Unpublished cloudbreaks

Introduction

The purpose of this Information Notice is offer advice to non-commercial operators making approaches or cloudbreaks in IMC in the absence of a published instrument approach procedure.

Throughout this document, "IAP" will be used to describe a published Instrument Approach Procedure and "CP" an unpublished Cloudbreak Procedure outside controlled airspace.

This information notice should not be interpreted as approving CPs, nor as suggesting that they meet a particular level of safety, even if carried out in conformance with this notice.

Public transport and commercial air transport operators must use the procedures set out in their Operations Manual, which are likely to restrict operations to published and discrete procedures.

Requirements

The requirements for minimum levels for IFR flights are set out in SERA.5015(b):

SERA.5015 Instrument flight rules (IFR) — Rules applicable to all IFR flights

(b) Minimum levels. Except when necessary for take-off or landing, or except when specifically authorised by the competent authority, an IFR flight shall be flown at a level which is not below the minimum flight altitude established by the State whose territory is overflown, or, where no such minimum flight altitude has been established:

- *(1) over high terrain or in mountainous areas, at a level which is at least 600 m (2 000 ft) above the highest obstacle located within 8 km of the estimated position of the aircraft;*
- *(2) elsewhere than as specified in (1), at a level which is at least 300 m (1 000 ft) above the highest obstacle located within 8 km of the estimated position of the aircraft.*

This attaches no special regulatory status to a published IAP: flights using IAPs do so "when necessary for landing". It is therefore not a legal requirement to use an IAP in order to descend below the levels set out in SERA.5015(b)(1) or(2). However, it should be noted that Art 109 of the Air Navigation Order means that the aerodrome operating minima for an IAP are binding for any runway to which one is notified.

Discussion

The risks of making unpublished approaches

IAPs are developed using international standards, recommendations and tools which have been developed over many decades. They ensure that the aircraft is safe from terrain and obstacles, taking into account aircraft speed and performance; accuracy, reliability and dependability of the aids used; runway characteristics; runway and approach lighting; pilot error and inaccuracy; atmospheric variability and a host of other considerations.

It is only after extensive consultation, reference to standards, study, calculation and testing by specialised aircraft that the IAP can be published and used.

The development of GNSS means that ground-based navigation aids are no longer required to fly a trajectory with precision appropriate to an approach. Most pilots of aircraft equipped with GNSS are therefore aware that a CP is theoretically possible. But a CP will not have been put through a rigorous process like an IAP, and therefore the risk of the aircraft hitting terrain, obstacles or other aircraft, whether in the descent or the missed approach, will be considerably higher. Later paragraphs will discuss how these risks can be mitigated to some extent, but the pilot must always be aware that the CP may bear a high level of risk compared to IAPs.

However, it should be noted that if a pilot is going to make an approach to a non-instrument runway in poor weather conditions, alternatives to CPs, such as flight under VFR in marginal VMC at minimum level ("scud running") may carry even greater risks. Scud running exposes the aircraft to close proximity to terrain and obstacles for much longer and over a much greater geographical area, and manoeuvring at low level in poor visibility has repeatedly been the cause of low level loss of control and spins.

Risk management of CPs should take account of those hazards associated with:

- unknown or unanticipated obstacles with unknown height
- inappropriate precision of navigation
- performance requirements that are more demanding than on a published IAP
- errors in inputting or retrieving data
- absence of ATC monitoring via radar
- the possible presence of VFR traffic below cloud
- absence of the protections associated with an instrument runway

It is the responsibility of the pilot-in-command of a non-commercial operation to manage risks, including these risks if using a CP.

GNSS Equipment

In the descriptions that follow, the assumption is made that most aircraft performing CPs will have an approved aviation GNSS unit driving an HSI or OBS indicator, and that an inbound QDM course can be set using an OBS function on the GNSS equipment. Other types of equipment, such as handhelds, tablets and smartphones are discussed below and may require slightly different techniques.

Planning a Cloudbreak Procedure

A CP below MSA should never be ad-hoc; it should always be planned and, whenever possible, validated in VMC before being used in IMC. The planning should take into account the following:

- Aerodrome Reference Point (ARP) displacement from the threshold, laterally and longitudinally.
- If there is no ARP coded in the database, how it is to be hand coded and verified.
- Ensuring that the descent offers reasonable clearance above any terrain or obstacle that poses a hazard on the inbound track.
- Final Approach Fix
- The visibility required to see the runway from decision altitude.
- Where QNH is reported, where it is derived and the qualifications of the person reporting it.
- The quality of GNSS equipment being used, installed equipment certified for IFR use with a current database through to uncertified equipment and consumer electronics.
- Checking RAIM, if technically feasible.
- Sensitivity of CDI settings, as this may not happen automatically when not on a published approach.
- The effects of turbulence and strong winds.

Generally the cloudbreak should be aligned with the runway of intended landing. It is important that the approach is stable in speed, configuration, ROD and pitch. These criteria eliminate the need for low level manoeuvring once below cloud. If the cloudbase is high enough to allow VFR circuit traffic, the approach should be discontinued once VMC are encountered and the visual circuit in the normal way.

If, for airspace or obstacle reasons it is necessary to plan a curved path either in the approach or the missed approach, the pilot should plan this exceptionally carefully, particularly in terms of speed and angle of bank, as this may add extra risk.

If the approach is to an airfield in the GNSS database, it is better to use the ARP waypoint than to enter manually a lat/long position, as manually entry of lat/long positions is known to be error prone.

If a position is entered manually (for a strip, for example) it should be saved as a uniquely memorable user waypoint, and it is even more important under these circumstances to test the approach under VMC to ensure that the waypoint has been accurately entered. Various techniques can be used to plot the position (Aviation Charts, Google Earth, Google Maps etc) but it should be noted that some charts (such as Ordnance Survey) use a different Geoid model to the WGS84 used in aviation, and significant differences in coordinates can arise. It is recommended that two different sources are used to double check their accuracy. Entering the waypoint manually does have the advantage that the runway end can be used, but if that is the case, names of user waypoints for each runway end should be chosen carefully to avoid confusion.

If the published ARP is used, its position compared to the runway ends should be checked and noted. The ARP is typically in the middle of the longest runway, meaning that it can be considerably displaced laterally from other runways. If the ARP is displaced, the pilot should raise both Minimum Descent Altitude (MDA) and visibility minima to allow longer to identify the runway and manoeuvre to it. An OBS course could be chosen to intercept the extended centreline of the runway at MDA, as in an offset IAP.

The ARP, whether using the longest runway or not, will also give a different CDFA profile from the runway end. A 1000m runway with the ARP at its mid-point will require a 100' lower CDFA to be flown to terminate at the runway end.

The most important part of the planning is to ensure that the course flown below the MSA is clear of terrain and obstacles. This can be checked to some extent using aeronautical charts, but pilots must be aware that obstacles of less than 300'AGL are not normally marked on the charts. Thus masts, power lines and tall buildings may not be plotted. The risks of these unmarked obstacles can be mitigated by:

- Flying the procedure in VMC;
- Asking locally based instructors, pilots and controllers about any obstacles;
- Adding 300' to whatever MDA is calculated based on known terrain to allow for these unknown obstacles.

IAPs are usually flown to runways with approach lights. These lights are designed to allow rapid and unambiguous visual acquisition of the threshold, and can be used as a visual reference in their own right until the runway surface or edge lights are perceived. The user of the CP does not have the benefits of approach lighting and accordingly it is much harder to identify the threshold. The pilot needs time for this visual acquisition, which means higher MDAs/DAs.

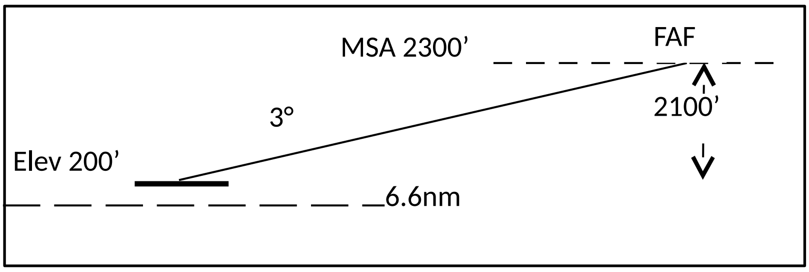
But higher MDAs also require greater in-flight visibility. On a 3° slope, a visibility of 600m is required for each 100' of height, and that allows no time for visual acquisition, so it is better to plan on 700m per 100'. Thus, a 600' MDH requires a visibility of over 4km.

Decision Height	**Minimum visibility possible**	**Minimum recommended visibility**
300'	1800m	2100m
400'	2400m	2800m
500'	3km	3.5km
600'	3.6km	4.5km
700'	4.2km	5km
800'	4.8km	6km

Normally, the CP will be flown on a 3° slope following an OBS course which follows the runway QDM towards the ARP or User waypoint. There will be a point where that OBS track descends below the MSA, and it is recommended that that point is calculated and its co-ordinates are entered into the database as a user waypoint.

A sample calculation might be:

Airfield elevation: 200’
MSA: 2300’
MSA - elevation: 2100’
3° Slope = 320’ per nm
Length of slope: 2100’/320’ = 6.6nm

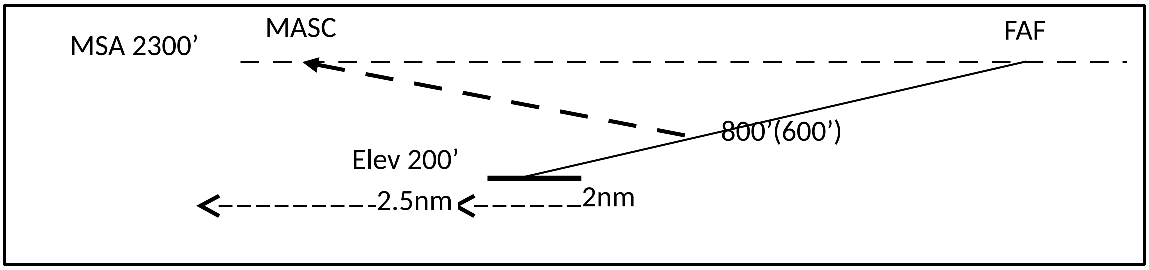


Thus the FAF would be plotted 6.6nm on the centreline and stored as a user waypoint. If possible, a position crosscheck using a ground aid, such as VOR/DME, should be noted to double check that the aircraft is in the correct position before descending below the MSA. The FAF should be approached at MSA on the runway QDM at the approach speed, such that a stable approach can be started at the FAF.

A further waypoint should be plotted for the missed approach. This should be on the extended centre line where the climbing aircraft would reach the MSA.

A sample calculation:

Airfield elevation: 200’
MSA: 2300’
Missed approach at 800’, 2nm on the centreline
1500’ at 500fpm = 3 minutes at 90kts = 4.5nm
4.5nm – 2nm = 2.5nm



So the Missed Approach Safe Climb (MASC) waypoint is 2.5nm on the extended centreline after the threshold or ARP.

These three points – the FAF, ARP (or threshold) and MASC – should be loaded into the route or flightplan of the GNSS, such that there is never any confusion or hesitation in the pilot’s mind as to the next point to be flown. If the aircraft has a suitable autopilot, it can be set to sequence through the waypoints.

However, it should be noted that in most GNSS systems, the more sensitive TERM mode will only activate automatically if the last item in the FPL is an airfield in the database, and therefore not if it is the MASC. Accordingly, sensitivity should be adjusted manually as discussed below.

The rate of descent required from the FAF should be calculated based on the GNSS groundspeed read out. This should be based on 300fpm at 60kts, 450fpm at 90kts and 600fpm at 120kts.

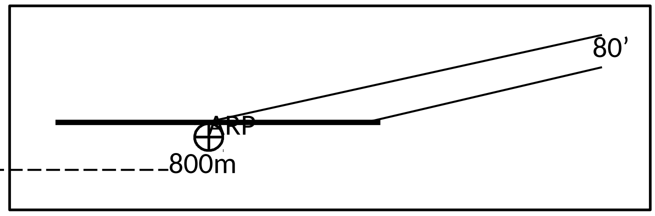
Before flight, the altitude at each nm from the threshold should be calculated, based on 318’/nm, and the calculations compared to actual altitude and used to adjust ROD.

Dist (nm)	8	7	6	5	4	3	2	1
Height (ft)	2544	2226	1908	1590	1272	954	636	318

If the ARP is being used, an allowance should be subtracted for the distance of the ARP to the threshold. Use 10’ per 100m of runway length as a guide.

A sample calculation.

ARP is in the middle of an 800m runway
800m/100m = 8
8 * 10’ = 80’ subtracted from check altitudes.



The MDA is at the discretion of the pilot, taking into account obstacles (on the final approach and in the missed approach), ease of spotting the runway, lighting conditions, visibility, turbulence, aircraft speed, recency and alertness of the pilot, quality and reliability of GNSS equipment and the reliability of the QNH.

Whatever MDA is chosen, the pilot must have the discipline to stick by that MDA and execute a missed approach to MSA if sufficient reference to make a safe visual landing is not available.

Pilots must remember that pressure setting on the altimeter subscale is the only reference to their altitude and height. Factors which affect the reliability of the QNH include the distance of the reporting station from the CP, the length of time since the QNH was reported and the reliability of the reporter. If the airfield being approached has an ATC, AFIS or A/G service, then the QNH is likely to be local, recent and reliable. If the best available is an aircraft on the ground twenty miles away, an hour previously then the opposite is true. The pilot should add allowances to MDA if the QNH is not wholly reliable. GNSS altitude can be used as a cross check, but must not be used as the prime source of altitude information.

Similarly, allowances should be made for the GNSS equipment in use. If an approved TSO C-146A GNSS is used, it has met certain reliability and accuracy benchmarks which a handheld unit has not, but a handheld aviation GNSS unit is, in turn, considerable more dependable than a piece of consumer electronics such as a tablet or mobile phone. If a pilot does choose to use sub-optimal equipment, extra allowance for interpretation errors, continuity, integrity and failure should be made in the choice of MDA.

When making a CP using GNSS, the pilot is dependent on the accuracy and availability of the satellite signal. Normally GPS is highly reliable and accurate, and that can lull users into the belief that it is always so, in all locations. But there are periods of both unavailability and inaccuracy. Before any descent below MSA is made, it is imperative to check RAIM availability, or integrity using EGNOS, and to check NOTAMs to ensure that no outages or jamming is planned in the area of the planned CP. On certified units, RAIM availability can be checked using the unit’s own software. Consumer devices generally have no such safeguards and there is no way of knowing if the position is within parameters. It is especially important with such devices to use other navigation aids to check position and to raise minima.

When an IAP retrieved from the database is performed on a certified GNSS unit, whether on an RNAV approach or an overlay, the sensitivity of the OBS/HSI is automatically adjusted through different phases of the approach. This does not happen in a CP. The pilot must therefore either change the sensitivity manually before the CP is commenced, or make allowance for the relatively lower sensitivity of navigation indications.

Also, when determining an MDA, the pilot should take into account the wind and turbulence on the day. Strong winds and turbulence make accurate track and ROD holding more difficult because of possible up/downdrafts caused by local terrain, and also tend to add to stress and workload, and the pilot should consider adding a margin to MDA in these conditions.

Training

Pilots with Instrument and IMC ratings will have received training in executing the full range of precision and non-precision IAPs and will have demonstrated these skills to an examiner on a regular basis. However, CPs are not included in the syllabuses or exam profiles and therefore will not have been taught in a formal course.

If a pilot is planning to make regular CPs to their home airfield or strip, the instructor should work with them on the procedure and techniques to be used, allow the student to practice in VMC without vision limiting devices and point out the hazards, both in the approach and the missed approach, before simulating IMC. The instructor should discuss minima and how minima should be varied according to weather conditions, light conditions, fatigue and stress.

If the student is wishing to develop the skill with no particular runway in mind, the instructor should discuss the general principles, as described below, and then encourage the student to develop a procedure to a convenient runway, and then proceed as above.

Instructors may also wish to teach the basic skills on a simulator or procedure trainer.

Strict adherence to SOPs and minima should be stressed. As instrument students are taught a standard way to fly IAPs, they should be thoroughly taught that similar SOPs, particularly the missed approach at a pre-determined Decision Altitude, are equally, if not more, important in CPs.

Summary

The CAA does not encourage the flying of unapproved cloudbreak procedures, but it does acknowledge that pilots will fly them nonetheless. If approaches are to be made to airfields without IAPs in IMC, then it may be better that they are done according to the guidance given in this information notice than attempts be made to “scud-run” or descents be made ad-hoc without careful planning. Instructors should emphasise the same message – discouraging their students, but if they are going to make CPs, then to train them to do so as safely as possible.

However, in the UK it is legal to descend below IFR enroute minima for the purposes of making a landing, and it is accepted that pilots do make CPs to VFR runways and strips, and therefore the CAA has decided to make recommendations that a pilot choosing to do so:

- Is aware of the risks, and has concluded that they are commensurate with the nature of the operation
- Carefully plans the CP using all available information
- Is very careful and methodical in the execution of the CP
- Sets operating procedures and minima in advance and sticks rigidly to them