

Factual Report – Attachment 19
FAA Circle Approach Guidance

OPERATIONAL FACTORS

CEN17MA183

Instrument Procedures Handbook (FAA-H-8083-16A)

This handbook is a technical reference for all pilots who operate under instrument flight rules (IFR) in the NAS. There are numerous references to circling procedures throughout the guidance material in this handbook. The two most extensive discussions are on Aircraft Approach Categories and Circling-Only Procedures. Below is the information from the IPH referencing Aircraft Approach Categories and circling. It is not inclusive of all references to circling in the IPH.

IPH, pg. 4-8- 4-9

“Circling approaches are one of the most challenging flight maneuvers conducted in the NAS, especially for pilots of CAT C and CAT D turbine-powered, transport category airplanes. These maneuvers are conducted at low altitude, day and night, and often with precipitation present affecting visibility, depth perception, and the ability to adequately assess the descent profile to the landing runway. Most often, circling approaches are conducted to runways without the benefit of electronic navigation aids to support the descent from the Circling Minimums Decision Altitude (CMDA) to the runway.

Circling approaches conducted at faster-than-normal, straight-in approach speeds also require a pilot to consider the larger circling approach area, since published circling minimums provide obstacle clearance only within the appropriate area of protection and is based on the approach category speed. [Figure 4-2] The circling approach area is the obstacle clearance area for airplanes maneuvering to land on a runway that does not meet the criteria for a straight- in approach. The size of the circling area varies with the approach category of the airplane, as shown in Figure 4-2.

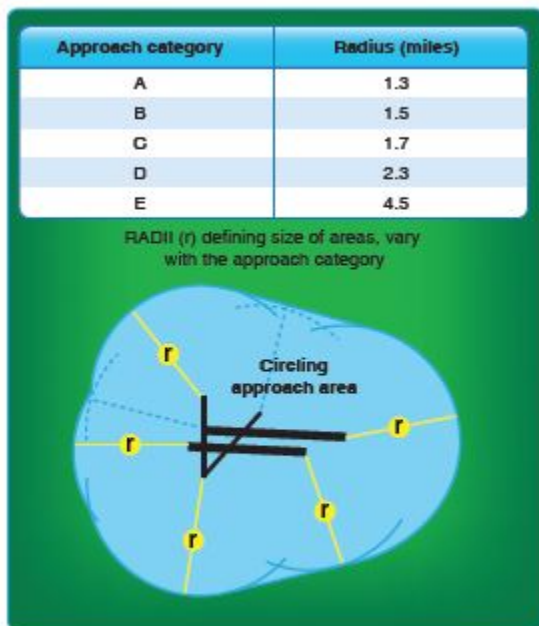


Figure 4-2. Construction of circling approach area.

A minimum of 300 feet of obstacle clearance is provided in the circling segment. Pilots should remain at or above the circling altitude until the airplane is continuously in a position from which a descent to a

As can be seen from the example, the first approach of this type created at the airport is labeled with the letter A, and the lettering continues in alphabetical order. Typically, circling only approaches are designed for one of the following reasons:

- The final approach course alignment with the runway centerline exceeds 30°.
- The descent gradient is greater than 400 feet per nautical mile (FPNM) from the FAF to the threshold crossing height (TCH). When this maximum gradient is exceeded, the circling only approach procedure may be designed to meet the gradient criteria limits. This does not preclude a straight-in landing if a normal descent and landing can be made in accordance with the applicable CFRs.
- A runway is not clearly defined on the airfield.

Instrument Flying Handbook (FAA-H-8083-15B)

This Instrument Flying Handbook is designed for use by instrument flight instructors and pilots preparing for instrument rating tests. There are numerous references to circling throughout this guidance material. Below are the guidance for circling approach patterns, circling approaches and missed approach during a circling approach. This is not inclusive of all of the circling guidance material in the IFH.

IFH, pg. 7-32

Circling Approach Patterns

Pattern I

1. At A, start timing for 2 minutes from A to B; reduce airspeed to approach speed. [Figure 7-45]
2. At B, make a standard rate turn to the left for 45°.
3. At the completion of the turn, time for 45 seconds to C.
4. At C, turn to the original heading; fly 1 minute to D, lowering the landing gear and flaps.
5. At D, turn right 180°, rolling-out at E on the reciprocal of the entry heading.
6. At E, enter a 500 fpm rate descent. At the end of a 500 foot descent, enter a straight constant-airspeed climb, retracting gear and flaps.

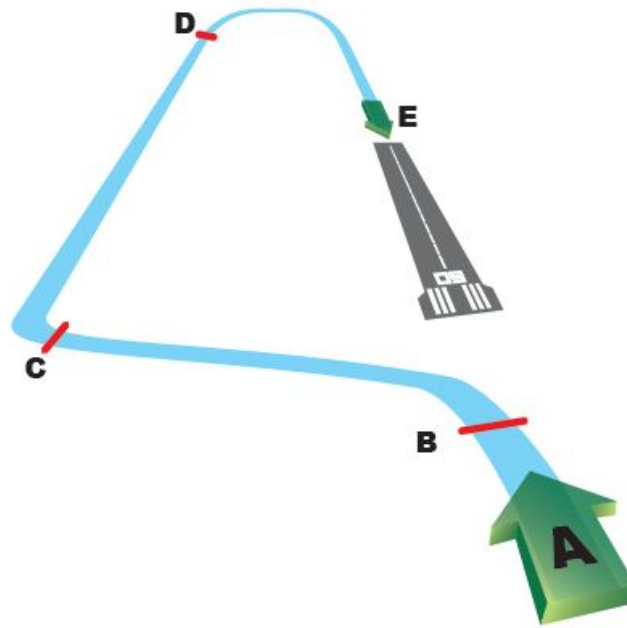


Figure 7-45. *Circling approach pattern I (imaginary runway).*

Pattern II

Steps:

1. At A, start timing for 2 minutes from A to B; reduce airspeed to approach speed. *[Figure 7-46]*
2. At B, make a standard rate turn to the left for 45° .
3. At the completion of the turn, time for 1 minute to C.
4. At C, turn right for 180° to D; fly for 1-1/2 minutes to E, lowering the landing gear and flaps.
5. At E, turn right for 180°, rolling-out at F.
6. At F, enter a 500 fpm rate descent. At the end of a 500 foot descent, enter a straight constant-airspeed climb, retracting gear and flaps.

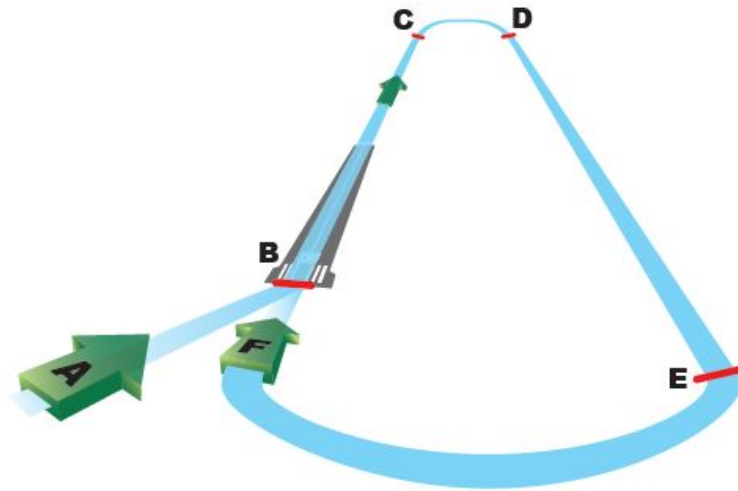


Figure 7-46. *Circling approach pattern II (imaginary runway).*

IFH, pg. 10-20

Circling Approaches

Landing minimums listed on the approach chart under "CIRCLING" apply when it is necessary to circle the airport, maneuver for landing, or when no straight-in minimums are specified on the approach chart. [Figure 10-11]

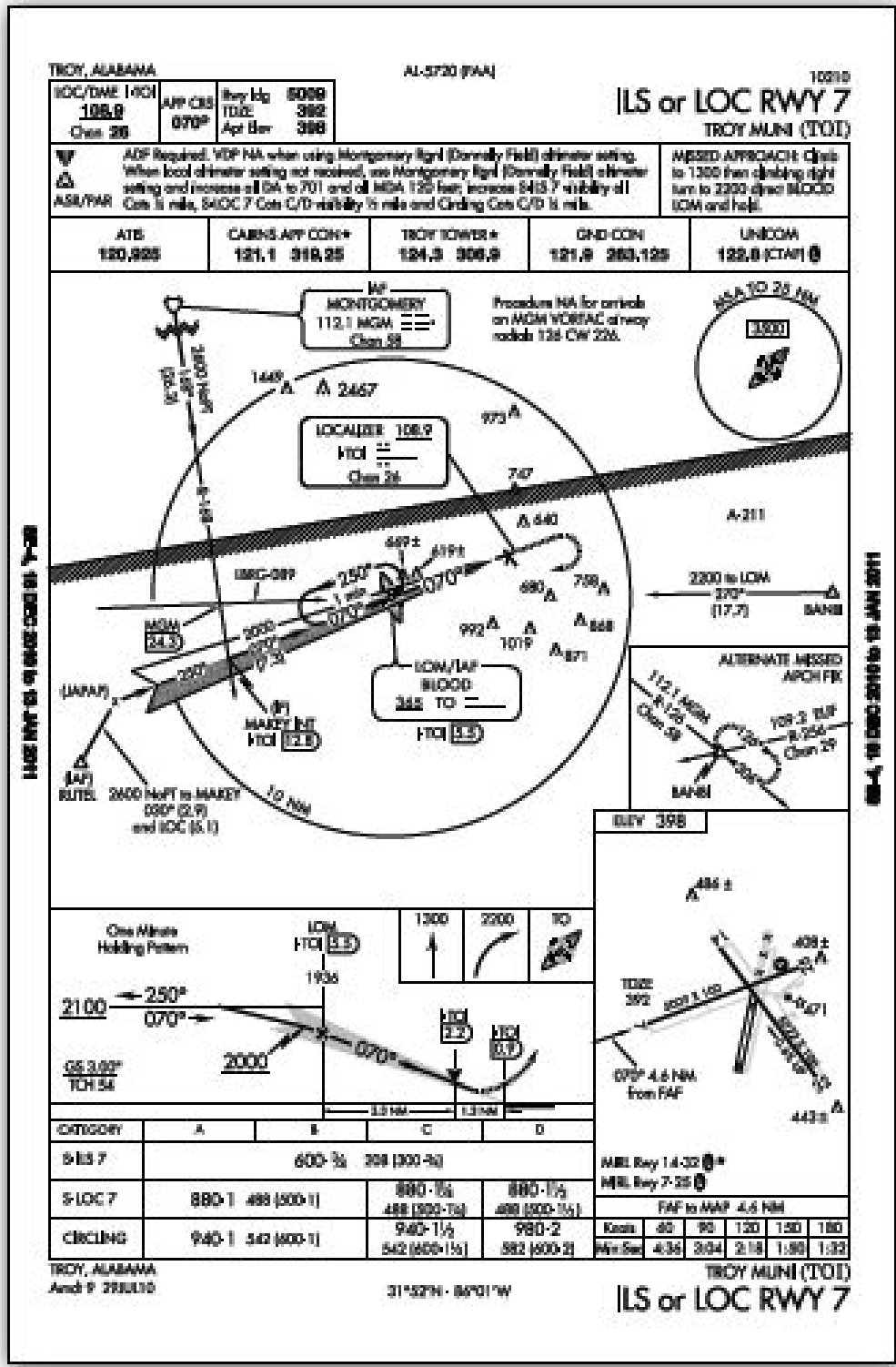


Figure 10-11. ILS RWY 7 Troy, Alabama.

The circling minimums published on the instrument approach chart provide a minimum of 300 feet of obstacle clearance in the circling area. [Figure 10-12] During a circling approach, the pilot should

maintain visual contact with the runway of intended landing and fly no lower than the circling minimums until positioned to make a final descent for a landing. It is important to remember that circling minimums are only minimums. If the ceiling allows it, fly at an altitude that more nearly approximates VFR traffic pattern altitude. This makes any maneuvering safer and brings the view of the landing runway into a more normal perspective.

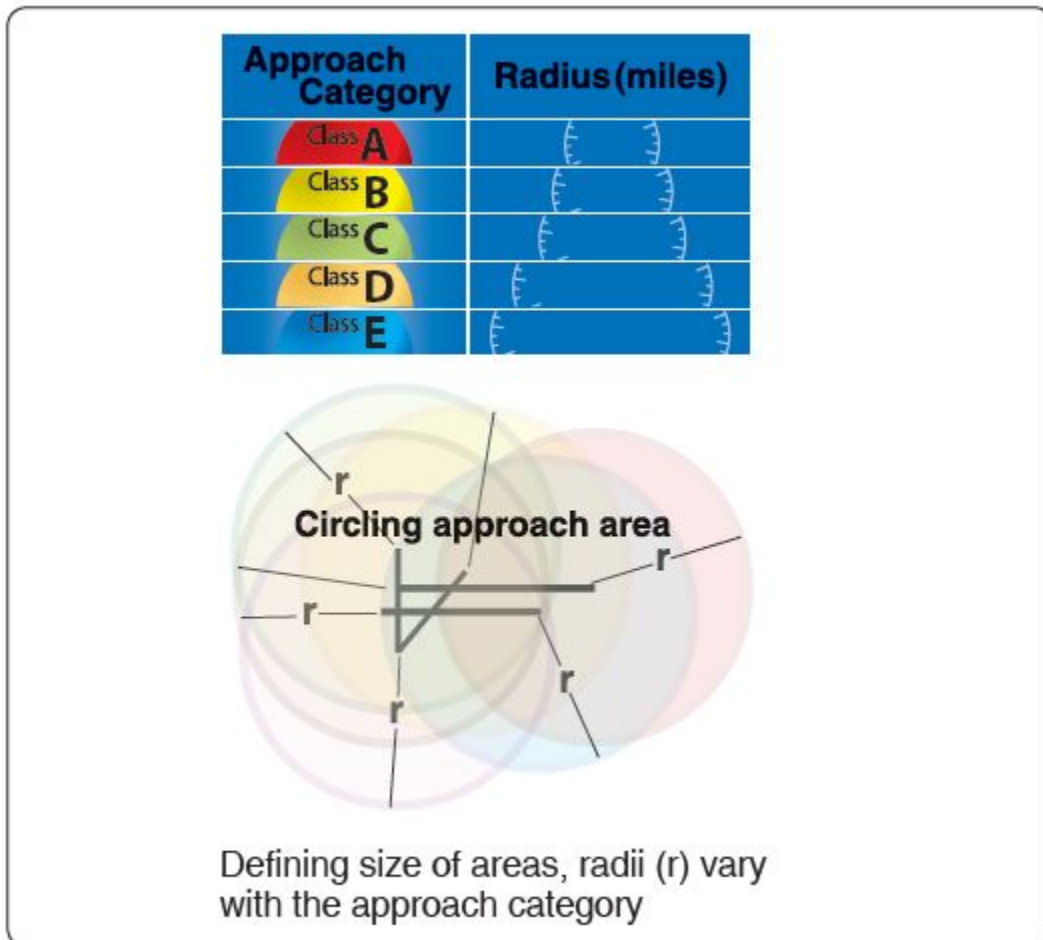


Figure 10-12. *Circling approach area radii.*

Figure 10-13 shows patterns that can be used for circling approaches. Pattern A can be flown when the final approach course intersects the runway centerline at less than a 90° angle, and the runway is in sight early enough to establish a base leg. If the runway becomes visible too late to fly pattern A, circle as shown in B. Fly pattern C if it is desirable to land opposite the direction of the final approach, and the runway is sighted in time for a turn to downwind leg. If the runway is sighted too late for a turn to downwind, fly pattern “D.” Regardless of the pattern flown, the pilot must maneuver the aircraft to remain within the designated circling area. Refer to section A (“Terms and Landing Minima Data”) in the front of each TPP for a description of circling approach categories.

The criteria for determining the pattern to be flown are based on personal flying capabilities and knowledge of the performance characteristics of the aircraft. In each instance, the pilot must consider all factors: airport design, ceiling and visibility, wind direction and velocity, final approach course alignment, distance from the final approach fix to the runway, and ATC instructions.

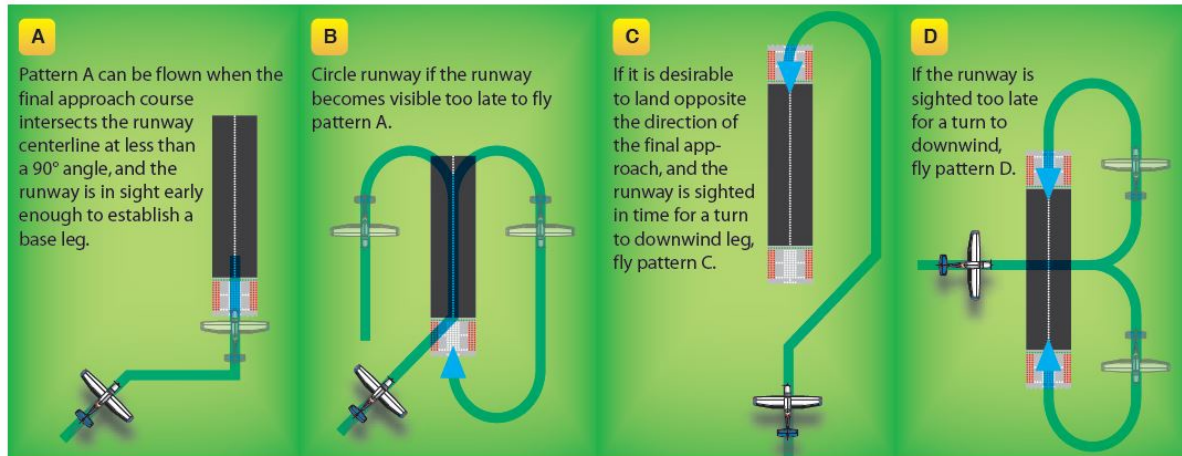


Figure 10-13. Circling approaches.

IFH, pg. 10-21

Missed Approaches

If visual reference is lost while circling-to-land from an instrument approach, execute the appropriate MAP. Make the initial climbing turn toward the landing runway and then maneuver to intercept and fly the missed approach course.

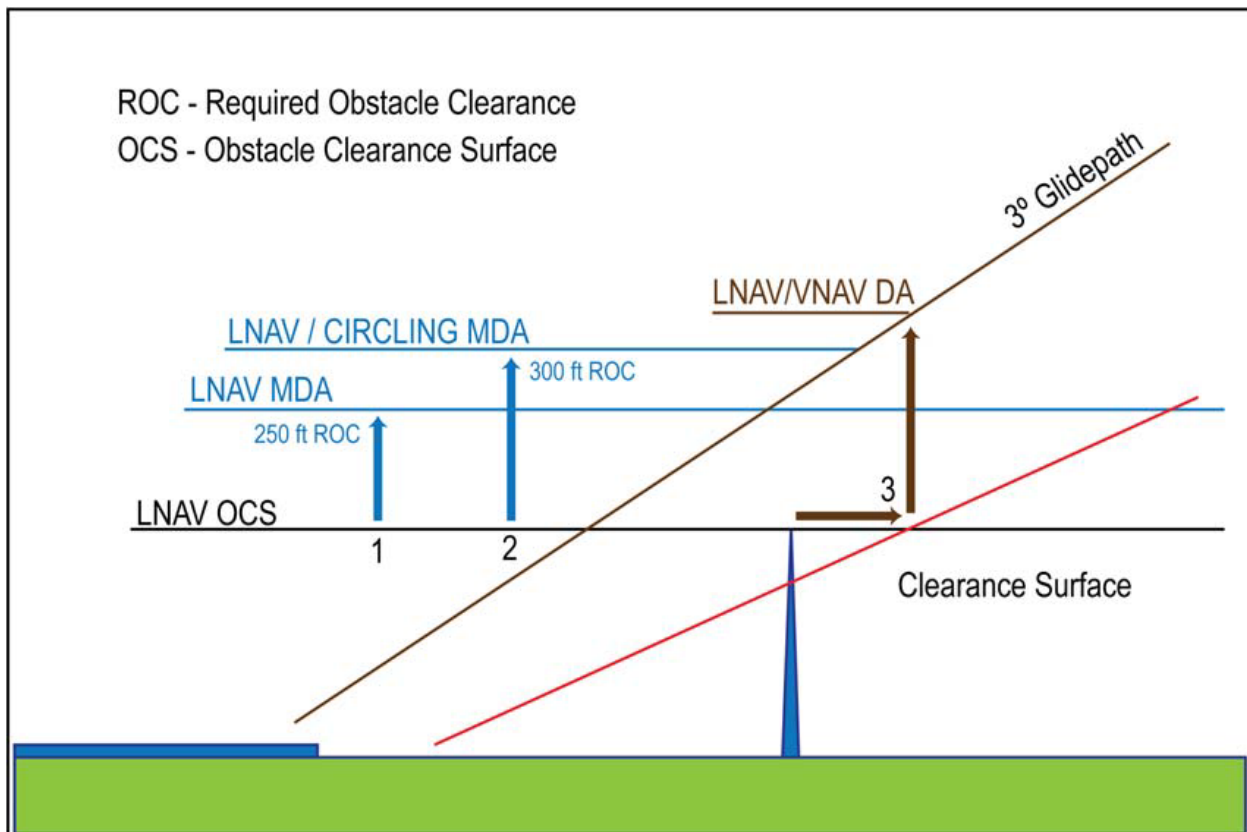
References taken from the Aeronautical Information Manual (AIM)

The Aeronautical Information Manual (AIM) is designed to provide basic flight information and ATC procedures. It contains fundamentals required for flying.

AIM 5-4-16

f. Circling. Circling minimums charted on an RNAV (GPS) approach chart may be lower than the LNAV/VNAV line of minima, but never lower than the LNAV line of minima (straight-in approach). Pilots may safely perform the circling maneuver at the circling published line of minima if the approach and circling maneuver is properly performed according to aircraft category and operational limitations.

Fig 5-4-12



g. FIG 5-4-12 provides a visual representation of an obstacle evaluation and calculation of LNAV MDA, Circling MDA, LNAV/VNAV DA.

5. Chart Terminology.

(b) Minimum Descent Altitude (MDA) has been in use for many years, and will continue to be used for the LNAV only and circling procedures.

AIM 5-4-52 Arrival Procedures

5-4-20 Approach and Landing Minimums

1. Circling approach protected areas are defined by the tangential connection of arcs drawn from each runway end (see FIG 5-4-27). Circling approach protected areas developed prior to late 2012 used fixed radius distances, dependent on aircraft approach category, as shown in the table on page B2 of the U.S. TPP. The approaches using standard circling approach areas can be identified by the absence of the “negative C” symbol on the circling line of minima. Circling approach protected areas developed after late 2012 use the radius distance shown in the table on page B2 of the U.S. TPP, dependent on aircraft approach category, and the altitude of the circling MDA, which accounts for true airspeed increase with altitude. The approaches using expanded circling approach areas can be identified by the presence of the “negative C” symbol on the circling line of minima (see FIG 5-4-28). Because of obstacles near the airport, a portion of the circling area may be restricted by a procedural note; for example, “Circling NA E of RWY 17-35.” Obstacle clearance is provided at the published minimums (MDA) for the pilot who makes a straight-in approach, side-steps, or circles. Once below the MDA the pilot must see and avoid obstacles. Executing the missed approach after starting to maneuver usually places the aircraft beyond the MAP. The aircraft is clear of obstacles when at or above the MDA while inside the circling area, but simply joining the missed approach ground track from the circling maneuver may not provide vertical obstacle clearance once the aircraft exits the circling area. Additional climb inside the circling area may be required before joining the missed approach track.

See Paragraph 5-4-21, Missed Approach, for additional considerations when starting a missed approach at other than the MAP.

AIM 5-4-55

f. Circling Minimums. In some busy terminal areas, ATC may not allow circling and circling minimums will not be published. Published circling minimums provide obstacle clearance when pilots remain within the appropriate area of protection. Pilots should remain at or above the circling altitude until 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 maneuvers. Circling may require maneuvers at low altitude, at low airspeed, and in marginal weather conditions. Pilots must use sound judgment, have an in-depth knowledge of their capabilities, and fully understand the aircraft performance to determine the exact circling maneuver since weather, unique airport design, and the aircraft position, altitude, and airspeed must all be considered. The following basic rules apply:

1. Maneuver the shortest path to the base or downwind leg, as appropriate, considering existing weather conditions. There is no restriction from passing over the airport or other runways.
2. It should be recognized that circling maneuvers may be made while VFR or other flying is in progress at the airport. Standard left turns or specific instruction from the controller for maneuvering must be considered when circling to land.
3. At airports without a control tower, it may be desirable to fly over the airport to observe wind and turn indicators and other traffic which may be on the runway or flying in the vicinity of the airport.

REFERENCE-

AC 90-66A, Recommended Standards Traffic patterns for Aeronautical Operations at Airports without Operating Control Towers.

4. The missed approach point (MAP) varies depending upon the approach flown. For vertically guided approaches, the MAP is at the decision altitude/decision height. Non-vertically guided and circling procedures share the same MAP and the pilot determines this MAP by timing from the final approach

fix, by a fix, a NAVAID, or a waypoint. Circling from a GLS, an ILS without a localizer line of minima or an RNAV (GPS) approach without an LNAV line of minima is prohibited.

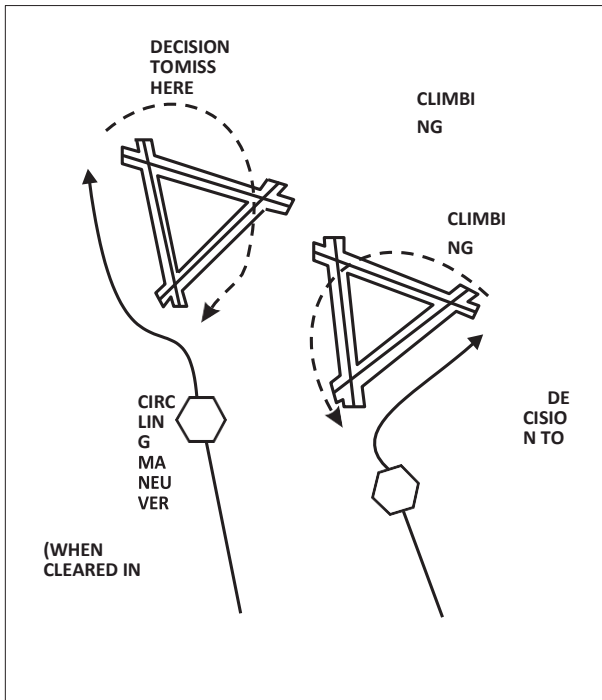
AIM 5-4-56

c. If visual reference is lost while circling-to-land from an instrument approach, the missed approach specified for that particular procedure must be followed (unless an alternate missed approach procedure is specified by ATC). To become established on the prescribed missed approach course, the pilot should make an initial climbing turn toward the landing runway and continue the turn until established on the missed approach course. Inasmuch as the circling maneuver may be accomplished in more than one direction, different patterns will be required to become established on the prescribed missed approach course, depending on the aircraft position at the time visual reference is lost. Adherence to the procedure will help assure that an aircraft will remain laterally within the circling and missed approach obstruction clearance areas. Refer to paragraph h concerning vertical obstruction clearance when starting a missed approach at other than the MAP. (See FIG 5-4-30.)

h. A clearance for an instrument approach procedure includes a clearance to fly the published missed approach procedure, unless otherwise instructed by ATC. The published missed approach procedure provides obstacle clearance only when the missed approach is conducted on the missed approach segment from or above the missed approach point, and assumes a climb rate of 200 feet/NM or higher, as published. If the aircraft initiates a missed approach at a point other than the missed approach point (see paragraph 5-4-5b), from below MDA or DA (H), or on a circling approach, obstacle clearance is not necessarily provided by following the published missed approach procedure, nor is separation assured from other air traffic in the vicinity.

AIM 5-4-57

Fig 5-4-30
Circling and Missed Approach Obstruction Clearance Areas



AIM 5-5-2

5-5-4. Instrument Approach

g) The circling minimums published on the instrument approach chart provide adequate obstruction clearance and pilots should not descend below the circling altitude until the aircraft is in a position to make final descent for landing. Sound judgment and knowledge of the pilot's and the aircraft's capabilities are the criteria for determining the exact maneuver in each instance since airport design and the aircraft position, altitude and airspeed must all be considered.

REFERENCE-

AIM, Paragraph 5-4-20 , Approach and Landing Minimums

AIM PCG A-6

AIRCRAFT APPROACH CATEGORY- A grouping of aircraft based on a speed of 1.3 times the stall speed in the landing configuration at maximum gross landing weight. An aircraft must fit in only one category. If it is necessary to maneuver at speeds in excess of the upper limit of a speed range for a category, the minimums for the category for that speed must be used. For example, an aircraft which falls in Category A, but is circling to land at a speed in excess of 91 knots, must use the approach Category B minimums when circling to land. The categories are as follows:

- a. Category A– Speed less than 91 knots.
- b. Category B– Speed 91 knots or more but less than 121 knots.
- c. Category C– Speed 121 knots or more but less than 141 knots.
- d. Category D– Speed 141 knots or more but less than 166 knots.
- e. Category E– Speed 166 knots or more.

(Refer to 14 CFR Part 97.)

AIM PCG C-2

CIRCLE-TO-LAND MANEUVER– A maneuver initiated by the pilot to align the aircraft with a runway for landing when a straight-in landing from an instrument approach is not possible or is not desirable. At tower controlled airports, this maneuver is made only after ATC authorization has been obtained and the pilot has established required visual reference to the airport.

CIRCLE TO RUNWAY (RUNWAY NUMBER)–

Used by ATC to inform the pilot that he/she must circle to land because the runway in use is other than the runway aligned with the instrument approach procedure. When the direction of the circling maneuver in relation to the airport/runway is required, the controller will state the direction (eight cardinal compass points) and specify a left or right downwind or base leg as appropriate; e.g., “Cleared VOR Runway Three Six Approach circle to Runway Two Two,” or “Circle northwest of the airport for a right downwind to Runway Two Two.”

PCG L-1

LANDING MINIMUMS– The minimum visibility prescribed for landing a civil aircraft while using an instrument approach procedure. The minimum applies with other limitations set forth in 14 CFR Part 91 with respect to the Minimum Descent Altitude (MDA) or Decision Height (DH) prescribed in the instrument approach procedures as follows:

- b. **Circling minimums.** A statement of MDA and visibility required for the circle-to-land maneuver

Other FAA guidance to Airmen, including Advisory Circulars and SAFOs active during the period from 2007 – 2017:

FAA Guidance	Title	Applicability	Paragraph or Page Reference
AC 61-137B	Approval of Manufacturer's Required Training Programs	Training programs; Requires crewmembers to have circling training	15, (3)
SAFO 17007	Manual Flight Operations Proficiency	Encourages the development of training and line-operations policies which will ensure proficiency in manual flight operations for air carrier pilots. Emphasis on manually controlled slow flight and instrument arrival as well as stall prevention and recovery.	All
SAFO 15011	Roles and Responsibilities for Pilot Flying (PF) and Pilot Monitoring (PM)	"Whether by inputs to autoflight systems or by manually flying, controlling the flight path of the aircraft is the pilot's highest priority"	All
SAFO 13002	Manual Flight Operations	A recent analysis of flight operations data (including normal flight operations, incidents, and accidents) identified an increase in manual handling errors	All
SAFO 12005	Aircraft Approach Category as defined under Title 14, Code of Federal Regulations, Chapter I, Subchapter F, Part 97, Subpart A., § 97.3	May apply. Discusses pilot's responsibility to determine if a higher approach category applies. If the requirement for a faster approach speed places the aircraft in a higher speed approach category, the minimums for the appropriate higher category must be used, e.g., emergency returns requiring overweight landing, approaches made with inoperative flaps or in icing conditions, e.g., category C aircraft may be required to apply category D minimums.	All

SAFO 10005	Go-Around Callout and Immediate Response	<p>May Apply. Recommends that all operators should provide written policy to flightcrews emphasizing that either pilot may make a go-around callout and that the response to a go-around callout is an immediate missed approach. Recommended Action: Directors of Operation, Directors of Safety and Directors of Training for Title 14 of the Code of Federal Regulations (14 CFR) part 121, 125, 135, and Part 91 subpart K operators should publish or reinforce existing written policy emphasizing that:</p> <ol style="list-style-type: none"> 1. Either the pilot flying or the pilot monitoring may make a go-around callout, and 2. The flying pilot's immediate response to a go-around callout by the non-flying pilot is execution of a missed approach. 	All
Charting Notice TCP 12-09	New Expanded Circling Approach Icon Legend Page	<p>May apply. Some of the Teterboro approaches had a "Negative C." Discussion: Affected procedures will have a negative "C" icon on the circling line of minima to which the new criteria has been applied. For a detailed explanation of the new criteria, see the explanatory text and tables in the front matter of the TPP (pages B1 & B2), as well as a detailed explanation to be published in the AIM.</p>	All
TERPS 8260.3C	United States Standard for Terminal Instrument Procedures (TERPS)	Describes procedures for designing and evaluating instrument flight procedures.	Chapter 2, section 2-7