FLIGHTINSIGHT

IFR CHECKRIDE AT A GLANCE

IFR FLIGHT REQUIREMENTS*

AM I LEGAL?

Experience required for IFR rating (61.65)
- 50 hours xc PIC time (10 hours in airplanes)
- 40 hours actual or simulated instrument time
  - 15 hours with CFII, including 1 xc flight:
    i. 250 NM
    ii. Routing along airways or by ATC, i.e. on an IFR flight
    iii. Inst. approach at each airport
    iv. Using 3 diff kinds of approaches
    v. On filed IFR flight plan
  - 3 hours in last 2 cal months in prep

Personal documents required for US IFR flight (61.3)
- Airman Certificate
- Medical (BasicMed if applicable)
- Gov't Photo ID

Currency to act as PIC on IFR flight (61.57(c))

0 - 6 mo
- In last 6 cal months, fly in inst or sim conditions:
  - 6 inst approaches
  - Holding procedures
  - Intercept & tracking of nav systems

6 - 12 mo
- Must be in simulator or with instructor or safety pilot with hood on, if safety pilot is:
  - At least a private pilot
  - Act as PIC and legal in the aircraft
  - Current Medical (or BasicMed)
  - Logged by name in logbook

+12 mo
- If not current for more than 12 mo. IPC needed:
  - CFII required for IPC
  - Some, but not all tasks, allowed in sim
  - Required tasks in IFR ACS append 5

Currency to act as PIC on VFR or IFR flight (61.56)**
- Completed flight review in last 24 cal mo:
  - Minimum 1 hour flight instruction
  - Minimum 1 hour ground instruction
  - With an authorized instructor (CFI)
- May be substituted by:
  - A practical test for a new rating or cert
  - Completion of WINGS program
  - Flight instructor renewal (61.197)

Currency to act as PIC with passengers (61.57)
- 3 takeoffs and landings:
  - In the preceding 90 days
  - In same aircraft category, class, & type
  - Full stop landings (taildragger)

  at night:
  - Btwn 1 hour after sunset and 1 hour before sunrise, to a full stop

Preflight Info Required for IFR (91.103)

1) NOTAMS, 2) Weather reports and forecasts, 3) Known traffic delays, 4) Runway length of intended use, 5) Alternatives available, 6) Fuel requirements, 7) Takeoff and landing perf data

IS THE AIRPLANE LEGAL?

Required documents on board

A – Airworthiness certificate (91.203)
R – Registration certificate (91.203)
R – Radio station license (Int'l only)
O – Operating limitations & AFM (91.9 & 21.5)
W – Weight & Balance sheet (23.2620)

Required maintenance inspections

A – Annual inspection – 12 cal mo. (91.409)
A – Airworthiness directives complied with (Part 39)
V – VOR check – 30 days (91.171)
1 – 100 hour inspection if for hire (91.409)
A – Alt: xpdr and static sys – 24 cal mo. (91.411)
T – Transponder – 24 cal mo. (91.413)
E – ELT – 12 cal mo., battery replaced after 1 hour use or past 50% of life (91.207)

Required equipment on board (91.205)***

A – Airspeed indicator
T – Tachometer (each engine air cooled)
O – Oil pressure gauge (each air-cooled engine)
M – Manifold press gauge (for each alt engine)
A – Altimeter
T – Temperature gauge (liq cooled engine only)
O – Oil temperature gauge (air cooled engine)
F – Fuel gauge (each tank)
L – Landing gear position indicator
A – Anti collision lights (cert after 3/11/96)
M – Magnetic compass
E – ELT
S – Safety belts

(at night) all above, plus:

F – Fuses (spare set, not needed with breakers)
L – Landing light (if for hire)
A – Anti-collision lights (cert after 8/11/71)
P – Position lights
S – Source of electricity

(for IFR) all above (including FLAPS at night), plus:

G – Generator or alternator
R – Radios and navigation suitable for route
A – Attitude Indicator
B – Ball (inclinometer)
C – Clock (hours, minutes, and seconds)
A – Altimeter (sensitive, adjustable for press.)
R – Rate of turn indicator
D – Directional gyro

VOR 30 day checks (91.171)
- VOT ± 4°
- Repair Station ± 4°
- VOR Ground Checkpoint ± 4°
- VOR Airborne Checkpoint ± 6° (Dual ± 4°)
- Prominent Landmark ± 6°
- Log date, place, bearing error and signature

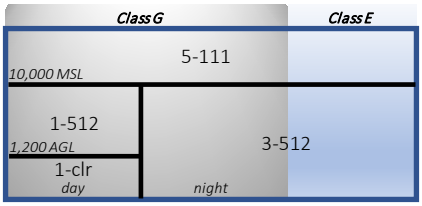
Inoperative Equipment (91.213)
- No flying w/o special air permit if equipment in 91.205, or required by AD or operation is inop
- Other inop equipment must be removed or placarded and a pilot/mech deems safe to fly

ARE THE CONDITIONS LEGAL?

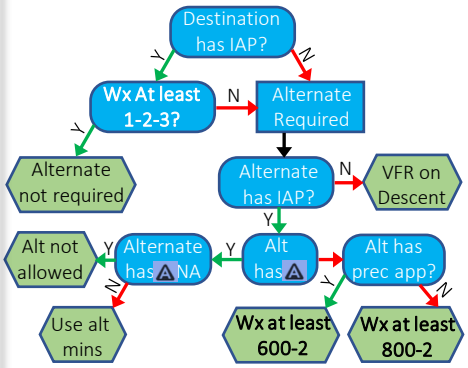
When an IFR rating is required
- When acting as PIC in IFR conditions (61.3)
- When carrying passengers for compensation or hire on xc flights >50 NM or at night (61.133)
- Flight in Class A airspace (non-gliders) (91.135)
- SVFR between sunset and sunrise (91.157)

Basic VFR weather mins (IFR required) (91.155)

Class A – N/A; No VFR
Class B – 3SM, clear of clouds
Class C – 3SM, stay ≥ 500' below, 1000' above, and 2000' horizontally separated from clouds (3-512)
Class D – 3-512



Should we file an alternate airport? (91.167 & 169)



†Without a WAAS-enabled GPS either the alternate or destination must have a non GPS-based approach available

IFR takeoff minimums (91.175f)
- No minimums req under Part 91, unless mandated by dep proc, for others:
  - Published mins for runway
  - 1-2 engines: 1 SM visibility
  - >2 engines: ½ SM visibility
- Non-standard mins denoted by ▼ in TPP

IFR flight plan requirements (91.173)
- To operate IFR in controlled airspace (Class A-E), must :
  - Be on filed IFR flight plan
  - Receive appropriate ATC clearance

IFR Minimum Fuel Requirements (91.167)
- Fuel to get from departure to destination, *plus*
- From destination to alternate, if req, *plus*
- 45 minutes calculated at normal cruise

*Remember that what keeps you legal doesn't always keep you safe. Ensure that you are both current *and* proficient for a flight!
**See FAR for exceptions such as certain checkrides completed
***Equipment in green required for all aircraft, even the most basic kind like a glider

IFR CHECKRIDE AT A GLANCE

FLIGHT INSTRUMENTS

PITOT-STATIC SYSTEM

Airspeed Indicator

Altimeter

Vertical Speed Indicator

Airspeed Indicator (ASI)

- ASI measures difference between ram air pressure in pitot tube and ambient pressure in static port

Altimeter

- Uses an aneroid barometer to compare air pressure in the static port to a known local pressure, set by the pilot
- Above 18,000 feet, the altimeter is set to standard 29.92" Hg
- Susceptible to temperature errors
- Remember: "high to low, look out below!" flying into lower pressure or temperature, the altimeter will indicate higher than true altitude

Vertical Speed Indicator (VSI)

- The VSI shows rate of climb using a calibrated leak within the unit's pressure chambers, causing a lag between indicated and actual rate

Pitot-Static System Errors

			
Front of pitot blocked; static port clear	Reads zero	No error	No error
Front and drain of pitot blocked; static port clear	Increases with altitude	No error	No error
Pitot clear; static port blocked	Decreases with altitude	Frozen in place	Reads zero

VACUUM DRIVEN GYRO

Attitude Indicator

Directional Gyro

Gyroscopic Instruments

- Rigidity in Space – will remain fixed in its plane despite outside forces
- Precession – will exhibit a turning force perpendicular to the direction of spin

Attitude Indicator (AI)

- Shows bank and pitch
- Should come erect within a few minutes of engine start
- May show a pitch up (pitch down) during acceleration (deceleration)

Directional Gyro (DG)

- Reflects changes in heading, must be calibrated to magnetic compass
- Due to procession, must be recalibrated to correct magnetic heading periodically

ELECTRIC GYRO

Turn Coordinator

MAGNETIC

Magnetic Compass

Turn Coordinator (TC)

- Shows rate of turn and rate of roll
- Works off direct current electric source
- One standard rate turn with a wing on the left or right hash mark is a full circle in 2 minutes

Example: A 90° standard rate turn takes 30 seconds

Magnetic Compass Errors

- Deviation – due to electrical fields in cockpit
  - Check compass card
- Variation – difference between true heading and magnetic heading
  - "**East is least, west is best**" subtract east variation from true heading to get magnetic heading and vise versa
- Magnetic Dip* - Turns from a northern heading show a lag, turns from southern heading show a lead, to roll out on correct heading, **UNOS** (Undershoot North Overshoot South)
- Acceleration – Speed changes show a turn **ANDS** (Accelerate North/Decelerate South)

PRIMARY & SUPPORTING INSTRUMENTS

	PITCH		BANK		POWER	
	primary	*supporting*	*primary*	*supporting*	*primary*	*supporting*
Straight & Level	**ALT**	AI, VSI	**DG**	AI, TC	**ASI**	TACH
S&L w/ speed changes	**ALT**	AI, VSI	**DG**	AI, TC	**TACH**	ASI
Starting a climb or descent	**AI**	ASI, ALT, VSI	**DG**	AI, TC	**TACH**	ASI
Constant speed climb/descent	**ASI**	AI, VSI	**DG**	AI, TC	**TACH**	ASI
Starting a turn	**ALT**	AI, VSI	**AI**	TC	**ASI**	TACH
Constant rate turn	**ALT**	AI, VSI	**TC**	AI	**ASI**	TACH

IFR TAXI CHECKS

- Clock is accurate and operating
- Airspeed reads zero
- Attitude indicator is erect and level within a few minutes of engine start
- Altimeter reads within 75 feet of field elevation
- VSI reads zero or if inaccurate note difference and compensate while in flight
- DG matches known magnetic heading and moves in same direction of turns
- TC moves in same direction of turns and ball moves opposite turn
- Compass reads known magnetic heading and indicates direction of turns (no magnetic dip in wings level taxi)

GLASS COCKPIT

Attitude Heading Reference System (AHRS)

- Accurate and reliable attitude and heading data
- Replaces AI, DG, & TC

Air Data Computer (ADC)

- Fed by pitot static system
- Replaces ASI, Altimeter, & VSI

Flight Director (FD)

- Computes desired flight path
- Assists with turns, heading, course, pitch and VS for autopilot or human hand flying

Primary Flight Display (PFD)

- Graphically displays information typically found on traditional "big six" instruments
- Facilitates instrument scan with one screen

Multi Function Display (MFD)

- Displays moving maps, weather, system data, traffic, and other stored information
- Can revert to PFD in emergency

*Applies in Northern Hemisphere only

BEFORE DEPARTING IFR

IFR FLIGHT PLAN

Filing an IFR Flight Plan, via:

- Flight Service
  - 1-800-WX-BRIEF
  - Remote Communications or Ground Communications Outlet
  - www.1800wxbrief.com
  - FSS radio while airborne
- Air Traffic Control ("Pop-Up" Clearance)
  - Request IFR while VFR
  - Subject to ATC workload
  - Must be at or above minimum IFR altitude before receiving clearance
- Commercial Third Party
  - www.skyvector.com
  - www.fltplan.com
  - ForeFlight (or other EFBs)

IFR Flight Planning Tips (AIM 5-1-6)

- Flight plans should be filed at least 30 minutes prior to estimated departure time
- Direct routes should only be used if necessary
- A route crossing multiple control sectors should have at least one waypoint in each sector
- DPs and arrivals can be assigned unless the pilot specifies "No SIDs/STARS" in flight plan remarks
- Altitudes should (but are not required to) conform to direction of flight conventions (odd thousands for eastbound courses, even for westbound)
- Preferred IFR routes should be used from:
  - Preferred routes in the chart supplement
  - ForeFlight route advisor
  - Prior ATC cleared routes (FlightAware)

IFR CLEARANCE

Elements of a Clearance

C – Clearance Limit
R – Route
A – Altitude
F – Frequency
T – Transponder Code

Example: "N518FT. Cleared to Atlantic City Airport. Radar vectors to PALEO, Victor 44, Sea Isle. Maintain 2,000. Expect 7,000 10 minutes after departure. Departure frequency 125.65. Squawk 4211."

Abbreviated Departure Clearance (AIM 5-2-6)

- When filed flight plan is approved with little or no revision, an abbreviated clearance can be issued
- The clearance will still include clearance limit, any DP and transition point, altitude, frequency, and transponder code

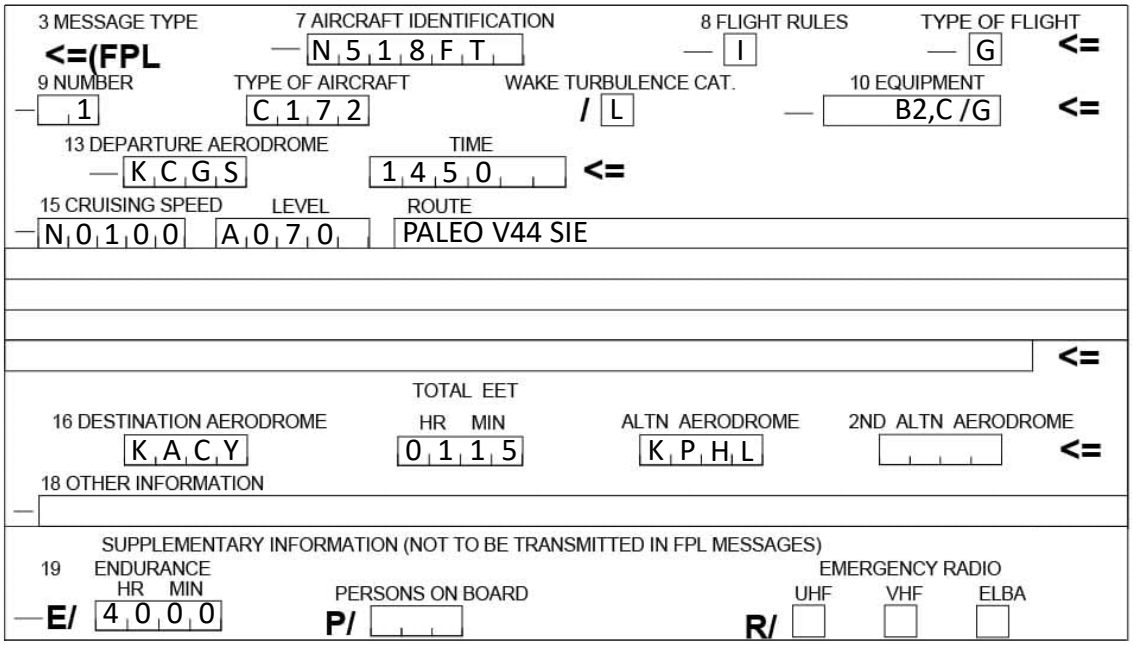
Example: "N518FT. John Wayne Clearance. Cleared to North Las Vegas Airport. Anaheim One Departure. Hector Transition, then as filed. Climb via the SID. Departure frequency on 133.85. Squawk 5174."

IFR Release (AIM 5-2-7)

- At tower controlled airports, the tower will coordinate a release with ATC
- At nontowered airports, the pilot coordinates release themselves via:
  - Clearance frequency if available on field
  - Phone line connection to ATC facility
  - Relay through Flight Service using RCO or GCO
- If instructed to "hold for release," an IFR departure cannot be made until released by ATC
- A release time will be given, the earliest that the aircraft may depart IFR
- A clearance void time will also be given, the latest you can depart. A notify time may also be given, the latest an aircraft should advise ATC if a departure has not been made before the void time

Example: "N518FT. Released for departure at 1450 zulu. Clearance void if not off by 1455 zulu. Advise ATC of intentions no later than 1500 zulu. Time now 1448 zulu."

IFR FLIGHT PLAN FORM



DEPARTURE PROCEDURES

ENSURING OBSTACLE CLEARANCE

- Consider the type of terrain in the airport vicinity
- Check takeoff obstacle notes in the Terminal Procedures Publication (Section L), as well as in any NOTAMs
- Check for a departure procedure for the airport and runway of intended use
    - Departure procedures (DP) can be found in the Terminal Procedures Publication (TPP), under:
    1) Terminal Charts Section; and/or
    2) IFR Takeoff Minimums, Departure Procedures, and Diverse Vector Areas (Section L),
- If no DP is listed, obstacle clearance can be maintained by (AIM 5-2-9 f):
    1) Climbing at least **200 feet per NM** (climb gradient)
    2) Crossing the **departure end** of the runway **at least 35 feet above it**; and
    3) Reaching **400 feet** above the departure end of the runway elevation before making initial turn

Convert feet per NM to feet per min with:
Feet Per Minute = Feet Per NM * Gndspd/60

Example: To climb the standard 200 feet per NM in an aircraft that climbs at 90 knots groundspeed, 300 feet per minute is required (200[90/60]=300)*

PUBLISHED PROCEDURES

Obstacle Departure Procedures (ODP)

- Provides obstacle clearance for the departure to join the enroute phase
- Printed textually (Section L of TPP), graphically (charts in TPP), or both
- May provide nonstandard takeoff minimums and minimum climb gradient
- Can be flown whether ATC assigns in clearance (recommended in poor vis)
    - If flown without ATC assignment, advise ATC as soon as possible

Standard Instrument Departure (SID)

- Provides obstacle clearance *and* reduces pilot/controller workload
- Only printed graphically in TPP
- May provide nonstandard takeoff minimums and minimum climb gradient
- Will be assigned by ATC in clearance
- May include a transition to enroute phase
  Example: WAGGE7 Lovelock Transition below

Visual Climb over Airport (VCOA)

- Allows pilot to climb in visual conditions while circling airport
- Weather must meet ceiling and visibility minimums specified in procedure
- Must remain in visual conditions until reaching "at or above" altitude
- Must inform ATC of intent to fly VCOA

RADAR DEPARTURES

Radar SID (Example: CAPITAL ONE at KIAD)

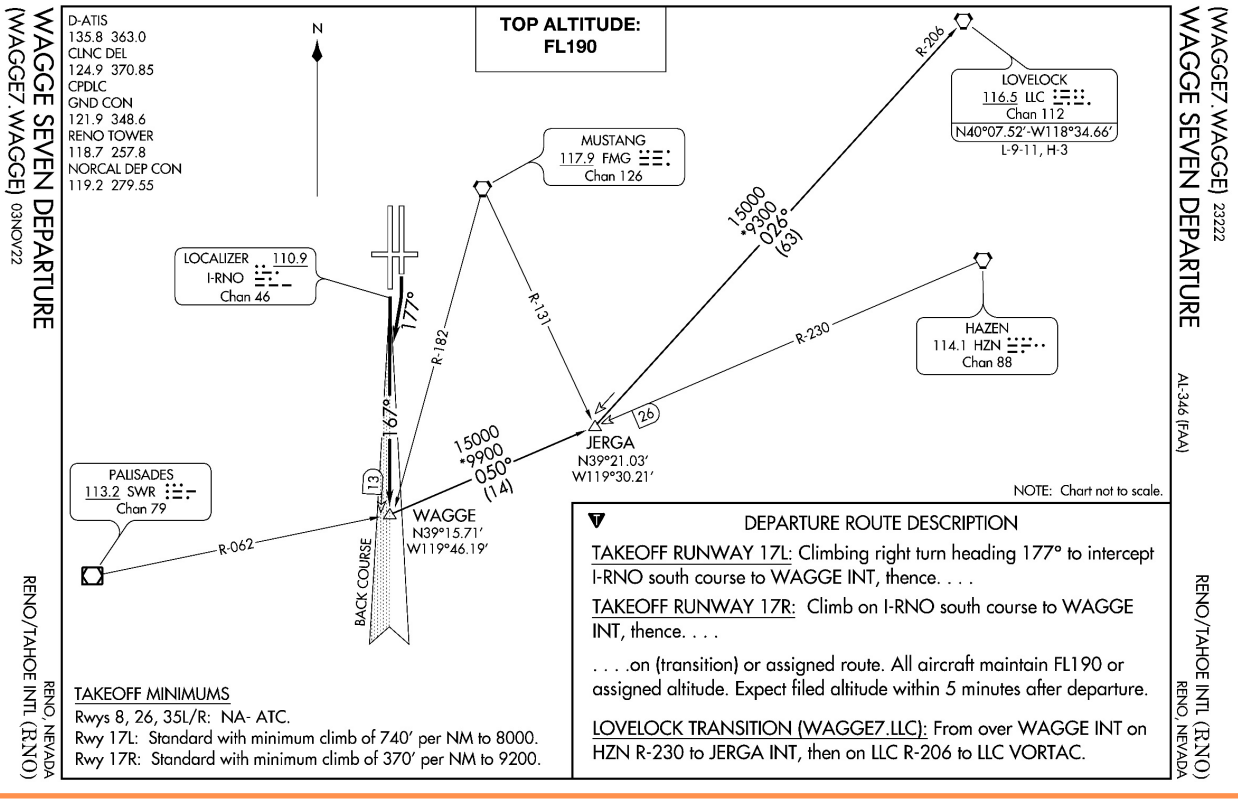
- Some SIDs do not contain published routes but assign an initial heading, and then provide for an expected radar vector to a route or fix
- ATC assumes responsibility for terrain and obstacle avoidance on vectors
- Like all SIDs, a radar SID will be assigned in an IFR clearance

Diverse Vector Area (DVA - Example: Santa Monica Airport KSMO)

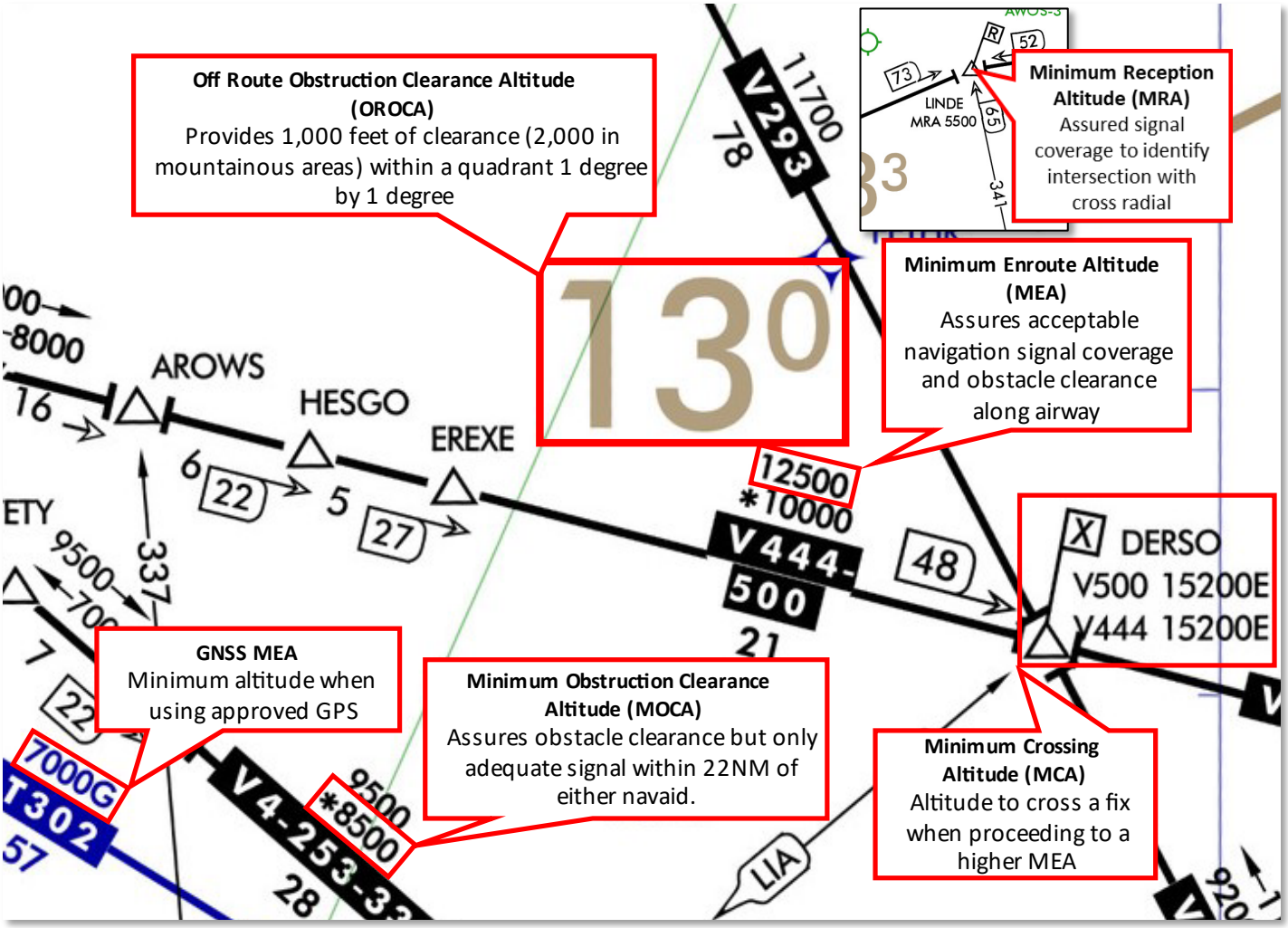
- Allows controllers to assign a "random" vector to departing aircraft below the minimum IFR altitude
- Only available where a detailed survey of obstructions has deemed it safe
- DVAs may have different takeoff minimums or climb gradients than a SID, so ATC must choose which procedure to vector an aircraft under
- DVAs are not assigned in a clearance, they can be found in the TPP
- Radar vector will be assigned either with a clearance or prior to takeoff
- Pilots assume responsibility for their own terrain and obstruction avoidance below the min IFR altitude if not vectored on a DP or DVA

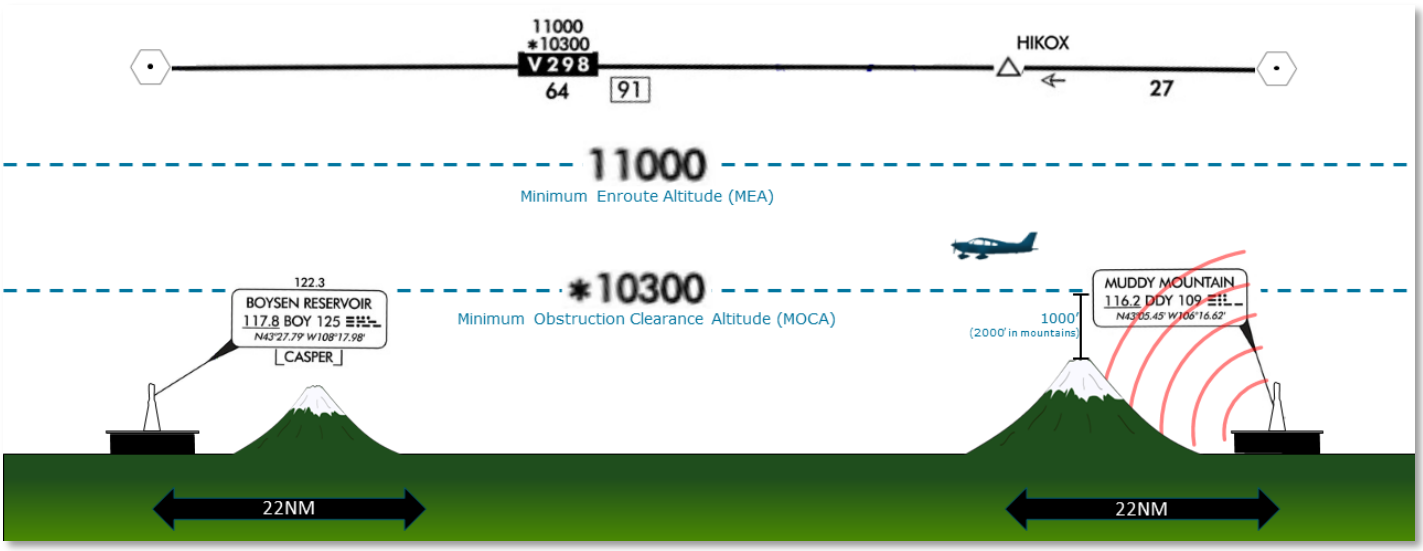
Example: At KSMO, which has a DVA, the tower instructing an aircraft to "fly heading 230 on departure" is a radar vector and ATC assumes responsibility. At a nontowered field, ATC release instruction to "enter controlled airspace flying 230" is not a vector and the pilot has responsibility.

SID EXAMPLE

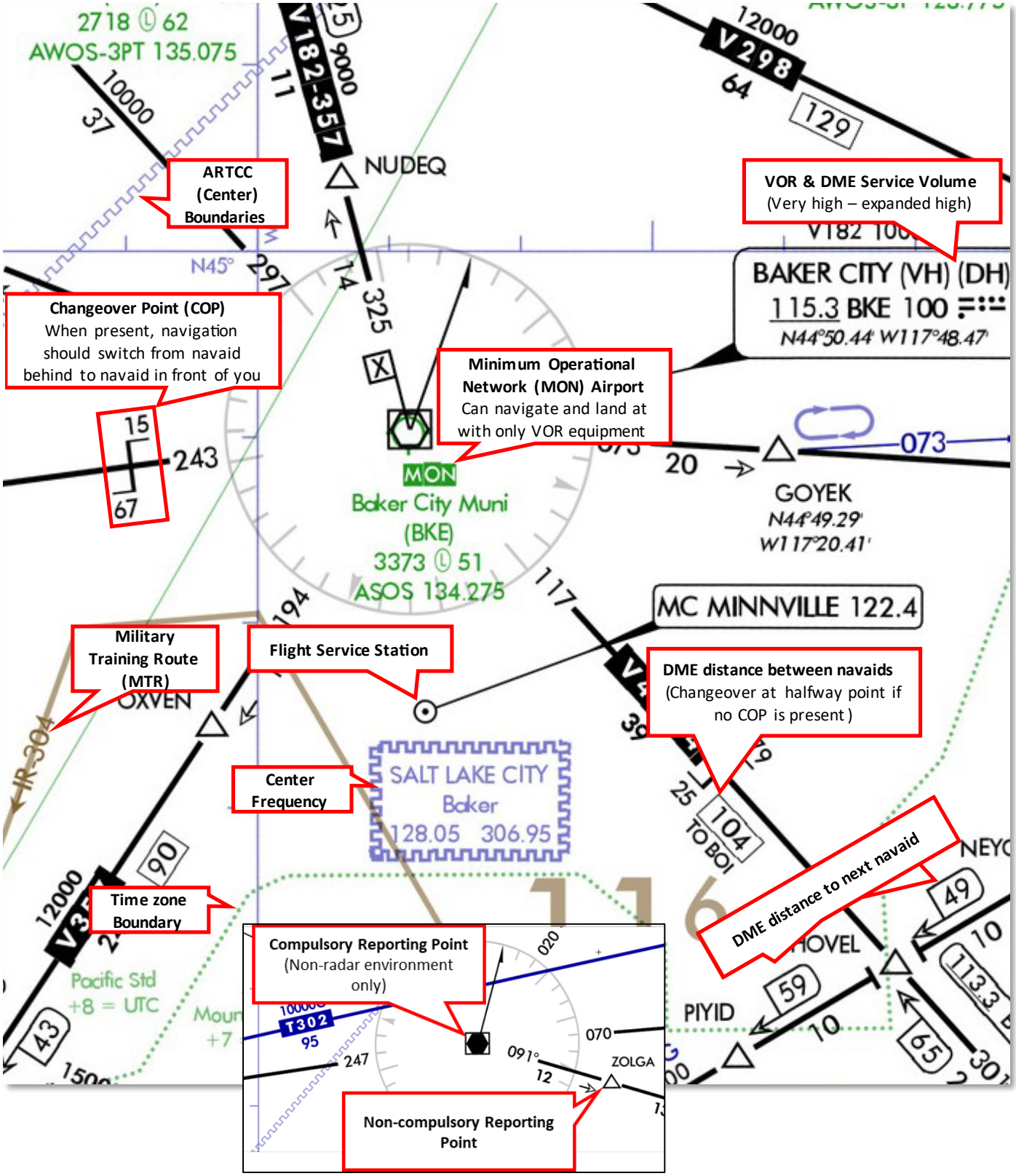


MINIMUM ALTITUDES





LOW ENROUTE CHART



ENROUTE PROCEDURES

MANDATORY IFR REPORTING

14 CFR 91.183

- Any un-forecast weather conditions
- The time and altitude passing a compulsory reporting point (if not under radar control ATC)
- Any information relating to safety of flight

AIM 5-3-3

- Vacating any previously assigned altitude or FL
- When unable to climb/descend at least 500 fpm
- When executing missed approach (say intention)
- Change in average cruise true airspeed by 5% or 10 knots from filed speed
- When leaving an assigned holding fix
- Loss of navigation equipment

Position Reporting (non radar 5-3-2)

1) Aircraft identification 2) Position 3) Time 4) Altitude or FL 5) ETA and name of next reporting point and succeeding one 6) Pertinent remarks

SURVEILLANCE REQUIREMENTS

Mode C Transponder (91.215)

- Class A, B, and C airspace
- Above Class C airspace
- Within 30 NM of primary airport in Class B airspace (Mode C veil)
- Above 10,000 MSL
- Within some Special Flight Rules Areas

ADS-B Out Requirements

- Anywhere Mode C is required, excluding Class E above 10,000 MSL and below 2,500 AGL
- Class E over Gulf of Mexico above 3,000 MSL within 12 NM of the US Coast

Common Squawk Codes

- 1200 –VFR
- 7500 – Hijacked Aircraft
- 7600 – Lost Comms
- 7700 - Emergency

DISTANCE MEASURING EQUIPMENT (DME)

- Gives direct (slant range) distance to transmitter
- Tuned automatically with VOR/LOC frequency
- Slant range error is negligible at 1NM from the station for every 1,000 feet in height above transmitter
- Required above FL240 (91.205e)
- Can sub with IFR approved GPS (AIM 1-2-3)

PICKING UP IFR ENROUTE

Activating IFR Flight Plan Enroute

- Depart and remain in VFR conditions
- Contact local approach or center controller (find frequency on enroute chart or a chart supplement page for nearby airport
- Report position, altitude, and IFR request
- Squawk assigned transponder code
- Controller will not provide radar services until above minimum IFR altitude, will ask if you are able to maintain your own terrain and obstruction clearance until then

Pop-up IFR Clearance

- Create and activate IFR flight plan with controller, workload permitting
- Contact local approach or center controller
- Report position, altitude, and request

VFR-On-Top

- File IFR flight plan with remark "VFR-On-Top"
- Climb through IFR layer, and proceed in VFR conditions
- Fly at VFR altitude per 91.159
- Maintain VFR cloud and visibility mins in 91.155
- Advise any altitude change while VFR-On-Top
- Not to be confused with "VFR over the top", which is not an IFR procedure, but simply VFR flight above instrument conditions

Cruise Clearance

- "Cruise" is a term used by ATC to assign a block of airspace to an IFR aircraft
- The block of airspace begins at the minimum IFR altitude and goes up to the assigned cruise
- The aircraft can climb, descend, and level off at any intermediate altitude within the block
- Once the aircraft reports leaving an altitude during a descent, it cannot return to that altitude without additional clearance
- A cruise clearance automatically includes a clearance to execute an instrument approach at the destination airport

LOST COMMUNICATIONS

91.185

Altitude – Fly the Higher of:

- Minimum altitude prescribed for IFR
- Expected
- Assigned (last assigned by ATC)

Example: Your IFR clearance instructs you to maintain 2,000 feet and expect 5,000 feet 10 minutes after departure. 20 minutes into your flight plan, you will join an airway with an MEA of 7,000 feet. You lose comms shortly after takeoff. You first maintain 2,000 feet, your last assigned, then climb to your expected altitude of 5,000 feet after 10 minutes, then, after joining the airway, climb to the MEA of 7,000.

Route – Select course in order of:

- Assigned route
- Vectored (continue to published route in clearance)
- Expected
- Filed route

Leaving Clearance Limit (if other than destination):

- If limit is a fix from which an approach begins begin descent and approach as close as possible to estimated arrival time
- If limit is not a fix on an approach, leave the limit at expected time and proceed to a fix where an approach begins

In VFR Conditions

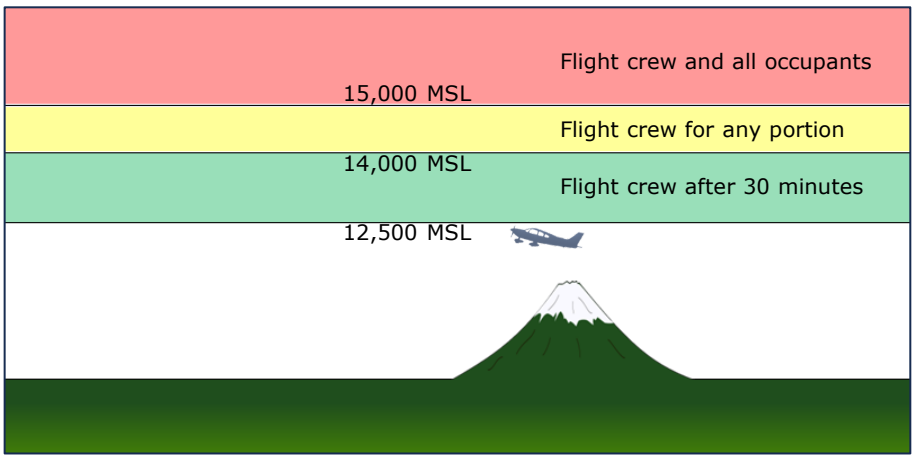
- Continue under VFR and land as soon as practicable

CANCELLING IFR

91.185

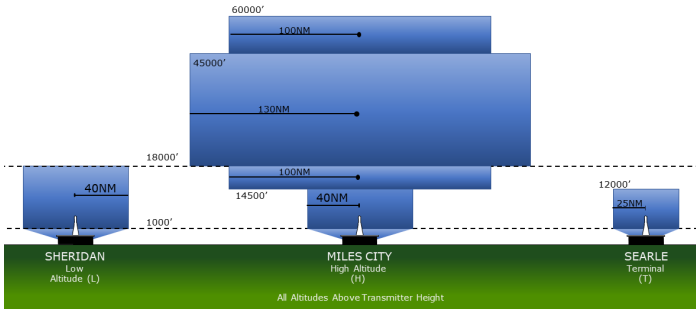
- Pilot may cancel IFR in flight anytime if not in IMC or in Class A airspace
- The tower automatically closes an IFR flight plan after landing
- At a nontowered field, pilot must cancel IFR through ATC or Flight Service by radio or phone
- Failure to cancel IFR after flight will trigger search and rescue operations!

SUPPLEMENTAL O_2 REQUIREMENTS

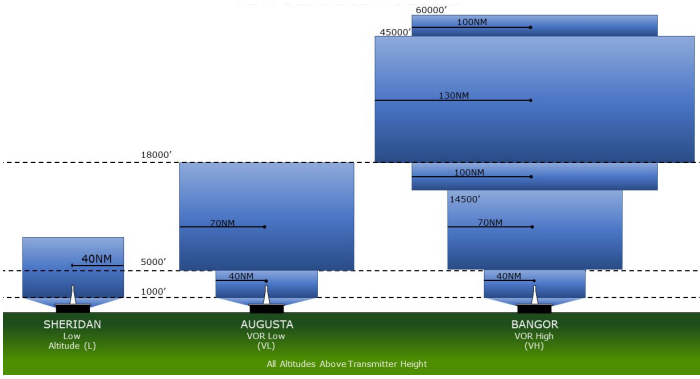


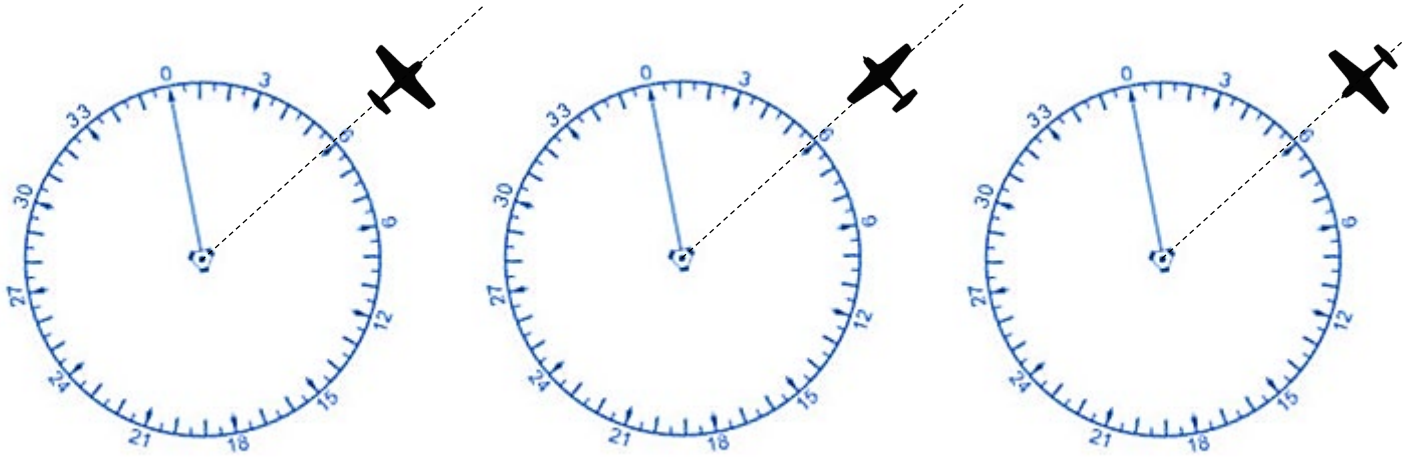
VOR NAVIGATION

TRADITIONAL VOR SERVICE VOLUME

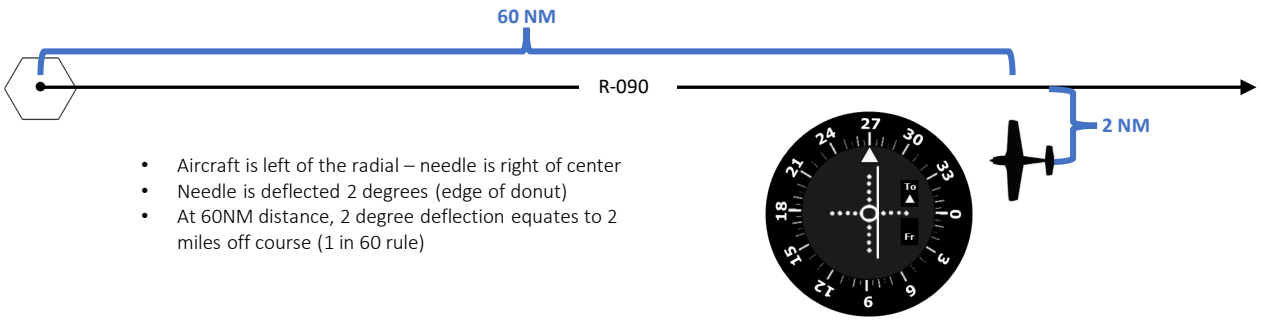


NEW VOR SERVICE VOLUME





- All three aircraft are on the 060 radial, regardless of which direction they are pointed or flying
- All VOR indicators are correct for all three aircraft
- A heading of 240 will bring the aircraft to the station



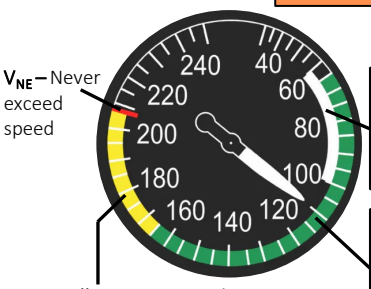
- Aircraft is left of the radial – needle is right of center
- Needle is deflected 2 degrees (edge of donut)
- At 60NM distance, 2 degree deflection equates to 2 miles off course (1 in 60 rule)

AIRSPEEDS

TYPES OF SPEEDS

- **Indicated Airspeed (IAS)** – Speed displayed on airspeed indicator
- **Calibrated Airspeed (CAS)** – IAS corrected for instrument and position errors – most POHs show CAS for a given IAS
- **True Airspeed (TAS)** – Actual speed through the air. CAS corrected for non standard temperature and pressure – lower pressure, and higher altitude or temperature increase TAS relative to CAS
  Example: An aircraft travelling 120 knots CAS at 5,000 feet in standard conditions will be at 130 knots TAS – at 8,000 feet, it will be at 135 knots TAS – it flies faster!
- **Groundspeed** – Actual speed moving over the ground – TAS plus (minus) tail (head) wind component
  Example: An aircraft heading due north at 130 knots TAS, with a 20 knot wind out of 060° will have a headwind component of about 9 knots and a groundspeed of 121 kts
- **Mach Number** – Ratio of TAS to the local speed of sound

V SPEEDS



V_{NE} – Never exceed speed

Yellow Arc – Smooth air only speed

V_{S0} – Stall speed, landing configuration - bottom of white arc

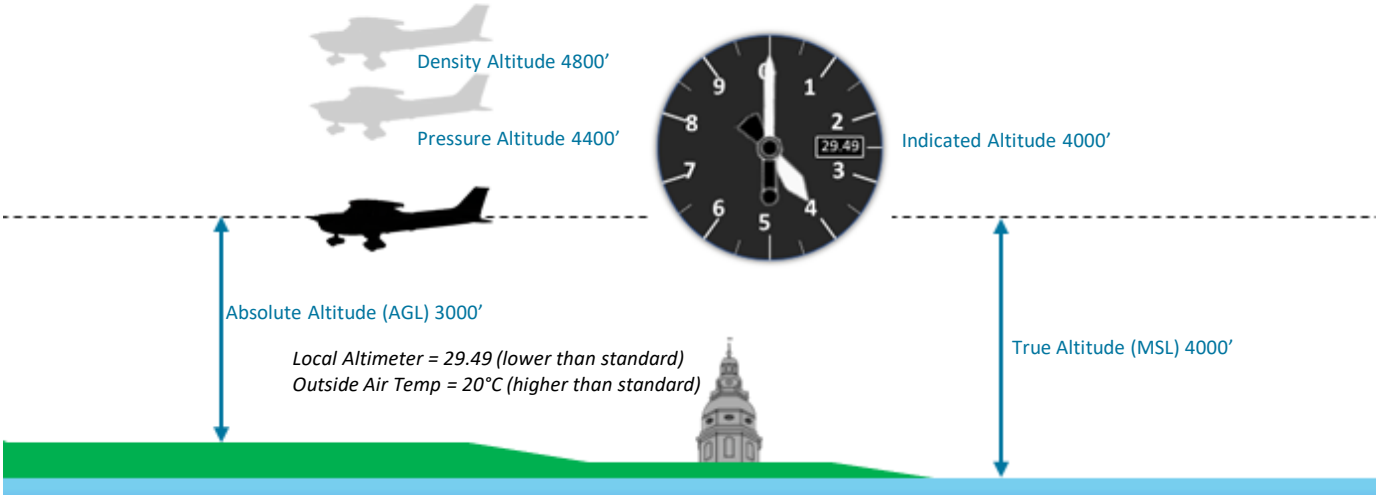
V_{fe} – Max flap extended speed - top of white arc

V_{S1} – Stall speed, specified configuration - bottom of green arc

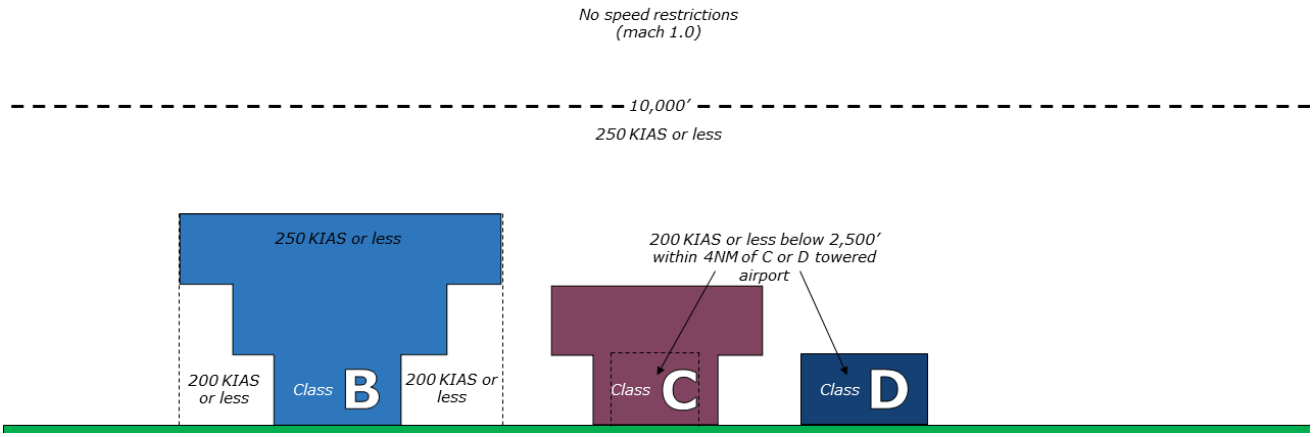
V_{NO} – Max structural cruising speed - top of green arc

V_A – Maneuvering speed V_x – Best angle of climb V_Y – Best rate of climb

TYPES OF ALTITUDES

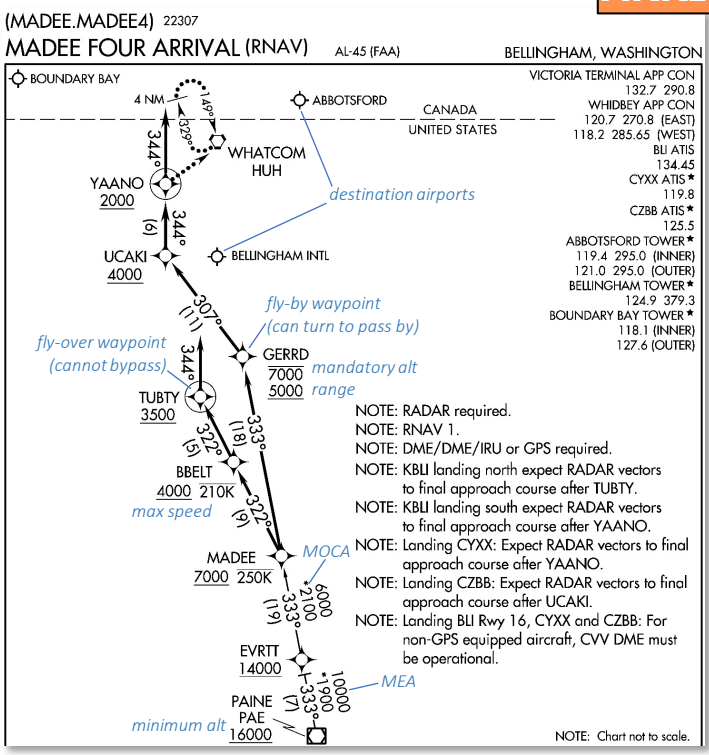


SPEED RESTRICTIONS



IFR CHECKRIDE AT A GLANCE

ARRIVALS



ARRIVAL ROUTE DESCRIPTION

PAINE TRANSITION (PAE.MADEE4)

LANDING BLI RUNWAY 16: From MADEE on track 333° to cross GERRD between 5000 and 7000, then on track 307° to cross UCAKI at or above 4000, then on track 344° to cross YAANO at or above 2000, then on track 344°. Expect RADAR vectors to final approach course.

LANDING BLI RUNWAY 34: From MADEE on track 322° to cross BBELT at or above 4000 and at or below 210K, then on track 322° to cross TUBTY at or above 3500, then on track 344°. Expect RADAR vectors to final approach course.

LANDING CYXX/CZBB: From MADEE on track 333° to cross GERRD between 5000 and 7000, then on track 307° to cross UCAKI at or above 4000, then on track 344° to cross YAANO at or above 2000, then on track 344°. Expect RADAR vectors to final approach course.

LOST COMMUNICATIONS

LANDING BLI RUNWAY 16, CYXX, and CZBB: After YAANO proceed direct HUH and hold.

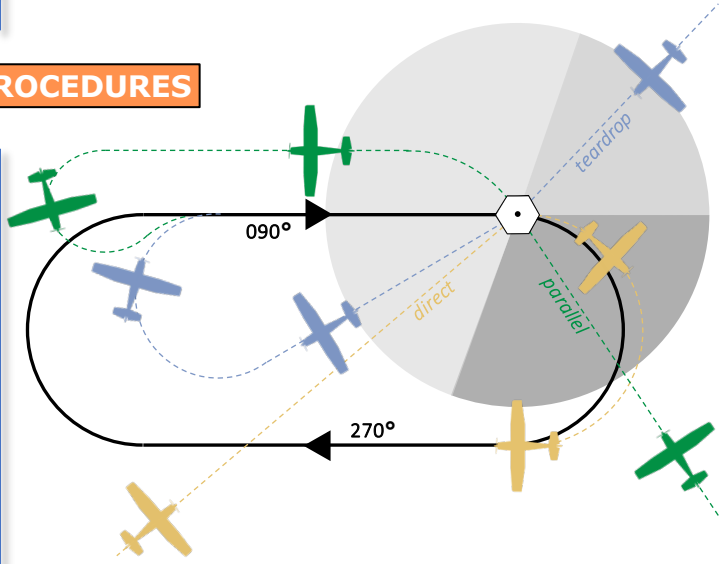
LANDING BLI RUNWAY 34: After TUBTY execute RNAV (GPS) Y RWY 34 approach.

- A Standard Terminal Arrival Route (STAR) is a transition between enroute and approach environment
- Begins at transition point, a fix along enroute course where arrival begins
- Many STARs are intended for jets and turboprops, with high altitude and speed minimums, but some apply to prop aircraft
- Arrivals may have multiple destination airports
- "NO STARs" in the flight plan remarks tells ATC not to assign one
- STARs are depicted graphically and textually, found in Section G of the TPP
- An instruction to "descend via" the arrival allows a pilot to descend at their discretion to meet altitude and speed restrictions
- An instruction "cleared for arrival" allows the pilot to fly the course but NOT to descend from last assigned altitude
- When an arrival is assigned, the controller will typically indicate the direction of operations (north, south, east, or west) so pilots can plan

Example: The MADEE FOUR Arrival applies to Bellingham, Boundary Bay and Abbotsford Airports. The arrival begins at the Paine VOR, and splits off depending on destination and if runway 16 or 34 is used for Bellingham.

HOLDING PROCEDURES

- Unless otherwise instructed or published, turns are to the right side, and legs are one minute long
- To draw a hold:
  - Start with the radial you are holding on. This is the inbound course
  - At the holding fix or station, draw a left or right turn as needed
  - Draw a straight line parallel to the inbound course, this is the outbound course
  - Draw another turn to connect back up with the inbound course
- Begin timing the outbound leg when the VOR flag flips from FROM to TO, or you are otherwise abeam the holding fix
- There is no "protected" or "unprotected" side of a hold. Protection exists on both sides, with wider protection on the holding side
- Fly the outbound leg long enough to allow the inbound leg to last one minute (or however much time is instructed)
- Note the wind correction required to maintain the inbound course. Triple this correction the opposite way when flying the outbound course
- The AIM recommends holding entries (see figure to right) based on direction approaching the hold, but any entry that keeps you within the protection is acceptable



"November 518 Foxtrot Tango. Hold west of the VOR on the 270 radial. One minute legs. Right hand turns. Expect further clearance in one zero minutes."

Maximum Holding Speeds

Altitude (MSL)	Max Airspeed (KIAS)
6,000 or lower	200
6,001 to 14,000	230
14,001 and above	265

Direct Entry

- Upon crossing the fix, turn to follow the holding pattern

Parallel Entry

- Upon crossing the fix, turn to a heading parallel the inbound course
- After one minute, turn 210 degrees around (30° intercept to inbound)
- Intercept and fly inbound course

Teardrop Entry

- Upon crossing the fix, turn outbound to a heading 30° into pattern (240° heading in this example)
- After one minute, turn 210° around to intercept inbound course

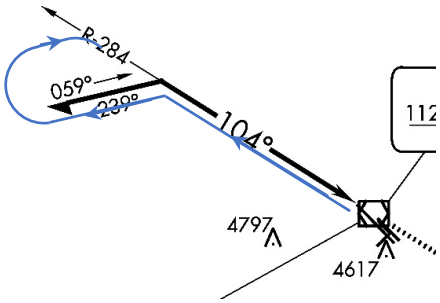
IFR CHECKRIDE AT A GLANCE

PROCEDURE TURNS

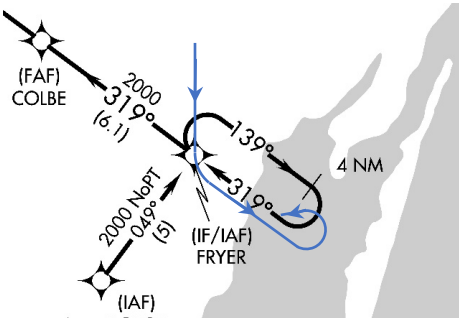
AIM 5-4-9

- Procedure turns are designed to enable a course reversal, a descent from the initial approach fix to the approach altitudes, and an interception for the final approach course, while staying within a protected area, away from a published segment of an approach, as long as the pilot remains within a charted distance
- For the hold in lieu of procedure turn or teardrop entry, depicted below, the shape and direction of the turn is mandated, for the barbed arrow, the side of the approach course is mandated, but the directions of the turn and shape of the procedure are up to the pilot, as long as the charted distance is adhered to
- On the teardrop entry, if the navaid is located at the airport, the final approach starts after the turn

Barbed Arrow

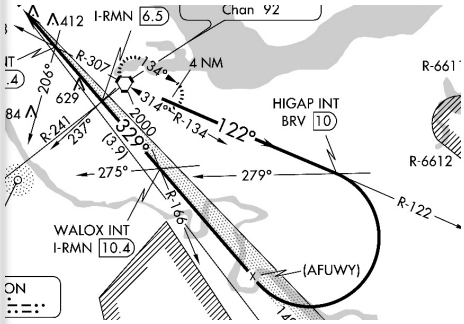


Hold in Lieu of Procedure Turn



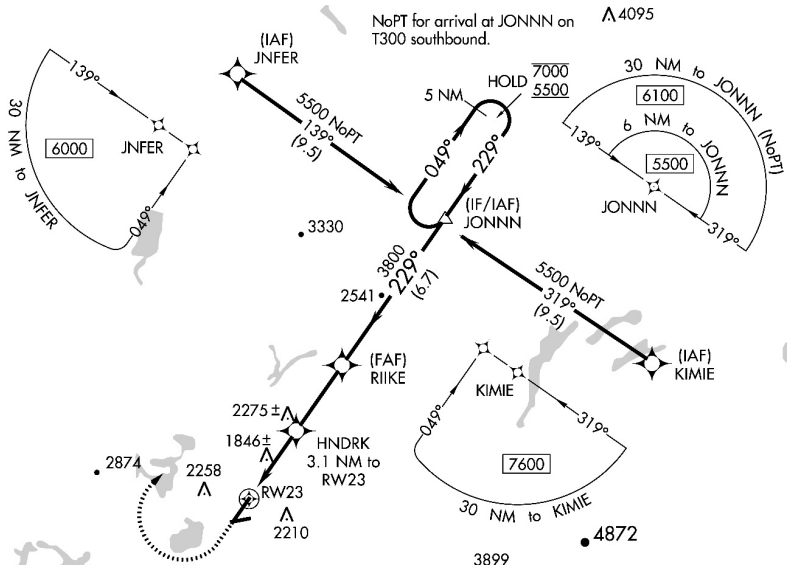
- When charted on an approach plate, a procedure turn, hold in lieu of, or teardrop entry must be executed, except if:
  - A straight in approach clearance is given
  - On a DME arc
  - Given radar vectors to final
  - "NoPT" is published on the chart
  - Making a timed approach from the fix

Teardrop Entry



TERMINAL ARRIVAL AREA (TAA)

AIM 5-4-5d



- Provides a transition to the approach with little required pilot/controller interaction
- Primarily used on RNAV approaches, and follow a "T" design (see left)
- T design incorporates two IAFs plus a dual purpose IF/IAF with a hold in lieu of procedure turn at it, proceeding to FAF
- Minimum altitudes are published based on distance to a fix along the T design
- Minimums altitudes replace MSAs on a typical approach and give usual obstacle clearance
- Aircraft can be cleared much further out than on a normal approach (30NM in this example)
- ATC will not clear an aircraft to the right or left IAF with a greater than 90° turn needed
- Entry via one of the base leg IAFs typically does not allow a procedure turn

VISUAL APPROACH

AIM 5-4-23

- Authorizes pilot to proceed visually and clear of clouds to airport
- Must have airport or a preceding aircraft in sight prior to being cleared
- Ceiling at destination must be at least 1000' with 3SM or more visibility
- VFR minimum cloud separations do not apply as this is an IFR procedure, aircraft must simply remain clear of clouds
- A visual approach is not an instrument approach procedure and has no missed approach procedure
- Aircraft going missed on a visual approach will be given instructions by tower or at nontowered fields should remain clear of clouds and land
- Charted Visual Flight Procedures may be published for certain airports

CONTACT APPROACH

AIM 5-4-25

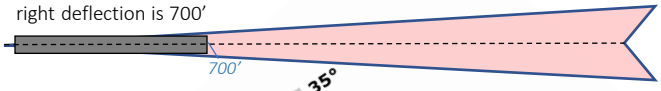
- Enables aircraft to proceed to land without flying an instrument procedure
- Requires at least 1 statute mile of visibility
- Destination airport must have a published instrument approach procedure
- Aircraft must remain clear of clouds at all times
- Can only be requested by the pilot, ATC cannot offer a contact approach
- Due to inherent risk of proceeding to land at an airport in IFR conditions without being on an instrument approach, pilot assumes responsibility for obstacle clearance, and should only proceed if familiar with the area

INSTRUMENT LANDING SYSTEM (ILS)

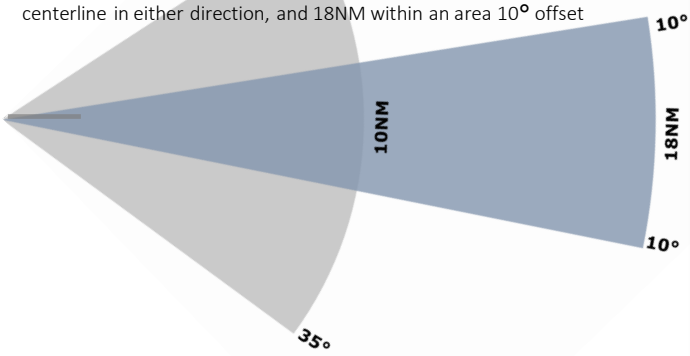
AIM 1-1-9

LOCALIZER

- Lateral guidance for precision ILS approach
- Localizer antenna situated at departure (opposite) end of runway
- Signal is set up such that at runway threshold, full scale left to full scale right deflection is 700'

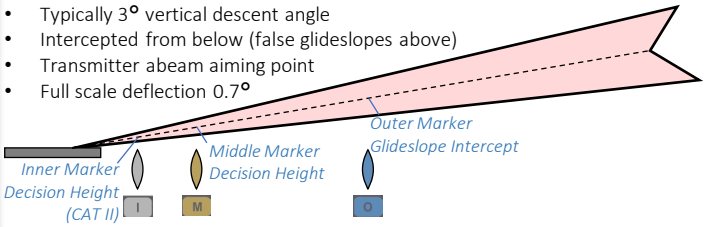


- Localizer signal is 4 times more sensitive than VOR (i.e., full deflection is 2.5 degrees off center, not 10)
- Coverage range is approximately 10NM within an area 35° offset from the centerline in either direction, and 18NM within an area 10° offset



GLIDESLOPE

- Vertical guidance for precision ILS approach
- Typically 3° vertical descent angle
- Intercepted from below (false glideslopes above)
- Transmitter abeam aiming point
- Full scale deflection 0.7°



Marker Beacons

- Provide range information over specific points along approach
- Transmit over radio, and can be simulated on advanced avionics like G1000
- Outer Marker: 4-7 miles out at glideslope intercept (final approach fix)
- Middle Marker: typically 3500 feet from the runway, at decision height
- Inner Marker: indicates decision height for Category II ILS approach

ILS INDICATIONS

Right of course, on glideslope

Left of course, above glideslope

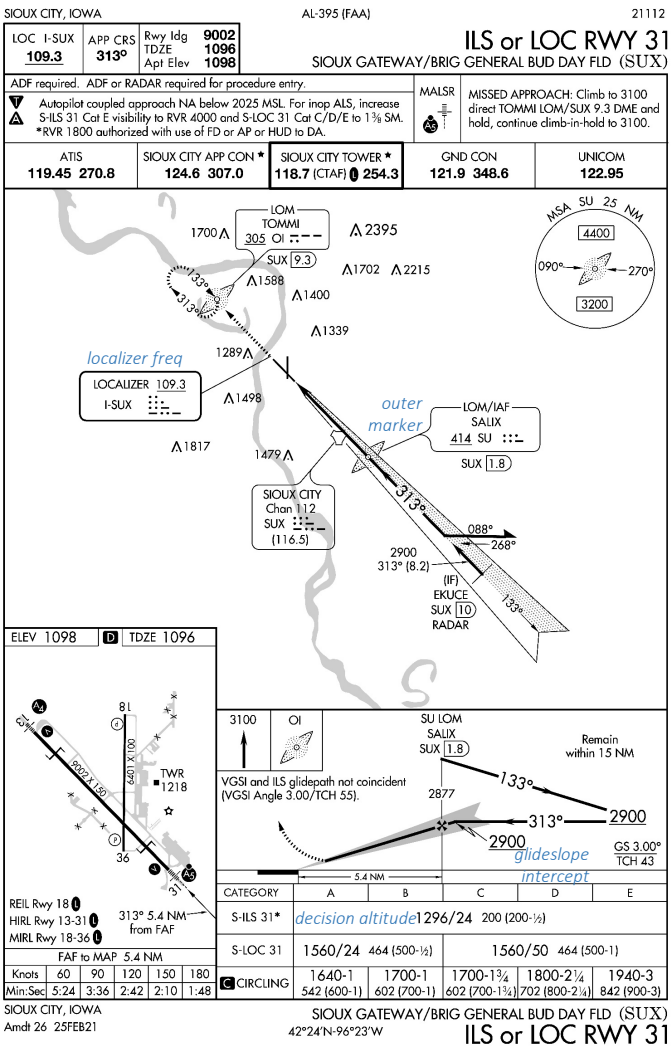
On course, below glideslope

On course, on glideslope

BACKCOURSE

- Localizer signal on opposite side of runway (for approaching departure end)
- Cannot use glideslope signal on backcourse (i.e., non precision only)
- Signal is reverse sensing when flying inbound, rather than chase the needle, fly away from needle

ILS APPROACH PLATE

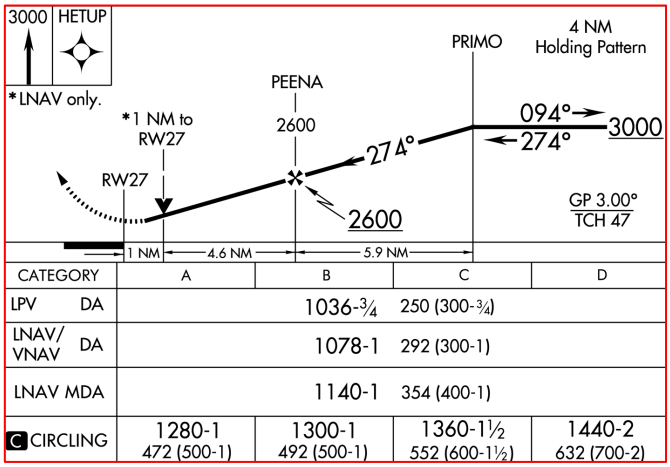


GPS NAVIGATION

AIM 1-1-17

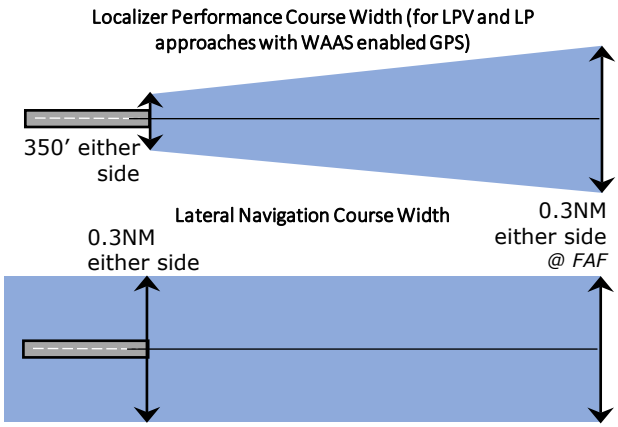
SYSTEM BASICS

- GPS is the Global Navigation Satellite System (GNSS) of the United States
- A minimum of 24 satellites orbit in such a way that at least five satellites are in view at all times from any point on Earth
- At least three satellites are required for a latitude/longitude position
- At least four satellites are required for latitude/longitude and altitude
- Onboard receivers compute the time in transit of messages from the satellites to determine distance from each, and thereby aircraft position
- Changes in position over time give data about aircraft groundspeed and track, they cannot determine airspeed or heading



CATEGORY	A	B	C	D
LPV DA		1036-¾	250 (300-¾)	
LNAV/VNAV DA		1078-1	292 (300-1)	
LNAV MDA		1140-1	354 (400-1)	
C CIRCLING	1280-1 472 (500-1)	1300-1 492 (500-1)	1360-1½ 552 (600-1½)	1440-2 632 (700-2)

GPS COURSE WIDTHS

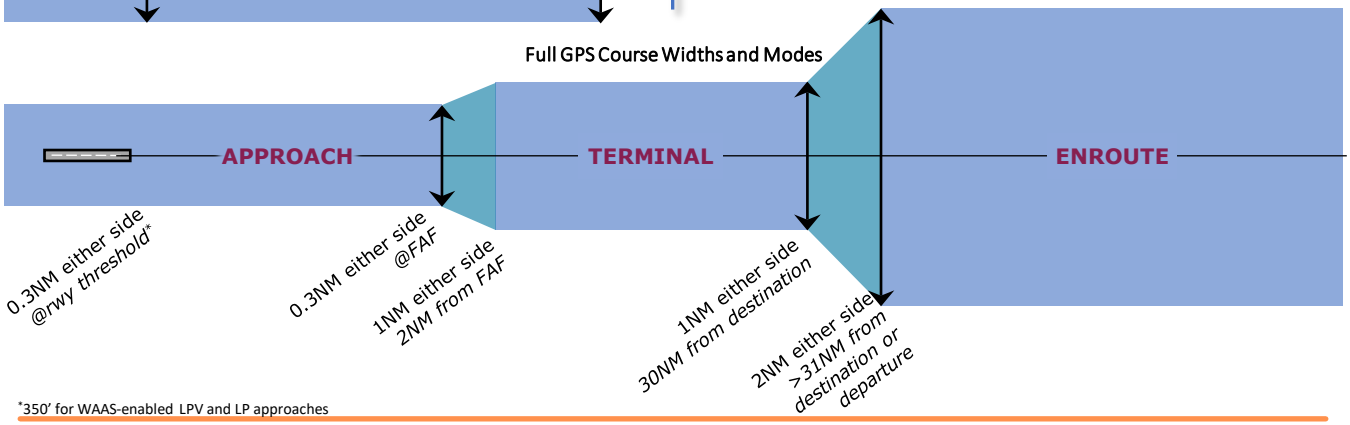


GPS ACRONYMS

- **RAIM - Receiver Autonomous Integrity Monitoring –** A fifth GPS satellite is used to cross check the position determined from the other four in sequence. If a fault is detected in the position information from one of the satellites, it is excluded by the receiver. RAIM coverage can be predicted using a satellite database or flight planning tool. If RAIM will be unavailable for a flight, an alternative means of navigation like VOR is required for IFR
- **WAAS - Wide Area Augmentation System –** GPS receivers with this augmentation use signals from ground stations to improve accuracy of satellite signals. WAAS equipped and enabled GPS units can provide accurate vertical position and can be used for all approaches with vertical guidance. RAIM coverage is not required when WAAS is available
- **Technical Standard Order (TSO) C129 & C196 –** Unaugmented older GPS units that are capable of IFR flight, but cannot be used for alternate planning, are unable to perform some approaches with vertical guidance, require RAIM coverage, and must be supplemented with other forms of navigation. **TSO-C145 & TSO-C146** units are WAAS enabled and can be used for approaches with vertical guidance and for alternate planning

GPS Approach Acronyms

- **LPV - Localizer Performance w/ Vertical –** provides both lateral and vertical guidance, and terminates at a decision altitude, similar to ILS, requires WAAS to simulate more precise lateral guidance similar to localizer
- **LNAV/VNAV - Lateral & Vertical Navigation –** also provides lateral and vertical guidance and terminates at a decision altitude, but does not require WAAS because it uses an external source like baro-assist for vertical
- **LP - Localizer Performance –** Uses WAAS to simulate more precise lateral course but does not have vertical guidance like an LPV, terminates in minimum descent altitude
- **LNAV - Lateral Navigation** – Basic type of GPS approach that only provides lateral navigation, though not as precise as localizer performance, terminates in a minimum descent altitude like a non precision approach like a VOR
- **LNAV+V - Lateral Navigation plus Vertical –** uses WAAS to compute an advisory glidepath on approaches with only LNAV minimums. It is not an official type of approach and does not provide official vertical guidance. It terminates in a minimum descent altitude just like any non precision approach
- **APV - Approach with Vertical Guidance** – GPS approaches with both lateral and vertical guidance, flown similar to a precision approach like an ILS and terminate at decision altitude, but are not strictly defined as precision approaches for purposes of alternate planning
- **RNP – Required Navigation Performance –** A set of standards for an **Area Navigation (RNAV)** system like a GPS to have certain performance requirements, which can be monitored onboard (like by using RAIM or WAAS). Most WAAS enabled IFR GPS units can perform to a RNP APCH specification, which has a lateral accuracy of 1NM in the terminal phase, scaling to 0.3 in the final approach

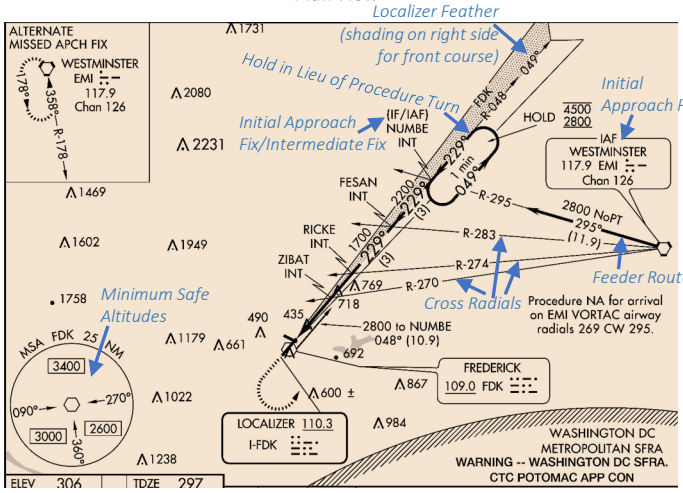


*350' for WAAS-enabled LPV and LP approaches

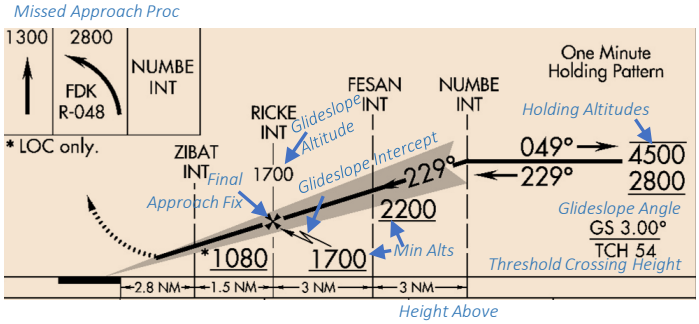
INSTRUMENT APPROACHES

APPROACH PLATE

Plan View



Profile View



Minimums Section

CATEGORY	A (<91 KIAS)	B (91-120 KIAS)	C (121-140 KIAS)	D (141-165 KIAS)
S-ILS 23	Decision Alt 689-1		392 (400-1)	Visibility
S-LOC 23	1080-¾ 783 (800-¾)	1080-1 783 (800-1)	Minimum Descent Altitude 1080-2	Min (SM) 783 (800-2)
C CIRCLING	1080-1 774 (800-1)	1080-1¼ 774 (800-1¼)	1100-2½ 794 (800-2½)	1140-2¾ 834 (900-2¾)

Expanded Circling Minimums

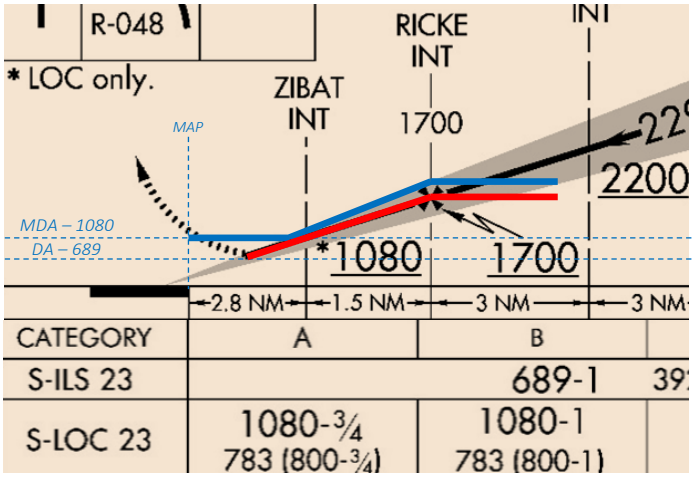
DESCENDING BELOW MINIMUMS

91.175c

- Descent below minimums (MDA or DA) can only be made if:
  1) The aircraft is in position to make a normal descent to land
  2) The flight visibility is not below minimums; and
  3) For Category I approaches (almost all GA approaches), at least one of these visual references for the runway must be seen:
     - Runway threshold
     - Threshold markings
     - Threshold lights
     - Visual glideslope indicator
     - Touchdown zone or touchdown zone markings
     - Touchdown zone lights
     - Runway or runway markings
     - Runway lights
     - Approach lighting system can be used, but the pilot can only descend to 100 feet above the touchdown zone elevation, until the red terminating bars, the red side row bars, or the other visual references are above are visible

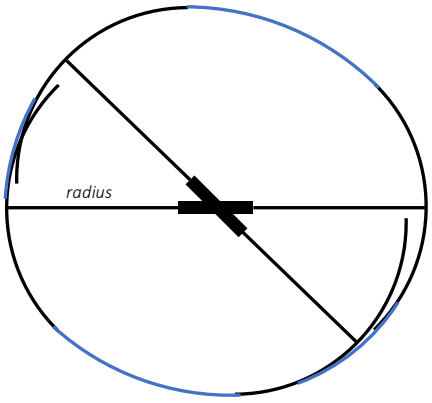
MDA vs DA

- On an ILS approach or GPS Approach with Vertical Guidance, the glideslope is intercepted from beneath, and followed down to the decision altitude, where the approach is either continued visually or a missed approach is made (see red course)
- On a localizer only or other non precision approach, the minimum altitude is maintained until crossing the final approach fix, and then a descent is made to the minimum descent altitude, the aircraft remains at that altitude until continuing visually, or going missed at the missed approach point, in this case the runway threshold (see blue course)
- A visual descent point (VDP) is depicted by a black triangle on the profile view (not seen here) indicating where a normal descent from the MDA can begin



CIRCLING APPROACH

- A descent is made to the circling MDA, and when the runway is spotted the aircraft maneuvers to land, remain at the MDA until a normal descent to land can be made
- The aircraft must stay within a protected area defined by arcs of a certain radius from each runway threshold. The radius length is determined by aircraft approach speed, altitude, and whether traditional or expanded circling minimums (noted with black "C" symbol in minimums section) are used
- In the diagram below, and aircraft approaching at 80 knots (cat A) below 1000' AGL, would have an expanded circling radius of 1.3 nautical miles
- If the aircraft loses sight of the runway at any time, or if the protected area is departed, a missed approach should be executed immediately, with the aircraft circling in the protected area until a safe altitude is reached
- See the TPP for the full standard and expanded circling approach maneuvering radii



IFR CHECKRIDE AT A GLANCE

WEATHER SOURCES

METAR

METAR KINK 121845Z 11012G18KT 15SM SKC 25/17 A3000

Station	Time	Winds	Visibility	Precipitation	Cloud Layers	Temp/Dew Point	Altimeter	Remarks
KINK	12th @ 1845Z	110 @ 12 gusting 18	15 SM		Sky Clear	25/17	30.00	

TAF

KOKC 051130Z 0512/0618 14008KT 5SM BR BKN030 TEMPO 0513/0516 1 1/2SM BR
FM051600 18010KT P6SM SKC BECMG 0522/0524 20013G20KT 4SM SHRA OVC020
PROB40 0600/0606 2SM TSRA OVC008CB BECMG 0606/0608 21015KT P6SM SCT040=

Time of Report	Valid Period	Winds	Visibility	Precipitation	Clouds
5th @ 1130Z	5th @ 1200Z to 6th @ 1800Z	140° @ 8 KT	5 SM	Mist	Broken 3000'
	Forecast Change Temporary btwn 1300Z and 1600Z		1 1/2 SM	Mist	
	From 1600Z	180° @ 10 KT	> 6 SM		Sky Clear
	Becoming btwn 2200Z and 2400Z	200° @ 13 gusting 20 KT	4 SM	Rain Showers	Overcast 2000'
	Probability 40% 0000Z thru 0600Z		2 SM	Thunderstorm and rain	Overcast 800' Cumulonimbus
	Becoming btwn 0600Z and 0800Z	210° @ 15 KT	> 6 SM		Scattered 4000'

PIREP

UA/OV KOKC-KTUL/TM 1800/FL120/TP BE90/SK BKN018-TOP055/OVC072-TOP089/CLR ABV/TA M7/WV 08021/TB LGT 055-072/IC LGT-MOD RIME 072-089

Report Type	Location	Time	Flight Level	Aircraft Type	Sky Cover	Weather	Temperature	Wind	Turbulence	Icing	Remarks
Routine	OK City/Tulsa	1800Z	FL120 (12000')	BE90 (King Air)	Broken 1800' Tops 5500' Overcast 7200' Tops 8900'	Clear Above	Minus 7°C	080° @ 21	Light 5500-7200'	Light/ Moderate 7200-8900'	

WINDS ALOFT

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
ALS			2420	2635-08	2535-18	2444-30	245945	246755	246862
AMA		2714	2725+00	2625-04	2531-15	2542-27	265842	256352	256762
DEN			2321-04	2532-08	2434-19	2441-31	235347	236056	236262
HLC		1707-01	2113-03	2219-07	2330-17	2435-30	244145	244854	245561
MKC	0507	2006+03	2215-01	2322-06	2338-17	2348-29	236143	237252	238160
STL	2113	2325+07	2332+02	2339-04	2356-16	2373-27	239440	730649	731960

@STL*

	3000′	6000′	34000′
Wind Dir	210°	230°	230°
Wind Speed	13	25	106
Temperature		7°C	-49°C

*When wind forecast is over 100 knots, 50 is added to the direction and 100 is subtracted from wind

ABBREVIATIONS

"-" = Light	**No sign** = Moderate		"+" = Heavy
"VC" = Vicinity, but not at aerodrome. In the US METAR, 5 to 10 SM from the point of observation. In the US TAF, 5 to 10 SM from the center of the runway complex. Elsewhere, within 8000m.			
BC – Patches	**BL** – Blowing	**DR** – Drifting	**FZ** – Freezing
MI – Shallow **DZ** – Drizzle	**PR** – Partial **GR** – Hail	**SH** – Showers **GS** – Small Hail/Snow Pellets	**TS** – Thunderstorm
IC – Ice Crystals	**PL** – Ice Pellets	**RA** – Rain	**SG** – Snow Grains
SN – Snow	**UP** – Unknown Precipitation in automated observations		
BR – Mist (≥5/8SM)	**DU** – Widespread Dust	**FG** – Fog (<5/8SM)	**FU** – Smoke
HZ – Haze	**PY** – Spray	**SA** – Sand	**VA** – Volcanic Ash
DS – Dust Storm	**FC** – Funnel Cloud	**+FC** – Tornado or Waterspout	
PO – Well developed dust or sand whirls		**SQ** – Squall	**SS** – Sandstorm

SKY COVERAGE

Ceiling is lowest layer of clouds covering at least half the sky (broken or overcast), here it is 3000 AGL, while the scattered layer is at 2000 AGL