

VOR/NDB Approaches

Instrument Rating

Relevant FARs

CFR § 61.65(b) - Aeronautical Knowledge				
Area				
(1) Federal Aviation Regulations of this chapter that apply to flight operations under IFR;				
(2) Appropriate information that applies to flight operations under IFR in the "Aeronautical Information Manual;"				
(3) Air traffic control system and procedures for instrument flight operations;				
(4) IFR navigation and approaches by use of navigation systems;				
(5) Use of IFR en route and instrument approach procedure charts;				
(6) Procurement and use of aviation weather reports and forecasts and the elements of forecasting weather trends based on that information and personal observation of weather conditions;				
(7) Safe and efficient operation of aircraft under instrument flight rules and conditions;				
(8) Recognition of critical weather situations and windshear avoidance;				
(9) Aeronautical decision making and judgment; and				
(10) Crew resource management, including crew communication and coordination.				



Relevant ACS

Task	D. Circling Approach				
References	14 CFR parts 61, 91; FAA-H-8083-15; IFP; AIM				
Objective	To determine the applicant exhibits satisfactory knowledge, risk management, and skills associated with performing a circling approach procedure.				
Knowledge	The applicant demonstrates understanding of:				
IR.VI.D.K1	Elements related to circling approach procedures and limitations including approach categories and related airspeed restrictions.				
Risk Management	The applicant demonstrates the ability to identify, assess and mitigate risks, encompassing:				
IR.VI.D.R1	Failure to follow prescribed circling approach procedures.				
IR.VI.D.R2	Executing a circling approach at night or with marginal visibility.				
IR.VI.D.R3	Losing visual contact with an identifiable part of the airport.				
IR.VI.D.R4	Failure to manage automated navigation and autoflight systems.				
IR.VI.D.R5	Failure to maintain an appropriate altitude, airspeed, or distance while circling.				
IR.VI.D.R6	Low altitude maneuvering including stall, spin, or CFIT.				
IR.VI.D.R7	Executing an improper missed approach after the MAP while circling.				
Skills	The applicant demonstrates the ability to:				
IR.VI.D.S1	Comply with the circling approach procedure considering turbulence, windshear, and the maneuvering capability and approach category of the aircraft.				
IR.VI.D.S2	Confirm the direction of traffic and adhere to all restrictions and instructions issued by ATC or the evaluator.				
IR.VI.D.S3	Demonstrate SRM.				
IR.VI.D.S4	Establish the approach and landing configuration. Maintain a stabilized approach and a descent rate that ensures arrival at the MDA, or the preselected circling altitude above the MDA, prior to the missed approach point.				
IR.VI.D.S5	Maintain airspeed ±10 knots, desired heading/track ±10°, and altitude +100/-0 feet until descending below the MDA or the preselected circling altitude above the MDA.				
IR.VI.D.S6	Visually maneuver to a base or downwind leg appropriate for the landing runway and environmental conditions.				
IR.VI.D.S7	If a missed approach occurs, turn in the appropriate direction using the correct procedure and appropriately configure the airplane.				
IR.VI.D.S8	If landing, initiate a stabilized descent. Touch down on the first one-third of the selected runway without excessive maneuvering, without exceeding the normal operating limits of the airplane, and without exceeding 30° of bank.				



VOR and NDB Approaches

- These are approaches that rely on VORs or NDBs
- They can either line up on final with a runway or be circling approaches
- Because there is no vertical guidance, the minimums are reported as MDA (minimum descent attitude)
- Minimum Descent Altitude (MDA) "The lowest altitude, expressed in feet above mean sea level, to which descent is authorized on final approach or during circle-to-land maneuvering in execution of a standard instrument approach procedure where no electronic glideslope is provided." (Nonprecision approaches)

[AIM Glossary]



Straight in or Circling only







VOR Approaches

- VOR approaches require an CDI (Course Deviation Indicator) or HSI (HSI (Horizontal Situation Indicator)
- These can be flown using a GPS (either programmed or in OBS mode) but they *must* be backed up with the ground-based navigation









NDB Approaches

- NDB approaches require an ADF (automatic direction finder)
- These display relative bearing from the aircraft to a radio station
- They are flown similarly to VOR approaches but are less precise and rely on bearings
- This will focus on VOR approaches





VFR Charts



IFR Charts







Circling Categories (97.3)

Based on VREF speed or 1.3 V_{so} if VREF not specified

- Category A: Speed less than 91 knots
- Category B: Speed 91 knots or more but less than 121 knots
- Category C: Speed 121 knots or more but less than 141 knots
- Category D: Speed 141 knots or more but less than 166 knots
- Category E: Speed 166 knots or more



Circling Radius (TPP)

CIRCLING APPROACH OBSTACLE PROTECTED AIRSPACE

The circling MDA provides vertical obstacle clearance during a circle-to-land maneuver. The circling MDA protected area extends from the threshold of each runway authorized for landing following a circle-to-land maneuver for a distance as shown in the tables below. The resultant arcs are then connected tangentially to define the protected area.

STANDARD CIRCLING APPROACH MANEUVERING RADIUS

Circling approach protected areas developed prior to late 2012 used the radius distances shown in the following table, expressed in nautical miles (NM), dependent on aircraft approach category. The approaches using standard circling approach areas can be identified by the absence of the C symbol on the circling line of minima.

Circling MDA in feet MSL	Approach Category and Circling Radius (NM)				
	CAT A	CAT B	CAT C	CAT D	CAT E
All Altitudes	1.3	1.5	1.7	2.3	4.5



Expanded Circling Radius (TPP)

C EXPANDED CIRCLING APPROACH MANEUVERING AIRSPACE RADIUS

Circling approach protected areas developed after late 2012 use the radius distance shown in the following table, expressed in nautical miles (NM), 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 **C** symbol on the circling line of minima.

Circling MDA in fact MSI	Approach Category and Circling Radius (NM)				
Circling MDA in leer MSL	CAT A	CAT B	CAT C	CAT D	CAT E
1000 or less	1.3	1.7	2.7	3.6	4.5
1001-3000	1.3	1.8	2.8	3.7	4.6
3001-5000	1.3	1.8	2.9	3.8	4.8
5001-7000	1.3	1.9	3.0	4.0	5.0
7001-9000	1.4	2.0	3.2	4.2	5.3
9001 and above	1.4	2.1	3.3	4.4	5.5



Let's Brief It

Relevant material from the digital Terminal Procedures Publication Supplement will also be included







This is the VOR Runway 5 into Naples Municipal Airport





The VOR frequency is 108.6 and we'll IDENT it





Final approach course is 039





Runway length is 5,000'; touchdown zone elevation and airport elevation is 8'



tabulation.



Takeoff and alternate minimums are published for this approach



Alternate Minimums not standard. Civil users refer to tabulation. USA/USN/USAF pilots refer to appropriate regulations.
A Alternate minimums are Not Authorized due to unmonitored facility or absence of weather reporting service.
Airport is published in the Takeoff Minimums, (Obstacle) Departure Procedures, and Diverse Vector Area (Radar Vectors)



For a missed approach we'll make a climbing right turn to 1,800' MSL to the CYY VOR for the hold













And tower is 128.5



2. Approach lighting systems that do not bear a system identification are indicated with a negative "()" beside the name.



These are less immediately relevant



From our IAF (initial approach fix) of the CYY VOR, we will travel outbound on the 219 radial for ~1:30 and then make a ~1:00 procedure turn before returning inbound on the 039 radial

It is also possible to be vectored to final by ATC







There are some obstacles to the right of the final approach course













We'll expect to say 1,800' or higher until the procedure turn is complete

From the Terminal Procedures Supplement









Our Category A minimums will be the same 580' regardless of Straight in (S-) for RWY 5 or for circling





Remember the expanded circling radius applies

From the Terminal Procedures Supplement

C EXPANDED CIRCLING APPROACH MANEUVERING AIRSPACE RADIUS

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3001-5000	1.3	1.8	2.9	3.8	4.8
5001-7000	1.3	1.9	3.0	4.0	5.0
7001-9000	1.4	2.0	3.2	4.2	5.3
9001 and above	1.4	2.1	3.3	4.4	5.5







We'll expect a displaced threshold for 5 with a PAPI on the right

From the Terminal Procedures Supplement





Considerations

- In this example, the missed approach point for straight in is the VOR which is almost halfway down the runway
- Recall from the "IFR Cross Country" lesson that landing under 91.175 requires a stabilized descent from MDA using normal maneuvers
 - [§ 91.175(c)(3)]
- We should calculate our own VDP (visual descent point) for a standard 3° glideslope using the equation: VDP $\approx \frac{MDA (in AGL)}{300}$
- For circling approaches, be aware you are flying a traffic pattern that may be lower and slower than usual; also be aware of the circling radius







Questions?

