

VOR Approach Nomenclature

- VOR RWY ## Approach to a specific runway is aligned within 30° of the runway heading
- VOR A Letter approach is more than 30° from the runway heading
- VOR DME Operable DME required to use the approach
- DME Arc Arc must be >7 NM from the airport
- TACAN Military tactical air navigation (TACAN) equipment. When installed with a VOR, it is known as a VORTAC
- Phantom or Ghost VOR Occurs when a TACAN is not frequency paired with a VOR, but the frequency is presented to enable DME tuning – e.g, Ellington ILS 17R EFD TAC 31 is on frequency (109.4)
- VOR is short for VHF Omni-directional radio range
- VOT A VOT is a low-power VOR station that transmits only the 360° radial to use as a VOR receiver check

VOR Approach Background

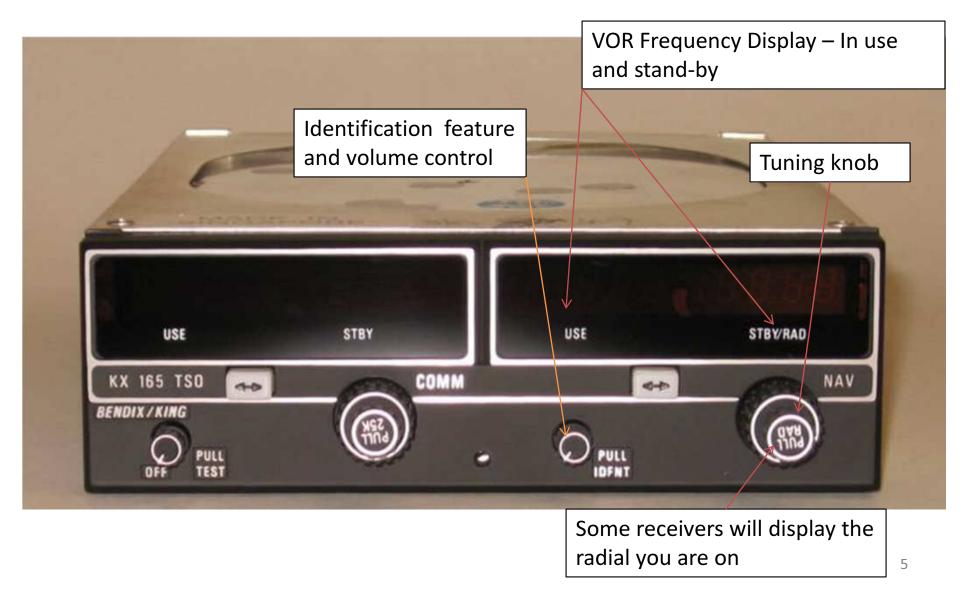
- One of the most widely used types of approach
- Uses VORs both on and off of the destination airport for the approach and the VOR normally is the IAF
- One VOR can serve several airports (e.g. Hobby VOR) Hobby, Sugar Land, La Porte, etc.
- VOR approaches can be on the TO or FROM side of a VOR
- May or may not have a final approach fix
- It is a non-precision approach as there is no vertical guidance
- MDAs as low as 250' AGL
- VOR radial typically intersects the extended runway centerline 3000' from the threshold for a straight in approach
- Not more than 30° between straight in approach course and runway
- 300' of obstacle clearance in the final approach area

VOR Equipment

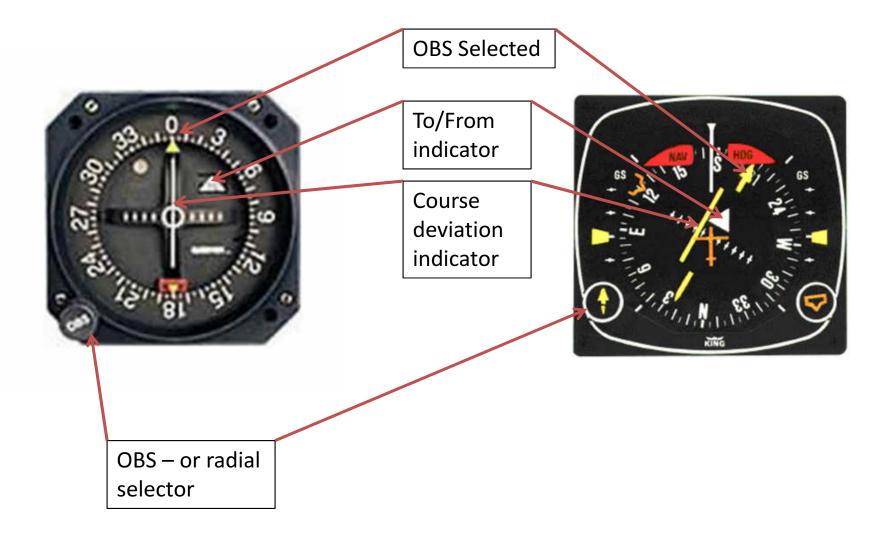
- Nav receiver and CDI display, HSI or glass cockpit display
- Some approaches also require a DME receiver
 - Can substitute GPS distance BUT be careful measuring points may not be the same



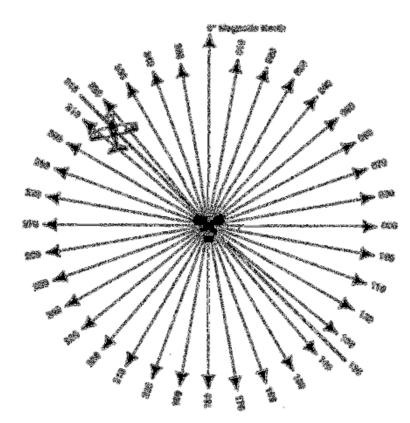
VOR Equipment



VOR Equipment



VOR Information Received

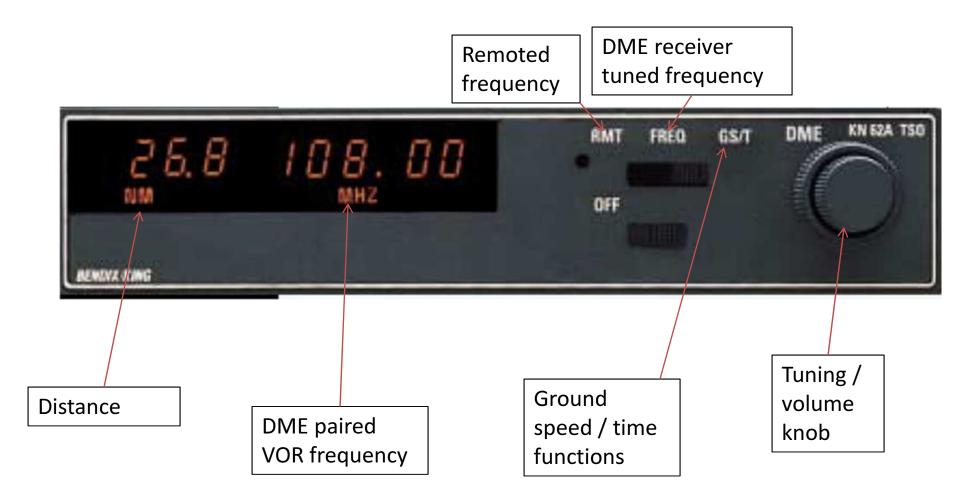


- Two signals are transmitted from the VOR ground station.
 - The first signal is a non-directional reference signal.
 - The second signal is a rotating variable phase signal that transmits around the entire 360 degree circle approximately 30 times per second. This signal is transmitted by antennas circling the reference signal antenna.
 - The reference phase signal is transmitted every time the rotating signal goes past the 0 radial.
- Radial information is derived by your receiver from the difference in time between the two signals.
- VORs transmit between 108 to 117.95 MHz

ILS Ground Station



DME Receiver



DME Transmitter



THALES 415 DME



Understanding the Signals

• Tune the VOR frequency



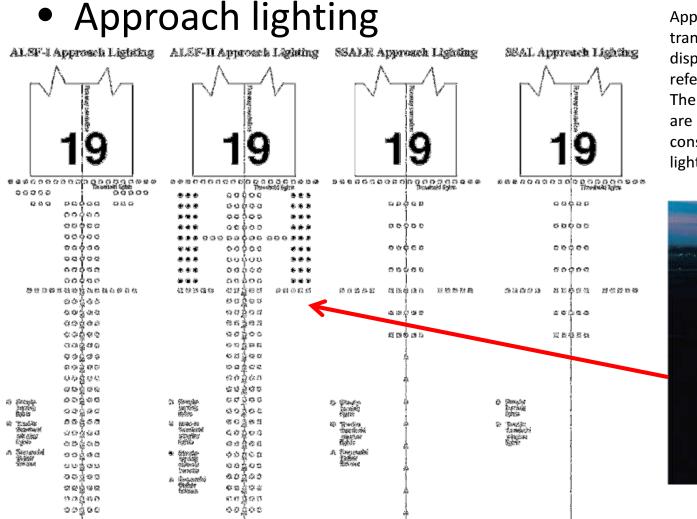
- Morse code identifier identify and keep it on in the background
 - DME coded identifier is transmitted once for every 3 or 4 times the VOR identifier transmits. About once every 30 seconds. DME identifier is also higher-pitched 1350 Hz compared with 1020 Hz for a VOR.
 - Can listen to DME identifier on DME receiver in many cases

Using the CDI



- CDI is a performance instrument Keep it in the scan
- Set the OBS to the course
- Confirm there is no failure flag and that the needle does not have erratic indications
- Look at CDI for needle location and trend; BUT FLY THE ATTITUDE INDICATOR / DG – don't chase the CDI
- Center the needle as early as practicable
- Initially steer desired radial +/- wind correction
- Make corrections with gentle coordinated turns to reference headings on the DG using bracketing
- Make corrections early and often to avoid the need for large corrections remember corrections become finer and finer as you get closer due to the "funnel effect" of the signal and will have zone of confusion near the VOR

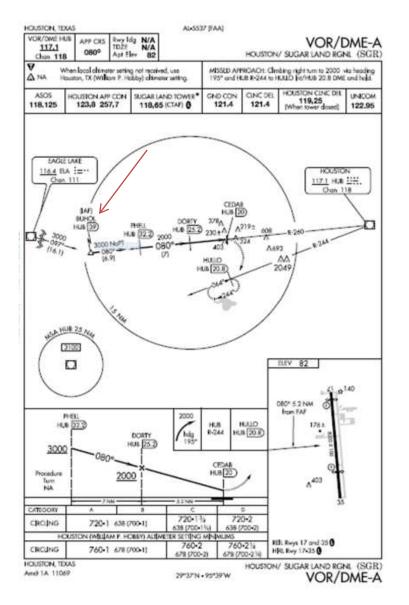
Approach Lighting



Approach lights help you transition from the cockpit displays to outside visual reference for the landing. There are a various ways these are displayed. The lighting consists of white and red lights.



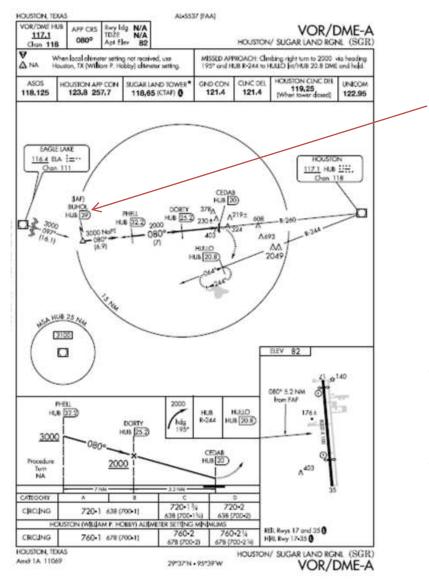
Let's Fly - IAF



Starting the Approach

- Approach starts at the initial approach fix (IAF) – There can be several IAF's – IAFS join at one or more common intermediate segments
- You will reach the IAF from a "feeder route" which can be a radar vector
- Must fly the entire procedure unless otherwise advised by ATC

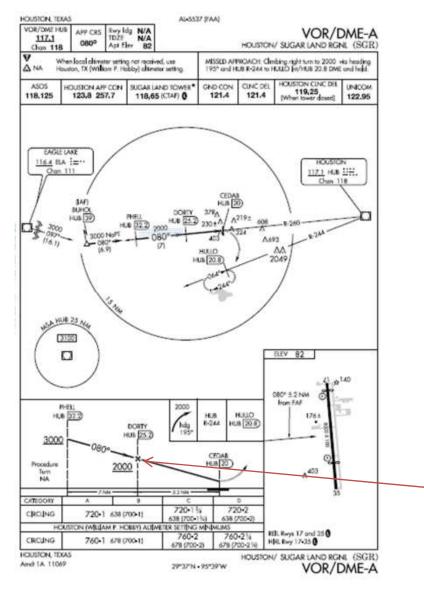
Let's Fly - IAF



Starting the Approach

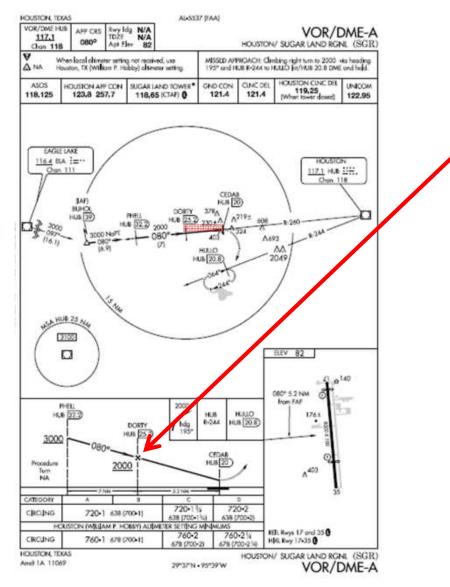
- IAF is where the initial approach segment begins.
 - Purpose is to align the aircraft with the intermediate or final approach segment
 - Accomplished by using a DME arc, a course reversal, such as a procedure turn or holding pattern, or straight in route
 - IAF is usually a designated intersection, VOR, NDB, or DME fix
- IAF may be collocated with the intermediate fix of the instrument approach. In that case there is no initial approach segment
- Segment usually ends at the intermediate approach segment or at an Intermediate Fix (IF)

Let's Fly – Intermediate Segment



Starting the Approach

- Intermediate segment positions the aircraft for the final descent to the airport
- Normally aligned within 30° of the final approach course
- Segment begins when
 - you are proceeding inbound to the FAF,
 - are properly aligned with the final approach course, and
 - are located within the prescribed distance before the FAF
- May not be charted
 - Approach with a procedure turn is the most common example of an uncharted IF
 - intermediate segment begins when you intercept the inbound course after completing the procedure turn
 - Ends at beginning of Final approach

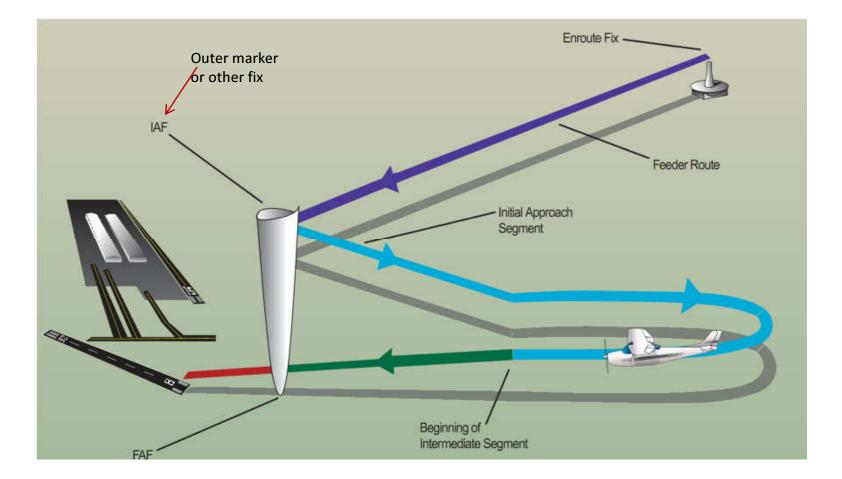


Starting the Approach

Final approach segment begins at a designated FAF, depicted as a Maltese cross (X) on the profile view, or at the point where the aircraft is established inbound on the final approach course

- Mandatory ATC report
 - When leaving the FAF
 - When you go missed in nonradar environment

Let's Fly Approach Segments



Before the Initial Segment

- Preflight Plan the approach Must be familiar with "all available information concerning a flight" prior to departure and FDC Notams
- Enroute Get weather (ATIS, FSS information, etc.) to help determine likely approaches and review
- Calculate / review performance data, approach speeds, and power settings – confirm aircraft and weather are appropriate for the ILS procedure for aircraft's certified category or, if higher, the actual speed to be flown
- Set navigation / communication and automation The navigation equipment required for an approach is generally indicated by the title of the procedure and chart notes

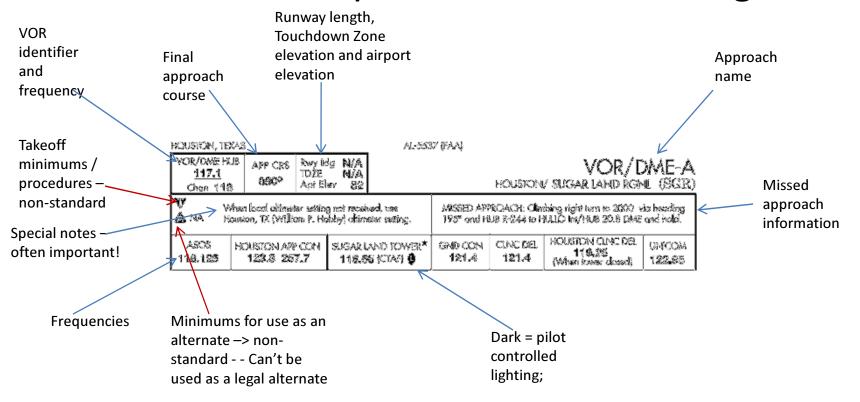
Before the Initial Segment

- Review and brief the approach Don't forget to brief the missed approach
 - Commit to memory
 - Altitude step downs
 - MDA
 - Time from FAF to MAP or DME Visibility minimums
 - Missed approach procedure (at least initial steps)
- Begin reducing speed
- Obtain ASOS/ATIS/AWOS on comm 2 listen in the background
- Note the time you cross the IAF

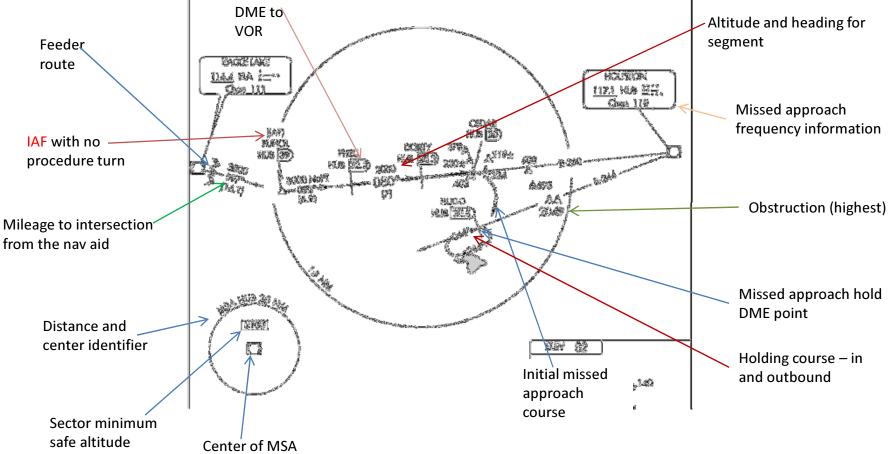
Initial Segment

- Complete briefing the approach
- Begin landing checklist complete before final segment
- Reset comm and nav radios with required frequencies
- Comply with the clearance and approach
- Finish reducing power to approach settings (consider wind gusts, shear and turbulence)
- Configure aircraft for landing Flaps
- Fuel related items set for landing (pumps, mixture, selectors)

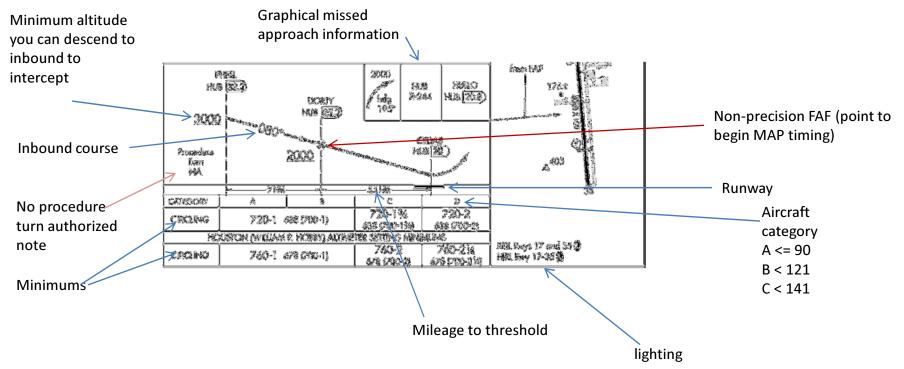
 Brief and review approach to assure you can execute it - Complete before end of segment



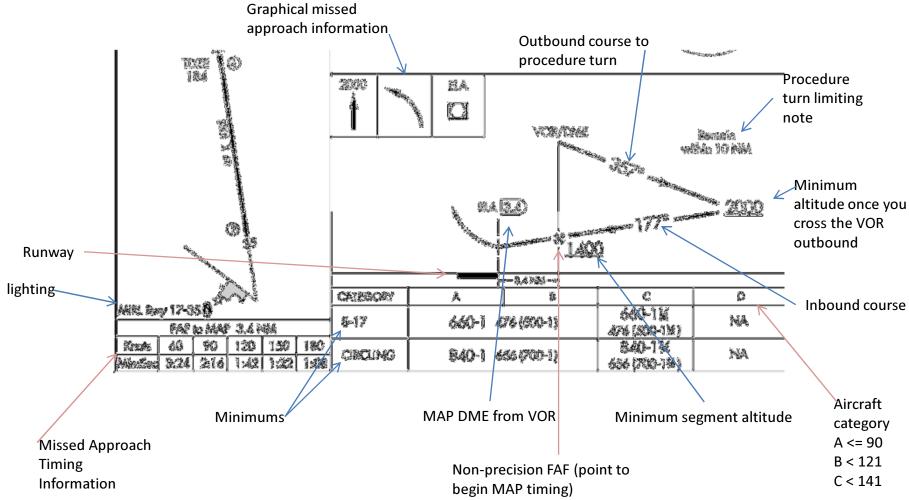
Plan view – mentally run through the approach



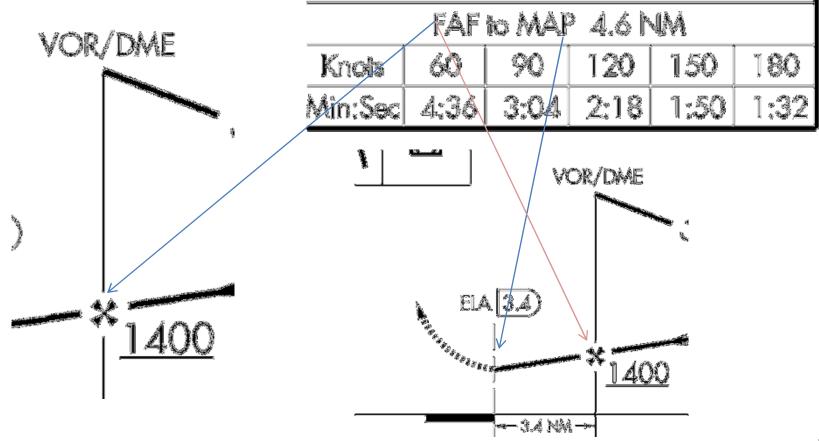
• Profile view – mentally run through the approach



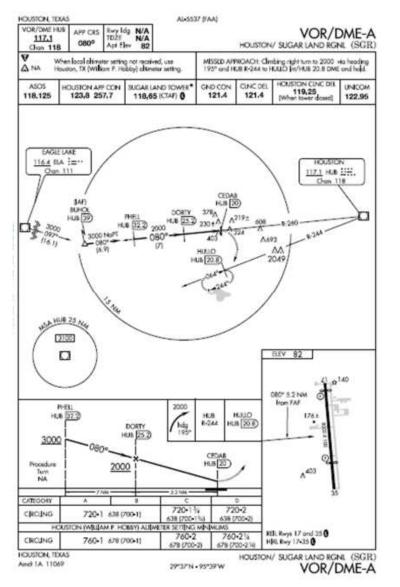
Non-DME Off Airport VOR Profile Briefing



- Missed Approach Timing Information (if ground speed information is unavailable)
 - Add tailwind to airspeed (1/2 wind speed for quartering winds)
 - Subtract headwind from airspeed (1/2 wind speed for quartering winds)
- Time even if DME is available as a back-up



Let's Fly – The Initial Segment



- Radios tuned to VOR to 117.1
- Confirm Morse code and leave on in the background
- Reduce power to approach setting
- Cross over the BUHOL at 3,000 feet
- As the VOR needle begins to move note the rate of movement to center the needle on the inbound course on HUB (080°) – determine heading to hold with the wind correction angle

VOR Procedures Off-Airport VOR

- Off-airport VOR is often the FAF and may also be the IAF
- For procedure turn go 1 to 2 minutes outbound before beginning the procedure turn – may need more time depending on the winds, etc.
- Missed approach point (MAP) may be determined from VOR FAF by time, DME, or another navaid

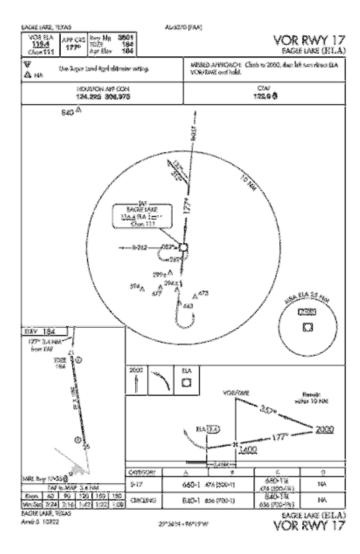
VOR Procedures On-Airport VOR

- You can tell VOR is on the airport from the approach chart profile view
- Generally an on airport VOR approach will have no depicted final approach fix. In which case, the final approach segment begins at the final approach point (FAP).
- The FAP is the point where you are established in-bound on the final approach course from the procedure turn/radar vector and can begin the final approach descent
- For a procedure turn fly out 3 to 4 minutes before the procedure turn to assure adequate distance to become established inbound
- VOR is the MAP when TO/FROM flag changes

VOR Procedures VOR DME

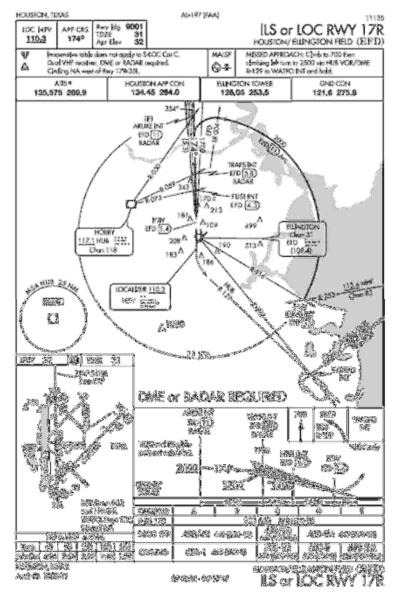
- Flown the same as other VOR approaches except that DME can be used for various fixes including:
 - IAF
 - FAF
 - MAP
 - Procedure turn limits
 - Step down altitudes
 - Tranistions

IAF With Course Reversal



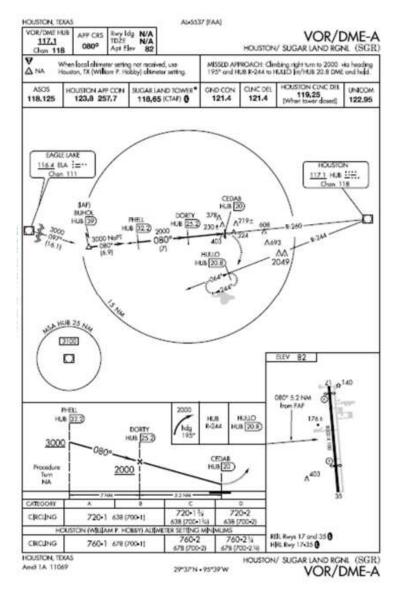
- Radios tuned to VOR to 116.4
- Confirm Morse code and leave on in the background
- Reduce power to approach setting
- Cross over the VOR at 2,000 feet or higher.
- As you pass the VOR turn north to intercept the outbound procedure turn (357 radial). Past the VOR descend to 2000.
- After 1 to 2 minutes turn left to 312° for 1 minute
- Then right turn to 132° after 1 minute
- Then intercept inbound course based on CDI to 177°
- Once established inbound you are in the intermediate segment and can descend to 1400'

IAF With DME Arc



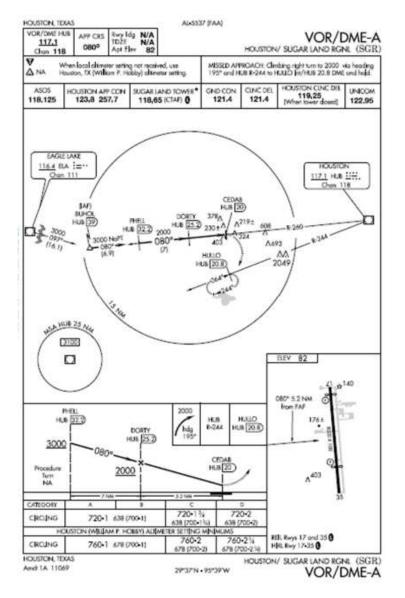
- Radios tuned to VOR to 109.4 (although this is a ghost VOR it will give you DME)
- Confirm Morse code and leave on in the background
- Intercept the DME arc (lead your turn to avoid overshooting the arc) at the IAF Entime intersection and then follow the arc – place your left wing-tip towards the VOR – watch your DME to stay within approx . 1 mile
- Minimum arc altitude is 2000'
- On an actual VOR your heading will be about 90 degrees from the radial your on +/- wind correction
- When you get to the lead radial begin your turn into the inbound VOR course (although this approach is a localizer)
- Reduce power to approach setting
- Intercept inbound course based on CDI to 174°
- Once established inbound the procedures are the same as other localizer approaches

Let's Fly – The Intermediate Segment

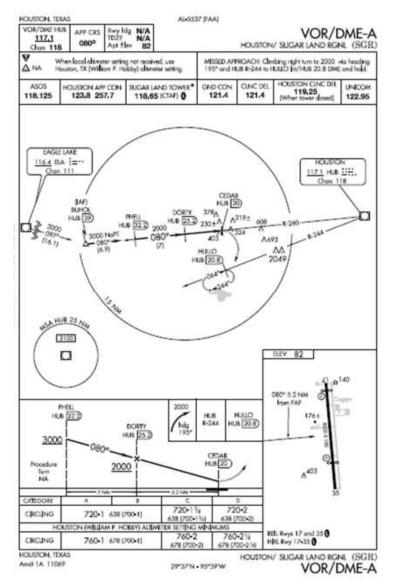


- Inbound on HUB (080°)
 - Verify power settings for the approach and drop first notch of flaps
 - After PHELL descend from 3000 to 2000
 - Descent rate rule of thumb for 3° is approximately
 5 X your groundspeed
- Set radios for missed approach Nav 2 to 117.1 CDI to 064 (To setting for the 244 radial)
- Corrections become smaller and smaller the closer you get

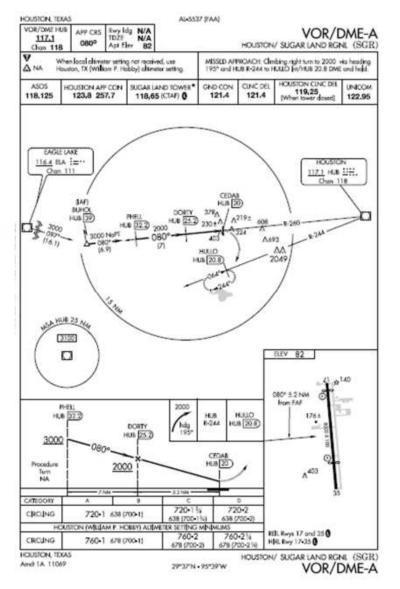
Let's Fly – The Intermediate Segment



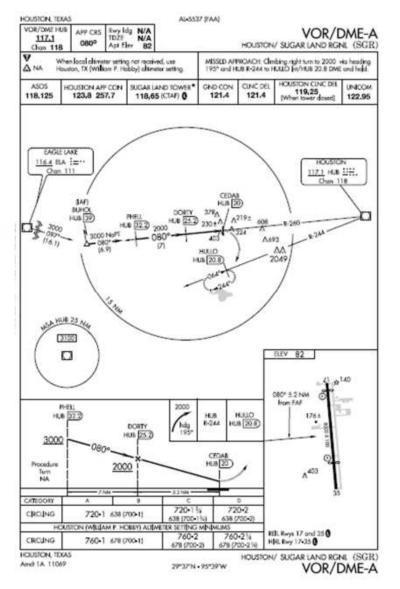
- Likely to be told to switch to local frequency – swap comm 1 to 118.65 when transferred to SGR Tower
- Complete landing checklist as much as possible
- You are now at the final segment!



- At FAF (DORTY) start timing for missed approach if non-DME approach (timing is based upon ground speed)
- Expeditious but safe descent (gen <700 ft min @ 90 kts) – However, if there is an angle of descent, you should calculate the corresponding rate of descent (inside back cover of TERPS)
- Maintain a constant speed level and descending
- FAF inbound report to ATC required in non-radar environment
- Likely to be told to switch to local frequency swap comm 1 to 118.65
- Confirm gear down
- Second notch flaps Check in white arc



- Final speed reduction
- Glance out the window to look for the runway environment
- Begin level off about 100' before you reach the MDA 720' (760' with Hobby altimeter setting)
- Airport Communications
 - Tower
 - Non-towered airport Broadcast your intentions on the CTAF
 - Approach you are executing
 - Your position (every mile for last 5 miles)
 - Arrival over the FAF inbound
 - Missed approach



- If you now have an identifiable segment of the approach environment unmistakably visible and identifiable you may continue the approach if:
 - Visibility is above the minimums for approach category
 - You are in a position to make a normal descent to the intended runway using normal maneuvers
 - FAR 91.175
- If not, commence missed approach turn - do not turn out early (e.g. if full needle deflection)
- MAP identified by
 - TO / FROM reversal
 - DME fix
 - Time from VOR
 - Other e.g. cross radial

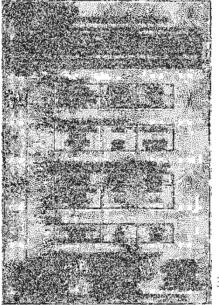
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- Commence circle to land
- When aligned with final, drop full flaps and land
- At MAP:
 - Runway environment in sight
 - Visibility above minimums
 - Able to make a normal descent to intended runway

VOR Approach Problems

- Report any instrument or communication malfunctions to ATC
- If full deflection of the CDI at any time, go missed but follow the course do not turn out early
- Inoperative components
 - No change in MDA
 - Increase visibility
 requirements ¼ to ½

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Considerations

- If you are low generally do NOT climb – level off and re-intercept
- Make small adjustments see what happens and readjust
- Remember sensitivity increases as you get near the VOR
- DO NOT FLY VOR needles bad things will happen! FLY the DG and AI
- With aircraft properly trimmed small changes in power will cause a pitch change and allow you to maintain airspeed
- Must execute missed after the MAP if you lose sighting of the runway environment

- Runway environment
 - Approach lighting system not below 100' AGL until you see red side lights or red terminating bar
 - Runway or runway markings or lights
 - Threshold, threshold markings or lighting
 - REILS
 - VASI
 - Touchdown zone or markings or lighting
- Know for the approach
 - IAF and how to arrive at the FAF
 - Minimum altitudes for each segment and MDA
 - Missed approach procedure

Common Errors

- Failure to have essential approach information in memory
 - IAF
 - FAF
 - Altitudes, including MDA
 - MAP
- Poor communications
- Failure to complete checklist items or use checklist
- Descent below altitudes (keep a cushion on checkride)

