INSTRUMENT APPROACH PROCEDURES

What is an instrument approach?

An instrument approach is a procedure that allows an aircraft to descend from the en-route stage of flight (at or above MSA), to an altitude (or height) at which the pilot makes a decision whether to land or carry out a missed approach.

Considerations

These briefing notes will consider the following areas:

- Beacon use associated with an instrument approach.
- Precision approach and minima.
- Non-precision approach and minima.
- The sectors of an approach.
- Approach plates.
- Flying an example approach down to minima.
- Radar vectored approaches.
- Noise abatement procedures.
- Single engine (asymmetric) considerations.

Beacon use

As with all beacon use the instrument should be selected, identified, with the display set up in the correct sense. Further consideration must be made with regards to **re-identifying all the navaids** to be used during the approach, before the aircraft descends to low level. This will normally be done in the following way:

- For a precision approach – re-identing the ILS/DME frequency when within 30 degrees of the final approach track, when both the localiser and glideslope indications are 'alive'. Any other beacons may be identified as for non-precision approach below.

- For a non-precision approach – re-identing all the beacons in use when the pre-landing checks are complete. For an NDB approach the ident should be left on continuously from this stage onward (at low volume!), due to the lack of any failure warning.

- Any secondary navigation equipment should be used to back up the primary where possible, potentially allowing an approach to continue should the primary equipment fail.

Precision approach

A precision approach is one that provides both horizontal and vertical information with regards to the aircraft progress along the final approach track. Examples of such procedures are the ILS (instrument landing system) and a PAR (precision approach radar). The aircraft is therefore guided down the approach, following pre-determined lateral and glideslope parameters (see AIC 34/1997 in the AIC section) to a point at which the pilot decides

whether to land or carry out a missed approach. This point is known as the **decision altitude (DA** or height DH). **If the pilot can see the runway, or the runway environment, at the decision altitude he may land. If not visual at this point, a missed approach must be carried out immediately**. The aircraft may descend below DA whilst carrying out the missed approach, but it must be actioned not below DA.

Minima

The minima for the approach consist of 2 parameters – RVR (runway visual range) and DA/DH. The determination of these minima is based upon consideration of system minima and obstacle clearance. As this is covered during ATPL ground study the exact determination will not be covered in these notes.

As pilots we are interested in the minima on the approach plates (see the approach plates section), and the absolute minima for single pilot IFR (800m RVR and 200' DH). When flying an approach we will always use the more restrictive of the given and the absolute minima. For certain aircraft an additional 50' must be added to the minima for pressure error correction (PEC). This is noted in the POH for the aeroplane if not required. It is required for the Seneca.

It is therefore vital that prior to commencing an approach the latest weather is checked. Should the RVR be below our minima, then an **approach ban** is said to be in force, and we must not pass below 1000' AGL on the approach. If we do so we are making an illegal approach. We may however attempt an approach if the cloud base/ceiling is below minima, although being a good instrument pilot involves being able to make a decision as to whether or not such an attempt might be viable.

Non-precision approach

A non-precision approach is one that provides horizontal guidance only (ie no glideslope indications). Nominal glideslope information may be provided, but this has to be pilot interpreted. Examples of beacons used for such approaches are VOR's and NDB's. Non-precision approaches also include the SRA (surveillance radar approach). The lack of any exact vertical guidance means that the pilot can only descend to a **minimum descent altitude (MDA**, or height MDH). From this point the pilot flies the aircraft level until he either sees the runway (or environment) and descends for landing, or reaches the missed approach point and executes a missed approach. **The aircraft must not descend below MDA at any point unless the pilot is able to land**.

Minima

The minima for non-precision approaches consist of RVR and MDA/MDH. These tend to be higher for these approaches due to the less accurate nature of the guidance. Once again we must check the weather before commencing the approach to ensure it is sensible and legal to do so. The 50' PEC need not be added to non-precision approaches.

The sectors of an approach

Figure 1

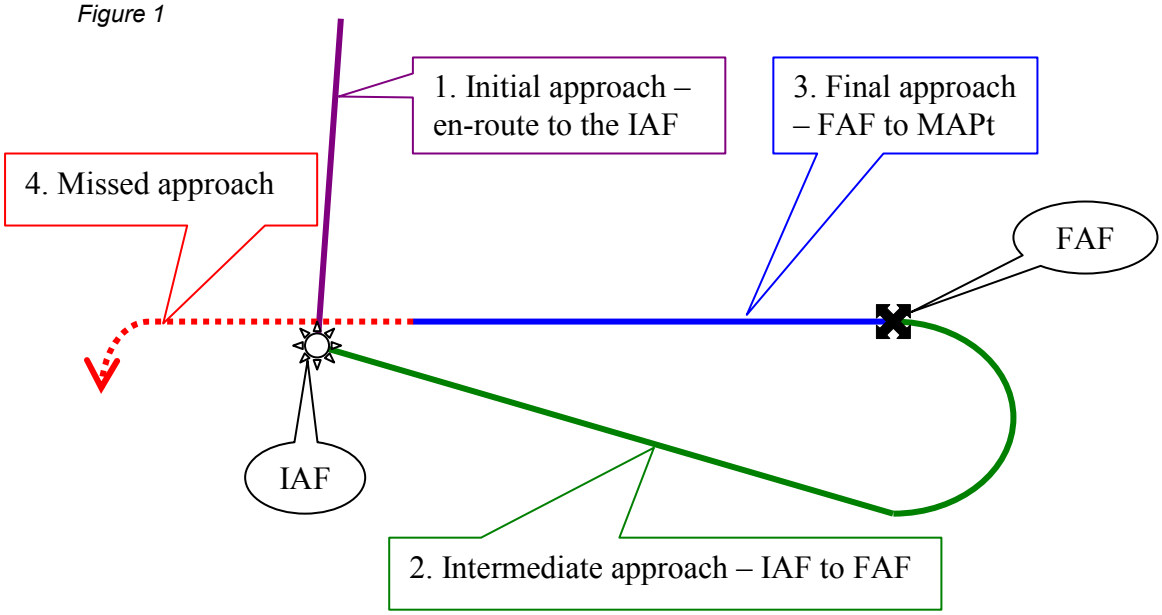


Figure 1 shows the various sectors of an approach. We will now look at each one in turn, and note the tasks we should complete during each sector.

Initial approach:

- This sector begins at the end of the en-route stage and ends at the intermediate approach fix. It will often be linked to a STAR (standard terminal arrival).

- Either prior to this stage (during en-route), or during the early part of this stage we need to ensure we have checked the weather and briefed ourselves on the key areas of the approach.

- Top of descent checks will have been completed, and initial approach checks are carried out during this stage. All relevant beacons will have been set up and identified. Hold or approach power will also be set as appropriate.

Intermediate approach:

- This sector takes us from the intermediate approach fix to the final approach fix.

- We will carry out our pre-landing checks, ensure we have our missed approach instructions, re-identify all the navaids for the approach and recheck the RVR if marginal.

Final approach:

- This sector takes us from the final approach fix to our missed approach point.

- The aircraft will be descended to DA or MDA depending on the type of approach. If a landing can be achieved we may continue our descent.

Missed approach:

- From the missed approach point, if we did not become visual for landing.

- The aircraft will climb back to MSA for a further attempt to land or for a diversion to an alternate airfield, whichever is appropriate.

Approach plates

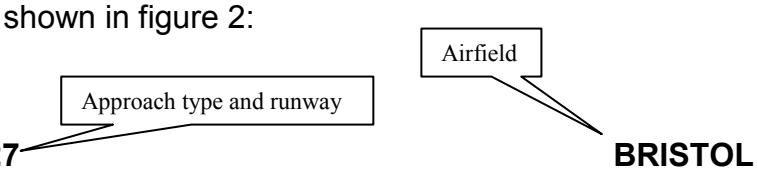
An approach plate provides all the information required to fly a procedure in relation to:

- Radio and navaid frequencies.
- Horizontal profile and MSA.
- Vertical profile.
- Minima, descent guidance and any relevant notes.

They are published by the CAA, AERAD and Jeppessen. For the purposes of training at Blackbushe we will be using the AERAD plates, although they all contain the same information.

Looking at one of the plates provided in the approach plates section (the example used is the NDB to ILS/DME 27 at Bristol), we can see that it is divided into the sections shown in figure 2:

Figure 2



Elevation	Variation	Trans alt	Trans level	Navaids	Plate date/no.
Comms	Comms		Comms	Comms	
Horizontal profile Radio aids shown in boxes are associated with the approach Those shown without boxes are not directly associated Holding information is also given, including sector entry headings MSA sectors within 25 nm					
Vertical profile, missed approach & comms failure					
Rwy QFU	Threshold elevation	Notes			Assumed eye height
DA (or MDA) & RVR minima					Vertical profile guidance
Rate of descent guidance					

Flying an example approach down to minima

The following example will follow a Seneca aircraft inbound to Bristol from the northeast to fly the ILS approach to runway 27, after holding at the NDB:

En-route:

- The weather is checked on the Bristol ATIS (126.025) to confirm RVR above 800m (even though the plate says 700m, single pilot absolute minima apply) and cloud base appropriate for a descent to 860' QNH (the given minima for category A plus 50' PEC). The ATIS will also confirm the runway in use, wind, QNH and who to contact for arrival.

- The approach brief is completed, including – correct plate in use, MSA, hold entry and inbound, outbound track and altitude, inbound track, final approach fix, minima, and missed approach.

- If possible the navaids are set up (or on standby), with nav1 & nav2 showing 110.15, the NDB showing 414, and the DME set to 110.15.

Initial approach:

- Once clearance is given for descent, top of descent checks are carried out, and the power brought back initially to 25" MAP (to prevent shock cooling), then further if required.

- A steady track is held inbound to the beacon whilst descending to cleared level (assuming 3000'). MSA from the northeast is 2200' within 25nm.

- On training flights, if not already requested by ATC, intentions at the airfield should be passed (ie what our training requirement is).

- Initial approach checks are carried out, and hold power 24" MAP & 2200RPM selected (115kts).

- The navigation equipment should now be set up with nav1 on the ILS frequency, and the HSI display showing the inbound track of 270 degrees. Nav2 should also display this information. The NDB will be set to 414, and the DME to 110.15, with all beacons identified if possible.

- Holds will be carried out until 'cleared for the procedure'. The aircraft will then leave the hold next time over the beacon.

Intermediate approach:

- From the hold the aircraft will proceed 'beacon outbound' on a QDR of 101 degrees, descending to 2500' by 8d.

- Pre-landing checks will be completed, with lowering the undercarriage delayed. The checks include setting approach power, 22-24" MAP &

2400RPM (115kts).

- 1st stage of flap is selected (ensuring the speed is below 140kts).

- Missed approach instructions are requested from ATC, if appropriate. This will confirm if the published procedure is to be followed or an alternative missed approach (common on training flights).

- The RVR will be confirmed with ATC if marginal, to ensure it is above minima.

- The approach navaids are re-identified, ensuring the ILS is checked when both localiser and glideslope indications are 'alive'.

- At 8d the aircraft makes a level turn to 'intercept the localiser'. This has occurred when the needle is within a half scale deflection.

Final approach:

- Once the aircraft has reported 'localiser established', the next expected reply from ATC will be 'cleared to descend with the ILS', along with a possible change to the tower frequency. The aircraft **does not descend** on hearing this. We must wait for the glideslope indications first.

- All heading changes whilst tracking the localiser must be small, ideally with the heading bug.

- Approaching 5.8d the glideslope indicator is moving down towards the central position. With 1 dot fly up gear is selected down (confirm speed less than 130kts), and the 2nd stage of flap lowered (confirm less than 122kts). This helps the aircraft slow down for descent, and the MAP is also reduced to set up the appropriate rate of descent at 100kts.

- Glideslope is secured using pitch to correct any movement, but power must also be altered to ensure a stable speed.

- The glideslope indications are checked once against a DME spot height on the plate to ensure correct indications.

- At 1000' AAL the props are set to MAX RPM in preparation for a possible go around.

- Landing clearance is received (or low approach/go around, etc.)

- Once we get within 500' of our minima we begin counting down (1300' for 860') and confirm progress every 100'.

- At minima a visual check is made to see if a landing can be made. If yes – fly visually and carry out a PUF check, ensuring a good transition from instrument to visual flying. If not – execute missed approach,

ensure maximum power (40” MAP, 2800RPM), achieve 92kts ASAP and clean up the aircraft once a positive rate of climb is achieved.

Missed approach:

- Once the aircraft is clean, set max continuous or climb power.

- As soon as practical report ‘missed approach’ to ATC who will issue further instructions.

Radar vectored approaches

The difference with a radar vectored approach is that, once in the radar vectoring area, ATC will give headings and altitudes to the pilot in order to position the aircraft on the final approach track. This makes our life easier in many ways, but there are a couple of things to consider:

- The controller is responsible for terrain separation, but we must not abdicate control completely. The radar vector chart should also be used, so we can confirm our position and the relevant MSA the controller is not allowed to vector us below.

- The controller will know the track over which he is going to take us, but we may not, so ‘track miles to run’ may be requested if appropriate, in order to determine the amount of time we have to prepare for the approach.

Noise abatement procedures

Many airfields have strict noise abatement procedures that must be complied with at all times, except in emergency situations. This often requires a non-precision approach to be flown according to the same glideslope as a precision approach. When flying a non-precision approach therefore, a stable approach should be established, using the nominal glideslope information given to plan and fly the approach accurately.

Noise abatement procedures can be found on the AERAD/Jeppessen plates, or in the AIP (aerodrome section).

Single engine considerations

With the loss of an engine and the subsequent asymmetric power, flying an approach becomes a little bit more challenging. There are a number of things to bear in mind:

- Turning towards the dead engine is the preferable option, so we might consider requesting vectors with a certain direction of turn.

- Flap should only be lowered on the beacon outbound leg if we are certain the aircraft will be able to maintain level flight. If not, delay lowering until just before glideslope/FAF interception.

- Power settings on a single engine are MAP as required (around 33" for level flight), with the prop set to 2600RPM. MAX RPM must be used for any missed approach/go around, and whilst dealing with any engine failure in the climb. Remember though that maximum power has a 5 minute limit. Airspeed should not be allowed to decay below 92kts (Vyse) until the aircraft has become committed to a landing.

- Any change in power will require a change of rudder pressure. This is especially notable during a single engine missed approach. With the trimmer being used, it will need adjustment as power settings change.

- For single engine operation we must consider our **'single engine committal altitude (or height), ACA/H'**. This is an altitude below which we become committed to landing. It is based on two factors: firstly, how much height will be lost in executing a single engine missed approach, and recovering to a positive rate of climb; secondly, with severely reduced climb performance, at what altitude must we commence a missed approach in order to ensure obstacle clearance back to MSA. When flying a single engine approach therefore, on passing minima, and assuming we are in a position to land, we fly through ACA on our way down to the runway. Airspeed must be kept above 92kts until after this altitude, and in order to go below we need to ensure: we are cleared to land; we have 3 greens; the aircraft is 'in the slot' on a stable approach; the runway is clear. The 3rd stage of flap is not selected until we go below ACA, at which point we transition for landing. **The CAA recommend a minimum ACH of 250'**, but it is up to us as pilots to calculate our own requirements, based on the circumstances at each airfield.

- Rate of climb in the event of a missed approach might be marginal at best, so turns should be avoided (if possible) until at a safe altitude.

- During a missed approach, ensure maximum power is delivered (40", 2800RPM), and control the yaw, whilst maintaining pitch for 92kts. If the drag flap has been inadvertently selected it should be retracted immediately after the initial vital actions have been carried out. Gear and remaining flap should be retracted only when a positive rate of climb is achieved. If a positive rate cannot be achieved, then a decision has to be made as to the best course of action: keep the gear down and land ahead; or retract gear and try to achieve a positive rate.

- If ATC instructions or noise abatement procedures cannot be followed, then ATC should be advised as soon as practical that the aircraft is carrying out a performance climb.