4).

Ground training course

A ground course based on the syllabuses detailed in Appendix I meets the requirements of the ground course in air law; flight navigation - IFR; meteorology; instruments and navigation aids; and human factors in rule 61.801(a)(3).

Flight training course

Appendix II of this advisory circular meets the requirements of the 10 hours of dual flight training in IFR procedures in rule 61.801(a)(4).

Written examination credit

The written examination credit required by rule 61.801(a)(5) comes into effect when all the written examinations have been passed in the qualifying period of three years and the written examination credit is valid for three years as detailed in rule 61.17(c) and (d).

The instrument rating written examinations are based on the syllabuses detailed in Appendix I of this advisory circular. The meteorology and human factors training and examinations required by rules 61.801(a)(3) (iii) and (v) and 61.801(a)(5) are the same as those for the CPL; therefore credits in these subjects are acceptable towards the issue of an instrument rating.

Flight test

The requirements of the flight test in rule 61.801(a)(6) are set out in the Instrument Rating Flight Test Standards Guide published by the Director. These are detailed in Appendix II of this advisory circular and the flight tests are conducted by appropriately authorised flight examiners on behalf of the Director.

The successful demonstration of competence in a technically enhanced aircraft (TEA) is only valid for use in a TEA.

An examination knowledge deficiency report (KDR) is a report issued on completion of a written examination that details areas where questions were answered incorrectly. The applicant for a instrument rating flight test must provide the flight examiner with written examination KDRs in accordance with rule 61.21(a)(5). These KDRs, with content acknowledged against the relevant rule reference(s), must be certified prior to the flight test by a Category A or B flight instructor that the applicant has been examined in these areas and their knowledge has improved. The flight examiner conducting the flight test will test the applicant's knowledge of the written examination subject areas including but not limited to items included in the KDRs.

General guidance

Where a pilot is undertaking their instrument rating training as part of an integrated 200 hour CPL (aeroplane) training course conducted by a training organisation certificated under Part 141, where the certificate authorises the holder to conduct that training, the Director considers it acceptable for the pilot to spend more of the total flight time experience required for the CPL flying on IFR cross-country navigation rather than accumulating VFR cross-country navigation flight time, to meet the 50 hours that is acceptable to the Director under rule 61.801(a)(2).

Instrument time accumulated in a synthetic training device towards the instrument time experience under rule 61.801(a) and (b) should be certified in the pilot's logbook in accordance with rule 61.33.

Rule 61.803 Issue

Licence endorsement

Navigation aid or system

The additional approach aid or systems, which may be endorsed on the licence under rule 61.803(b) and (c), are: ADF, ILS or GNSS. Privileges, such as, single pilot or two pilots, single engine or multi-engine, technically enhanced aircraft (TEA), the type and model of GPS unit and PBN qualifications (RNAV 2, RNAV 1, RNP 2 and RNP 1) only need to be entered in the pilot's logbook and recorded on the flight test report.

Rule 61.805 Privileges and Limitations Competency demonstration on approach aid or system

The approach aids or systems that may be certified in the holder's logbook under rule 61.805(b)(3) are: ADF, VOR, GNSS, ILS and PBN.

In the case of GPS the type and model of each GPS unit demonstrated also needs to be recorded in accordance with rule 19.205(a).

PBN qualifications should be specified as RNAV 2, RNAV 1, RNP 2 and/or RNP 1.

Pilots holding a current GNSS endorsement under rule 19.205(b) are competent in RNAV 2, RNAV 1 and RNAV(GNSS) approaches as detailed in advisory circular AC91-21.

On issue of this advisory circular amendment, a pilot with a current GNSS endorsement may, until their next competency demonstration, also exercise RNP 1 privileges. After 1 Jan 2017, any pilot seeking initial GNSS endorsement or having their annual competency checked and who requires RNP 1 privileges must demonstrate competency on an appropriate RNP 1 procedure as part of the flight test. The flight test at Appendix II of this advisory circular contains the RNP 1 standards acceptable to the Director. Pilots who demonstrate RNP 1 competency meet the requirements of, and may be issued with, RNP 2 and RNAV 1 privileges.

Flight examiners may continue to flight test in accordance with the instrument examiner privileges they hold and in accordance with the above.

The following logbook format may be used:

<p><i>I hereby certify that _____ has satisfactorily demonstrated competency in the use of ADF, VOR, ILS, GNSS (delete as applicable) and PBN: RNAV 2/RNAV 1/RNP 2/RNP 1(delete as applicable) for aeroplanes/helicopters(delete one).</i></p> <p><i>GPS type _____ Model _____</i></p> <p><i>Examiner _____</i></p> <p><i>Client ID _____ Date _____</i></p>

Rule 61.807 Currency Requirements

A demonstration of competency required by rule 61.807(a)(1) generally consists of items detailed in Appendix II of this advisory circular. However, as set out above, a successful demonstration of competence in a technically enhanced aircraft is only valid for use in a technically enhanced aircraft.

EXCEPT:

- (i) Pilots who meet the IFR operational requirements of Part 119 in a non-TEA and hold a current IR in a TEA may exercise IR privileges in either configuration.
- (ii) Similarly, pilots who meet the IFR operational requirements of Part 119 in a TEA **and** hold a current IR in a non-TEA may exercise IR privileges in either configuration.
- (iii) In addition, a current flight examiner who holds the examiner privilege of IR renewal may, at their discretion, also exercise the privileges in either configuration provided both the examiner rating and IR are current.

A successful demonstration of competence in a single engine or centre line thrust aircraft is only valid for use in a single engine or centre line thrust aircraft.

A successful demonstration of competence in a multi-engine or centre line thrust aircraft would meet the requirements of a single engine demonstration provided that both the multi-engine and single engine (or centre line thrust) aircraft are conventional or both aircraft conform with the definition of a TEA.

Definition - technical enhanced aircraft (TEA)

A technically enhanced aircraft (TEA) is defined as an aircraft approved for IFR flight in which the primary flight instruments and navigation information are displayed electronically, by an integrated system that has been certified at TSO level, and is capable of displaying critical information about an aircraft's flight path, situation, position, and progress.

Logbook endorsement

The following format may be used to certify the successful demonstration of competency required by rule 61.807(a)(1)(ii):

I hereby certify that _____ has successfully demonstrated competency in accordance with the instrument rating flight test syllabus in a conventional/technically-enhanced (TEA) aircraft, centreline-thrust/multi-engine/single-engine aeroplane/helicopter to single-pilot/two-pilot standard.

Annual currency demonstration due (day/month/year).

Examiner _____

Client ID _____ Date _____

Co-pilots

Rule 61.807(a)(1) and (2) for co-pilots. Instrument rating holders acting as co-pilot in a two pilot crew may not credit instrument time toward the currency requirement of rule 61.807(a)(1) and (2) unless the aircraft's type certificate, flight manual, or operating rule, requires that the aircraft be operated by a two pilot crew and; in accordance with rule 61.31(c), the co-pilot is manipulating the controls during actual or simulated instrument conditions.

Similar navigation system

Rule 61.807(a)(4) allows for approach currency to be maintained by using a similar type of navigation system. While the rule does not define what type of navigation systems are similar, VOR, NDB, LLZ, and GNSS are generally regarded as similar types of navigation systems.

Pilots operating under Part 119

For a pilot conducting IFR operations in accordance with Part 121 or Part 125 under the authority of a Part 119 air operator certificate, the following would meet the requirements of rule 61.807(a)(5):

- (i) A satisfactory demonstration of competency required in accordance with rule 61.801(a)(6), each element of which may be spread over the immediately preceding 12 months.
- (ii) The certificate holder is authorised in accordance with rule 119.13(b)(3) and rule 121.603 or rule 125.603 (as appropriate).
- (iii) The pilot is the 'handling pilot' and is flying as if they were pilot-in-command during the demonstration of each element required by rule 61.801(a)(6).
- (iv) The demonstration of competence is conducted by a flight examiner meeting the requirements of rule 121.583 or rule 125.605 (as appropriate).

- (v) The aircraft type meets the requirements of rule 119.153(a)(1) or (a)(2) as appropriate or in the case of a flight simulator is approved for the purpose under rule 121.11.

General guidance

The three approaches required by rule 61.807(a)(2)(i) and (ii) may be completed in actual or simulated conditions, be the same approach type, and one approach may be carried out in a synthetic flight trainer approved for that purpose.

For the purpose of meeting this currency requirement an 'approach' is one that conforms with the published approach procedure and includes flight under actual or simulated conditions to include at least the final leg of the approach procedure to the missed approach point or MDA.

The number and type of approach procedure carried out on each flight should be recorded in the pilot's logbook. Column 16 or 17 may be used for this purpose, for example: 1xVOR.

Where a safety pilot is used for the purpose of simulated instrument flight, the safety pilot's name should be entered in the logbook of the pilot under training under the co-pilot column.

Appendix I Instrument Rating Written Examination Syllabuses

Air Law Syllabus Matrix:

Sub-Heading	PPL	CPL	IR	ATPL(A)	ATPL(H)
	Subject # 4	Subject # 16	Subject # 52	Subject # 36	Subject # 37
General					
Aviation Legislation	4.2	16.2	52.2	36.2	37.2
Definitions	4.4	16.4	52.4	36.4	37.4
Abbreviations	4.6	16.6	52.6	36.6	37.6
Personnel Licensing					
Requirements for Licences and Ratings	4.10	16.10	52.10	36.10	37.10
Eligibility, Privileges and Limitations	4.12	16.12	52.12	36.12	37.12
Competency, Currency and Recency	4.14	16.14	52.14	36.14	37.14
Medical Requirements	4.16	16.16	52.16	36.16	37.16
Airworthiness of Aircraft and Aircraft Equipment					
Documentation	4.20	16.20	52.20	36.20	37.20
Aircraft Maintenance	4.22	16.22	52.22	36.22	37.22
Instruments and Avionics	4.24	16.24	52.24	36.24	37.24
Equipment	4.26	16.26	52.26	36.26	37.26
General Operating and Flight Rules					
General Operating Requirements	4.30	16.30	52.30	36.30	37.30
General Operating Restrictions	4.32	16.32	52.32	36.32	37.32
General Meteorological Requirements and Restrictions	4.34	16.34			37.34
Carriage of Dangerous Goods	4.36	16.36		36.36	37.36

Helicopter External Load Operations		16.38			37.38
Air Operations					
Air Operations Crew Requirements		16.40		36.40	37.40
Air Operations Requirements and Restrictions		16.42		36.42	37.42
Air Operations Meteorological Requirements and Restrictions		16.44		36.44	37.44
Air Operations Performance Requirements		16.46		36.46	37.46
Air Operations Weight and Balance Requirements					37.48
Flight Planning and Preparation					
Flight Preparation	4.50	16.50	52.50	36.50	37.50
Alternate Requirements			52.52	36.52	37.52
Fuel Requirements	4.54	16.54	52.54	36.54	37.54
Flight Plans	4.56	16.56	52.56	36.56	37.56
Enroute Limitations		16.58		36.58	
Air Traffic Services					
Communications	4.60	16.60	52.60	36.60	37.60
Clearances	4.62	16.62	52.62	36.62	37.62
Separation	4.63	16.63	52.63	36.63	37.63
Terrain Clearance			52.64	36.64	37.64
Weather Avoidance			52.65	36.65	37.65
Radar Services	4.66	16.66	52.66	36.66	37.66
Oceanic Procedures				36.67	
Global Navigation Satellite System		16.68	52.68	36.68	37.68
Airspace; Aerodromes; and					

Heliports					
Altimetry	4.70	16.70	52.70	36.70	37.70
Cruising Levels	4.72	16.72	52.72	36.72	37.72
Transponders	4.74	16.74	52.74	36.74	37.74
Airspace	4.75	16.75	52.75	36.75	37.75
Aerodromes and Heliports	4.76	16.76	52.76	36.76	37.76
Aerodrome Lighting	4.78	16.78	52.78	36.78	37.78
Emergencies; Incidents; and Accidents					
Responsibilities of Operators and Pilots	4.80	16.80		36.80	37.80
Communications and Equipment	4.82	16.82	52.82	36.82	37.82
Instrument Departures and Approaches					
Departure Procedures			52.90	36.90	37.90
Holding Procedures			52.92	36.92	37.92
Approach Procedures			52.94	36.94	37.94
Communications and Navigation Aid Failure			52.96	36.96	37.96

Subject No 52 IR Air Law (Aeroplane and Helicopter)

Each subject has been given a subject number and each topic within that subject a topic number. These reference numbers will be used on knowledge deficiency reports and will provide valuable feed back to the examination candidate. These topic reference numbers may be common across the subject levels and therefore may not be consecutive within a specific syllabus.

Sub Topic Syllabus Item

General

52.2 Aviation Legislation

52.2.2 Describe the requirements to hold an aviation document, as laid down in S7. CA Act 1990

52.2.4 Describe the duties of the pilot-in-command, as laid down in S13. CA Act 1990

52.4 Definitions

CAR Part 1 (unless otherwise noted)

State the definition of:

- (a) Act;
- (b) aerodrome control service;
- (c) aerodrome operational area;
- (d) aerodrome traffic circuit;
- (e) aeronautical information circular;
- (f) aeronautical information publication (AIP);
- (g) AIP supplement;
- (h) air traffic control (ATC) service;
- (i) airworthiness certificate;
- (j) alternate aerodrome;
- (k) altitude;
- (l) approach control;
- (m) area control;
- (n) area navigation;
- (o) ATC clearance;
- (p) ATC instruction;
- (q) AWIB service;
- (r) barometric vertical navigation (baro-VNAV); AIP GEN
- (s) Category II precision approach procedure;
- (t) ceiling;
- (u) change over point (COP); AIP GEN
- (v) clearance limit;
- (w) command practice;
- (x) controlled airspace;

Sub Topic	Syllabus Item
	(y) controlled flight;
	(z) co-pilot;
	(aa) crew member;
	(bb) day;
	(cc) decision altitude (DA);
	(dd) decision height (DH);
	(ee) dual flight time;
	(ff) final reserve fuel;
	(gg) flight examiner;
	(hh) flight level;
	(ii) height;
	(jj) IFR flight;
	(kk) instrument approach procedure;
	(ll) instrument flight;
	(mm) instrument flight time;
	(nn) instrument meteorological conditions;
	(oo) instrument time;
	(pp) Mach number;
	(qq) minimum descent altitude (MDA);
	(rr) minimum descent height (MDH);
	(ss) minimum safe altitude (MSA); (AIP GEN)
	(tt) minimum sector altitude (MSA 25M); (AIP GEN)
	(uu) night;
	(vv) NOTAM;
	(ww) pilot-in-command;
	(xx) precision approach procedure;
	(yy) pressure altitude;
	(zz) procedure altitude; (AIP GEN)
	(aaa) rated coverage; (AIP GEN)
	(bbb) rating;
	(ccc) reporting point;
	(ddd) RNP;
	(eee) runway visual range;
	(fff) segment OCA; (AIP GEN)
	(ggg) SEIFR passenger operation;
	(hhh) transition altitude; (AIP GEN)

Sub Topic	Syllabus Item
	(iii) transition layer; (AIP GEN)
	(jjj) transition level; (AIP GEN)
	(kkk) VFR flight;
	(lll) visibility;
	(mmm) visual meteorological conditions;
	(nnn) visual reference. (AIP GEN)

52.6**Abbreviations**

CAR Part 1 (unless otherwise noted)

State the meaning of the following abbreviations:

- (a) ACAS;
- (b) ADF;
- (c) DME;
- (d) FAF; (AIP GEN)
- (e) FAP; (AIP GEN)
- (f) GNSS; (CAR 19.203)
- (g) GPWS;
- (h) IAC; (AIP GEN)
- (i) IAF; (AIP GEN)
- (j) ILS;
- (k) PAR;
- (l) PRA;
- (m) QFE;
- (n) QNH;
- (o) RVSM;
- (p) STA; (AIP GEN)
- (q) TAWS;
- (r) TCAS;
- (s) VOR;
- (t) VORSEC; (AIP GEN)
- (u) VORTAC; (AIP GEN)
- (v) VPA; (AIP GEN).

Personnel Licensing**52.10****Requirements for Licences and Ratings**

- 52.10.2 State the requirements for holding a pilot's licence. CAR 61
- 52.10.4 State the requirements for a pilot-in-command to hold a type rating on the type of aircraft being flown. CAR 61

Sub Topic	Syllabus Item
52.10.6	State the requirements for entering flight details into a pilot's logbook. CAR 61
52.10.8	State the requirements for holding an instrument rating. CAR 61
52.10.10	State the licence and rating requirements for acting as a safety pilot during simulated instrument flight. CAR 91
52.12	Eligibility, Privileges and Limitations
52.12.2	Describe the allowance for a person who does not hold a current pilot's licence to fly dual with an instructor. CAR 61
52.12.4	State the eligibility requirements for the issue of an instrument rating. CAR 61
52.12.6	State the privileges of holding an instrument rating. CAR 61
52.12.8	State the limitations on the holder of an instrument rating. CAR 61
52.12.10	State the qualification requirements for carrying out various types of instrument approach. CAR 61
52.14	Competency, Currency and Recency
52.14.2	State the currency requirements of a pilot who is the holder of an instrument rating CAR 61.
52.14.4	State the currency requirements for carrying out an instrument approach. CAR 61
52.16	Medical Requirements
52.16.2	State the hearing standard required for the holder of an instrument rating. CAR 61
	Airworthiness of Aircraft and Aircraft Equipment
52.20	Documentation
52.20.2	State the documents which must be carried in aircraft operated in New Zealand. CAR 91
52.22	Aircraft Maintenance
52.22.2	State the inspection period for radios. CAR 91
52.22.4	State the inspection period for altimeters. CAR 91
52.22.6	State the inspection period for transponders. CAR 91
52.22.8	State the inspection period for the ELT. CAR 91
52.24	Instruments and Avionics
52.24.2	State the minimum instrument requirements for an IFR flight. CAR 91
52.24.4	State the communications and navigation equipment requirements for an IFR flight. CAR 91
52.24.6	State the equipment requirements of aircraft operating in airspace where RVSM is applied by ATC. CAR 91
52.26	Equipment
52.26.2	State the equipment requirements for an IFR flight. CAR 91
52.26.4	State the requirements for indicating the time in flight. CAR 91
52.26.6	State the requirements for night flight. CAR 91
52.26.8	Explain the requirement for altitude alerting/assigned altitude indicating. CAR 91

Sub Topic	Syllabus Item
52.26.10	State the requirements for an ELT. CAR 91
	General Operating and Flight Rules
52.30	General Operating Requirements
52.30.2	State the requirements for operating an aircraft in simulated instrument flight. CAR 91
52.30.4	State the requirements for carrying appropriate aeronautical publications and charts in flight. CAR 91
52.30.6	State the requirements for the maintenance of an enroute track. CAR 91
52.30.8	State the requirements for IFR cruising altitude or flight level. CAR 91
52.32	General Operating Restrictions
52.32.2	State the restrictions on the use of portable electronic devices in flight. CAR 91
52.32.4	State the speed limitations on aircraft operating under IFR. CAR 91
52.32.6	State the restrictions when operating IFR in icing conditions. CAR 91
52.32.8	State the minimum altitudes for IFR flight. CAR 91
	Flight Planning and Preparation
52.50	Flight Preparation
52.50.2	Explain the requirements for obtaining and considering relevant information prior to flight. CAR 91
52.50.4	Describe the publications and their content that provide operational route and aerodrome information.
52.50.6	Derive operational information from charts and publications that provide route, approach and aerodrome information.
52.52	Alternate Requirements
52.52.2	State the meteorological minima at destination which would require an alternate to be nominated. CAR 91
52.52.4	Determine the meteorological minima required at an aerodrome for it to be nominated as an IFR alternate. CAR 91
52.52.6	State the power supply requirements for the selection of an aerodrome as an alternate on an IFR air operation. CAR 91
52.52.8	State the reference datum for takeoff meteorological minima for IFR operations. CAR 91
52.52.10	State the reference datum for landing meteorological minima for IFR operations. CAR 91
52.52.12	State the reference datum for alternate meteorological minima for IFR operations. AIP ENR
52.54	Fuel Requirements
52.54.2	State the fuel reserve required for an IFR flight in a non-turbine-powered aeroplane. CAR 91
52.54.4	State the fuel reserve required for an IFR flight in a turbine-powered aeroplane or a helicopter. CAR 91
52.56	Flight Plans

Sub Topic	Syllabus Item
52.56.2	State the requirements for the filing of a flight plan for flight under IFR. CAR 91
52.56.4	State the notification lead time for filing an IFR flight plan. CAR 91 & AIP ENR
52.56.6	State the requirements for adhering to an IFR flight plan. CAR 91
52.56.8	State the requirements for the notification of changes to a filed IFR flight plan. CAR 91
52.56.10	State the requirements for an inadvertent departure from an IFR flight plan. CAR 91
52.56.12	State the requirements for the terminating an IFR flight plan at an aerodrome without ATS. CAR 91
	Air Traffic Services
	52.60 Communications
52.60.2	Derive from operational publications, the required radio frequency for communicating with specified ATC units.
52.60.4	State the requirements for making position reports to an ATS unit. CAR 91 & AIP ENR
52.60.6	State the contents of various IFR position reports. AIP ENR
52.60.8	State the purpose of Universal Communications Services (UNICOM). AIP GEN
52.60.10	State the purpose of an Aerodrome Frequency Response Unit (AFRU). AIP GEN
52.60.12	State the purpose of Aerodrome and Weather Information Broadcasts (AWIB). AIP GEN
52.60.14	State the meaning of the various light signals from a control tower. CAR 91 & AIP AD
52.60.16	State the communications requirements when TIBA procedures are in force. AIP ENR
	52.62 Clearances
52.62.2	State the requirements for complying with ATC clearances and instructions. CAR 91 & AIP ENR
52.62.4	State the requirements for coordinating with an aerodrome flight information service. CAR 91
52.62.6	State the requirements for receiving an ATC clearance prior to entering various types of airspace, and ground manoeuvring area. CAR 91 & AIP ENR
52.62.8	State the requirements for receiving an ATC clearance prior to re-entering controlled airspace. CAR 91 & AIP ENR
	52.63 Separation
52.63.2	Describe the situations where Air Traffic Control is responsible for the provision of separation between VFR, SVFR and IFR traffic. AIP ENR
52.63.4	Describe the situations where the pilot-in-command of an IFR flight is responsible for maintaining separation from other traffic. AIP ENR
52.63.6	Describe the normal separation standards applied by ATC. AIP ENR
52.63.8	Describe the situations where the normal separation may be reduced. AIP ENR
52.63.10	State the meaning of the term “Essential Traffic”. AIP ENR
52.63.12	State the conditions under which longitudinal separation between reciprocal track aircraft may be reduced. AIP ENR
52.63.14	State the minimum lateral and longitudinal separation between RNP10 aircraft, as

Sub Topic	Syllabus Item
	permitted by ICAO Regional Supplementary procedures (Doc 7030). AIP ENR
52.63.16	State the deviation from an assigned indicated airspeed or Mach number and ETA outside of which pilots are required to notify ATC. CAR 91
52.63.18	State the wake turbulence separation requirements for light and medium aircraft. AIP AD
52.63.20	State the maximum airspeed below 10,000 feet. CAR 91
52.63.22	State the minimum descent height in IMC at an unattended aerodrome where traffic conflict may exist. AIP ENR
52.64	Terrain Clearance
52.64.2	Describe the determination of the minimum safe altitude for IFR flight. AIP GEN
52.64.4	Explain the coverage and use of VORSEC charts. AIP GEN
52.64.6	Explain the coverage and use of 25nm Minimum Sector Altitude diagrams. AIP GEN
52.64.8	State when the radar control service is responsible for the provision of terrain clearance. AIP ENR
52.64.10	Explain how radar control provides terrain clearance. AIP ENR
52.64.12	Describe the use of DME descent steps for maintaining terrain clearance during departure climb or descent for an approach. AIP GEN & ENR
52.65	Weather Avoidance
52.65.2	State the requirements for deviation off track for weather avoidance. AIP ENR
52.66	Radar Services
52.66.2	Describe the radar services available to IFR flights. AIP ENR
52.66.4	Describe the responsibility of the radar controller to keep an aircraft within controlled airspace. AIP ENR
52.66.6	State the accuracy limits required when under radar speed control. AIP ENR
52.66.8	State the distance from touchdown that radar speed control can be maintained on an instrument and a visual approach. AIP ENR
52.66.10	State the meteorological and other conditions which allow a radar controller to vector an aircraft for a visual approach. AIP ENR
52.66.12	State the criteria for a radar controller to consider an unknown aircraft to be on a conflicting path with another aircraft. AIP ENR
52.68	Global Navigation Satellite System
52.68.2	State the equipment required by aircraft within the New Zealand flight information region, using GPS as a primary means navigation system. CAR 19
52.68.4	State the meaning of a GPS “sole means navigation system”. CAR 19
52.68.6	State the restriction on using GPS as a sole means navigation system under IFR in the New Zealand flight information region. CAR 19
52.68.8	State the actions required of pilots, under IFR using GPS equipment as a primary means navigation system, if system degradation occurs. CAR 19
52.68.10	State the requirements which must be met before a pilot of an aircraft operating within the New Zealand flight information region, under IFR, using GPS equipment as a primary means navigation system, is permitted random flight routing. CAR 19

Sub Topic	Syllabus Item
52.68.12	State the requirements for carrying out an instrument approach using GPS equipment as a primary means navigation system. CAR 19
52.68.14	State the requirements for the nomination of an alternate if GPS is used as a primary means navigation system. CAR 19
	Airspace; Aerodromes; and Heliports
52.70	Altimetry
52.70.2	Explain the altimeter setting requirements for flight under IFR. CAR 91 & AIP ENR
52.70.4	State the procedure to use to obtain an altimeter setting when QNH is not available prior to takeoff and the requirement to obtain a QNH once in flight. AIP ENR
52.70.6	Describe QNH zones and state when zone QNH should be used. AIP ENR
52.70.8	Describe the transition altitude, layer and level. AIP ENR
52.72	Cruising Levels
52.72.2	State the altitude/flight level requirements when cruising IFR within the New Zealand FIR. CAR 91 & AIP ENR
52.72.4	Determine from charts and publications the minimum flight altitude (MFA) for a route sector.
52.72.6	Describe situations where ATC may assign cruising altitudes not in accordance with the IFR table of cruising altitudes. AIP ENR
52.72.8	State the position by which an aircraft must be at a higher MFA if changing to a track with a higher MFA. AIP GEN
52.74	Transponders
52.74.2	State the requirements for the operation of transponders within the New Zealand FIR. CAR 91 & AIP ENR
52.74.4	Describe the procedures required of pilots operating transponders. AIP ENR
52.74.6	Describe the procedure whereby ATC can verify the accuracy of the Mode C function of a transponder. AIP ENR
52.74.8	State the requirements and limitations on an aircraft operating in transponder mandatory airspace without an operating transponder. CAR 91 & AIP ENR
52.75	Airspace
52.75.2	State the rules pertaining to operating IFR in the various classes of airspace. CAR 91 & AIP ENR
52.75.4	Describe the vertical limits and purpose of control zones (CTR). CAR 71
52.75.6	Describe the vertical limits and purpose of control areas (CTA). CAR 71
52.75.8	State the status and conditions relating to flight in VFR transit lanes. AIP ENR
52.75.10	Describe the status and purpose of a general aviation area (GAA), and state the process for IFR flights to transit through GAA airspace. CAR 91 & AIP ENR
52.75.12	Describe visual reporting points.
52.75.14	Describe the status of controlled airspace when ATC go off duty. AIP GEN
52.75.16	State the restrictions on operating an aircraft in a restricted area. CAR 91 & AIP ENR
52.75.18	State the restrictions on operating an aircraft in a military operational area (MOA).

Sub Topic	Syllabus Item
	CAR 91 & AIP ENR
52.75.20	State the restrictions and operating considerations relating to operating an aircraft in a mandatory broadcast zone (MBZ). CAR 91 & AIP ENR
52.75.22	State the restrictions and operating considerations relating to operating an aircraft in a volcanic hazard area (VHA). CAR 91 & AIP ENR
52.75.24	State the restrictions and operating considerations relating to operating an aircraft in a danger area. CAR 91 & AIP ENR
52.75.26	State the restrictions and operating considerations relating to operating an aircraft in a parachute drop zone (PDZ). AIP ENR
52.75.28	State the operating considerations relating to operating an aircraft in a common frequency zone (CFZ). AIP ENR
52.75.30	State the operating considerations relating to operating an aircraft over or close to temporary hazards/airspace. AIP ENR
52.75.32	Explain the requirements for the operation of an aircraft in RNP airspace. AIP ENR
52.75.34	Interpret airspace information on aeronautical charts.
52.76	Aerodromes and Heliports
52.76.2	Describe the limitations on the use of a place as an aerodrome or heliport. CAR 91
52.76.4	Describe the method of runway designation. AIP AD
52.76.6	Describe the movement area of an aerodrome. CAR 1
52.76.8	Interpret information on aerodrome/heliport charts. AIP GEN & AIP Volume 4
52.78	Aerodrome Lighting
52.78.2	Describe the lighting intensity classifications.
52.78.4	Describe the following lighting systems: <ul style="list-style-type: none">(a) Runway edge lighting (REDL);(b) Runway landing threshold lighting (RTHL);(c) Runway end lighting (RENL);(d) Runway centreline lighting system (RCLL);(e) Runway end identifier lighting (REIL);(f) Approach lighting systems (ALS);(g) Circling guidance lighting (CGL);(h) Runway lead in lighting (RLLS);(i) Pilot activated lighting (PAL);(j) T-Visual approach slope indicators (T-VASIS);(k) Visual approach slope indicators (VASIS); and,(l) Precision approach path indicators (PAPI).
52.78.6	Describe aerodrome beacons.

Emergencies; Incidents; and Accidents**52.82 Communications and Equipment**

- 52.82.2 State the transponder code a pilot should set to indicate an emergency condition. AIP ENR
- 52.82.4 State the transponder code a pilot should set to indicate a loss of communications. AIP ENR
- 52.82.6 State the transponder code a pilot should set to indicate that the aircraft is being subjected to unlawful interference. AIP ENR
- 52.82.8 Describe the means by which ATC will verify the transmission of an emergency SSR transponder code. AIP ENR
- 52.82.10 Describe the use of the speechless technique using un-modulated transmissions. AIP ENR
- 52.82.12 State the procedures for the emergency activation of an ELT. AIP GEN
- 52.82.14 State the pilot action required following the inadvertent transmission of an ELT. AIP GEN
- 52.82.16 State the requirements for the operational testing of an ELT. AIP GEN
- 52.82.18 State the procedures to be followed on receiving an ELT signal. AIP GEN

Instrument Departures and Approaches**52.90 Departure Procedures**

- 52.90.2 Interpret information on SID and Departure Procedure charts.
- 52.90.4 Determine the IFR takeoff minima for a departure off a given runway. AIP ENR
- 52.90.6 State the IFR takeoff minima if it is not prescribed in the AIPNZ VOL 2 & 3. AIP ENR
- 52.90.8 State the CAR Part 91 requirements and limitations of IFR reduced takeoff minima. CAR 91 & AIP ENR
- 52.90.10 State the minimum height for a turn after takeoff on departure. AIP ENR
- 52.90.12 State the minimum climb gradient on a SID unless otherwise specified. AIP ENR
- 52.90.14 Calculate the rate of climb required to meet the net climb gradient specified on instrument departures. AIP ENR
- 52.90.16 State when a departure procedure terminates. AIP ENR
- 52.90.18 State the limitation on the termination of radar vectoring for a departing IFR aircraft. AIP ENR
- 52.90.20 State the requirements for broadcasting intentions when departing from an unattended aerodrome. AIP ENR
- 52.90.22 State the requirements for and limitations on a visual departure. AIP ENR
- 52.90.24 Describe the operating restrictions where an IFR departure procedure is not promulgated. AIP ENR

52.92 Holding Procedures

- 52.92.2 State the maximum speed in enroute holding patterns. AIP ENR
- 52.92.4 State the maximum entry and holding pattern speeds. AIP ENR
- 52.92.6 Identify and describe appropriate holding pattern entry procedures. AIP ENR
- 52.92.8 State when an onwards clearance time will be passed to the pilots of an aircraft

instructed to hold enroute. AIP ENR

52.92.10 State when an expected approach time will be passed to the pilots of an aircraft instructed to hold at an initial approach fix. AIP ENR

52.92.12 State the angle of bank required during turns in a holding pattern. AIP ENR

52.94 Approach Procedures

52.94.2 Describe the descent limitations from cruise to approach commencement. AIP GEN

52.94.4 Interpret information on STAR charts.

52.94.6 State the limitation on a clearance to fly a STAR. AIP ENR

52.94.8 Define the minimum initial approach altitude. AIP ENR

52.94.10 Interpret information on instrument approach charts.

52.94.12 Determine the IFR meteorological minima for an instrument approach to a given runway.

52.94.14 State the meteorological minima which must exist prior to a landing off an instrument approach. CAR 91 & AIP ENR

52.94.16 Describe the procedures for joining overhead a navigation aid for an instrument approach. AIP ENR

52.94.18 State the minimum meteorological conditions which must exist before ATC may clear an aircraft for an instrument approach with a descent restriction. AIP ENR

52.94.20 State the meteorological and other conditions which will allow a pilot to request a visual approach in controlled airspace. AIP ENR

52.94.22 State the meteorological and other conditions which allow ATC to advise that conditions are suitable for a visual approach. AIP ENR

52.94.24 State the meteorological and other conditions which will allow a pilot to carry out a visual approach in uncontrolled airspace. AIP ENR

52.94.26 Describe the provision of separation and terrain clearance during a visual approach. AIP ENR

52.94.28 Given an aircraft's Vs, determine its category for approach speeds and minima. AIP ENR

52.94.30 State the category A and B speed limitations during an instrument approach under ICAO PANS OPS II procedures. AIP ENR

52.94.32 State the requirements for making position reports during an instrument approach in controlled and uncontrolled airspace. AIP ENR

52.94.34 Describe the procedures for carrying out an instrument approach at an unattended aerodrome. AIP ENR

52.94.36 Determine the minimum descent altitude using a QNH from a remote location. AIP ENR

52.94.38 State when descent below decision altitude or minimum descent altitude may be made on an instrument approach. AIP ENR

52.94.40 Describe the missed approach procedures and limitations. AIP ENR

52.96 Communications and Navigation Aid Failure

- 52.96.2 Describe the procedures required following a communications failure enroute. AIP ENR
- 52.96.4 Describe the procedures required following a communications failure during an instrument approach. AIP ENR
- 52.96.6 Describe the procedure to be carried out in the event of a radio navigation aid failure during an approach. AIP ENR
- 52.96.8 State the requirements for changing approach types in the event of a radio navigation aid failure during an approach. AIP ENR

Flight Navigation Syllabus Matrix						
-	-	Topic No.	PPL	CPL	IR	ATPL
-	-		6	18	54	38
Fundamentals of Air Navigation	Form of the Earth	2	√	√		√
	Direction on the Earth	4	√	√		√
	Distance on the Earth	6	√	√		√
	Speed/Velocity	8	√	√		√
	Position Referencing	10	√	√		√
	Altimetry	12	√	√	√	√
	Principles and Terminology	14	√			
	Time	16	√	√		√
	Twilight	18	√			
	Visibility	20				√
Aeronautical charts	Properties and Principles	22	√	√	√	√
	Scale	24				√
	Chart Reading	26	√	√	√	√
Circular Slide Rule	Computations	28	√	√		√
	Relative velocity	30				√
	Wind Components	32	√			
	Triangle of Velocities	34	√	√		√
	1:60 Rule	36	√	√		
Deduced Reckoning	In Flight Revisions	38	√			
Flight Planning	Route Selection	40	√	√	√	
	Chart Preparation	42	√	√		
	Plan Preparation	44	√	√	√	
	Fuel Planning	46	√	√	√	
Navigation Procedures - VFR	VFR Flight Navigation	48	√	√		
	Special Procedures	50	√	√		
Navigation Procedures - IFR	Properties and Principles	52			√	
	Chart Plotting	54			√	√
	Chart reading	56			√	
	Enroute Diversion Calculation	58		√	√	√
Flight Management	Flight Management	60	√			√
	Fuel Management	62	√			
Radio Aids	ADF	64			√	
	VOR	66			√	
	DME	68			√	
GNSS	Global Navigation Satellite System	70	√	√	√	√
Radar	Procedures	72	√			

Subject No 54 Flight Navigation - IFR

Note: This syllabus is based on IFR navigation as applicable to navigating a multi engine turbine air transport type aeroplane or IFR equipped turbine helicopter.

Each subject has been given a subject number and each topic within that subject a topic number. These reference numbers will be used on knowledge deficiency reports and will provide valuable feed back to the examination candidate.

This syllabus presupposes a knowledge and understanding already attained at PPL level.

Sub Topic Syllabus Item**Fundamentals of Air Navigation****54.12 Altimetry**

54.12.2 Define:

- (a) indicated altitude;
- (b) calibrated altitude;
- (c) true altitude;
- (d) pressure altitude (PA);
- (e) density altitude (DA);
- (f) flight level (FL);
- (g) transition altitude;
- (h) transition layer;
- (i) transition level;
- (j) QNH;
- (k) QFE.

54.12.4 Explain and apply the table of IFR cruising levels below and above transition.

54.12.6 Explain how true and indicated altitudes are affected by changes in air pressure and air temperature.

54.12.8 Explain:

- (a) How changes in air pressure and air temperature affect the vertical profile during a non ILS approach;
- (b) The risks associated by low temperatures and QNH errors during a non ILS approach.

54.12.10 Explain how true and indicated altitudes are related when using flight levels.

Sub Topic	Syllabus Item
	Aeronautical Charts
54.22	Properties and Principles
54.22.2	List the aeronautical charts used in New Zealand for operations under IFR and VFR.
54.22.4	Identify the information published in the legends of aeronautical charts and in the CHART Symbols section of the AIPNZ Vol 2 & 3.
54.22.6	Explain the meaning of abbreviations and codes used in Operational Data for aerodromes in the AIPNZ.
54.22.8	Interpret information published on aerodrome Instrument Approach charts.
54.22.10	Demonstrate proficiency in determining distances on IFR enroute charts using the linear scales printed separately on the charts, and using the latitude scale along meridians.
54.22.12	Describe how magnetic tracks and distance are presented on enroute charts.
54.22.14	Define and plot a great circle and rhumb line on an appropriate chart.
54.22.16	Explain the function of the International date line.
54.22.18	Explain what is meant by: <ul style="list-style-type: none">(a) ADEP;(b) ADES;(c) RNAV;(d) GNSS;(e) RNP;(f) RVSM;(g) waypoint;(h) SID;(i) STAR.
54.22.20	Define the following terms presented on enroute charts: <ul style="list-style-type: none">(a) minimum enroute altitude (MEA);(b) minimum reception altitude (MRA);(c) minimum safe altitude (MSA);(d) route operating limitations (ROL);(e) minimum flight altitude (MFA);(f) compulsory reporting point;

Sub Topic Syllabus Item

- (g) non-compulsory reporting point;
- (h) VOR change-over point;
- (i) DME steps.

54.22.22 With regard to Standard Routes, describe in detail the:

- (a) function of the routes;
- (b) associated standard route clearance system;
- (c) manner in which standard routes are highlighted on enroute charts;
- (d) designator allocated to individual standard routes;
- (e) documents where standard routes are published.

54.22.24 With regard to uncharted routes, state the:

- (a) document, and section, where the routes are published;
- (b) designator allocated to the routes;
- (c) meaning of chart symbols (e.g. asterisks).

54.26 Chart Reading

54.26.2 Using a protractor, describe how non-published magnetic tracks can be drawn on enroute charts.

54.26.4 Describe how to identify, on appropriate enroute charts;

- (a) different airspace classes and types;
- (b) airspace boundaries;
- (c) airspace vertical limits;
- (d) airspace controlling authority.

54.26.6 With regard to the World Geodetic System 1984 (WGS 84) datum, state:

- (a) where this datum is published;
- (b) the abbreviation used to denote the datum;

54.26.8 Describe the information contained in the following charts, tables and diagrams published in the AIPNZ VOL 2 & 3, and explain compliance procedures associated with:

- (a) VOR/DME MRA Sector charts;
- (b) 25 DME Minimum Sector Altitude diagrams;
- (c) Standard Instrument Departure (SID) diagrams;
- (d) visual arrival charts;

Sub Topic Syllabus Item

- (e) Standard Arrival Route (STAR) charts;
- (f) ground movement charts;
- (g) instrument T/O procedure chart – rate of climb table;
- (h) IFR alternate aerodrome minima table.

Flight Planning**54.40 Route Selection**

54.40.2 For the preparation of a flight plan, determine:

- (a) route details, including reporting points and turning points;
- (b) climb performance data including minimum climb gradients associated with published departure procedures;
- (c) descent performance data including rate of descent required to arrive at a position at a stipulated altitude, or to comply with published arrival procedures;
- (d) fuel consumption details during climb, cruise, descent, and during diversion (if different);
- (e) cruising level(s) considering topography, navigational and meteorological considerations;
- (f) ATC and Noise Abatement requirements;
- (g) speed limitations, if applicable;
- (h) requirement for, and availability of, alternate(s).

54.40.4 Define:

- (a) point of no return (PNR);
- (b) equi-time point (ETP).

54.44 Plan Preparation

54.44.2 Prepare an IFR flight plan which contains the following details:

- (a) point of departure including minimum departure altitude or departure instructions, if applicable;
- (b) rate of climb required to comply with published climb gradient;
- (c) location and altitude of top of climb and top of descent;
- (d) each sector of the flight identified as From/To;
- (e) point of arrival including minimum procedure commencement altitude, if applicable;
- (f) the altitude and time of each sector including mean climb and mean descent altitude;

Sub Topic Syllabus Item

- (g) each sector distance;
- (h) outside air temperatures for the calculation of TAS during climb, cruise and descent;
- (i) the wind velocity used for climb, cruise and descent, including split climb and split descent;
- (j) TAS for each sector;
- (k) track (°M) of each sector;
- (l) heading (°M), groundspeed and time for each sector;
- (m) climb, cruise and descent details of a diversion;
- (n) time and distance to the point of no return (PNR);
- (o) time and distance to the qui-time point (ETP);
- (p) SARTIME.

54.46 Fuel Planning

- 54.46.2 Calculate total fuel load required including provision for diversion, reserve and contingency fuel.

Navigation Procedures - IFR**54.52 Properties and Principles**

- 54.52.2 Define:

- (a) drift, drift angle, drift correction;
- (b) track error, closing angle, total correction;
- (c) magnetic and true bearing;
- (d) radial;
- (e) position line;
- (f) fix.

- 54.52.4 Through the use of the navigation computer and mathematical means, solve problems involving:

- (a) the triangle of velocity;
- (b) the 1 in 60 rule;
- (c) time/speed/distance;
- (d) time/fuel used/fuel consumption rate;
- (e) height/time/distance/rate of climb/rate of descent;

Sub Topic	Syllabus Item
	(f) calculate the track miles flown on a segment of a DME arc.
54.52.6	Interpret meteorological information for IFR take-off minima.
54.52.8	Based on information derived from currently used ADF, VOR and DME displays, and from GNSS instrumentation, describe, determine or calculate: <ul style="list-style-type: none">(a) navigation aspects associated with published departure procedures;(b) magnetic headings required to maintain, or regain, required magnetic tracks;(c) determination of magnetic tracks to specified point(s);(d) CAS/TAS, drift and groundspeed;(e) estimated times of arrival at destination or intermediate positions;(f) requirements with respect TOC/TOD and rate of climb/rate of descent;(g) wind velocity;(h) position in terms of a radial, magnetic or true bearing and distance to or from a navigation aid;(i) alteration in magnetic heading to make good a position or track;(j) fuel consumption, and operational details or requirements resulting from fuel flow information;(k) navigation aspects associated with published arrival procedures;(l) holding time over a navigation aid before diversion must be commenced;(m) DME steps;(n) DME arc procedure.
54.54	Chart Plotting
54.54.2	Describe the principles involved in obtaining an accurate fix.
54.54.4	Describe the information that should be displayed by ADF/ VOR/ DME instrumentation to confirm position in relation to: <ul style="list-style-type: none">(a) a navigation aid or aids; or(b) a magnetic track.
54.54.6	Locate a position on a chart: <ul style="list-style-type: none">(a) from an NDB given magnetic direction to and from;(b) from a VOR given radial and DME distance;(c) from a pair of NDB tracks or VOR radials.
54.54.8	Calculate the distance from a VOR/NDB, given track, groundspeed and two VOR/NDB radial/bearing fixes.

Sub Topic Syllabus Item

- 54.54.10 Calculate the lateral distance off track, given track error and distance from a navaid.
- 54.54.12 Using the transfer of position lines procedure (°M), determine a new position, given:
- (a) an initial position;
 - (b) a track required from that position;
 - (c) a magnetic heading, or information to determine a magnetic heading;
 - (d) a TAS, or information to determine TAS;
 - (e) distance(s), or information to determine distance(s);
 - (f) ADF, VOR, and/or DME information at specific times to calculate and plot position lines.
- Note: The new position may be required to be expressed in terms of lat/long, or as a bearing and distance from or to a navigation aid.*
- 54.54.14 Having established a new position using the transfer of position line procedure, calculate or determine any or all of the following:
- (a) drift;
 - (b) track error;
 - (c) wind velocity;
 - (d) correction to heading to make good a point or track;
 - (e) estimated time of arrival at a point of a track.

54.56 Chart Reading

- 54.56.2 Determine:
- (a) the type or class of airspace in which an IFR flight is operating;
 - (b) ATC aspects when operating IFR in controlled and uncontrolled airspace.
- 54.56.4 Interpret meteorological information for IFR approach minima.
- 54.56.6 Interpret, describe and explain the procedures involved during precision and non-precision instrument approaches.
- 54.56.8 Describe the procedures associated with published missed approaches.

54.58 Enroute Diversion Calculations

- 54.58.2 Calculate enroute:
- (a) time and distance to the point of no return (PNR) ;
 - (b) time and distance to the equi-time point (ETP).

Sub Topic	Syllabus Item
	Radio Aids
54.64	Automatic Direction Finder (ADF)
54.64.2	Describe the presentation and function of the ADF needle on a fixed card, rotatable card and RMI indicator.
54.64.4	Describe the purpose of each control on the ADF control panel.
54.64.6	List the publications and charts that show NDB callsigns and frequencies.
54.64.8	Explain why it is important to check the NDB ident before using an NDB.
54.64.10	Explain what is meant by relative bearing.
54.64.12	Given an aircraft magnetic heading and a relative bearing, or an RMI presentation calculate: (a) magnetic bearing to an NDB; (b) magnetic bearing from an NDB.
54.64.14	Describe the track followed by an aircraft experiencing a crosswind when the ADF needle is kept on the 360°R position.
54.64.16	Explain how the ADF can be used to maintain track with drift correction applied: (a) when tracking to an NDB; (b) when tracking away from an NDB.
54.64.18	Identify aircraft position relative to NDB or multiple NDB's.
54.64.20	Describe the limitations associated with NDB navigation.
54.66	VOR
54.66.2	Describe the presentation and function of the VOR CDI on a fixed card, rotatable card and a HSI indicator.
54.66.4	Explain the importance of station identification before using the VOR.
54.66.6	List the publications and charts that show VOR callsigns and frequencies.
54.66.8	Describe what is meant by a (VOR) radial.
54.66.10	Describe how the VOR receiver can be used to: (a) establish orientation of that aircraft to and from a VOR station; (b) maintain a required track to a VOR station; (c) maintain a required track from a VOR station.
54.66.12	State the behaviour of the course deviation indicator (CDI) while the aircraft is off the selected radial, and the HDG °M and OBS selection are: (a) within 90° of each other;

Sub Topic	Syllabus Item
	(b) more than 90° apart.
54.66.14	State the orientation of the CDI while maintaining the required radial when drift correction is being applied.
54.66.16	Identify aircraft position relative to a VOR station or stations.
54.66.18	Describe the limitations associated with VOR navigation.
54.68	Distance Measuring Equipment (DME)
54.68.2	State the primary functions of the DME.
54.68.4	Describe current DME presentations.
54.68.6	Explain the importance of station identification before using the DME.
54.68.8	Explain how to engage the DME: (a) when the aid is coupled to a VOR; (b) when the aid is not coupled to a VOR.
54.68.10	Describe the limitations associated with DME navigation.
	GNSS
54.70	GNSS Global Navigation Satellite System (GNSS)
54.70.2	List the common GNSS reference systems used and the significance of using the correct system.
54.70.4	Explain the significance of RAIM predictions
54.70.6	State the factors influencing GNSS dependability including; (a) data base validity; (b) pilot data input; (c) GNSS/aircraft system integration.

Subject No 56 Instruments and Navigation Aids

Each subject has been given a subject number and each topic within that subject a topic number. These reference numbers will be used on knowledge deficiency reports and will provide valuable feed back to the examination candidate.

This syllabus presupposes a knowledge and understanding already attained at instrument rating level.

56.2 Pressure Instruments

56.2.2 Define, and distinguish between the following:

- (a) static pressure;
- (b) dynamic pressure; and,
- (c) total (or pitot) pressure.

56.2.4 With the aid of diagrams:

- (a) identify the elements of a basic pitot-static system;
- (b) distinguish between separate pitot probe/static vents, and a combined pitot-static probe;
- (c) label the basic elements of a typical pitot-static probe; and,
- (d) state the precautions to be taken with pitot heat and pitot covers.

56.2.6 Describe position error.

56.2.8 With respect to the airspeed indicator (ASI) and, where appropriate, with the aid of diagrams or charts:

- (a) explain the basic principle of operation;
- (b) identify the markings on a typical light twin-engine aeroplane ASI;
- (c) state the relationship between indicated, calibrated, equivalent and true airspeeds (IAS, CAS, EAS and TAS);
- (d) state the errors affecting the ASI;
- (e) explain the effect of blockages and leaks, and the remedies available to the pilot; and,
- (f) state the serviceability checks.

56.2.10 With respect to the altimeter and, where appropriate, with the aid of diagrams:

- (a) explain the basic principle of operation;
- (b) describe the use of the altimeter settings QNH, QFE and QNE;
- (c) describe the errors affecting the instrument;
- (d) explain the effect of blockages and leaks, and the remedies available to the pilot; and,
- (e) state the serviceability checks.

- 56.2.12 With respect to the vertical speed indicator (VSI) and, where appropriate, with the aid of diagrams:
- (a) explain the basic principle of operation;
 - (b) describe the errors affecting the instrument;
 - (c) explain the effect of blockages and leaks; and,
 - (d) state the serviceability checks.

56.4 Gyroscopic Instruments

- 56.4.2 Describe the gyroscopic principles of rigidity and precession.
- 56.4.4 Define the four classes of gyroscope (space, tied, earth, and rate).
- 56.4.6 Describe, and make a comparison between pneumatic and electrical gyroscopic instrument power sources.
- 56.4.8 Describe, and differentiate between real and apparent wander.
- 56.4.10 With respect to the turn indicator/turn coordinator and, where appropriate, with the aid of diagrams:
- (a) differentiate between the instrument presentations;
 - (b) explain the basic principle of operation;
 - (c) describe the errors affecting the instrument;
 - (d) explain the principle and use of the coordination ball; and,
 - (e) state the serviceability checks.
- 56.4.12 With respect to the heading/direction indicator (HI/DI) and, where appropriate, with the aid of diagrams:
- (a) describe the basic principle of operation;
 - (b) describe the errors affecting the instrument (including apparent drift); and,
 - (c) state the serviceability checks.
- 56.4.14 With respect to the attitude indicator (AI) and, where appropriate, with the aid of diagrams:
- (a) describe the basic principle of operation (for both air-driven and electrically driven instruments);
 - (b) describe the operation and function of the pendulous unit;
 - (c) describe the operation and function of the torque motor/levelling switch erection systems;
 - (d) describe the errors affecting the instrument; and,
 - (e) state the typical limits in freedom.

56.6 Compasses

- 56.6.2 Describe the earth's magnetic field and describe:
- (a) magnetic dip, and components H and Z; and,
 - (b) variation.
- 56.6.4 With respect to direct-reading magnetic compasses and, where appropriate, with the aid of diagrams:
- (a) explain how dip is compensated for;
 - (b) explain acceleration and turning error;
 - (c) define deviation; state how it is compensated for, and how correction can be made for residual deviation; and
 - (d) state the serviceability checks.
- 56.6.6 With respect to remote-indicating compasses and, where appropriate, with the aid of diagrams explain the basic principle of operation:
- (a) describe the compass card presentation on the radio magnetic indicator (RMI);
 - (b) describe interpretation of the annunciator, and the operation of the compass synchronising knob of the RMI; and,
 - (c) explain the errors which can affect remote indicating compasses (including deviation), and how these can be avoided or reduced.

56.8 Basic Radio Principles

- 56.8.2 Describe the basic features of electromagnetic radiation.
- 56.8.4 Describe where radio waves exist within the electromagnetic spectrum.
- 56.8.6 With respect to radio waves and, where appropriate, with the aid of diagrams define:
- (a) cycle;
 - (b) frequency, and state the unit describing frequency;
 - (c) wavelength, and explain how it is related to frequency;
 - (d) amplitude;
 - (e) attenuation;
 - (f) phase; and,
 - (g) phase difference.
- 56.8.8 Calculate frequency, given wavelength.
- 56.8.10 Calculate wavelength, given frequency.
- 56.8.12 Describe polarisation of a radio signal and its relationship to the orientation of transmission and receiving aerials.

- 56.8.14 Explain modulation of a carrier wave, and with the aid of diagrams, distinguish between amplitude modulation (AM) and frequency modulation (FM).
- 56.8.16 State the relative advantages and disadvantages of AM and FM.
- 56.8.18 Describe single sideband (SSB) and state the advantages and disadvantages in its use.
- 56.8.20 Describe the following types of radio wave propagation:
- (a) surface waves, and the effect of diffraction (scattering) and wave tilting;
 - (b) sky waves, including the effect of frequency, critical angle, skip distance and dead spaces; and,
 - (c) direct waves, and the rule-of-thumb formula for calculating maximum range of reception.
- 56.8.22 Briefly describe the effects of static and atmospheric attenuation.
- 56.8.24 Explain the relationship between frequency and refraction in the ionosphere.
- 56.8.26 Describe the changes to the height of the ionosphere at night and the effect of this change on the optimum useable HF frequencies.
- 56.8.28 Explain the optimum useable frequency of an HF signal.
- 56.10 Primary Surveillance Radar (PSR)**
- 56.10.2 Explain the principle of operation of PSR, including:
- (a) the frequency bands/wavelengths typically used; and,
 - (b) the principles of radar ranging and direction.
- 56.10.4 Explain the factors affecting the operational range of PSR.
- 56.10.6 State the maximum range of PSR in New Zealand.
- 56.10.8 Explain the factors which effect the minimum and maximum range of a primary radar system.
- 56.10.10 Describe the limitations in the operational use of PSR.
- 56.12 Secondary Surveillance Radar (SSR)**
- 56.12.2 Explain the principle of operation of SSR.
- 56.12.4 Distinguish between primary surveillance radar (PSR) and secondary surveillance radar (SSR).
- 56.12.6 Describe the advantages and disadvantages of SSR over PSR.
- 56.12.8 Explain the factors affecting the operational range of SSR.
- 56.12.10 State the maximum operational range of the SSR system in New Zealand.

56.14 Transponders

56.14.2 Distinguish between Mode A and Mode C transmissions from a transponder, and describe the following functions on a typical transponder control panel:

- (a) standby (SBY);
- (b) ON;
- (c) ALT;
- (d) test (TST);
- (e) code selection controls; and,
- (f) reply monitor light.

56.14.4 Describe the correct use of the IDENT button (or switch).

56.14.6 Explain the meanings of typical transponder terminology.

56.14.8 State the operational limits of Mode C readouts.

56.14.10 State the transponder emergency codes.

56.14.12 Describe the operation precautions required when changing codes.

56.16 Airborne Weather Radar

56.16.2 Explain the principle of operation of airborne weather radar.

56.16.4 State the frequency band used in an airborne weather radar, and explain why this band is used.

56.16.6 Describe the function of:

- (a) the tilt control;
- (b) the range control;
- (c) the ANT STAB switch; and,
- (d) the GAIN control.

56.16.8 Interpret the indications from a weather radar, in its various modes.

56.16.10 Describe the weather radar return strengths of various types of precipitation.

56.16.12 Describe the advantages of a narrow beam in a primary pulsed radar system.

56.16.14 Explain the advantages of Doppler Weather Radar.

56.18 Visual Landing Aids

56.18.2 Describe the purpose of approach lighting systems and distinguish between the three types of system commonly used in New Zealand.

56.18.4 Describe the purpose of circling guidance lighting and runway lead-in lighting.

- 56.18.6 Given suitable diagrams, interpret the approach slope indications given by the following systems.
- (a) T-VASIS;
 - (b) RAE red-white VASIS; and,
 - (c) precision approach path indicator (PAPI) and abbreviated PAPI.
- 56.18.8 Explain the standard PAPI angle setting, and the setting of PAPI threshold crossing height (TCH).
- 56.18.10 State the possible atmospheric effects on approach slope indication.
- 56.18.12 Describe typical layout and presentation of the following lighting:
- (a) normal runway;
 - (b) displaced threshold;
 - (c) runway touchdown zone;
 - (d) runway end indicator lighting;
 - (e) taxiway;
 - (f) wind direction aerodrome beacons;
 - (g) obstruction lighting; and,
 - (h) aeronautical/marine beacons.
- 56.18.14 Describe pilot activated lighting (PAL) and the standard system of keying PAL.
- 56.18.16 Describe the means available for remote control of lighting other than PAL.
- 56.20 NDB and ADF**
- 56.20.2 Describe the basic features of a non directional beacon (NDB), including:
- (a) the range of frequencies usually employed;
 - (b) the factors affecting operational range; and,
 - (c) typical name, frequency, identification and location details.
- 56.20.4 Describe the basic components of an aircraft automatic direction finder (ADF).
- 56.20.6 Explain the basic principles of loop direction finding, including the:
- (a) generation of maximum and null signals in different loop positions;
 - (b) use of polar diagrams;
 - (c) application of a sense aerial to resolve ambiguity; and,
 - (d) automatic seeking of the null position (hence ADF).
- 56.20.8 Describe the basic principle of operation of a fixed loop, and state the advantages a fixed versus rotating loop.

- 56.20.10 State the importance, when tuning an NDB, of making a positive identification of the station tuned, and of checking proper functioning of the ADF.
- 56.20.12 Describe the function of the controls on a typical ADF control panel, including:
- (a) ANT (or REC or VOICE) mode;
 - (b) ADF (or COMP) mode;
 - (c) TEST mode;
 - (d) BFO (or CW); and,
 - (e) the LOOP position, where fitted.
- 56.20.14 Given suitable diagrams of instrument presentation, describe the use of a relative bearing indicator (RBI), a rotatable card ADF, and a radio magnetic indicator to determine:
- (a) magnetic bearing to an NDB (orientation);
 - (b) position in relation to required track to/from an NDB;
 - (c) interception of a required track to/from an NDB; and,
 - (d) station passage.
- 56.20.16 Explain the following factors which affect the accuracy of ADF indications:
- (a) night effect;
 - (b) coastal refraction;
 - (c) mountain effect; and,
 - (d) precipitation static and thunderstorms.
- 56.22 VOR**
- 56.22.2 Explain the basic operating principles of a VOR ground station, including the:
- (a) reference phase signal;
 - (b) variable phase signal; and,
 - (c) measurement of phase difference.
- 56.22.4 Given suitable diagrams, explain the operation of a typical VOR indicator, including:
- (a) radials, and the use of the omni-bearing selector (OBS);
 - (b) the course deviation indicator (CDI); and,
 - (c) the TO/FROM indicator.
- 56.22.6 Given suitable diagrams of VOR presentation (including RMI and HSI presentation), demonstrate its use for:
- (a) orientation;
 - (b) crossing a radial and station passing;

- (c) maintaining track on a radial; and,
- (d) intercepting radials inbound and outbound.

56.22.8 Discuss the factors affecting range and accuracy of VOR, including:

- (a) maximum range, published route operating limitations; and,
- (b) errors, particularly terrain effect error with “scalping” and “radial bending”.

56.24 Distance Measuring Equipment (DME)

56.24.2 Describe the basic principle of operation of DME.

56.24.4 Explain the operation of a typical DME controller, including:

- (a) tuning with a paired VOR or ILS frequency;
- (b) tuning directly to a DME frequency;
- (c) DME ident;
- (d) indication of signal loss;
- (e) saturation;
- (f) tuning a VORTAC frequency.

56.24.6 Explain and calculate the following:

- (a) design maximum range;
- (b) expected maximum range at different altitudes; and,
- (c) DME distance (slant range) versus horizontal range.

56.26 Instrument Landing System (ILS)

56.26.2 Explain the basic principle of operation of an instrument landing system (ILS), including:

- (a) localiser principles; standard rated coverage, and CDI indication;
- (b) glideslope principles; angle, and indication; and,
- (c) marker beacons, indication of passage.

56.26.4 State the localiser and glideslope displacement represented by full scale deviation of the CDI and glideslope indicators.

56.26.6 State the rule-of-thumb methods of calculating:

- (a) required height above threshold for a 3° glideslope; and,
- (b) rate of descent required to maintain a 3° glideslope at any given groundspeed.

56.26.8 Given suitable diagrams of instrument presentation, interpret aircraft position with respect to ILS centreline and glideslope.

56.28 Global Navigation Satellite System (GNSS/GPS)

- 56.28.2 State the three main elements of the GNSS (GPS) system.
- 56.28.4 Describe the GNSS satellite constellation including:
- (a) frequency used for transmissions;
 - (b) types of pseudo-random code;
 - (c) GNSS time reference;
 - (d) ephemeris;
 - (e) almanac.
- 56.28.6 Outline the elements of the control segment.
- 56.28.8 Describe the user segment, including the basic principle of satellite ranging.
- 56.28.10 Explain the principles of fixing position using the GNSS system; including:
- (a) the number of satellites required for 2D and 3D fixing;
 - (b) elimination of clock error;
 - (c) the operation of RAIM;
 - (d) PDOP/GDOP;
 - (e) barometric aiding; and,
 - (f) receiver masking function.
- 56.28.12 Explain how the receiver predicts the position of various satellites.
- 56.28.14 State the sources of GNSS error, and the maximum error which could be expected with and without selective availability applied.
- 56.28.16 State the reasons for the display of a RAIM warning message, and the requirements under CAA Rules for continued navigation.
- 56.28.18 Explain the operation of the RAIM prediction service.
- 56.28.20 Describe the application of the WGS 84 datum, and the likely effects on the GPS display of using coordinates from another datum.
- 56.28.22 Explain the principle of operation of Differential GPS (DGPS).

Subject No 20 Meteorology

A pass in subject No 20 CPL meteorology meets the requirement for the instrument rating meteorology written examination.

Subject No 34 Human factors

A pass in subject No 34 CPL human factors meets the requirement for the instrument rating human factors written examination.

Appendix II Instrument Rating Flight Test Syllabus

Flight test conduct

This flight test is conducted in accordance with the Flight Test Standards Guide Instrument Rating (A) or (H).

The use of checklists is mandatory for the purpose of instrument rating issue or currency demonstrations.

Demonstrations of NDB, GNSS and VOR tracking, holding and approach procedures should be carried out individually (without the benefit of any other aid).

For the issue or renewal of a GNSS rating after 1 January 2017, competency in a GNSS/RNAV 2 route, RNAV 1 procedure (RNP 1 if this privilege is required) and RNAV(GNSS) approach will be required. PBN procedures can be demonstrated on a GNSS departure, en-route, arrival, hold and approach appropriate to the PBN privilege being sought. A demonstration of competence on an RNP 1 procedure also meets the requirements for the issue of RNAV 1 and RNP 2 privileges.

For single pilot privileges, the flight examiner will examine the ability of the candidate to competently perform all normal and emergency phases of flight without autopilot use or any form of assistance from the examiner.

The extent to which autopilot use is permitted throughout the remainder of the flight test is at the examiner's discretion. If the aircraft is fitted with a suitable auto-pilot the flight examiner may require the candidate to fully utilise the autopilot during at least one approach.

If the flight examiner deems it necessary, in the interests of safety, to intervene with any physical action, then the test will result in mandatory failure.

Unless otherwise stated all manoeuvres and procedures are to be performed having recourse to all available instruments. The applicant may demonstrate competence either using a co-pilot or as a single-pilot.

It is expected that crewing of the aircraft will be in accordance with its flight manual. However, if an applicant elects to operate with two crew in a single-pilot certificated aircraft, or the test is conducted in a multi-crew certificated aircraft, the candidate will be expected to demonstrate proper management of the co-pilot. In this case the flight examiner or a suitably rated co-pilot will act as a co-pilot.

An instrument rating issue flight test taken as single-pilot will be one in which the candidate is to carry out all the pilot duties relating to that flight. If any assistance in the form of oral advice is necessary from the flight examiner during the issue flight test, then the test will result in mandatory failure.

If any assistance in the form of oral advice is necessary from the flight examiner during a currency demonstration, then at the discretion of the flight examiner and with the candidate's consent, the currency demonstration *may* be continued as a two pilot flight test with the examiner acting as co-pilot.

Where the examiner carries out the duties of the co-pilot, for the purpose of a two pilot flight test, the examiner will perform those duties by neither being obstructive nor above average, primarily relying on prompts from the candidate.

The competency demonstrations required by two pilot and single pilot demonstrations are the same. However, for two pilot demonstrations the candidate is required to divide in-flight responsibilities so as to utilise the co-pilot in a meaningful way.

Where the examiner, with the candidate's consent, elects to continue a single pilot currency demonstration as a two pilot demonstration, the candidate's pre-flight briefing of the co-pilot's duties may be examined post flight.

Where the instrument rating flight test is carried out in an approved simulator, the flight examiner *may* elect to conduct the flight test from an observer's position.

The degree of accuracy required is published for flight examiner guidance in the Instrument Rating Flight Test Guide, and while the applicant is intended to maintain flight within these tolerances, temporary excursions outside the established limits are acceptable providing positive remedial action is taken.

It is neither recommended nor required that unusual attitudes or simulated asymmetric (where applicable) be carried out in IMC.

Flight test form, CAA 24061/07, may be used as an aid to examiners for recording and reporting instrument rating issue, competency demonstrations or the addition of a navigation aid.

Aircraft and equipment

The aircraft must be certified for IFR flight and to the PBN standard required for the flight test. The radio communication and navigation equipment is to be of an approved standard, and an intercommunication system acceptable to the flight examiner is to be fitted. Should a flight examiner determine, during the course of the test, that the aircraft instrumentation or equipment fails to meet an acceptable standard, the flight examiner may cancel the test and the aircraft is not to be used for such purposes again until such time as the defects have been remedied.

An acceptable means of simulating instrument flight conditions, such as a hood, foggles or screens that prevent peripheral external visual reference to the pilot being tested must be used.

The aircraft is to be fitted with:

- Fully functioning dual flight controls.
- Those instruments essential to the manoeuvres planned to be demonstrated during the flight visible to both pilots without excessive parallax error.
- At least three-point lap-and-sash harness.
- Intercommunication equipment acceptable to the flight examiner.

General requirements

The candidate is to provide adequate and private facilities for briefing prior to and after the flight test.

The test is to include an oral knowledge test followed by a pilot competency test. Failure to demonstrate competence in any item of the test may result in the applicant and the instructor being advised of the failure aspects and the further training believed necessary before a further flight test may be undertaken.

An applicant is to demonstrate an ability to perform solely by reference to instruments the flight manoeuvres and procedures applicable to the type of approach aid or system for which a rating is desired.

For the purpose of issue or currency, a demonstration of the DME or GPS arc procedure is compulsory, and both the VOR and one other approach (ADF or GNSS) are compulsory with at least one approach commencing from overhead the aid or the final approach fix.

As a result of the introduction of PBN within New Zealand all applicants for a GNSS endorsement on an instrument rating must complete a theory ground course in accordance with Appendix III of this advisory circular. Appendix III meets the requirements of rule 61.801(a)(3)(ii).

Personal preparation

The candidate is to demonstrate a professional attitude to aviation by arriving punctually for the flight test, suitably attired and fit for flying.

The candidate is to present, for the examiner's inspection, evidence of identity, their summarised and certified pilot's logbook, pilot's licence (that meets the night flight requirements of that licence), written exam credits, knowledge deficiency reports (KDRs), current AIPNZ Volumes 2 & 3, appropriate current Navigation Charts and previous competency demonstration record (if applicable).

The candidate will demonstrate a sound knowledge of IR privileges, currency, and medical requirements.

Operational flight plan preparation

The candidate is to demonstrate proficiency in the following.

- (a) Preparation of an operational flight plan along charted or promulgated routes between two aerodromes at least 35nm apart, one of which must be a controlled aerodrome. The applicant is to use appropriate meteorological information and is to have a good knowledge of the requirements governing such flights including fuel requirements, applicable weather minima, choice of altitudes and air traffic services procedures, choice of alternate (as and when required).
- (b) Making a sound go/no-go decision based on all available information (including, if applicable, GNSS RAIM prediction).
- (c) Assessing the aircraft's performance capabilities in respect to departure, en-route and approach procedure requirements.

Knowledge of flight rules

The candidate is to demonstrate knowledge of:

- (a) Fuel requirements under IFR.
- (b) The conditions that would require an alternate to be nominated and the criteria for the selection of a suitable alternate.
- (c) Take-off, en-route, approach and circling minima.
- (d) IFR cruising levels.
- (e) Icing conditions.

Flight preparation

The candidate will exhibit knowledge of the:

- (a) CAA Form 2129 - Aircraft Radio Station Approval.
- (b) Aircraft technical log.
- (c) Fuel requirements including reserves for IFR flight in accordance with Parts 91, 135 and 125 or Part 121 as appropriate.
- (d) Fuel quantity on board the aircraft prior to flight, the aircraft's fuel consumption and endurance and the correct tank selection in accordance with the aircraft's flight manual.
- (e) Pre-flight inspection with emphasis on items applicable to IFR operations.
- (f) Aircraft's instruments serviceability checks.

RTF procedures and navigation aid tuning

The candidate will:

- (a) Obtain, record, read back and comply with clearances as appropriate.
- (b) Make appropriate transmissions at compulsory reporting points.
- (c) Use correct aeronautical phraseology with appropriate assertiveness.
- (d) Tune, identify and test the aircraft's navigation equipment in accordance with recommended procedures and the manufacturer's instructions.
- (e) Tune, test and operate the aircraft's transponder as required.
- (f) Load, check and operate any required PBN routes, procedures and approaches.

Loss of communication or navigation aid failure procedures

The candidate will demonstrate knowledge of the loss of communications procedure or navigation aid failure for various phases of flight, including GPS loss of integrity or failure for PBN operations. For TEA aircraft this will include failure of the multi function display (MFD) if applicable.

Two pilot crew responsibility briefing (if applicable)

When the flight test is to demonstrate multi-crew IFR competency the applicant is to brief the co-pilot/examiner on their duties and responsibilities. The candidate will:

- (a) Brief the co-pilot (examiner) on their responsibilities and duties applicable to the flight.
- (b) Prior to departure the applicant is to demonstrate proficiency in radiotelephone procedures, understanding clearances and the ground checking of radio navigation/communication equipment and flight instruments. The examiner will carry out in flight duties, when requested.
- (c) Monitor the co-pilot's actions during flight.

In flight

In a single-engine, technically enhanced or multi-engine aircraft as the case may be, the applicant is to demonstrate competence to the given limitations over the planned route.

Simulated instrument flight is to be introduced at the take-off minima for the aerodrome of departure, and discontinued at the landing minima for the aerodrome of destination. The flight will be planned at least in part within controlled airspace.

Attention will be given to the applicant's ability to:

- Fly the aircraft accurately on instruments.
- Conform to the appropriate departure procedure.
- Intercept and track using both the VOR and ADF or GNSS individually as en route and approach aids.
- Update estimated times of arrival as required.
- Transition to the instrument approach procedure.

Instrument transition

The candidate will transition smoothly from visual flight to instrument flight at the published IFR minimum for take-off.

The holder of a PPL or CPL(H) will demonstrate for IR issue, as specific exercises:

Straight and level flight:

Achieve and maintain accurate level flight at the nominated altitude. Accurately maintain the nominated (DI) heading and accurately trim for level flight.

Level turns:

Coordinated level medium turns through 180° left and right, using and maintaining an accurate bank angle of 30°.

Climbing and descending:

Entering and maintaining climbing and descending flight, maintaining a constant airspeed and heading.

Climbing turns to altitude:

Climbing turns at Rate 1 whilst maintaining the nominated airspeed to enter level flight at a predetermined altitude.

Descending turns to altitude:

Descending turns at Rate 1 whilst maintaining the nominated airspeed to enter level flight at a predetermined altitude.

Limited panel:

By sole reference to basic flight instruments, and in the case of helicopters (where the flight manual permits), without benefit of stabilisation systems, or in the case of a technically enhanced aircraft by sole reference to standby instruments as a result of a primary flight display (PFD) failure, demonstrate achieving and maintaining level flight, maintain the nominated compass heading and accurately trim for level flight.

Demonstrate level Rate 1 turns onto a nominated compass heading maintaining the nominated altitude.

Recognise and demonstrate recovery from power on (reduced power setting at examiner discretion) nose high, nose low and spiral dive attitudes (appropriate to the aircraft size and type). During the

recovery, correctly identify the aircraft's attitude, apply the correct recovery technique to initially return to straight and level flight and then return to the nominated altitude and compass heading.

Note: If the weather precludes, this item may be completed on a separate flight within 30 days of the initial part of the test.

All candidates will demonstrate:-

Departure procedures:

By carrying out a departure procedure in accordance with a standard instrument departure (SID) using ground-based aids (GBA), PBN procedures or ATC instructions.

En-route procedures:

By complying with IFR procedures en-route (PBN where required) and for helicopters, demonstrate level acceleration and deceleration between the minimum speed for IFR flight and normal cruise.

Use of checklists:

By using normal and emergency checklists as applicable to the operation.

General use of autopilot:

By carrying out the appropriate serviceability checks prior to flight.

Utilising the autopilot in flight (as appropriate and applicable).

Demonstrating knowledge of the autopilot's capabilities and limitations and recognising autopilot mode failures (as applicable).

Interception and tracking VOR:

By intercepting and maintaining a track by sole reference to VOR.

Interception and tracking GNSS (if applicable):

By intercepting and maintaining a track by sole reference to GNSS data.

Interception and tracking NDB (if applicable):

By intercepting and maintaining a track by sole reference to an NDB.

ATS compliance:

By maintaining a listening watch.

Communicating clearly and concisely using aviation phraseology.

Recording and complying with clearances and instructions as appropriate.

Engine failure after take-off: (for multi-engine aeroplanes or helicopters)

By maintaining control after a simulated engine failure under simulated instrument flight conditions, with continued climb in accordance with the departure procedure (or an appropriate emergency procedure).

Using the emergency checklist or QRH to follow up memory items.

Making appropriate simulated radio calls and nominating an appropriate plan of action.

Note: Feathering the propeller (aeroplane) is neither required nor encouraged for instrument rating demonstrations. In approved simulators, engine failure at or above V1 may be simulated.

Unusual attitudes, full panel:

Immediate recognition and correct recovery from steep climbing turns and spiral dives as appropriate to the aircraft size and type. Note: If the weather precludes, this item may be completed on a separate flight within 30 days of the initial part of the test.

One engine inoperative performance (multi-engine aircraft only)

Failure of an engine will be simulated prior to, or during, an instrument approach procedure and an engine-out missed approach initiated from minimum altitude in accordance with the missed approach procedure for that aid.

Missed approach procedure:

The applicant is to demonstrate a missed approach from minimum altitude in accordance with the missed approach procedure for the aid

Circling approach: (aeroplanes only)

Demonstration of the transition from an instrument approach procedure to a visual circuit approach and landing on a runway preferably at an angle of at least 80° to the final instrument approach track within the lowest circling minima authorised for the aircraft at the aerodrome concerned. A higher altitude may be nominated by the flight examiner.

Distance from aerodrome - not more than visibility minima.

Accuracy for all aircraft

(Note: flight test demonstration parameters are stated for the guidance of examiners in the relevant flight test standards guide)

Recovery from unusual attitudes:

Immediate recognition and correct recovery to straight and level flight followed by a return to the heading and height nominated by the examiner.

Speeds:

Instrument procedures flown are to comply with the requirements of the aircraft flight manual and with the relevant approach procedure design speeds. If nominated, the higher minima are to be applied when a higher speed is utilised for the approach.

En route tracking:

En route tolerances are subject to consideration of bends or fluctuations of track guidance and within the rated coverage of the navigation aid or where applicable meet PBN standards and minima.

Holding procedure:

The tracking tolerance is that applicable to the en route standards for the applicable aid. The holding procedure design is based on turns at 25° angle of bank or Rate 1 (whichever is the lesser). The pilot may increase or decrease the angle of bank to make good the inbound track. VOR and NDB or GNSS holding procedures are a compulsory demonstration for issue. For the purpose of instrument rating renewal, only one holding procedure (at the discretion of the flight examiner) need be demonstrated.

Departure and missed approach:

Tolerances are as for instrument approach procedures.

DME or GPS Arc arrival procedures:

Descent as required to maintain profile on crossing designated radials.
Tracking standards are those for the appropriate navigation aid.

Initiation of missed approach procedures:

Up to three seconds for recognition and up to 3 seconds to initiate climb or turn, or both, as appropriate.

Angle of bank and rate of turn:

For all procedures except circling approach, the approach procedures are designed to provide terrain clearance using a maximum of 25° angle of bank or Rate 1 (whichever is the lesser). Lesser angles of bank apply to procedure design for high performance aircraft on departure.

Circling approach procedure designs are based on, 20° angle of bank or Rate 1 (whichever is the lesser). The angle of bank and rate of turn used by the pilot should be appropriate to the procedure and the conditions. Therefore, the pilot may increase or decrease the angle of bank to make good the desired track; however, the procedure design minimum angles of bank must be achieved in terrain critical areas, whilst excessive angles of bank must also be avoided.

VOR approach: (Compulsory for instrument rating issue and annual competency demonstrations.)

Within 5° of the inbound track, descent may be commenced

NDB approach: (Not compulsory for instrument rating issue or annual competency demonstrations unless currency is required for ADF approach.)

Within 5° of the inbound track, descent may be commenced.

GNSS approach: (Not compulsory for instrument rating issue or annual competency demonstrations unless currency is required for GNSS approach). Where possible the GNSS approach should be preceded by a PBN STAR (with holding if required).

Within half scale of the inbound track, descent may be commenced. Alternatively, bearing to waypoint should remain within 2° of desired track to waypoint.

Subsequent makes and model of GPS unit are to be demonstrated to a flight examiner in flight. Except that, a current instrument rating holder whose instrument rating is endorsed with one make and model of GPS unit and who meets the currency requirements for GPS as an approach aid, may demonstrate subsequent types and models of GPS unit to a flight examiner in the 'simulation' mode or an approved simulator.

ILS approach: (Not compulsory for instrument rating issue or annual competency demonstrations unless currency is required for ILS approaches.)

Go-around commenced not below DA/H.

Knowledge of LLZ procedure. Satisfactory compliance with radar directions, smooth acquisition and maintenance of track and approach profile.

IR annual competency demonstration

This will be to the same standard and contain the same elements (except where provided) as the initial issue flight test.

Operators certificated to conduct annual competency demonstrations within their training organisations may be certificated to conduct annual instrument rating competency demonstrations using an approved synthetic flight trainer.

IR approach aid endorsement

An applicant for an additional approach-aid endorsement to the instrument rating is to demonstrate competence to a flight examiner on that approach aid in accordance with the Instrument Rating Flight Test Standards Guide. Such a demonstration may be completed independently or as part of the annual competency demonstration.

Appendix III GNSS Theory Course Syllabus

Introduction

This syllabus is guidance for developing a course for RNP and RNAV Instrument Rating privileges.

Pilot training must include classroom training and examination, and practical training on the equipment to be used (in simulator, training device, or aircraft), covering the following matters with appropriate logbook endorsement.

Course concept

This course is a prerequisite for the issue of GNSS as a navigation aid endorsement to an instrument rating.

Prior to undertaking the endorsement demonstration, the applicant must provide evidence to the holder of a current flight examiner rating with the examiner privilege of additional navigation aid GNSS that they have successfully completed a course in accordance with this syllabus.

The flight examiner must be satisfied with the content of the course as delivered to the candidate by questioning the candidate appropriately on the content of the course syllabus.

Classroom training and examination

Performance Based Navigation (PBN) Principles

1. State the principles of RNAV 1 and 2, RNP 1 and 2 and RNP APCH
2. Describe in basic terms the principal GNSS systems – GPS, Galileo, GLONASS and BeiDou.
3. Explain navigation database menus and sub menus.
4. Explain how to confirm data validity and a verifiable source for current applicable software versions.
5. Understand system software configuration management.
6. Using the basic block diagram of an RNAV system explain the function and operation of each component.
7. Describe the effects of RAIM outages, Fault Detection (FD), and Fault Detection and Exclusion (FDE) on PBN.
8. Explain the difference between an almanac and ephemeris data on GNSS operations.
9. Explain the effect of barometric altitude input.
10. Explain the operating principle of RAIM.
11. Explain the difference between Fly-by and Fly-over waypoints.
12. List the required navigation and communication equipment for RNAV, RNP, and RNP APCH operations.
13. Describe the basic differences between TSO C129 and C145/146 receivers, including scaling differences.
14. State and apply the operational conditions required to support RNP 1 and 2 (no surveillance) operations and RNAV 1 and 2 operations (under surveillance).
15. State the actions to be taken in the event of loss of integrity, system failure and system messages.
16. List the effects on turn anticipation with consideration to speed and altitude.
17. Explain the contingency procedures for RNAV/RNP failures.

18.State the aviation documents required for PBN operations.

Charting

1. Demonstrate a working knowledge of definitions and abbreviations associated with RNP, RNAV and RNP APCH operations.
2. Be familiar with the interpretation of chart legends including route depiction, flyover and fly-by waypoints.
3. Explain the significance of the WGS-84 earth model.

Aircraft and equipment knowledge

1. Describe the use of navigation database menus and submenus.
2. Describe system software configuration management.
3. Describe annunciator message importance of warnings; both cautions and advisory, and their applicability.

Pilot operations

1. Discuss human factors in PBN.
2. Demonstrate filing of ICAO flight plans in compliance with current flight planning requirements.
3. Identify operator procedures, including methods to minimise cross track error.
4. Explain monitoring procedures for each stage of flight.
5. Explain turn anticipation with consideration of speed and altitude effects.
6. Demonstrate appropriate RTF phraseology.

Equipment specific training

On ground

1. Describe the capabilities and limitations of the installed system from the Aircraft Flight Manual or AFM Supplement.
2. Explain levels of automation, mode annunciations, changes, alerts etc.
3. Explain system software configuration management.
4. Demonstrate removal and re-selection of navigation sensor input.
5. Demonstrate confirmation of exclusion of sensor input.
6. Describe functional integration with other aircraft systems.
7. Interpret electronic displays and symbols.
8. Identify where HDG, GS, TK, XTK,G/S etc. are displayed.
9. Demonstrate RAIM prediction.
10. Verify currency and integrity of the aircraft navigation data.
11. Initialise navigation system self-tests.
12. Verify the successful completion of the navigation system self-tests.
13. Verify waypoints and flight plan programming.
14. Edit or amend current flight plan with routing changes.
15. Perform an FDE prediction for flights to a destination and alternate.

In aircraft, simulator, or training device

1. Initialise system position.
2. Perform a manual or automatic update with take-off point shift if applicable.
3. Verify waypoints and navigation system flight plan programming.
4. Retrieve and fly a planned SID and reprogram with a subsequent runway change.
5. Adhere to speed and/or altitude constraints associated with a SID.
6. Vector off and re-join a route or procedure.
7. Determine allowable deviation limits and maintain flight within those limits.
8. Carry out contingency procedures for RNAV/RNP failures.
9. Demonstrate how to change CDI scaling.
10. Perform parallel track offset functions if capability exists.
11. Perform gross navigation error checks with legacy aids.
12. Perform RNAV/RNP holding functions.
13. Change the planned destination and alternate airport.
14. Select and fly the appropriate STAR and demonstrate and handle a runway change.
15. Adhere to speed and/or altitude constraints associated with a STAR.
16. Retrieve and fly, an RNAV (GNSS) approach.
17. Adhere to speed and/or altitude constraints associated with an RNP APCH.