VOR Instrument Approach

5.98 When carrying out a VOR approach, as depicted in Figure 5–35 for Kalgoorlie-Boulder, the VOR is used as the sole tracking aid. Of course, the VOR must be identified before you may use it for navigation. The coded IDENT for the Kalgoorlie-Boulder VOR is shown as KG (dah-dit-dah, dah-dah-dit). To position the aircraft for the approach you must track to the KG VOR at or above the lowest safe altitude (LSALT) specified on the ERC for your inbound track, or the minimum sector altitude (MSA), which on the chart is 3100 ft AMSL.

5.99 The elevation of Kalgoorlie-Boulder aerodrome is 1203 ft AMSL and the runway threshold of RWY 11 (THE ELEV) is 1203 ft AMSL (shown on the profile view). The published aerodrome elevation should always be equal to or higher than any THR ELEV specified, since this, by definition, is the highest point on the landing area.

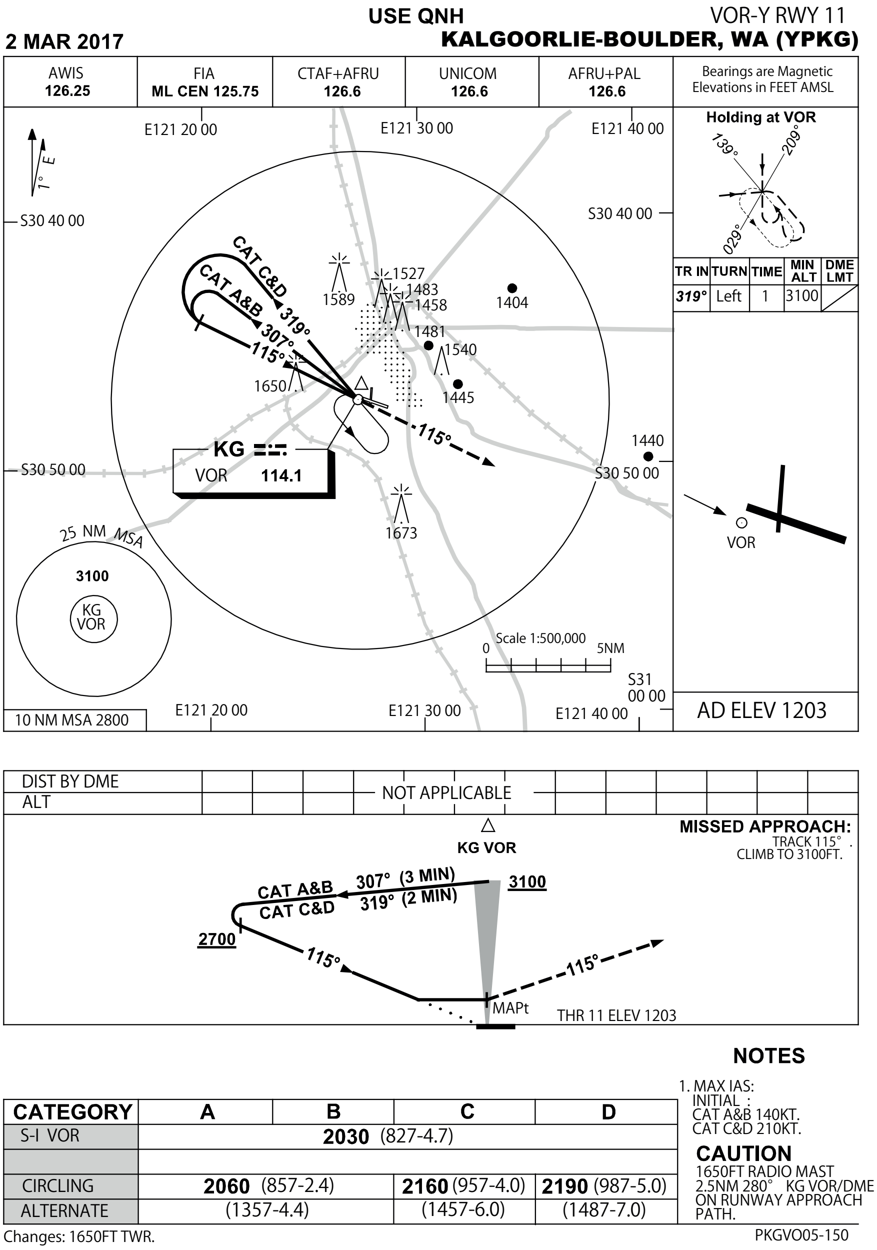


Figure 5-35 Kalgoorlie VOR-Y RWY 11 approach.

7.37 Remember that this is height above threshold. If the THR ELEV is 2,350 ft AMSL, 600 ft height is indicated on the altimeter by 2,950 ft AMSL.

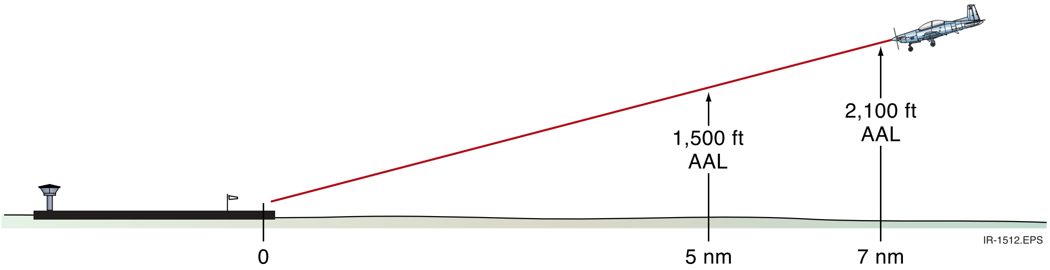


Figure 7-9 A 3° glideslope loses height by about 300 ft/nm.

Ground Equipment

7.38 The glideslope antenna is usually situated 225–380 m (about 1,000 ft) in from the landing threshold, to ensure that any aircraft following the glideslope will have adequate wheel clearance over the threshold and any objects and/or terrain on the final approach path. On some runways, the glideslope antenna may be positioned further in if there are restricting obstacles on the approach path.

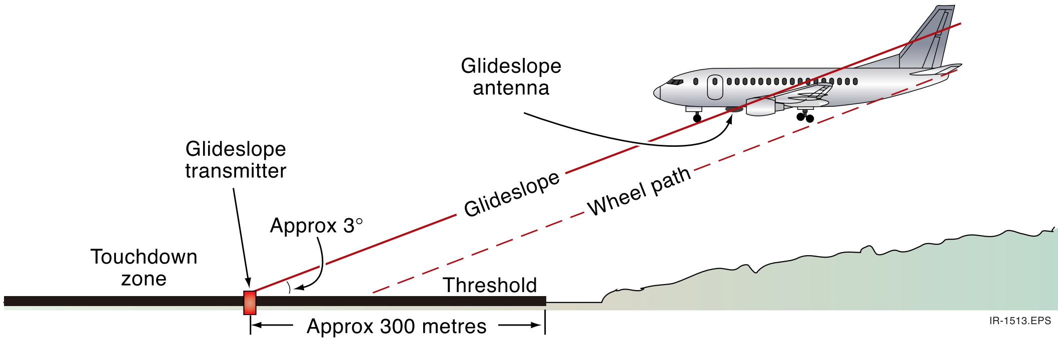


Figure 7-10 The typical glideslope transmitting antenna is approximately 1,000 ft in from the runway threshold.

7.39 The *threshold crossing height* (TCH) of the glideslope is specified on the ILS approach chart: this is the height of the glideslope receiving antenna as the aircraft crosses the threshold precisely on slope. The mainwheels on some larger aircraft follow a much lower flightpath than the glideslope receiving antenna, which is usually located in the nose section of the aircraft. The reference datum height (RDH) is the height of a point that is located above the intersection of the runway centre-line and the threshold - and through which the downward extended straight portion of the glide path passes.

7.40 The aim is to touchdown within the designated *touchdown zone* (TDZ) on the runway, indicated by special fixed-distance markings on the runway.

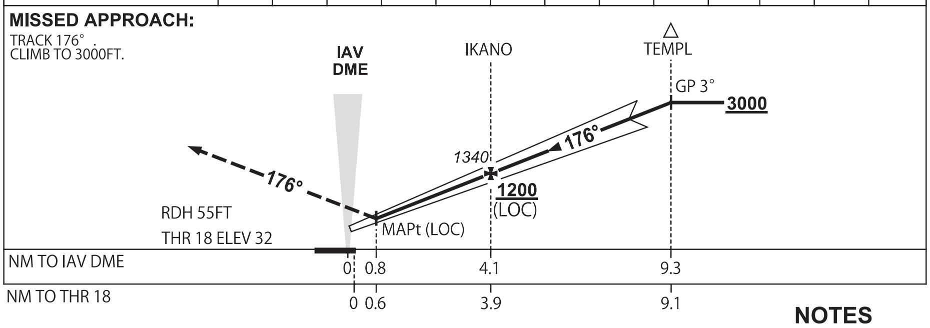
7.41 The glideslope transmitting antenna is usually offset by some 120–210 m to the side of the runway, both to prevent it from being an obstacle to aircraft operating on the runway, and to avoid interference with the glideslope signal by nearby aircraft on the ground.

7.42 The glideslope signal is transmitted on an ultra high frequency (UHF) carrier wave using a similar principle to the localizer transmission, that of two overlapping lobes modulated at different frequencies (90 Hz and 150 Hz), although the actual transmission pattern is often slightly more complex than the ideal shape illustrated in Figure 7–11.

7.60 The glideslope signal is only approved for guidance down to the decision altitude (DA) for the particular ILS. Reference to glideslope indications below the DA must be supported by visual references in the runway environment.

7.61 If the glideslope fails but not the localizer, then you may still be permitted to carry out a non-precision localizer approach, using checkpoints such as the marker beacons or DME distances, to monitor GP and adjust descent. The checkpoints and limiting altitudes will be marked on the profile section of the instrument approach chart. The minimum descent altitude (MDA) for LOC approaches will always be higher than the ILS approach DA.

NM TO IAV DME	1.9	3	4.1	5	6	7	8	9	9.3				
ALT (3° APCH PATH)	620	980	1340	1620	1940	2250	2570	2890	3000				



CATEGORY	A	B	C	D
S-I ILS	**390** (358) 2.0 (VIS 1.5 WITH ACTUAL QNH)			
S-I LOC	**620** (585-3.3)			
CIRCLING *	**660** (625-2.4)		**760** (725-4.0)	**830** (795-5.0)
ALTERNATE	(1125-4.4)		(1225-6.0)	(1295-7.0)

NOTES
*1. NO CIRCLING WEST OF RWY 18/36.
2. HLDG PATTERN NOT CONTAINED WITHIN CTA.

Changes: FAF WPT, NAVAID RQ, RDH, DIST/ALT TABLE, Editorial. MAVII02-157

Figure 7-17 The Avalon RWY 18 ILS-Z approach.

7.62 The DA shown on the Avalon chart is 390 ft. Because this is a new criteria chart, you must add either the *pressure error correction* (PEC) for your aircraft or 50 ft, to the DA, to determine the aircraft landing minima. An operator must state in the company operations manual whether the PEC or 50 ft additive is to be used. If the aircraft is on slope when passing 4.1nm DME, the altimeter should read 1,340 ft on QNH. If the glideslope is not available, then a localizer approach can be made. However, you cannot descend below 1,200 ft AMSL until passing 4.1nm DME (which is the final approach fix for this non-precision approach). After this point, the descent may be continued to the minimum descent altitude (MDA) of 620 ft on QNH or 520 ft if you have the current QNH. Because the LOC is a non-precision approach, there is no requirement to add a correction for pressure error to the MDA value. *Pressure error correction* (PEC) only applies to a precision approach (ILS). Non-precision approaches require no PEC or 50 ft buffer.

Flying the Glideslope

7.63 The technique to adopt in flying the glideslope is similar to that of flying the localizer: small attitude changes are the key to success. The aim is to keep the aircraft on a constant descent path. Therefore, during an ILS, the glideslope needle is checked regularly to ensure that the desired slope is being maintained and any tendency to deviate is corrected immediaetly - by a small amount.

7.131 For any instrument approach, be sure you determine correctly the minima applicable to your aircraft, particularly if you regularly fly a number of different aircraft types of varying levels of sophistication or performance.

7.132 For a straight-in approach to RWY 12, using the full ILS procedure and assuming actual aerodrome QNH has been received, the decision altitude (DA) is 2000ft (the SI-ILS box is shaded, therefore 100 feet can be subtracted from the existing minima). A factor of 50ft must be added to the published DA to allow for altimeter pressure error unless and additive *pressure error correction* (PEC) is specified for the aircraft in the flight manual or you are required to operate to higher minima by the company operations manual. If Category I ILS approach requirements can be met, the minimum visibility of 800m applies if the actual QNH is available. If for any reason the ATIS or AWIS (and therefore actual QNH) is not available, the minimum visibility required is 1.2km and a DA of 2100ft.

7.133 Bear in mind that the 50ft allowance is not required for the MDA which applies to the LOC approach. If the glideslope is not available, a localizer approach may be flown in place of the ILS, provided that the aircraft has DME and the descent is flown using the DME DIST/ALT scale on the profile chart and the limiting altitudes specified are adhered to.

7.134 Note that this approach may only be conducted if the aircraft has a DME as indicated in the box near the upper right corner of the approach plate. However, GNSS is permitted in lieu of DME, with the reference waypoint AS VOR (see note above profile view of approach). For a LOC approach straight-in to RWY 12, the MDA is 2,320 ft and a minimum visibility of 2.1 km is required. To this must be added 900m visibility if HIAL is not available, making the minimum visibility 3 km.

7.135 Should you intend to make a circling approach to another runway, perhaps due to excessive crosswind on RWY 12, then an MDA of 2,470 ft AMSL and a visibility of 2,400 m applies for categories A and B. Remember, PEC or the 50 ft allowance does not apply to an MDA.

7.136 We mentioned that the missed approach procedure should be included in the pre-approach brief, and if there is any doubt about a successful approach being possible, such as cloud and visibility fluctuating around the minima, then you should also consider your options should you 'miss out'. For example, the minimum fuel on board required for a diversion and/or the amount of holding fuel available, should be calculated, allowing for the appropriate reserves. This will determine whether you will have sufficient fuel for another approach, whether you can hold to wait for conditions to improve, or whether an immediate diversion to a suitable alternate will be necessary after the missed approach. As part of this analysis, you should check the current weather at your alternate aerodrome(s); for example, the visibility at your nominated alternate may have deteriorated, making diversion to an unplanned alternate necessary. All planning and calculations in arriving at your options must be completed well before starting the approach.

7.137 Never commence any instrument approach without first having thoroughly considered your options should you not become visual.

7.148 Gradually, the glideslope needle will move down the scale from the upper peg as you intercept the glideslope from below. Commence descent in the appropriate configuration as soon as the glideslope is intercepted with a rate of descent to follow a 3° approach slope. There is a variety of methods used to achieve glideslope intercept, and you should use the technique recommended by your instructor. Two methods commonly used are:

- lower the undercarriage as the GS needle centres, thereby increasing drag, and then pitch down to maintain airspeed and the required rate of descent; or
- pitch down slightly to achieve the required rate of descent, reducing power to maintain airspeed.

7.149 Again, it is not necessary to have the GS needle perfectly centred immediately. It is far more important to establish the aircraft in a descent smoothly at the required rate and airspeed. However, you should not allow a glideslope error to persist for too long.

7.150 When the descent is stabilised, make minor pitch adjustments to centre the GS needle. Reference to the VSI can be of great assistance. Airspeed changes, if required, should be made by altering the power setting. Throughout the approach, make minor pitch attitude and heading corrections in response to any wind changes to keep the needles centred. Remember, the ILS indicator is a navigational performance instrument. Do not use it to make attitude changes, and never attempt to 'chase the needles'. Instead, include the ILS indicator in your scan, periodically noting any deviation from the localizer or glideslope, then return to the AI and performance instruments to make any small adjustments to pitch or heading. Aim to detect any deviations from the glideslope early, so that only small heading and pitch corrections are required.

7.151 Concentrate on flying on instruments regardless of whether the aircraft is in or out of cloud. Remember, if you treat instrument indications merely as a substitute for visual indications, and keep visualising your progress down the glidepath towards the runway, you can proceed as comfortably as you would on a visual approach.

7.152 During the descent, you will pass overhead the ALDIM waypoint, which is the final approach point (FAP). The FAP is identified by a Maltese cross symbol on the plan and profile diagram on the chart. Also shown is the minimum altitude of 3,600 ft for obstacle clearance when crossing ALDIM for a LOC approach.

7.153 As you pass ALDIM with the glideslope needle centred, you should check that the altimeter reads 3,100 ft with QNH set. This is an important check. Assuming you are within half-scale deflection of the glideslope needle, the aircraft is within acceptable tolerances, so no action is required. If either localiser or glideslope needle should reach full-scale deflection at any point after commencing the final descent, a missed approach should be commenced immediately. If at ALDIM, the glideslope needle is found to be within tolerances, but there is a discrepancy between the altimeter reading and 3,960 ft, you have the choice between initiating a missed approach, thus discontinuing the ILS approach, or converting it into a LOC approach. It could be that the QNH has been incorrectly set, but if the discrepancy cannot be satisfactorily explained, the safest course would be to initiate a missed approach.

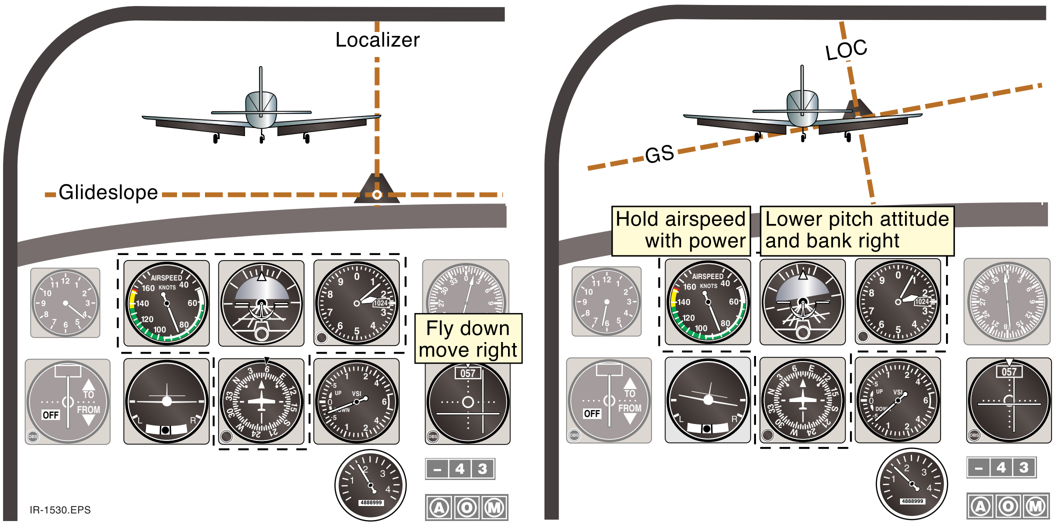


Figure 7-33 Flying the ILS.

7.154 After ALDIM, the glideslope and localizer will become increasingly sensitive. You should therefore aim to have the ILS needles 'tied down' by this point, so that only very small pitch and heading corrections will be required for the rest of the approach. The airspeed should also be stabilised at the approach value, and pre-landing checks completed, with possibly just the final flap setting left to go.

Note: If there is a glideslope failure prior to ALDIM, and you decide to revert to a localizer approach, then you can monitor and adjust your descent by reference to the DME DIST/ALT scale at the base of the chart. In this case, it is essential that the DME indicator and the DME DIST/ALT table are incorporated into your scan. At each mile, you should note the difference, if any, between your altitude and the nominated altitude, and adjust pitch attitude and rate of descent to be at the altitude specified for the next mile ahead. In doing so, you must not allow the aircraft to descend below the LOC minimum heights for obstacle clearance shown on the profile diagram, i.e. not below 3,600 ft AMSL until passing the ALDIM, or below 2,800 ft AMSL until passing 4.2 DME or below 2,420 ft before passing 2.2 DME. Complying with the DME distance/altitude scale shown on the bottom of the chart will ensure this. Descent to the LOC MDA of 2,320 ft is then permissible for either a landing or a missed approach from the *missed approach point* (MAPt) approaching the middle marker.

7.155 If the full ILS approach is available, proceed down to the DA 2,100 ft (2,000 ft with actual QNH) AMSL (+ PEC additive), occasionally checking outside as you approach the minima for the runway environment, such as the approach lights and VASIS, or even the runway itself. If you break out of cloud at or above the DA, and the visibility is equal to or better than the minimum required, you may continue for a landing (select final flap, as required). The runway will be straight ahead, although possibly a little left or right of the nose, depending upon the wind correction angle (WCA) being applied.

7.156 During the final approach, from the point at which you first establish visual reference through to the commencement of the flare, it is vital that you continue to monitor the glideslope needle, the approach lights and the VASIS (if available) to confirm that you are still on glideslope. In poor visibility, watch for the tendency to steepen the descent momentarily and 'duck under', which, if uncorrected, can develop into a dangerous undershoot. Moreover, at night, you may encounter cloud that is not apparent when you first become visual. If this occurs while you are still above the DA, you can easily revert to instruments and continue the approach.

7.157 If it is necessary to apply a significant wind correction angle during an ILS approach, the runway and approach lighting will appear well to the left or right of the nose when you become visual. At low level and in poor visibility, avoid an almost instinctive tendency to turn towards the runway. If you do happen to head for the runway, the aircraft will immediately drift off the centreline, and in the remaining 200 to 300 ft it may be difficult to safely realign the aircraft and establish a stable flightpath.

7.158 With the aircraft satisfactorily maintaining the glidepath during the approach, experienced IFR pilots make a conscious effort to refrain from significant control inputs immediately after becoming visual. The aircraft should continue to maintain a stable descent along the glidepath, allowing the pilot to acquire visual cues to complete the approach and landing.

7.159 If you do not break out of cloud by the time the DA is reached, or the minimum required visibility does not exist, then you must carry out a missed approach, climbing straight ahead on 116° in the missed approach configuration for your aircraft (gear up, flaps as required).

7.160 Localizer indications will become unusable for track guidance very soon after the missed approach is commenced. Maintain track of 116° and climb to 5500ft or as directed by ATC. Although the chart indicates that the climb should be continued to track 116°M climbing to 5,500 ft AMSL, ATC may instruct you otherwise, possibly to enter a holding pattern overhead WAY to await further instructions.

7.161 Remember, a missed approach is a normal manoeuvre. It is simply an integral part of the total instrument approach procedure, carefully designed to provide safe vertical and lateral obstacle clearance along the path from the MAPt. It is a simple manoeuvre, so you should have complete confidence in carrying it out.

A Final Word of Advice

7.162 Low minima operations, although not inherently difficult to fly, require a high level of concentration, discipline and situational awareness. Often, a decision has to be made in a very limited time frame since things can happen fast as you approach the minima. You have to decide positively, on the basis of what you can or cannot see, to go around or to continue the approach. There is no room for indecision or error.

Level Changes in Class G Airspace

(Ref: AIP ENR 1.7 Para 4.2.1)

12.19 In airspace where ATC approval is not required to change level, the pilot of an IFR flight must report present position and intention to ATC approximately one (1) minute prior to making any change. If you are unable to comply with a particular flight planned level en route, for instance due to ice accumulation, you must advise ATS as soon as possible so that they can make a traffic assessment. If you decide to cruise at a non-standard cruising level, i.e. a level other than those in the AIP tables of IFR cruising levels, you should advise ATS. You should give way to any aircraft at your level that is operating at the appropriate cruise level for its track or flight procedure.

VFR Operations by IFR Flights in Class E Airspace

12.20 When weather conditions are good, the pilot of an IFR flight may elect to conduct the flight within controlled airspace to the VFR while still maintaining the status of an IFR flight. The decision to operate this way would only be taken once the flight has commenced. It would therefore involve a request to ATC to vary the conditions under which the flight is to proceed. The advantage of these procedures is to provide the pilot with more flexibility in the conduct of the flight.

IFR Pick-Up

12.21 An IFR flight intending to operate in Class E airspace is required to obtain an airways clearance in the same way as if it was intending to operate in Class C airspace. A VFR aircraft in the class E airspace does not require a clearance. There will be occasions when as an IFR flight, you will be approaching the lower limit of Class E airspace on climb, and you request your clearance to be faced with the response that 'CLEARANCE IS NOT AVAILABLE'. This is probably because, the weather being fine, the controller is dealing with a heavy workload! If weather conditions would permit an IFR aircraft to fly to the VFR while in Class E airspace, you can get round the delay in obtaining your clearance by making the request 'REQUEST IFR PICK-UP'. If ATC grants this request, it would permit you to continue your climb (essentially as a VFR flight not requiring a clearance) until your IFR clearance does become available.

VFR Climb and Descent

12.22 If you are operating an IFR flight, you may arrange for a climb or a descent under the VFR by requesting 'CLIMB (DESCENT) VFR'. If the controller deems that the procedure will be practical, he will issue you with a clearance to 'CLIMB (DESCEND) VFR'. If you are cleared for this procedure, you are required to maintain VFR separation from cloud, maintain your own obstacle clearance and operate on a 'see-and-be-seen' basis for traffic avoidance. You are still required to comply with your IFR requirements for position reporting, radio communications and adherence to route and ATC clearances. ATC will continue to provide you with known traffic information and general flight information but will not provide you with IFR separation.

12.23 Note that VFR climbs or descents as described here, may only be conducted in Class E airspace.

16. Refer to Figure 12–17. Use 10% VR (CAAP 234-1(2.1). You have arrived overhead AKMIR at 0720 en route from Wagga (WG) to Sydney (SY). SY ACC instruct you to enter the holding pattern at AKMIR awaiting approach clearance due low cloud. You consider a latest divert time to Canberra (CB) based on an endurance ex WG of 250 minutes, and TEMPO holding requirements at CB. Latest divert time is . . . . . ?

17. What would be the latest divert time in question 16 if there were no alternate requirements due to weather, but you were holding at AKMIR due to both runways being rendered unserviceable by an immobilised 747 on the intersection at SY? Canberra is a suitable alternate if required, but still requires 60 min holding.

Fuel available at AKMIR is the same as in question 16, i.e. 200 min. Use 10% VR (CAAP 234-1(2.1).

You should calculate fuel required based on the worst possible case, i.e. where most fuel is required. The worst possible case in this situation is that the 747 will not be moved in time, i.e. you would be unwise to hold until you had fuel for AKMIR–SY only, and then be told that the 747 will not be moved until the next day!

So, your latest divert time should be based on flight from AKMIR–CB plus 60 min holding. (Always double check that this is greater than the fuel required to fly onto SY, otherwise you will be caught with low fuel if you are forced to hold for the maximum time and then allowed to continue to SY.)

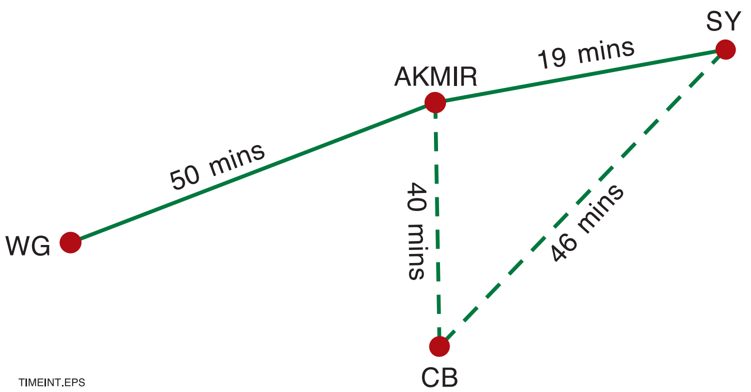


Figure 12-17 IFR route.

Review 13 IFR Arrivals

1. Notification of flight plan details to the airways operating unit should occur at least . . . . . minutes before departure.
2. If operating in radar controlled airspace beyond 30 nm, typical of a controlled aerodrome, you would be in contact with (approach/centre).
3. In radar controlled airspace within 30 nm of a destination in a CTR you would expect to be in contact with (approach/centre).
4. Having been radar identified by centre, you are instructed to contact approach. The information you would give approach is. . . . .
5. At a busy aerodrome you could expect to be transferred from tower to. . . . . after landing.
6. When inbound, or overflying a non-towered aerodrome, you should change to the CTAF no later than. . . . . miles from the aerodrome.
7. If you have arrived at a non-controlled aerodrome in IMC you (should/need not) fly a visual circuit. *Refer to* Chapter 16 *regarding circling approaches.*
8. If conducting a circling approach in IMC you (must/need not) fly a circuit conforming to the normal circuit direction? *Refer to* Chapter 16 *regarding circling approaches.*
9. When arriving at a non-towered aerodrome you (may/may not) cancel SARWATCH on changing the CTAF.
10. When changing to (location) CTAF, and cancelling SARWATCH at that point, you should use the term. . . . .
11. A straight-in approach subject to conditions (is/is not) an option when arriving at a non-towered aerodrome in VMC.

22. Are DME indications available when the VHF-NAV is selected to the IBA localizer?

23. Once you have intercepted the localizer you may descend to. . . . . ft prior to 10 DME.

24. The FAF, if conducting the LOC approach, is . . . . .

25. Approaching Glenn, and cleared for the approach, are you required to enter the holding pattern at AF?

26. The glidepath angle (GP) is . . . . . °.

27. The RDH of the ILS glide path is . . . . . ft.

28. Threshold elevation RWY 01 is . . . . . ft.

29. Decision altitude is . . . . . ft, which is . . . . . ft (DH).

30. The visibility required to continue with the landing is . . . . . or . . . . . without . . . . .

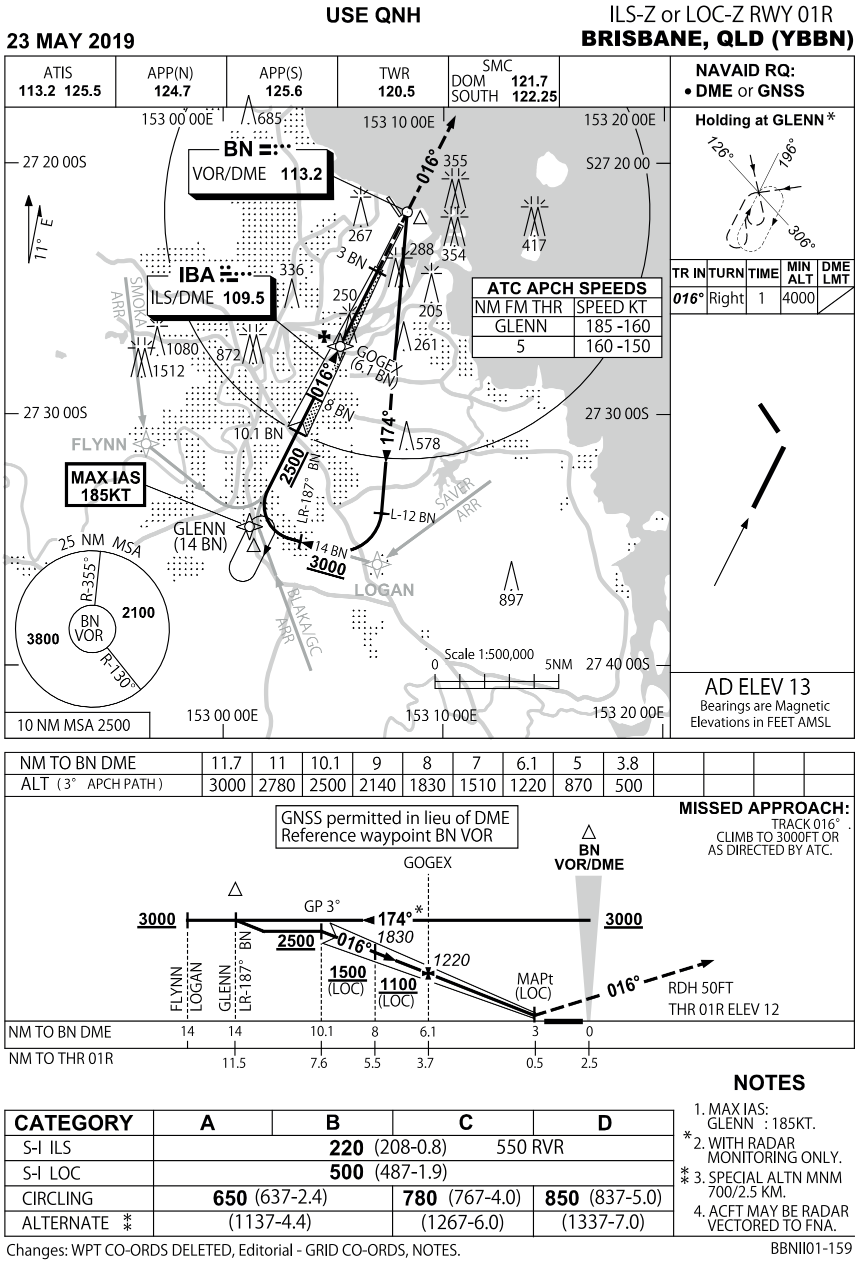


Figure 15-30 Brisbane ILS-Z or LOC-Z RWY 01R chart.

31. If the glide slope fails and you have to make a localised approach, the minimum becomes. . . . . . ft (MDA).

32. The minimum sector altitude approaching from the northeast is . . . . . ft.

33. Is a DME required to make this approach?

34. You are holding at GLENN for an ILS approach, and ATC has advised you to expect clearance for the approach at time 0915. At 0907 you experience radio failure. What action, if any, should you take with your transponder? At what time would you begin your approach?

35. How many initial approach fixes are there for this approach?

36. Considering the RWY 01 LOC/DME, what are the minimum and optimum altitudes for crossing the GOGEX?

37. Due to excessive crosswind on RWY 01, you have been given a clearance to conduct an ILS RWY 01 approach for a landing on RWY 32. What minima are applicable for this procedure for a category B aircraft?

38. On which frequency can you receive the ATIS, and using which radio?

Review 21 RNAV Systems

1. The abbreviation for area navigation is. . . . .
2. Area navigation is normally achieved by tracking between. . . . .
3. The space element of GPS consists of. . . . . satellites orbiting the earth every. . . . . hours at an altitude of. . . . . km.
4. At least. . . . . satellites must be observed for a GPS three-dimensional fix.
5. Compared to a sole means navigation system, which two performance requirements are not necessarily satisfied in a primary navigation system?
6. RNP 12.5 standard means that the aircraft must remain within. . . . . nm of . . . . . with a. . . . . probability.
7. For civilian GPS operations the pseudo-random code used is the. . . . . code, and the service provided is known as the. . . . .
8. The deliberate degrading of the accuracy of GPS for civilian use was known as . . . . .
9. Range from a satellite is determine by. . . . .
10. What feature of the TSO-approved GPS system provides additional redundancy and RAIM capability?
11. The three operating modes normally provided by a GNSS are . . . . . .
12. How are ionospheric effects offset by the GPS receiver?
13. How are tropospheric effects minimised by the GPS receiver?
14. If RAIM is lost in CTA. . . . .
15. All data entered into the GPS, either manually or automatically, from a current data base should be checked against. . . . .
16. If data is derived from a data base, it should be checked to ensure that. . . . .
17. The degree to which a pilot is conscious of the constituents which make up the environment in which he or she is operating is known as. . . . .
18. The closest shape that the earth resembles is. . . . .
19. The 'earth model' that is used by GPS is. . . . .
20. Concerning RNAV routes, what is the significance of a route designated with the letter 'T'?
21. Specific LSALTs are not shown on RNAV routes. True or false?
22. During RNAV operations, whenever track guidance for the route flown is available from conventional radio navigation aids, the pilot must ensure that. . . . .

Summary of Symptoms

Condition	Cause/ altitude	Common symptoms	Notes	Actions
Hypoxia – a condition where oxygen concentration in the tissues is less than normal	Rare below 10,000 ft.	Euphoria. Visual disturbances. Dizziness. Light headedness. Confused thinking. Apprehension. Sense of well being.	May be unaware of condition due to decreased partial pressure of oxygen. Smoking increases your susceptibility.	Descend. Use oxygen. 10,000–33,700 ft, air-oxygen mix. 33,700–40,000 ft, 100% oxygen.
Hyper-ventilation – occurs when the body overbreathes due to some psychological distress, such as fear or anxiety (gasping for breath)	Anxiety. (Any altitude. Hypoxia if above 10,000 ft.)	Light headedness. Dizziness. Tingling. Tremors. Visual disturbances. Confused thinking. Faintness. Numbness.	Overbreathing, reduces carbon dioxide level in the blood.	Control breathing rate. If above 10,000 ft suspect hypoxia.
Carbon monoxide poisoning – is present in engine exhaust gases and in cigarette smoke. It is a colourless, odourless, tasteless and poisonous gas	Faulty exhaust/ heating. Smoking. Any altitude.	Headache. Breathlessness. Sluggishness. Impaired judgment. Feeling of warmth. Cherry red skin.	Haemoglobin has greater affinity for CO than for oxygen. (Smoking makes night vision poor.)	Immediate fresh air. Oxygen. Land and seek medical attention.
Decompression sickness (the bends) – condition that results when too rapid decompression causes nitrogen bubbles to form in the tissue of the body	Flying after diving. Unlikely below 18,000 ft.	Headache. Pain (joints). Paralysis. Choking. Skin irritation.	Nitrogen comes out of solution and forms bubbles in: ■ lungs (chokes); ■ joints (bends); ■ skin (creeps); ■ central nervous system (paralysis).	Do not fly for 4 hr for dive less than 30 ft; longer if deeper.
Dehydration – deficiency of water in the body tissue	Likelihood increases with altitude.	Thirst. Less urine. Darker urine.	Lower air temperature and air density increases the amount of water loss from the body.	Always carry drinking water to sip throughout the flight.

Table 22-1 Summary of symptoms.

9. Yes.
10. ±2 nm or more.
11. 112 nm.
12. 73 nm.
13. 129 minutes.
14. 264 nm (81.7 min to PNR at GS 195 kt).
15. Fuel-on-board at AD:
320 min ex BHI
–107 min burn-off
213 min available at AD
Fuel required AD–MIA:
82 min flight fuel
+08 min (VR 10%)
+45 min fixed reserve
135 min fuel required AD–MIA
∴ margin overhead AD:
213 min available at AD
–135 min AD–MIA fuel
= 78 min (1:13)
So latest divert time is 1:18 min after 0415
i.e.04:15
+1:18
ANS: 05:33Z.
16. Fuel-on-board at AKMIR:
250 min ex WG
–50 min burn-off
200 min available
Fuel required AKMIR–SY–CB (this is allowing for flight to the alternate CB):
19 min AKMIR–SY
+46 min SY–CB
65 min
+07 min (VR 10%)
+45 min fixed reserve
+60 min holding
177 min
∴ margin overhead AKMIR is:
200 min available at AKMIR
–177 min fuel required AKMIR–SY–CB
= 23 min margin
So, latest divert time is 23 min after 0720:
07:20
+ :23
ANS: 07:43Z.
17. Fuel required AKMIR–CB + 60 minutes:
40 min AKMIR–CB
6 min 15% VR
45 min fixed reserve
60 min holding
151 min required
Double checking fuel required AKMIR–SY (in case we are allowed to continue):
19 min AKMIR–SY
3 min 15% VR
45 min fixed reserve
67 min (less than 151 minutes, so OK to use AKMIR–CB)
∴ we can hold for:
200 min fuel available
–151 min fuel required
49 min.
So latest divert time is:
07:20
+0:49
Ans: 08:09Z.

Review 13

1. 30 minutes.
2. Centre.
3. Approach.
4. Level, flight conditions, received ATIS (if inbound to a primary aerodrome).
5. Surface Movement Control (SMC).
6. 10 miles.
7. Need not.
8. Need not.
9. May.
10. *'Changing to (location) CTAF, cancel SARWATCH'.*
11. Is.

Review 14

1. C. Racetrack.
2. 4 minutes.
3. 6 minutes.
4. 2 sec/kt.
5. 20° right
6. 15° right
7. See Figures, 14-11, 14-12, 14-13.
8. Parallel entry.
9. Teardrop entry.
10. Direct entry.
11. See Fig. 14-29.
12. Later.
13. 170 kt IAS
14. 230 kt IAS
15. Abeam the fix.
16. Abeam the fix.
17. Outbound.
18. See Figure 14–26.
19. Minimum sector altitude (MSA) within 25 nm (positive fix).
20. ±2 nm.
21. 076°M

Review 15

1. △.
2. May be.
3. 1.3, landing.
4. Minimum sector altitude.
5. 1,000 ft, 25 mile.
6. A straight-in landing may be made if the pilot has the runway in sight in sufficient time to make a normal approach for landing, and has been cleared to land.
7. Category C.
8. Will not.
9. No.

10. c.
11. Further from, and, closer to.
12. The tracking aid typically.
13. The decision altitude (DA).
14. 2.5% or 152 ft/nm.
15. Groundspeed.
16. Must.
17. 220 fpm.
18. B.
19. Commence a missed approach, make a climbing turn toward the landing runway and follow the missed approach procedure.
20. 3,000 ft.
21. Yes.
22. Yes.
23. 2,500 ft provided you have turned in from 14 DME.
24. GOGEX or 6.1 BN DME.
25. No, unless otherwise instructed.
26. 3°.
27. 50 ft.
28. 12 ft.
29. 220 ft (208 ft DH).
30. 0.8 km or 1.2 km without coupled autopilot.
31. MDA 500 ft.
32. 2,100 ft.
33. No, if radar vectored.
34. Squawk 7600, commence approach at 0915 (see ERSA – EMERG section).
35. 2 (BN VOR, GLENN).
36. Optimum 1220 ft, not below 1100 ft.
37. The circling minima (MDA 650 ft, visibility 2.4 km)
38. 113.2 MHz (VOR), 125.5 (VHF-COM).

Review 16

1. ±30°, circling, circling minima.
2. Circling MDA.
3. b.
4. 300 ft.
5. 1.68 nm.
6. 2.66 nm.
7. 120 kt IAS, category B ($1.3V_{s0}$ = 104 kt IAS).
8. 90 kt IAS, category A ($1.3V_{s0}$ = 85 kt IAS).
9. b.
10. b.
11. Are.
12. 30 nm, clear of cloud, 5000 metres, must.
13. In VMC, the circling area, 5 nm.

Review 17

1. Instrument cross-check (scan), instrument interpretation, aircraft control.
2. ASIAIAlt
TCDGVSI.
3. Attitude indicator.
4. Heading indicator.
5. Balance ball.
6. ASI.
7. Altimeter.
8. VSI.
9. AI.
10. AI, and reflected on the altimeter, VSI and ASI.
11. AI.
12. AI, and reflected on the turn coordinator and heading indicator.
13. Selective radial scan.
14. AI.
15. Altimeter, supported by the VSI.
16. ASI, supported by the AI and VSI.
17. ASI.
18. Turn coordinator.
19. Heading indicator.
20. ASIAIAlt
VSI.
21. AI
TCHI.
22. Altimeter and VSI.
23. HI and turn coordinator.
24. HI.
25. Turn coordinator.

Review 18

1. Magnetic compass.
2. ASI, altimeter, VSI.
3. ASI, altimeter, VSI.
4. ASI.
5. AI, HI, turn coordinator.
6. AI, HI.
7. Magnetic compass.
8. Climbing turn to the right (AI has failed) – right turn (turn coordinator and HI, not supported by AI); climb (altimeter VSI and ASI, not supported by AI); balanced (ball centred).
9. Straight-and-level flight; failure of ASI (perhaps iced-up pitot tube) – wings level (AI, turn coordinator and HI); level flight (AI, altimeter and VSI); balanced (ball centred); pitot system has failed (ASI indication not supported by other instruments) (turn on pitot heat).
10. Descending right turn – right turn (AI, turn coordinator and HI); nose down (AI); static system failed since there is no movement on the ASI, altimeter and VSI.
11. Level turn to the right, ASI has failed – right turn (AI, turn coordinator and HI); level (AI, altimeter and VSI); ASI reading not supported by other instruments.
12. Straight-and-level flight, with a malfunctioning vacuum system (AI and DG unreliable) – wings level (turn coordinator active but level, no 'off' flag, AI shows a bank to the right, HI shows a turn to the left); level flight (AI, altimeter and VSI).
13. Stopping.
14. Climbing right turn, with a malfunctioning turn coordinator – bank to the right (AI and HI, not supported by turn coordinator); climb (AI, altimeter and VSI).

15. Climbing right turn with a failed static system – right bank (AI, turn coordinator and HI); nose high (AI with no support, but fixed indications on the altimeter and the VSI along with an increasing indicated airspeed are consistent with a climb with a blocked static system).
16. AI (attitude), altimeter, VSI and ASI (flightpath).
17. AI, HI, turn coordinator.
18. Reduce power, roll to wings level, and then smoothly raise the nose to a level flight attitude.
19. Apply power, lower the nose to a level attitude, and simultaneously roll to wings level.
20. C.
21. A steep climbing turn to the right – apply power, lower the nose to a level attitude, and roll to wings level.
22. A nose-low spiral to the right – reduce power, level the wings, and raise the nose to a level pitch attitude.
23. Turn coordinator.
24. ASI, altimeter and VSI.

Review 19

1. Roll axis.
2. Without.
3. Circuit.
4. Decreases, decreasing, more.
5. Before flight on that day
6. Roll and pitch.
7. Cannot.
8. On the control column.
9. Pull the trim circuit breaker.
10. Grasp firmly and regain aircraft control, follow by press autopilot disengage switch, trim manually as needed and pull circuit breaker.

Review 20

1. There are no questions associated with this chapter.

Review 21

1. RNAV.
2. Waypoints.
3. ±2 nm.
4. 24, 12, 20,200 km.
5. 4.
6. Availability and continuity of service.
7. 12.5, track, and 95%.
8. Clear/acquisition (C/A), standard positioning service (SPS).
9. Selective availability (S/A).
10. The receiver measuring the period between the time of transmission and the time of reception of the satellite signal.
11. Barometric aiding.
12. Navigation with RAIM, navigation (two and three dimensional) without RAIM, and loss of navigation or DR.
13. By data received from the satellites.
14. By appropriate software modelling in the receiver.
15. ATC must be advised.
16. The relevant and current navigation chart.
17. It remains current for the duration of the flight.
18. Situational awareness.
19. An oblate spheroid.
20. WGS 84.
21. It is a two-way route.
22. True; however, area LSALTs are shown.
23. RNAV system keeps the aircraft within the tracking tolerances for the aids concerned.

Review 22

1. Hypoxia.
2. Insufficient partial pressure in the air and inability of the blood to carry oxygen.
3. 10,000 ft.
4. Yes.
5. Yes.
6. Gas bubbles form in the body and cause pain and immobilisation.
7. Hyperventilation.
8. Exhaust gases.
9. Slow down breathing rate, breathe into a paper bag.
10. Yes.
11. Empty field myopia.
12. To the side of.
13. Myopia.
14. Yes.
15. Yes.
16. Autokinesis.
17. Further away.
18. Either sloping cloud layers, and angled lines on the ground, or areas of light at night.
19. Greater.
20. Steeper approach and higher flare.
21. Spatial disorientation.
22. Sight.
23. You are entering a turn in the opposite direction.
24. Accurate and complete data and good judgement.
25. Situational awareness.

S

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