Advisory Circular
AC 91-11

Revision 2
14 January 2008

Single Pilot IFR

General

Civil Aviation Authority Advisory Circulars contain information about standards, practices, and procedures that the Director has found to be an **Acceptable Means of Compliance (AMC)** with the associated rule.

An AMC is not intended to be the only means of compliance with a rule, and 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.

An Advisory Circular may also include **guidance material (GM)** to facilitate compliance with the rule requirements. Guidance material must not be regarded as an acceptable means of compliance.

Purpose

The purpose of this Advisory Circular is to provide informative comment and **guidance material** for those pilots conducting Single Pilot IFR operations. In covering the wide variation in experience levels within the Single Pilot IFR community from Private Pilot to Airline Transport Pilot licence holders, some of the content of this Advisory Circular may already be known.

Related Rules

This Advisory Circular relates to Civil Aviation Rule Parts 61, 91, 125 and 135.

Change Notice

Revision 2 updates the link to NASA in Appendix B.

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1. Pre-amble

Advisory Circulars are frequently written on the basis of providing an acceptable means of compliance to various rule parts. Where this Advisory Circular differs, is that it addresses the more general requirements of more than one rule part. Additionally, this AC provides an operating philosophy to background some of the reasoning behind various suggested **standard operating procedures** (S.O.P.s) in the Single Pilot IFR environment.

As an operating philosophy does not lend itself to being quantified, much of the content of this document will be in narrative form, with a cross reference to the Civil Aviation Rule Parts 61, 91, 125 and 135 where applicable.

> ***Airmanship — the consistent use of good judgement and well-developed knowledge, skills and attitudes to accomplish flight objectives***
>
> The proposed ICAO definition.

2. Single Pilot IFR (SP IFR) special requirements

While Single Pilot IFR requires great skill, needs focused pilot attention and the ability to cope with high work loads, there are many counterpoints that will help pilots to achieve the highest levels of safety —

- A positive attitude of mind to conduct a flight while striving to observe standards over and above the minimum regulatory requirements
- A good standard of medical fitness
- A high level of demonstrated competency and personal discipline
- High on the pilot’s priority list is his/her refusal to accept any questionable serviceability status of aircraft equipment or avionics
- Observance of standard operating procedures and pre-flight preparation to cater for possible flight plan deviations following equipment failure, changing meteorological conditions, changed operator requirements for an in-flight diversion, or for Air Traffic Control’s changing requirements
- Cockpit equipment e.g. Instrument approach chart holder, torch holder, pencil/pen holders, etc
- Knee board or equivalent
- A sound understanding of Crew Resource Management including knowledge of basic autopilot capabilities and the more advanced sub-modes incorporating autopilot coupling to GPS and/or ILS and VOR
- If using a panel mounted IFR approved GPS a high level of competency is required. Limited knowledge or lack of competency in GPS operations can cause the cockpit workload to escalate. The complexity of programming some GPS units or the editing of flight plans without good technical knowledge can turn GPS usage into a major cockpit distraction rather than being an aid to increased safety.

This list is not exhaustive, but is indicative of some of the requirements necessary to operate safely during single-pilot IFR operations. For example, both Part 125.511 and Part 135.511 require an operating auto-pilot and headset with boom microphone and control wheel Press to Talk (PTT) switch when operating single-pilot IFR. For Part 91 Single Pilot IFR operations there is no such requirement.

It is not considered prudent to fly Single Pilot IFR operations without similar equipment levels as required by Part 125 and Part 135 operations. This is a matter of managing cockpit workload, and being aware of the manner in which it can be reduced. This takes on added importance in areas of high traffic density like Auckland, Wellington and Christchurch..

With effect from 24 November 2005 ICAO has a new requirement for Single-Pilot IFR operations in Annex 6, Chapter 6. This requires a "means of displaying charts that enables them to be readable in all ambient light conditions".

Part 91.221 (b) requires the use of checklists in aircraft above 5,700 kg MCTOW or more than 10 passenger seats. Fewer passenger seats do not reduce the cockpit workload, or prevent a memory lapse. This legal requirement, which was developed from past experience and deemed good operating practice for Part 135 operations, should be adopted in all single-pilot IFR operations regardless of the number of seats.

3. Communications

Not having another crew member to verify clearances, instructions or information from ATC or from other aircraft, and to ensure accurate receipt of all messages and that no assumptions have been made, is of considerable importance. Valuable protection can be gained by taking particular care with your "read back" to all ATC clearances and instructions. If a transmission is interrupted, e.g., talked over, **do not assume** you can fill in the missing parts. Ask the sender to "Say Again." Make certain that you use standard phraseology which has been developed over time to improve clarity of intentions and to minimise the possibility of any misunderstandings. (Refer to Advisory Circular AC91-9 relating to Civil Aviation Rule Parts 91 and 172 regarding communications requirements between pilots and ATS.)

4. Lessons from abroad

From an article published on the internet in AVWEB (See Appendix B - references) American statistics on the accident record for Single Pilot IFR operations is much higher than for Two Pilot IFR operations, whether they be Part 91 or Part 135. This is understandable to some extent, in that there are few Two Pilot IFR Part 91 operations, whereas there are many Single-Pilot IFR Part 91 operations. Many of these Part 91 operations include pilots with limited experience in IFR operations.

Using data gleaned from the NASA Aviation Safety Reporting System (ASRS) reports from the USA, the report identifies the five most common operational problems as —

- Altitude deviations
- Improperly Flown Instrument Approaches
- Heading Deviations
- Position deviations
- Loss of Control

All these bullet points are under the direct control of the pilot. This indicates that positive changes to the manner in which the pilot uses Crew Resource Management (CRM) skills and the adherence to Standard Operating Procedures can have a major impact on flight safety outcomes.

Altitude deviations can be contained if the pilot always makes a point of immediately writing down the new altitudes, setting the altitude alerter or other "aide memoir" before reading back the new assigned altitude to ATC. In this fashion, the pilot is not reading back what he/she thought the controller said, but in fact, has given him/her self protection in that what is read back has been actually written down, entered on the altitude alerter, or entered on the assigned altitude counter.

Improperly Flown Approaches accounted for about 21% of all the reported Single Pilot IFR deviations identified in the Battelle/NASA report. There was, however, no common thread to these deviations. You should make certain that you have a clear awareness of all the intermediate altitudes when flying the Approach Profile.

Think very carefully about making a second instrument approach. It is during these second attempts at an instrument approach that many fatal accidents occur. A timely diversion to the alternate aerodrome may prove to be a safer option than a second approach when conditions are marginal.

Heading deviations accounted for nearly 19 % of reported pilot errors. Nearly 70% of those reported occurred after take-off during the departure phase and 20% during the approach or missed approach. These statistics indicate again the merit of setting the assigned radar heading, and then and only then reading back to ATC the heading set on your HSI or DG. There can be a huge difference between reading back the ATC assigned heading and the heading bug setting. Again, in this manner you will ensure that you are in fact flying the assigned heading and not what you **thought** was said by the controller.

Position Deviations can be simply a case of inaccurate flying, auto-pilot heading hold disengaging or failure to monitor current position and flight path which could be diverging from the required track. It is easy to engage the navigation / approach coupler of the auto-pilot to ease track keeping chores during periods of high workload.

Loss of Control can be insidious. When operating single pilot the autopilot should be engaged whenever a task is required that will disrupt your instrument scan and flight monitoring process. If the aeroplane is properly trimmed and the heading bug is set to the aeroplanes current heading the pilot only needs to select heading hold on the autopilot to perform some short term task. This should provide sufficient control over the machine to allow a short term task to be completed in safety, i.e. copy ATIS information or clearance instructions.

5. Crew Resource Management (CRM)

5.1. CRM is not the sole domain of multi-crew aircraft, and can be applied to single pilot operations to great benefit, providing it is in a form that will withstand logical and searching scrutiny. CRM is as much a mind set as it is a practice. Central to the CRM philosophy in Single Pilot IFR is advance planning as to how certain tasks are to be executed, in what order and making the best of use of crew resources.

5.2. CRM comes in many different forms. Exceeding the minimum legal requirements may enhance flight safety when operating in a Single Pilot IFR environment. For example, an allowable inoperative cabin heater could make it difficult to focus on the primary tasks when your cockpit becomes a cold hostile environment.

5.3. CRM may include recognising the need to ask for external assistance. For example, cabin air flow has blown a dropped Instrument Approach Chart to an inaccessible position under a seat. This would be an occasion to ask for assistance from Air Traffic Control (ATC). In such a situation, you will be given the tracks to be flown, the various profile altitudes to be met and the directions to turn. It is easy to forget that this assistance is available immediately with a "PAN" urgency call to ATC.

5.4. Likewise, calling through a company frequency for engineering assistance may minimise the adverse effects of a system malfunction. In this situation in a multi-pilot crew, it would be of little consequence, but in the Single Pilot IFR situation it could increase the cockpit work load. For example, there may be pressurisation problems which require constant monitoring with each power change. These may be able to be minimised following engineering advice or input.

5.5. Checklists and their use constitute a major part of CRM in the Single Pilot IFR regime. (See Paragraph 6.)

5.6. Consideration should be given to the various emergency scenarios e.g. —

5.6.1. The single-engine performance requirements (rate of climb/drift down) before it happens and

5.6.2. Always plan an escape route should an icing encounter necessitate its use.

5.7. Plan ahead — instrument approach charts for the departure aerodrome should be readily available on takeoff in case an immediate return for landing is required – e.g. a baggage door pops open just after entering cloud, or if a passenger medical emergency arises shortly after take-off.

5.8. GPS use

With increasing numbers of GPS endorsed instrument rated pilots and the increasing use of GPS receivers in Single Pilot IFR operations, these instruments can assist in reducing cockpit work load, while at the same time helping to maintain situation awareness

WARNING: With the lack of integrity and associated non availability of RAIM warnings, the use of handheld GPS receivers in the IFR environment can only give the user a false sense of security. If there is an active applicable RAIM warning, a handheld GPS receiver cannot advise the pilot of the possible degradation of the navigation solution and is the reason handheld GPS receivers are not to be used for navigation on an IFR flight.

5.8.1. Loading your panel mounted TSO'd GPS receiver with a complete flight plan, including the SID, makes the maintenance of situational awareness during the departure phase that much easier while getting "mentally into synch" upon entering IMC with a low cloud base.

5.8.2. Should ATC issue a major change to your IFR clearance just prior to take-off, loading just your Standard Instrument Departure (SID) allows for minimum time to be spent reprogramming your GPS with a full flight plan immediately prior to takeoff.

5.8.3. At the completion of the SID, if you do not have an applicable stored flight plan available in the database, the **Direct -To** function to the first en-route reporting point/waypoint will ensure minimum cockpit workload. In this manner, you can still allow for unhurried time to load the ATC flight plan for your cleared route.

5.8.4. The procedure advocated in **5.8.2** above should not be considered to be Standard Operating Procedure (SOP) but is offered as a possible solution, when the pilot might otherwise have to vacate the runway to edit / re-programme a full GPS flight plan.

NOTE: The availability of GPS for primary means navigation should not preclude the pilot using good airmanship in tuning and identifying the sole means terrestrial navigation aids (VOR and NDB).

5.9. Autopilots

5.9.1. Do not engage the autopilot until comfortably established in the climb and certainly not below 400ft agl. Check the autopilot Flight Manual Supplement for limitations. The 400ft agl suggestion is to ensure an altitude buffer for incorrectly set turn/heading, or altitude commands or for an autopilot malfunction.

5.9.2. When flying Single Pilot IFR, surprises below 400ft agl are best avoided. This is achieved by careful observance of any required pre-takeoff autopilot checks and scrupulous observance of autopilot limitations.

5.9.3. Use an autopilot as much as possible to minimise cockpit workload. It is well proven that keeping the pilot in a monitoring role (rather than a controlling one) makes detection of flight deviations that much easier to accomplish.

5.9.4. Autopilot use allows the pilot to maintain a “global view” of the flight and its progress, instead of the immediate requirements of maintaining control when “hand flying” the aircraft. It is a simple matter to monitor the flight progress when using the autopilot as you complete checklists, get weather, check fuel status, tune navigation aids, confirm electronic database details against hard copy and prepare for an instrument approach, etc.

5.10. One area that has not been formally addressed in New Zealand is clearance shorthand. Once familiarity has been gained using such a system, it minimises the possibility of errors and after some practice, certainly makes it possible to copy long clearances as fast as they are spoken. Many NZ pilots have developed their own style of shorthand. The style recommended by the FAA in their “Instrument Flying Handbook – FAA-H-803-15” (which replaces FAA AC 61-27C) is widely used by many IFR pilots in the USA and offers a formal structure to assist you. This “Clearance Shorthand” is reproduced in Appendix A.

6. Checklists

6.1. Checklists take on added importance in the Single Pilot IFR environment, therefore, it is imperative that they be of good design and function. Some aircraft manufacturers’ checklists appear to have a legal bias rather than an operational one. For Single Pilot IFR, checklist design can often be improved so that it is more operationally relevant.

6.2. Appendix B offers a number of websites to research and consequently assist in the development of checklists which offer maximum benefit. Your new checklists may include using a geographic scan of the cockpit in a left to right flow, vertically, or more than likely a combination of both.

6.3. A review of your current checklists against these research findings and suggestions may encourage you to completely change the design, presentation and usage of your present checklists. Such a review may reduce cockpit workload with an accompanying increase in safety outcomes.

6.4. For Single Pilot IFR operations, the pilot is very reliant on the use of checklists to provide a suitable structure to replace the "Challenge and Response" checklists used in the multi-pilot cockpit. A simplified checklist using a single page laminated in plastic for each distinct check, in a small "lie flat" binder has merit, rather than many different checks on a single page. If the checks are interrupted, a paper clip along the page border may serve as an effective reminder as to where the checklist was interrupted.

6.5. One function of the checklist is to confirm what you have already completed, while in another type of checklist, it may take the form of "read and do". Both types have the same objective. The pre-takeoff checklist is to make certain the aircraft is configured correctly for takeoff and the avionics are tuned and set appropriately for the Standard Instrument Departure (SID) procedure, or for joining the cleared IFR route.

6.6. When making a system or switch selection, **make certain to verify that what you selected and expect to happen does in fact happen.** By failing to check for the correct response to your switch selection, you may inadvertently be configured for a flapless takeoff or landing. For example, the circuit breaker may have "tripped" when making a flap selection.

6.7. Know the system and failure indications so that you can identify the correct emergency solution/action. i.e. The real problem and the correct phase 1 actions.

6.8. For Single–pilot IFR operations, it is also important to develop useful trigger points at which to initiate the various checks. Pre-start is simple, but at what stage of the flight should the approach checklist be commenced. Similarly, where should the pre-landing checklist be commenced or completed?

6.9. The use and construction of checklists should ensure that a go-around is not the forerunner to a "wheels up landing"!

This can and has occurred following a go-around when the content of the checklist and the position at which the pre-landing checklist is executed does not cater for such a situation.

6.10. Develop a routine which is used on short final to confirm: - wheels – flaps – propellers and mixture set.

6.11. Convenient stowage and ready access to your checklists is paramount in Single Pilot IFR operations.

6.12. When developing the various checklists, bear in mind that emergency or abnormal checklists frequently contain phase one and phase two items with the phase one being executed from memory. Phase two items may be read and do, or if items are already completed, the checklist is used to verify that each item has been actioned /completed. (refer to Appendix B)

6.13. The form of any emergency or abnormal checklist may also be laid out in such a manner that one checklist covers both the abnormal and normal situation. For example, you may wish to develop a checklist for an in-flight emergency that also incorporates the descent and approach checklist plus the pre-landing checklist. This precludes having to use two different checklists in a high workload situation following an abnormal situation that has occurred in-flight.

7. Outline of a typical flight operating sequence for Single pilot IFR

The possible different segments may be as follows:

- Notification that a flight is required
- Initiation of the pre-flight planning
- Pre-flight
- Start
- Taxi
- Take-off
- Departure – SID
- Climb
- Transition (passing 13,000 feet)
- Top of climb
- Cruise — 15 minute checks
- Approach and descent review (ATIS, STAR, Instrument Approach and Missed approach)
- Transition (passing FL 150)
- Pre-landing
- Short final
- After landing
- Shutdown and Flight review

8. The Various Tasks — an individual breakdown of the pre-flight detail

8.1. The decision to make a flight

It is at this point the decision making process commences for the demanding role of Single Pilot IFR —

- Am I medically fit to undertake this proposed flight?
- When taking non-prescription medicines, keep in mind that there is no co-pilot to take over if required. Do you know about the adverse side effects of your non-prescription medication?
- Am I well rested or am I suffering from fatigue?
- Am I current for the planned flights in all respects eg, Instrument approach aids or night operations?

8.2. Initiation of the Pre-Flight Planning Process.

8.2.1. Operational considerations

This is where those experienced in Single Pilot IFR operations have developed their personal template for the flight planning process. If you haven't one, today would be an excellent time to start its development.

The philosophy for the pilot operating by him/herself can be stated in a number of ways, but all have a similar theme. For example:

- Add something for contingencies
- Always leave yourself an escape route
- Select destination alternates for weather diversions and mentally plan alternates for technical diversions to an engineering facility for system rectification, should for example, the flap system require servicing before the next leg.
- Always forward plan —**act rather than react**. Forward planning is paramount. It is much more difficult having to catch-up than to keep completely abreast of the situation in the first place.

The thought processes you want to establish are ones that will maintain their validity in all pre-flight situations. The order of reviewing weather forecasts, NOTAMS or the aircraft serviceability status doesn't really matter as all three could interact with one another. An alternate may be required due to weather, but if the proposed aerodrome is not available due to surface conditions (NOTAM) then the flight plan requires changing.

8.2.2. Commercial considerations

In addition to the operational problems there is the question of commercial considerations which can, and frequently do, impinge on the flight planning process. If, for example, a diversion aerodrome is required because fog is forecast at the destination, will it be one that has taxis or buses available for the passengers? If landing at this diversionary aerodrome with an aircraft defect, will the aircraft be grounded until such time as engineering support arrives from elsewhere, or do you have the option of diverting to an aerodrome with engineering and passenger support available?

The decisions are not always black and white. There is also the matter of payload versus desired fuel load. What options are available? Off-load freight and/or baggage, make a technical stop en-route for a fuel up-lift, or perhaps delay the flight for the new amended forecast when fog is no longer an issue, and the alternate aerodrome is no longer required?

8.2.3.Basic Single Pilot IFR Philosophy

You can see that the success of Single-pilot IFR has a very strong element of contingency planning. It is only by maintaining this on-going philosophy of forward planning that a single-pilot can maintain the highest level of potential safety.

8.3. Pre-flight

8.3.1. The preparation of the flight plan with all its contingency provisions is a very important activity. In generating your flight plan, there are no special operating requirements vis-à-vis single-pilot IFR versus multi-crew operations once the points raised in **8.2 Initiation of the pre-flight planning process** have been addressed.

8.3.2. In Single-pilot IFR operations there is one major area of difference. That is between what is legal and what is allowable under the Minimum Equipment List (MEL), and its relationship to minimising cockpit workload. The latter is of over-riding importance.

8.3.3. Single Pilot IFR operations frequently produce very high workload situations. Thorough **pre-flight planning** is essential if the pilot is to be properly prepared. This requires a thorough study of the entire route structure, SIDs, Lowest Safe Altitudes, STARS, Notams, weather, alternate aerodromes, and all possible instrument approaches and suitable diversion aerodromes along route, fuel requirements and, of course, a thorough knowledge of his aircraft and systems. The art of successful Single Pilot IFR is a well organised cockpit, maintaining situational awareness at all times and to "always be prepared".

8.3.4. Included in this mental preparation is consideration for the engine failure case. Standard Instrument Departures (SIDs) require "The pilot to consider the one engine inoperative climb performance of the aircraft in relation to the height of terrain over which the flight is planned." AIP New Zealand Volume 1, page ENR 1.5 **-** 2 **IFR Departure Procedures** Para 2.1.2**.**

8.3.5. Keep in mind Volume 1, page ENR 1.5 **-** 7 **Published Instrument departure Procedures** Para 2.2.4 "All instrument departure procedures, designed to PANS-OPS II criteria, portray the minimum net climb gradient required to achieve the designed obstacle clearance margins for the tracks shown, **originating from a point 16 feet above the departure end of the runway."** For example when departing into a low cloud base or when flying a SID, there may not be a lot of leeway in terms of terrain clearance should you experience an engine failure soon after entering cloud.

8.4. Cockpit preparation

8.4.1. Preparation of the cockpit takes on added importance for Single Pilot IFR as there is a definite requirement to have a place for everything and everything in its place.

There are three different requirements to be met –

- Support for cockpit activities
- Support for flight navigation requirements
- Support for passenger demands

The bullet points above are entirely under the control of the pilot.

8.5. Support for cockpit activities

8.5.1. Using your hand held microphone and the loud speaker prior to starting when requesting the initial IFR start clearance confirms that you have microphone and headset reception redundancy.

8.5.2. With any dual installation of Nav/Com and/or inverters use the Number 1 unit when flying odd altitudes and the Number 2 unit for even altitudes. This helps even out avionic equipment use.

8.5.3. CRM and its associated cockpit discipline demands that the pilot has spare pens and pencils, spare microphone, spare torch batteries, spare ANR headset batteries, spare batteries or battery packs for any other battery powered equipment carried and the pilot knows where to locate them blind folded. In other words which side wall pocket, or behind which seat back. In operations where more than one pilot may be flying an aircraft, the operator should establish by agreement amongst the pilot group, an acceptable standard cockpit configuration. Should there be more than one pilot this cockpit configuration should apply for all pilots flying this particular aircraft.

8.5.4. Have available some Post-It® pages so that any distraction caused by a failed indicator can be covered over with a Post-It® note. There is nothing more conducive to getting “the leans” than having to include a “toppled” artificial horizon in one’s instrument scan. Make sure a Post-It® page or equivalent is readily accessible if ever required.

8.5.5. An essential item of equipment is a well lit chart holder eg attached to the control wheel.

8.6. Support for flight navigation requirements

8.6.1. A flight computer (E6B) readily available for solution of time, speed and distance or wind velocity problems as required.

8.6.2. As part of your SOP there is a requirement to develop a system to handle your entire portfolio of instrument charts — SIDs, area charts, enroute charts, STARs and instrument approach charts.

8.6.3. This may be limited to having readily available, prior to take-off, the appropriate charts should an immediate return to the departure aerodrome be required. For really short stage lengths, there could well be the additional requirement to have the destination area chart and instrument approach charts to hand before take-off. As part of your contingency planning, charts for your diversion to an alternate aerodrome should also be readily available.

8.6.4. The cockpit preparation relating to maps and charts for easy retrieval may involve using Post-It® flags, or equivalent, for destination and alternates to bookmark your AIP. (This could include topographical charts. These may be required following loss of communications, or a transponder failure with ATC unable to accommodate you into the ATS system, and then encountering VMC, when reversion to VFR is required).

8.7. Support for passenger demands

8.7.1. It is a pilot responsibility to ensure tarmac safety standards are maintained by supervising passengers while embarking and disembarking from the aircraft.

8.7.2. Should the task not be assigned elsewhere control of your baggage and freight, to and from the tarmac and on and off the aircraft is also a pilot responsibility.

8.7.3. You must inform passengers when you require a sterile cockpit environment when no conversation should to be addressed to the pilot.

8.7.4. One small item which can have a major impact on flight safety is the ready availability of sick bags for a front seat passenger. As can be imagined a vomiting passenger without a sick bag, seated alongside the pilot during an instrument approach to minimums will be a significant distraction. Think carefully who you wish to occupy the front passenger seat.

8.7.5. Keep passengers informed about flight progress and expected weather conditions. In this manner, a pilot can minimise questions with their associated distractions at inopportune times. You should explain, when it occurs, that the disconcerting noise is from ice being shed by the propellers.

8.7.6. Keep in mind possible interference with controls if seating a nervous passenger in the front passenger seat, as they may reach for the flight controls for support on encountering unexpected turbulence. The passenger briefing should cover the fact that no touching of pedals or controls by the passengers is allowed.

9. Pre take-off

9.1. Pre start

Consideration should be given to the sequence you wish to adopt. Starting with external power or on aircraft batteries, may influence your pre-start sequence — copy ATIS, call for the IFR start clearance (using the hand microphone and speaker for audio) and receive ATC clearance after start complete, or to receive the ATC clearance prior to engine start, then configure the avionics to match the SID requirements prior to engine/s start.

9.2. After Start and pre taxi

This is more a matter of ensuring the safe and correct aircraft configuration for departure and that you are properly self-briefed to fly the departure procedure.

The aircraft configuration is considered a critical item, and in a similar manner so are the command inputs for the flight guidance system (autopilot) and the tuning and identifying of the navigation aids.

9.3. Night operations

During night operations (depending on the aircraft external lights switch configuration) it is prudent to use your white strobes only when crossing or occupying the active runway. It is not considered good airmanship to use strobe lights on the tarmac, with the real possibility of temporary vision impairment to others. When on a parallel taxiway, should you wish to turn off your taxi light when facing landing aircraft — **STOP**. With only one pilot monitoring both inside and outside the cockpit, don't risk the possibility of taking-off with unseen/unknown aircraft damage from picking up, or running over, unseen foreign objects while taxing blind. (Blowing plastic bags, stray animals or marker cones that have fallen from a maintenance truck).

10. Take-off until descent

10.1. Take-off, climb, top of climb, cruise and the various techniques involved along with the associated checklists are no different for a single pilot operation.

10.2. In a two pilot crew it is standard to call 1,000, 300 and 100 feet prior to assigned altitude/Flight Levels, MDA or DA when climbing or descending. This is a good habit for SP IFR operations.

10.3. Preparation for descent, approach and landing in single pilot operations does take on added significance due to lack of monitoring available without a second pilot.

11. Descent and Approach preparation

11.1. This flight segment requires firm resolve as to philosophies to be adopted and the standard operating procedures (SOPs) employed. Less than 5% of total flight time is spent on an instrument approach, but 85% of all fatal aircraft accidents occur during this phase of flight.

11.2. In light of the preceding paragraph, you as the pilot in command, make certain that crew resource management remains under your control. This means joining the holding pattern if you, as pilot in command require more time for your approach preparation or self briefing. It also means not accepting an ATC request for short turn on to the ILS final approach should you feel that such a request would add unnecessarily to your cockpit workload. This may compromise a stabilised approach which, in turn, could impinge on the ultimately safety of the flight.

11.3. Having a basic operating philosophy of planning for a missed approach and a diversion on every instrument approach, rather than thinking in terms of landing off the instrument approach and only diverting if you can't land is good CRM. This subtle change of emphasis from planning on landing, to planning for a missed approach, will go a long way to assist the single pilot in not infringing instrument approach minima. Landing off all approaches will only be considered if one of the requirements of **Part 91.413 (c) Operation below DA, DH, or MDA** is met. Buffers are included in the design of precision approaches to allow for the flight path transition at Decision Altitude/Height (DA/DH) into the missed approach flight profile. **There is no such design buffer in the design of non precision approaches**.

11.4. Circling approaches are acknowledged as being very demanding of pilot skill and knowledge and should be treated with caution. If there is an option, pilots should avoid doing right hand circling approaches where maintaining situational awareness is more difficult in marginal conditions with the possibility that the runway can disappear from view during the right base turn.

11.5. Pilots need to be aware of the necessity for remaining within the visual circling area, which for Category A aircraft encompasses that area within a radius 1.68 NM of the threshold and 2.66 NM radius of the threshold for Category B aircraft. Within this circling area, the obstacle clearance may be as low as 295 feet (90 metres). Refer to Appendix C **PANS OPS Doc 8168** Chapter 8 Visual Manoeuvring (Circling) Area.

11.6. The Minimum Descent Altitude (MDA) is inviolate, unless "the aircraft is continuously in a position from which a descent to a landing on the intended runway can be made at a normal rate of descent, using normal manoeuvres that will allow touchdown to occur within the touchdown zone of the runway of intended landing." **Part 91.413 (c) (1).**

11.7. Personal Briefing for the Approach

11.7.1. An overview of the destination STARS and approaches will be part of the pre-flight preparation.

11.7.2. Before commencing any approach procedure, the pilot will have established a divert time or fuel remaining/fuel required, for the diversion to an alternate aerodrome and annotated the time/fuel figure for ready reference on his/her flight plan.

11.7.3. The aim is an unhurried execution of your personal briefing and the checklists used. Dependant upon the groundspeed, you should plan on either having completed the briefing at top of descent or at least by 30 nm from destination. Bear in mind that at 180 knots groundspeed it is only 10 minutes from destination, or 15 minutes at 120 knots groundspeed. Detailed briefing for your approach can take a variety of forms, as there are many different acronyms in use. For example, physical flow patterns like moving the hand down the avionics stack, across the engine gauges, and finally to switches and engine controls. Some pilots use the Instrument Approach chart itself as an approach checklist to configure the avionics frequencies and to ascertain the courses to be used for the approach and missed approach.

11.7.4. It doesn't really matter which system you use. What does matter is that you have a system that satisfies your requirements for your self brief.

12. Post flight review

At this point a full review of the flight is undertaken to ensure that there are no discrepancies, unserviceability, or concerns relating to the aircraft and its equipment that should be reported in the aircraft Technical Log.

The success of Single Pilot IFR operations relies heavily on having a fully serviceable aircraft and equipment. This can only be achieved with diligent and full reporting of any discrepancies to engineering and maintenance staff.

13. Summary

It is a statement of the obvious, that in Single Pilot IFR operations it is the pilot who determines what level of safety will be achieved on any particular flight.

This Advisory Circular has offered a variety of scenarios, a variety of solutions, and an operating philosophy that is appropriate to Single Pilot IFR in the hope that these will assist in maintaining the best operating practices. If there is one overriding message, it is —

"the greatest contribution to flight safety in the Single Pilot IFR environment is achieved before the aircraft leaves the ground — pre-flight preparation"

Appendix A Clearance Shorthand

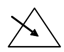
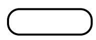
The shorthand system given here is that recommended by the Federal Aviation Administration. It has been edited to better reflect the New Zealand ATC environment. The full text is on FAA the website. (Instrument Flying Handbook FAA- H-8083-15. This document supersedes the 1980 FAA AC 61-27C Instrument Flying Handbook.)

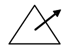
No shorthand system is required by regulation and no knowledge of shorthand is required for the written test; however, because of the vital necessity for safe co-ordination between the pilot and controller, clearance information should be unmistakably clear.

The following symbols and contractions represent words and phrases frequently used in clearances.

By using this shorthand, omitting the parenthetical words, you will be able, after some practice, to copy long clearances as fast as they are read.

WORDS AND PHRASES	SHORT HAND
ABOVE	ABV
ABOVE (ALTITUDE--HUNDREDS OF FEET)	$\underline{70}$
ADVISE	ADV
AFTER (PASSING)	<
AIRWAY (DESIGNATION)	V26
AIRPORT	A
ALTERNATE INSTRUCTIONS	( )
ALTITUDE 6, OOO—17, OOO	60-170
AND	&
APPROACH	AP
APPROACH CONTROL	APC
AT	@
(ATC) ADVISES	CA
(ATC) CLEARS OR CLEARED	C
(ATC) REQUESTS	CR
BACK COURSE	BC
BEARING	BR
BEFORE (REACHING PASSING)	>
BELOW	BLO
BELOW (ALTITUDE--HUNDREDS OF FEET)	$\overline{70}$
CENTER	CTR
CLEARED AS FILED	CAF
CLEARED TO LAND	L

CLIMB TO (ALTITUDE--HUNDREDS OF FEET)	↑170
CONTACT	CT
COURSE	CRS
CROSS	X
CRUISE	→
DELAY INDEFINITE	DLI
DEPART	DP
DEPARTURE CONTROL	DPC
DESCEND TO (ALTITUDE--HUNDREDS OF FEET)	↓70
DIRECT	DR
DIRECTION (BOUND)	
EASTBOUND	EB
WESTBOUND	WB
NORTHBOUND	NB
SOUTHBOUND	SB
INBOUND	IB
OUTBOUND	OB
DME FIX (MILE)	
EACH	EA
ENTER CONTROL AREA	
ESTIMATED TIME OF ARRIVAL	ETA
EXPECT	EX
EXPECT APPROACH CLEARANCE	EAC
EXPECT FURTHER CLEARANCE	EFC
FAN MARKER	FM
FINAL	F
FLIGHT LEVEL	FL
FLIGHT PLANNED ROUTE	FPR
FOR FURTHER CLEARANCE	FFC
FOR FURTHER HEADNGS	FFH
FROM	FM
HEADING	HDG
HOLD (DIRECTION)	H-W
HOLDING PATTERN	

ILS APPROACH	ILS
INITIAL APPROACH	I
JOIN OR INTERCEPT AIRWAY/JET ROUTE/TRACK OR COURSE	≥
LEFT TURN AFTER TAKEOFF	
MAINTAIN OR MAGNETIC	M
MIDDLE MARKER	MM
NON-DIRECTI ONAL BEACON APPROACH	NDB
OUT OF (LEAVE) CONTROL AREA	
OUTER MARKER	OM
OVER STATION (e.g. Christchurch)	OCH
ON COURSE	OC
PROCEDURE TURN	PT
RADAR VECTOR	RV
RADIAL (080^{0} RADIAL)	080R
REMAIN WELL TO LEFT SIDE	LS
REMAIN WELL TO RIGHT SIDE	RS
REPORT CROSSING	RX
REPORT DEPARTING	RD
REPORT LEAVING	RL
REPORT ON COURSE	R-CRS
REPORT OVER	RO
REPORT PASSING	RP
REPORT REACHING	RR
REPORT STARTING PROCEDURE TURN	RSPT
REPORTING POINTING	REP
REVERSE COURSE	RC
RIGHT TURN AFTER TAKEOFF	
ROUTE DESIGNATOR	V345/H123
RUNWAY (NUMBER)	RY18
SQUAWK	SQ
STANDBY- STBY	STBY
STRAIGHT-IN APPROACH	SI
SURVEILLANCE RADAR APPROACH	ASR

TAKEOFF (DIRECTION)	**T→N**
TOWER	Z
UNTIL	U
UNTIL ADVISED (BY)	UA
UNTIL FURTHER ADVISED	UFA
VIA	VIA
VISUAL APPROACH	VA
VOR	⊙
VORTAC	Ⓣ
WHILE IN CONTROL AREA	△

EXAMPLE

An example of a clearance written in shorthand:

(Zulu Kilo Mike) CAF M RY HDG RV H105 SQ 0700 DPC 120.4

Translated it reads: (Aircraft registration), cleared as filed, maintain runway heading for radar vector to HOTEL 105, squawk 0700 just before departure, departure control frequency--120.4.

Appendix B References & source documents

- FAA/Industry Training Standards (FITS) Personal and Weather Risk Assessment Guide — http://www.faa.gov/education_research/training/fits/guidance/media/Pers%20Wx%20Risk%20Assessment%20Guide-V1.0.pdf
- Personal Minimums Checklist - this can be printed out as a double sided list for the shirt pocket or flight satchel — http://www.faa.gov/education_research/training/fits/guidance/media/personal%20minimums%20checklist.pdf
- Flight Safety Foundation for checklist material in the FSF Accident Prevention Bulletin May 1991 and the FSF Flight Safety Digest May 1995. http://www.flightsafety.org/home.html
- NASA and their research on Checklist: Concepts, Design and Use: http://ase.arc.nasa.gov/people/asaf/pdd/pdf/Human%20Factors%20of%20Flight-Deck%20Checklists.pdf
- Battelle/NASA report as précised on the AvWeb website at http://www.avweb.com/cgi-bin/udt/im.display.printable?client.id=avweb&story.id=183181
- AOPA Safety reports and publications available to the public at http://www.aopa.org/asf/publications/
- AOPA Safety Advisor "Single Pilot IFR"
- "IFR – A Structured Approach" by John C. Eckalbar published by Sky Road Projects
- "IFR Risk Management", by Richard L. Collins on DVD — Sporty's Pilot Shop
- "Instrument Flying Tips", by Richard L. Collins on DVD — Sporty's Pilot Shop

Appendix C PANS OPS Doc 8168 Chapter 8 Visual Manoeuvring (Circling) Area.

Chapter 8
VISUAL MANOEUVRING (CIRCLING) AREA

8.1 GENERAL

8.1.1 Visual manoeuvring (circling) is the term used to describe the visual phase of flight after completing an instrument approach, to bring an aircraft into position for landing on a runway which is not suitably located for straight-in approach.

8.1.2 The visual manoeuvring (circling) area is the area in which obstacle clearance shall be considered for aircraft manoeuvring visually (circling).

8.1.3 This chapter does not apply to Category H. When flying an instrument approach where the landing axis does not permit a straight-in approach, the helicopter has to conduct a visual manoeuvre in adequate meteorological conditions to see and avoid obstacles in the vicinity of the FATO. When the instrument approach procedure is followed by visual manoeuvring, the OCA/H shall not be less than 75 m (246 ft).

8.2 ALIGNMENT AND AREA

8.2.1 The size of the visual manoeuvring (circling) area varies with the category of the aircraft. To define the limits of the area for the appropriate category, draw an arc from the centre of the threshold of each usable runway, using the appropriate radius according to the examples in Tables III-8-1 and III-8-2. From the extremities of the adjacent arcs lines are drawn tangent to the arcs. The area thus enclosed is the visual manoeuvring (circling) area. See Figures III-8-1 and III-8-2. Note that in Figure III-8-1, the radius for Category E aircraft is used. An operational advantage is realized by not casting an arc from the two runways not usable by Category E aircraft. In Figure III-8-2 all runways are used because they are available to Category A aircraft. However, since the radius for Category A is less than that for Category E the total area for all aircraft is slightly smaller than it would be if Category E criteria were applied completely.

8.2.2 *Parameters.* The parameters on which visual manoeuvring (circling) radii are based are as follows:

a) *speed:* speed for each category as shown in Tables III-1-1 and III-1-2;

b) *wind*: ± 46 km/h (25 kt) throughout the turn; and

c) *bank*: 20° average achieved or the bank angle producing a turn rate of 3° per second, whichever is the lesser bank. (See Figures IV-A-2 and IV-A-3 in Attachment A to Part IV.)

8.2.3 *Determination method.* The radius is determined using the formulae in Attachment E to Part III by applying a 46 km/h (25 kt) wind to the true airspeed for each category of aircraft using the visual manoeuvring IAS from Tables III-1-1 and III-1-2. The TAS is based on:

— altitude: aerodrome elevation + 300 m (1 000 ft)

— temperature: ISA + 15°

8.2.4 *Visibility and lowest OCA/H.* It is assumed that the minimum visibility available to the pilot at the lowest OCA/H will be as shown in Table III-8-3. This information is not required for the development of the procedure, but it is included as information which would be of interest to the procedure planning specialist and should not be construed as operating minima.

8.3 OBSTACLE CLEARANCE

See 6.3.4 and Table III-8-3.

8.4 VISUAL MANOEUVRING (CIRCLING) AREA NOT CONSIDERED FOR OBSTACLE CLEARANCE

8.4.1 It is permissible to eliminate from consideration a particular sector where a prominent obstacle exists in the visual manoeuvring (circling) area outside the final approach and missed approach areas. This sector, within the circling

Table III-8-l. Example of determining radii for visual manoeuvring (circling) area for aerodromes at 300 m MSL (SI-units)

Category of aircraft/IAS (km/h)	*A/185*	*B/250*	*C/335*	*D/380*	*E/445*
TAS at 600 m MSL + 46 km/h wind factor (km/h)	241	310	404	448	516
Radius (r) of turn (km)	1.28	2.08	3.46	4.34	5.76
Straight segment (km)	0.56	0.74	0.93	1.11	1.30
Radius ($\bar{R}$) from threshold (km)	3.12	4.90	7.85	9.79	12.82

Table III-8-2. Example of determining radii for visual manoeuvring (circling) area for aerodromes at 1 000 ft MSL (non-SI units)

Category of aircraft/IAS (kt)	*A/100*	*B/135*	*C/180*	*D/205*	*E/240*
TAS at 2 000 ft MSL + 25 kt wind factor (kt)	131	168	215	242	279
Radius (r) of turn (NM)	0.69	1.13	1.85	2.34	3.12
Straight segment (NM) (this is a constant value)	0.30	0.40	0.50	0.60	0.70
Radius ($\bar{R}$) from threshold (NM)	1.68	2.66	4.20	5.28	6.94

Note.— Radius from threshold ($\bar{R}$) = 2r + straight segment.

Table III-8-3. OCA/H for visual manoeuvring (circling) approach

Aircraft category	*Obstacle clearance m (ft)*	*Lowest OCH above aerodrome elevation m (ft)*	*Minimum visibility km (NM)*
A	90 (295)	120 (394)	1.9 (1.0)
B	90 (295)	150 (492)	2.8 (1.5)
C	120 (394)	180 (591)	3.7 (2.0)
D	120 (394)	210 (689)	4.6 (2.5)
E	150 (492)	240 (787)	6.5 (3.5)

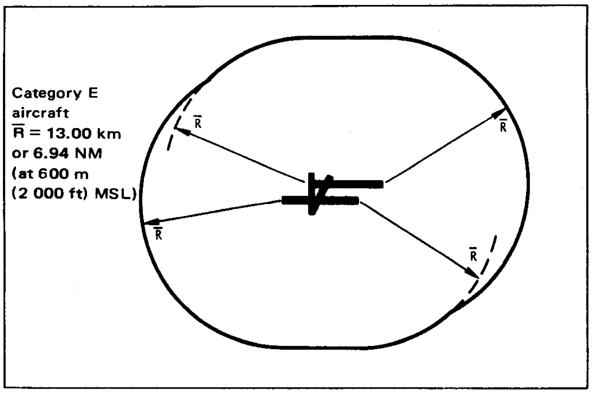


Figure III-8-1. Construction of visual manoeuvring (circling) area

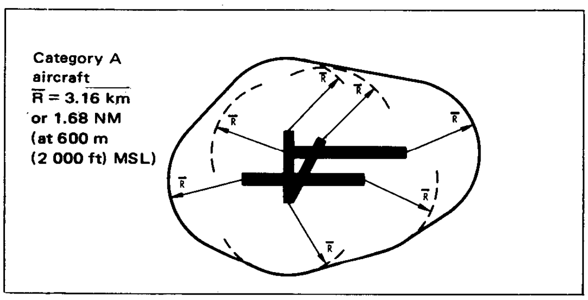


Figure III-8-2. Visual manoeuvring (circling) area

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area, is bounded by the dimensions of the Annex 14 instrument approach surfaces. (See Figure III-8-3.)

8.4.2 When this option is exercised, the published procedure must prohibit the pilot from circling within the total sector where the obstacle exists. (See Figure III-8-4.)

8.5 MISSED APPROACH ASSOCIATED WITH THE VISUAL MANOEUVRE

A missed approach area specific to the visual manoeuvre is not constructed.

8.6 PROMULGATION

The general criteria in Section 1.19 *Promulgation* apply. The instrument approach chart for a visual manoeuvre shall be identified by the navigation aid type used for final approach lateral guidance, followed by a single letter suffix, starting with the letter A. The suffix letter shall not be used again for any procedures at that airport, at any other airport serving the same city or at any other airport in the same State, serving a city with the same name. The OCA/H values for the procedure shall be the OCA/H for approach or missed approach, whichever is greater and shall be published in accordance with Part III, Chapter 6, 6.4.2 and 6.4.4.

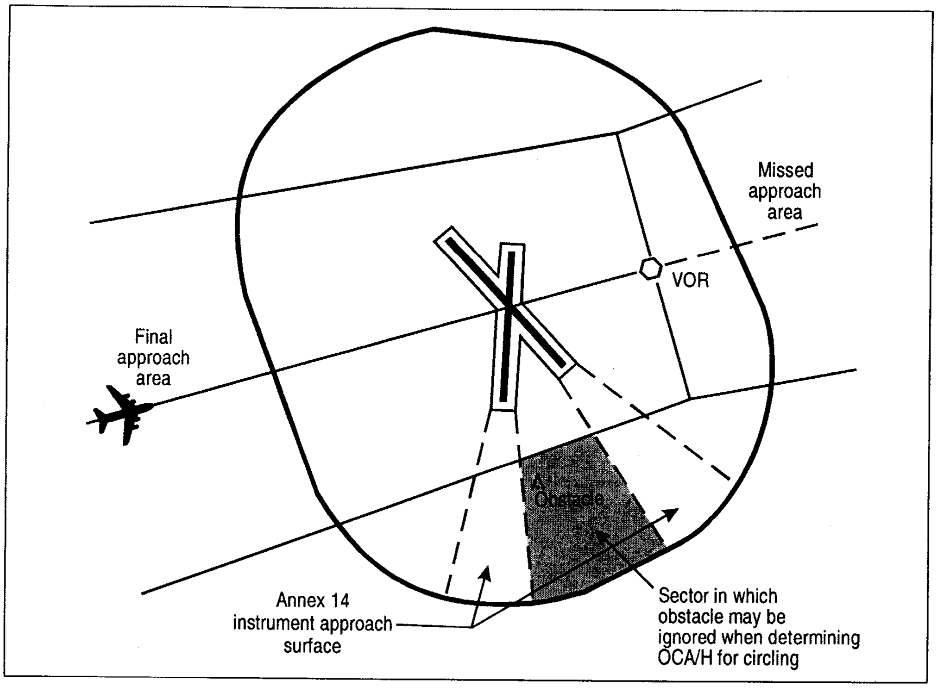

Figure III-8-3. Visual manoeuvring (circling) area — obstacle clearance

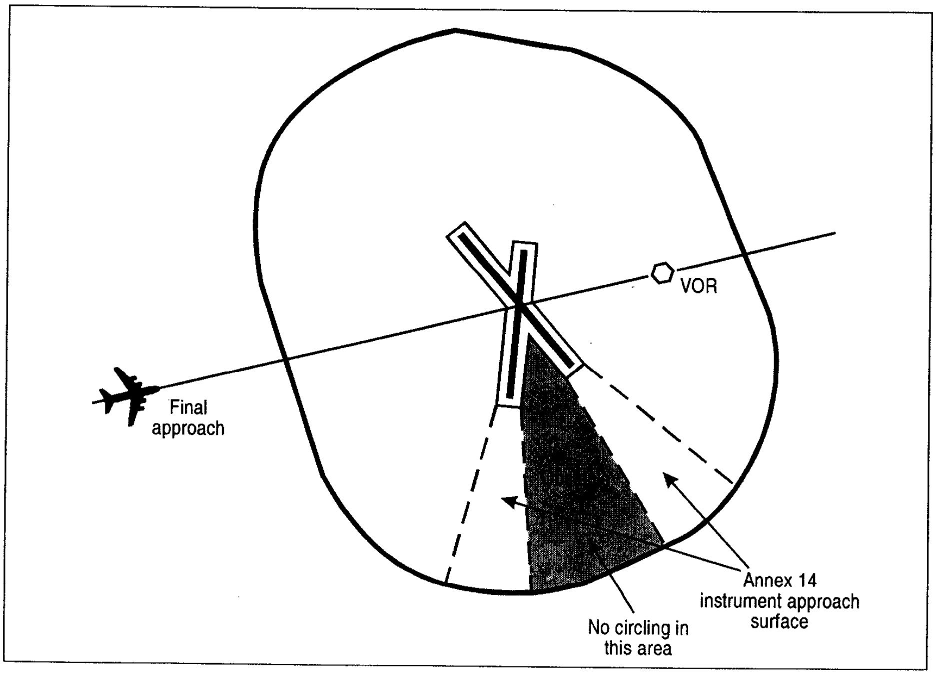

Figure III-8-4. Visual manoeuvring (circling) area — prohibition on circling