



Geoff Hatcher MEI, CFII, ATP,  
 Westwind Type Rating  
 1915 Biscayne Little Rock, AR 72227  
 (501) 680-7283

# Instrument Airplane Study Guide

[FARs](#)

[Instrument Flying Handbook](#)

[Instrument Procedures Handbook](#)

[AIM](#)

## IFR Pre-Flight Preparation

### Maintaining Instrument Currency

**Required Recent Instrument experience: in last 6 months [61.57\(c\)](#)**

- (i) Six instrument approaches.
- (ii) Holding procedures and tasks.
- (iii) Intercepting and tracking courses through the use of navigational electronic systems.
  - log (location, type of approach, name of safety pilot)
  - after 6 months requires a safety pilot to get current
  - after 12 months must complete an instrument proficiency check outlined in PTS, with a CFII or better
  - If not IFR current you cannot take commercial passengers beyond 50 NM or at night [61.133\(b\)](#)

**General Requirements [61.56](#)**

- Flight Review 1hr ground 1hr flight minimum

**General Requirements w/passengers [61.57\(a\)\(b\)](#)**

- 3 Take-offs and landings for day currency
- 3 Take-offs and landings to a full stop for night currency

### Aircraft Requirements

**Required Documents: ARROW**

- Airworthiness Certificate
- Registration
- Radio License (International flight only)
- Operation Limitations (POH)
- Weight and Balance (Aircraft specific)

## Instruments and equipment requirements §91.205

**Required Instruments**

VFR DAY	VFR NIGHT	IFR
G-Gas gauge	F-Fuses (spare)	G-Generator or alternator
O-Oil Temperature gauge	L-Landing Light (if for hire)	R-Radios (nav and comm)
O-Oil Pressure gauge	A-Anti-Collision	A-Altimeter (sensitive)
S-Seat belts	P-Position Lights	B-Ball
E-ELT	S-Source of power (Alt)	C-Clock (Hrs, min, sec)
		A-Attitude Indicator
A-Altimeter		R-Rate of turn indicator
		D-Directional Gyro
C-Compass		
A-Airspeed indicator		
T-Tachometer		



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### Required Inspections “AVIATES”

**A**= Annual inspection 12 calendar months

**V**= VOR (w/I 30 day for IFR flight) [91.171](#)

**I**= 100 hour inspection

**A**= Altimeter (2 yrs)

**T**= Transponder (2 yrs)

**E**= ELT & Battery (1 yr or ½ useful life of battery usual longer)

**S**= Static & Pitot System (2 yrs)

- 24 month avionics IFR checks: The Transponder/Mode C / Altimeter/Pitot/Static test are usually performed together and recorded under a single logbook endorsement.
- ELT Battery: Replace or recharge after more than 1 hour of continuous use or at ½ the average shelf-life To test: Tune to 121.5 during the first 5 min of every hour
- VOR 30 day check Test Note date, place, bearing error, and signature
  - Over airborne checkpoint: +/- 6<sup>0</sup>
  - Over ground checkpoint: +/- 4<sup>0</sup>
  - Against two VOR's: 4<sup>0</sup> maximum difference.
  - VOT test signal: +/- 4<sup>0</sup> -with 180<sup>0</sup> TO indication (182)360<sup>0</sup> from

- **Preflight Planning Required by 91.103 aim 5-1-1:**

- Weather reports and forecasts enroute and destination
- Known traffic delays as advised by ATC
- Runway lengths lighting and markings of intended use
- Alternatives if flight cannot be completed as planned
- Fuel burn and reserve requirements
- Takeoff and landing distance data in the approved aircraft flight manual
- weights and balances
- 

### FSS preflight Briefing 7-1-4

Adverse conditions VFR Flight not Recommended

Synopsis

Current conditions

Enroute Forecast

Destination Forecast

Winds Aloft

NOTAMS

ATC Delays

Requested info available:

- SUA info
- Review of NAP NOTAMS
- APPROX DENSITY ALTITUDE INFO
- ATC services, customs & procedures, ADIZ rules, search & Rescue
- GPS RAIM
- Other

### NOTAMS 5-1-3

- **NOTAM (D)** information is disseminated for all navigational facilities that are part of the National Airspace System (NAS) National: taxiway closures, personnel and equipment near or crossing runways, and airport lighting aids that do not affect instrument approach criteria, such as VASI
- **Flight Data Center FDC NOTAMS** regulatory in nature Changes in Published Procedure regulatory in nature



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- **Pointer NOTAMS** highlight or point out another NOTAM assist users in cross-referencing important information that may not be found under an airport or NAVAID identifier
- **Special Activity Airspace SAA NOTAMS** when Special Activity Airspace will be active outside the published schedule times and when required by the published schedule.
- **Military NOTAMS** pertaining to U.S. Air Force, Army, Marine, and Navy navigational aids/airports that are part of the NAS

## **A/F D Airport Facility Directory**

Know the 11 Sections without looking and have a general understanding of why they are there.

1. Seaplane Operations
2. Notices
3. LAHSO
4. FAA phone Numbers
5. ARTCC / FSS
6. FSDO
7. Routes / Waypoints
8. VOR Checks
9. Parachute Ops
10. Chart Bulletins
11. Airport Diagrams

Read an entire page and be able to decipher it without using the legend.

Amarillo  
Sanantonio  
Little Rock  
Abilene  
Albuquerque  
Alexandria LA  
Altus AFB OK  
Austin Bergstrom  
Batrou Rouge Metropolitan  
Beumont-port Arthur  
Ney Orleans -lakefront  
Vicksburg

Know the chart symbols on all the diagrams

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## **Weather Products**

HIWAS – Airmet, Sigmet, Convective Sigmet, CWA, UUA, AWW

TWEB – Transcribed weather enroute briefing

ASOS – Automated surface observation system

AWOS - Automated surface observation system

ATIS – Automated Terminal Information System

FSS – Flight Service station

EFAS/Flight Watch – Enroute Flight Advisory Service

- Airmet - Of significance to light aircraft, moderate turbulence, icing and winds, IFR 50% of the are, Mt. Obscurment
- Sigmet- Of significance to all aircraft, severe turbulence, icing and winds, Visibility below 3 miles, Volcanic ash, duststorms, sandstorms
- Convective Sigmet-Severe condition, LLWS, tornadoes, Line of Thunderstorms, embedded thunderstorms, hail better than  $\frac{3}{4}$ " and winds better than 50 knots

## **IFR Flight Plans:**

- No person may operate in **controlled airspace** under IFR unless that person has filed an IFR flight plan AND received an appropriate ATC clearance. [91.173](#)
- A flight plan should be filed at least 30 min in advance. ATC will generally delete it 2 hours after estimated departure time.
- Pick up your IFR clearance 10 minutes before departure. Usually it will stay in the system for 2 hours from the time you pick it up.
- If on a VFR/IFR composite flight plan, close the VFR 5 minutes before the IFR portion.
- When filing IFR plan, file the plan and then request Wx brief because FSS will now know your intended route.



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## Weather Minimums

Alternate Filing Requirements (use 1-2-3 rule)? [91.169](#)

### You must file an alternate unless:

1. 1 Hour before thru 1 hour after your planned arrival at your destination, WX is forecast to be:
2. 2000 foot ceiling or higher **and**
3. 3 miles visibility or greater **and**
  - Destination has a published instrument approach.
  - If no IAP..... be able to descend from Minimum IFR altitude to landing under basic VFR

### Choosing the alternate.....

First look at the candidate approach plate... does it have the following symbols **▲**NA or **▲**

**▲** Alternate Minimums not standard. Consult Alternate minimums section of the approach procedures.

**▲**NA Not authorized as an alternate

1. Has no approved weather reporting capability or
2. Unmanned facility accuracy can not be guaranteed

Otherwise:

Standard forecast Alternate weather minima at arrival for IFR filing purposes is:

- 600ft ceiling and 2 sm vis for Precision approaches. (ILS)
- 800ft ceiling and 2 sm vis for Non-Precision approaches

## Fuel Minimums

VFR – Destination plus 30 minutes

IFR –destination, shoot an approach, fly to alternate airport, and then 45-min thereafter at normal cruise power.

Night VFR – 45 Minutes

## Clearances

### **Clearances (key things \*\*) C-R-A-F-T**

Clearance Limit      Destination  
Route              A/F or Route,      Normally “as filed”  
Altitude            usually an EFC  
Frequency  
Transponder code  
Void Time if at an Uncontrolled field

### Clearances & Verbage:

- **Void Time Clearance** is a specific takeoff time window, usually 10 minutes, issued by ATC when departing into IFR conditions from an uncontrolled field. Notify ATC if not airborne by specified time
- **Special VFR** allows pilot to operate VFR in Class B, C, D, and E to the surface of the airspace with 1-mile visibility and clear of clouds. SVFR at night requires an instrument-equipped plane and an instrument rated pilot who is current.
- **Tower Enroute Control (TEC)** are short flights less than 2 hours and under 10,000’ MSL that are common in California and the New England area. Basically, departure radar coverage of one airport meets approach radar coverage of another airport
- **Hold for Release** When ATC states in the clearance, “hold for release,” the pilot may not depart utilizing that IFR clearance until a release time or additional instructions are issued by ATC
- **Cruise Clearance** - Can fly between MEA and assigned altitude at Pilot’s discretion but must request lower once altitude attained.
- **“CRUISE 6000”** “You may climb and descend between your clearance altitude and MEA all you want unless you report leaving an altitude. The key is to not report leaving an altitude! You are cleared to your destination



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airport and may shoot ANY of the instrument approaches upon arrival without further clearance. Cannot get a cruise clearance on the ground. Review a sectional for terrain and obstacles to avoid CFIT.

- **VFR on Top** – 4-4-8 Maintain visual separation but still IFR, and may want to get back down. Must maintain cloud clearances (2000’ hor, 1000’ above, 500 below)
- **Climb to VFR on Top** - Cancel IFR once VFR on Top, your on your own, NOT ALLOWED ABOVE FL 180.
- **SVFR** – Special VFR must be 1 mile clear of clouds, and can only be accepted at night if pilot and aircraft are IFR. Allowed in Class B, C, D, E airspace.
- **Weather Minimums of LAHSO** - 1000 feet, 3 miles visibility
- **VERY IMPORTANT:** If canceling IFR flight plan, be sure you have the VFR weather requirements for that particular airspace. In addition, before canceling IFR while *within* controlled airspace, you **MUST** get a VFR clearance into the airspace *prior* to canceling or you are in violation.

**Where to Get Clearance**

- Clearance Delivery
- Call FSS for designated area departing direct via phone
- Airborne-Generally any controller in the airspace system Back in the day: radio flight service station/

**Filing and Picking Up Clearances**

- File at least 30 minutes before you need it
- Pick up clearance 10 minutes before take-off
- Filed flight plans remain in system for 2 hours from ETD
- Void time allows you to depart IMC from an uncontrolled field

*NOTE: “Clearance on request” means to standby for clearance. (They have to retrieve it)*

**Instrument cockpit check (Before Take-off)**

Airspeed	Reads “0” on ground and is active on T/O
Attitude Indicator	+/- 5 <sup>0</sup> within 5 minutes of spool up, banks no more than 5 <sup>0</sup> in a turn
Altimeter	Accurate within +/- 75’ of airport elevation
Turn Coordinator	Level, no “Off” flag, banks in direction of taxi turn
Slip/Skid Indicator	Ball moves to outside of taxi turns, race is full of fluid, ball rests in center
Directional Gyro	Precession of no more than 3 <sup>0</sup> in 15 minutes
VSI	Note VSI indication-Set to 0 if necessary (note: not required)
Magnetic Compass	Full of fluid, level, and free-turning
Engine Gauges	Check for normal engine-off indications as well as normal engine-on indications
Procedures	Review departure procedures, charts, and clearance, ATIS
Radios	Set radios and identify nav aids if possible
Checklists	Complete all checklist including T/O checklists

**Departure Procedures aim 5-2-8**

Standard departures if not published is 400 feet before beginning turns

**Departure Procedures (DP’s) can be either**

**SIDs** – Standard Instrument Departure Established for traffic flow, can be avoided by requesting “no sids” on flight plan.



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**DP's** – Established for obstacle clearance, must be followed or you die.

**ATC- Pilot Navigation** – Formerly SIDs

**ATC- Radar Vectors** - Formerly SIDs

Obstacle Clearance (front or TRPPS) note terrible “T”s (

Standard take off min = 1 mile Vis for 2 eng or less ½ mile Vis for more than 1 eng.

Climb rate = Ground speed/60 x feet/nm = climb rate

- **Take Off Minimums**- None required expect if a specific DP exists for part 91. Part 121 and 135 must comply with published take off minimums in the front of the Approach plate book. These are noted by the “TerribleTs”:

▼ **Takeoff Minimums and (Obstacle) Departure**  
Procedures entry published. (DP)

- Two engines or less 1 mile visibility (part 121/135) no ceiling requirement
- Three engines or more ½ mile visibility (part 121/135) no ceiling requirement
- Part 91; no take-off minimums but must comply with non standard departure procedures
- If no procedure is specified, standard is climb to 400 feet before beginning a turn.

## **ENROUTE and ATC**

### **Position Reporting format: 5-3-2**

- Identification
- Position
- Time
- Altitude
- Type of flight plan
- ETA and name of next reporting point
- Name of reporting point following next point

Example:

“ATC, N1234 @ NAME”

“N1234 this is ATC go ahead”

“N1234 at NAME 12 hundred hours 03 minutes 8 thousand ft IFR Estimating 13 hundred hrs one two minutes NEXTNAME”

*NOTE: Position reports are typically made in non-radar environment. Practically they are not requested You can always ask ATC if they need to be made.*

### **Required Reports to ATC 5-3-3**

#### **Radar Environment**

T= TAS unable to maintain w/i 10 knots of 5% of airspeed

U= Unable to climb or descend at 500 FPM

L= Loss of Facility signal

S= Safety of flight (Instruments / gauges inop)

A= Altitude Changes

H= Hold- Arriving or leaving Hold

A= Altitude change on VFR on Top 5-5-13

M= Mandatory or Compulsory Reports

M= Missed Approach Executing



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### Non Radar

C= Change in ETA  $\pm$  2 minutes

F= Final Approach inbound

U= Unforecasted weather

### Required Reports in Non-Radar Environment 5-3-3:

- If ETA to a fix has changed more than +/- 2 minutes
- Inbound from the final approach fix or outer marker
- Time and altitude at compulsory reporting points -Solid black triangle
- Whenever requested

TEC- Tower En route Control-4-1-19

## Holding

### ATC instructions format: 5-3-8

1. **Direction** of holding **from the fix** in terms of the eight cardinal compass points (i.e., N, NE, E, SE, etc.) (Direction of outbound leg).
2. Holding fix **Name** (the fix may be omitted if included at the beginning of the transmission as the clearance limit).
3. **Radial, course, bearing, airway,** or route on which the aircraft is to hold.
4. **Leg length** in miles if DME or area navigation (RNAV) is to be used (leg length will be specified in minutes on pilot request or if the controller considers it necessary).
5. **Direction of turn**, if left turns are to be made, the pilot requests or the controller considers it necessary.
6. Time to **Expect-Further-Clearance (EFC)** and any pertinent additional delay information.

*"Bonanza 8136R Hold northwest of the little rock VOR on the 045 radial; expect further clearance at 40 past the hour; time now 10 past the hour"*

- Holding patterns are a racetrack pattern flown by the aircraft to help maintain separation and provide a smooth flow of traffic
- They begin and end at a holding fix, which you hold TO.
- Standard holding patterns are turns to the right. Non-standard are to the left.
- Below 14,000' MSL holding patterns are usually two standard-rate 180<sup>0</sup> turns separated by one minute straight segments. With no wind, a whole pattern takes 4 min
- Above 14,000' MSL straight legs are 1 ½ minutes or 10 miles, whichever is less.
- Before entering the hold, you are expected to slow down to holding speed 3 minutes before arriving at the holding fix
- The pilot is expected to report to ATC when entering and leaving the hold
- The ATC instruction "Hold southwest of the fix" best describes the out bound leg heading
- When should you start timing on a VOR hold? Ans. TO/FROM switch on reciprocal course
- When should you start timing on a NDB hold? Ans. When the needle is abeam the station
- Wind correction rule of thumb: Half wind speed in degrees. (20 kts of CW = 10 degrees of correction. Or triple the outbound correction)

### Holding Speed Limits

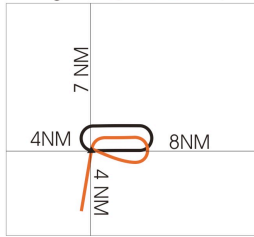
- Above 14,000 Feet 265 knots
- 6,000 to 14,000 Feet 230 knots
- Below 6,000 Feet 200 knots

**Protected Hold Area is typically:**



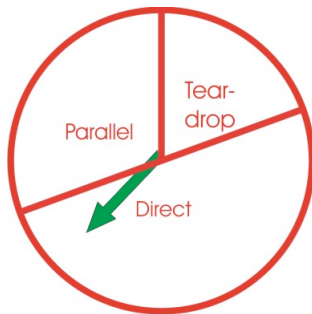
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Holding area protected space



### Entering a Holding pattern

- 3 Types of “suggested” entries into a hold are suggested: Teardrop, Parallel, or Direct
- These types or entries are not required, just recommended. What is required is to limit the amount of time and distance on the non protected side
- Holding instructions always begin with the direction from the fix. This is your outbound course and is the direction you will turn when you reach the fix. Parallel entries allway require a turn that is quickest to outbound heading always to the left. Teardrop entries are the quickest turn to the outbound heading - 30°. Direct entries always require a right turn to the outbound even if it requires more than a 180° turn.



- if the outbound course(green arrow) is ahead and to the left, make a parallel entry(left turn always),
- ahead and to your right make a teardrop (turn to outbound heading- 30°),
- if it is behind make a direct entry (right turn always).
- For memory sake- Think of the positions in which you sit while flying as viewed from above the plane. The student sits in the left seat (the Pupil = Parallel), teacher in the right (Teacher = Teardrop) and the dummy in the backseat (Dummy = Direct).

### **Descent planning**

3° slope = 3 x Altitude / 1000. (ie. 3 x 15,000ft / 1000 = 45 miles)  
 Ground speed/5.6 = required fpm rate of descent @ 3° slope

## **Approaches**

### **Approach Transitions?**

- Radar Vectors to Final
- Fly to IAF
- Fly a feeder route to IAF

### **Types of Approaches**

#### **PA-Precision Approaches Course and Glide Path**

- **ILS** , signal range 35° from center 10 NM, 10 from center to 18nm, Back course reverse sensing (more sensitive) HSI senses OK if set proper course





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CAT I – 3-6° course, 3° slope 200 feet DH OM 1400 ATDZE 4-6 miles, MM 200 Above TDZE RVR 1800 - 2400ft, (RWCTL, RVR and TDZL reduces mins to 1800 RVR)

CAT II – pilot must be certified and authorized, 100' RVR 1200(IM)

CAT III (A)– No DH, RVR 700 min

CAT III (B)– No DH, RVR 150 min

CAT III (C)– No DH, RVR 0

- **PAR-** 4-5-4 Radar Guided, told when to descend, when to turn and stop. 5-4-11
- **GLS** GBAS Landing System

**APV-Approach with Vertical Guidance** (not required to meet the ICAO precision approach standard but provides glidepath) (lateral and vertical integrity limits larger than a precision approach)

- Baro-VNAV
- LDA
- LNAV/VNAV 5-4-21
- LPV localizer performance with vertical guidance

### **NPA-Non-Precision Approaches Course Deviation / No Glide Path**

- LOC – Localizer
- VOR- Very High Frequency Omni Directional range, Requires a VOR receiver
- VOR/DME- Requires VOR Receive with DME capability
- VOR-A a inbound VOR course offset by 30 degrees or more from runway Circling only approaches VOR-A,B,C etc
- NDB- Non Directional Beacon, Required and ADF
- NDB/DME
- NDB (A) circling only
- SDF – Simplified Directional Facility, No shading on the feather, Course width, 6\_ or 12\_, never have glide slopes, Can be offset from runway
- LDA – Localizer Direction Aid, (e.g. I-LIT), offset from Runway, can have a glide slope, course width 3\_-6\_
- GPS Global Positioning System  
(RAIMS) Random Autonomous Integrity Monitoring mean must have enough satellites to ensure enough accuracy.  
IFR approved and certified to fly  
All GPS systems work differently so learn your  
GPS Overlays on VORs, etc)  
Uses basic T pattern on approaches on newer approaches. Newer approaches use the holding pattern, @  
IAF / FAF.  
If RAIM fails or do not have green light must go missed approach
- LORAN - Authorized enroute only
- RNAV (Area Nav) Resets VOR and aligns them
- MLS – Microwave landing system, (eg. M-LIT)
- ASR - Approach Surveillance Radar
- LP
- LNAV

**INS** – Inertial Navigation System - Internal to Aircraft and calculates via airspeed directions, time etc.  
DME Arc Approaches

### **Parallel ILS Approaches 5-4-13**

- Dependant 2500'-9000' staggered by 3 miles centerline
- Simultaneous 4300-9000'
- Simultaneous Close Parallel 3000-4300



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- Simultaneous Converging 5-4-17
  - Localizer
- PRM Precision Runway Monitor

### Timed Approaches 5-4-10

- Timed from the faf inbound
- Ceiling and vis. must be greater than the highest circ. Min for the IAP
- if more than one MAP exists Course reversals are not required AIM 5-4-10
- Must have a control tower

### Transition to landing

- **Visual Approach-** 3000 foot ceiling and 3 mile visibility, Field in sight or follow another A/C / must be VFR. ATC can assign
  - **Contact Approach-** Pilot must request, Must have 1 mile visibility and COC. Must be able to safety navigate to airport, Airport must have an instrument approach.
  - **Circling Approach-** More than 30 degrees from inbound course. May also be know as a slash A, or slash B approach
    - **Circling Standard Approach Distant Mins. (Remain Within this distance)**
      - Circling Approaches have 300 foot obstacle clearance. But only within these distances!
      - A 1.3 miles
      - B 1.5 miles
      - C 1.7 miles
      - D 2.3 miles
      - E 4.5 miles
- C** EXPANDED CIRCLING APPROACH MANEUVERING AIRSPACE RADIUS must consult the chart
- **Circling Missed Approach** turn, climb & fly toward the center of the airport then follow missed procedures.

### Approach Speeds are Based on Vso x 1.3

- A= below 90 knots
- B= 91 to 120 knots
- C= 121-140 Knots
- D= 141-165 knots
- E= Greater than 165 knots

## Approach Plate Notes

RVV Runway Visibility from a transmissometer Value in miles or fractions of miles?

RVR runway visibility range in feet

- Touchdown zone RVR
- Mid RVR
- Rollout RVR

Altitude Depictions 4 types on the charts

- Minimum
- Mandatory
- Maximum
- Recommended

TAA Terminal arrival Area 5-4-5(d)

### Substitutes for a Outer marker are:

1. LOM or Compass Locator
2. Radial off a VOR / NDB / DME
3. PAR / ASR



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#### **Substitutes for a MM are:**

1. PAR
2. LOM

**Visual Decent Point VDP-** Point at which you may descend visually from MDA. Maintain MDA until this point. Harmonized with the Vasi if installed

**VDA** visual descent angle.

**VASI-** obstacle clearance 10 deg of centerline for 4 NM  
normal angle= 3.00 deg. red over white  
lower angle 2.8 deg (papi)

**TCH-** Threshold Crossing Height, height above end of runway on a given glide slope measured AGL.

- **TDZE-** Highest point in MSL above the runway in first 3000 feet.
- **Missed Approach** airspeed in Vx until clear of obstacles and then Vy.
- **Enroute Feeder Rings** show nav aids & intersections that are part of the low alt enroute structure used in the approach.
- **Feeder Facility Rings** show nav aid, fixes, intersections, directions and altitudes used by ATC to direct A/C between enroute structure and the IAF.

#### **IAP's use three type of lines**

- Thin lines = VOR radial used to identify fixes and include course information only. (non-flyable)
- Dark Thin Lines = Feeder routes includes altitudes, course and distance information.
- Dark Bold Lines = Are instrument procedure tracks, includes altitude, course and distance information.
- MSA requires a VOR or NDB within 30 NM of an airport.

## **Airports**

### **Approach Glide Slope Lighting**

- VASI
- P- VASI pulsating vasi pulsates red when below
- PAPI
- TRI-Color VASI

### **Airport Markings & Lights**

#### **Visual Runway**

No touch down zone markings or side stripes

#### **Non-Precision Runway –**

1000 foot mark

No touch down zone markings or side stripes

#### **Precision Runways –**

Touch down zone marks

Side stripes

Aiming Points 500, 1000 (aiming point), 1500 to 3000 marks

**RELS** Yellow edge lights last 2000ft or last half which ever is less

**Touch down zone lights** start 100 feet beyond the landing threshold and extend to 3,000 feet beyond the landing threshold or to the midpoint of the runway, whichever is less.

**ILS Critical area** below 800 feet and within 2 miles

### **Airport Lighting**



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**REIL-2-1-3** Runway End Identifier Lights- Rapid identification of approach end of runway

**Runway Edge Light Systems HIRL MIRL LIRL**

**RCLS-** Spaced every 50ft, Last 3000 feet alternating red/white, last 1000 ft all red.

### Approach Lighting Systems

- ALSF1 – 2
- SSALR
- MALSR

**RWSL 2-1-6** Runway Status Light System: is a fully automated system that provide runway status information to pilots and surface vehicle operators to clearly indicate when it is unsafe to enter, cross, takeoff from, or land on a runway.

**FAROS** Final Approach Runway Occupancy Signal: fully automated system; When an aircraft or vehicle is detected on the runway, the Precision Approach Path Indicator (PAPI) flash as a signal to indicate that the runway is occupied and that it may be unsafe to land. activated by localized or comprehensive sensors detecting aircraft or ground vehicles occupying activation zones

### Transition to Landing

#### Required to descend below MDA [91.175](#)

1. Flight Visibility minimums on the approach (become VFR or identify filed of light to lower mins.)
2. Must be in a position to land
3. Must have Approach lighting allows decent to 100' AGL
4. Must have Runway Environment in sight 1 of 11 items in order to be able to land [91.175](#)

#### Threshold

1. Threshold
2. Threshold Markings
3. Threshold Lights

#### Approaching Runway

1. REIL
2. Visual approach slope indicator
3. Touchdown Zone
4. Touchdown Zone or Markings
5. Touchdown Zone Lights

#### Runway

1. Runway or Runway Markings
2. The Runway Lights

## Missed approach 5-4-21

- 200ft /nm standard required
- $(gs/60) \times 200 = fpm$  500fpm @150kts

## Navigation Aides

### VOR Check tolerances

VOT Transmits 360 deg radial 180/TO	4 degrees
Ground Check Point	4 degrees
Airborne Check	6 degrees



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Airway Check  
Dual Nav Check (air/Grd)  
Bench Check

6 degrees  
4 degrees between

### **VOR Types and Ranges**

VOR audible signal I.D. every 15 seconds

DME audible signal I.D. every 30 seconds

VOR (T)	25nm	1000-12,000 feet
VOR (L)	40nm	1000-18,000feet
VOR (H)	40nm	1000-14,500 feet
	100nm	14,500-18,000 feet
	130nm	18,000-45,000 feet
	100nm	45,000-60,000 feet

### **NDB Types and Ranges**

NDB (LOM)	15 NM
NDB (MH)	25 NM
NDB (H)	50 NM
NDB (HH)	75 NM

### **ADF formulas**

$MH + RB = MB$   
 $MB - MH = RB$

## **INSTUMENTS**

### **Compass Errors**

**compass deviation-** caused by metals and electrical accessories in aircraft

**variation-** Difference between true north and magnetic north (earths magnetic Field is not aligned with the rotational axis)

**Magnetic dip-** compass point to  $30^0$  below the surface not toward the horizon.

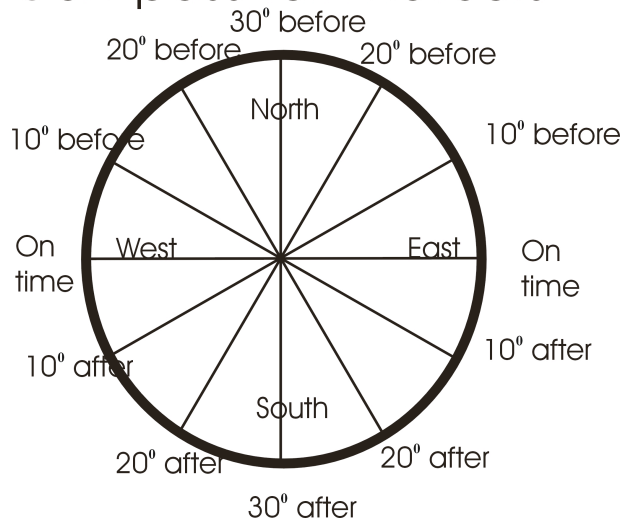
Drag When using compass, banking more than  $18^0$  will cause compass to drag on the side of the case and give inaccurate readings. When on an East or West heading acceleration ErrorANDS: Accelerate North, decelerate South

### **Compass turn techniques**



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## Compass Turn Rollouts



### Rollout “before north after south”

- UNOS- Undershoot (rollout Before) Northerly headings, undershoot 060<sup>0</sup>/300<sup>0</sup> headings-10° before  
undershoot 030<sup>0</sup>/330<sup>0</sup> headings-20° before  
undershoot northerly headings 30° before
- Overshoot (roll out After) Southerly headings.  
overshoot 120<sup>0</sup>/240<sup>0</sup> headings-10° after  
overshoot 150<sup>0</sup>/210<sup>0</sup> headings-20° after  
overshoot southerly headings 30° after

### Standard rate timed turns

360° 2 mi

270° 90 sec

180° 60 sec

90° 30 sec

45° 15 sec

30° 10 sec

10° 3.333 sec

3° 1sec

1° .333 sec

- ½ SRT 1.5\_ per sec, 4 minutes for 360\_

### Other Instrument Errors

Attitude Indicator Precession Errors- Vacuum Driven (newer modern Att Instruments Don't) [IFH 5-19](#)

- Accelerate - Indicates a climb
- Decelerate - Indicates a descent
- 180 Turn to Right - Shows slight left turn and nose up attitude upon rollout
- 180 Turn to Left - Shows a slight right turn and nose up attitude upon rollout

### Airspeed Indicator

- Measures difference between ram air and static pressure
- If pitot tube freezes, the ASI acts like an altimeter



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- Good practice to use pitot heat where there is visible moisture (even in the summer, the pitot heat evaporates moisture)

### **Altimeter**

- Always get current altimeter setting before an approach
- “Low-to-high, clear the sky”, “High-to-low, look out below.”
- There is 1” Hg per 1000’
- Pressure and temperature affect altimeter
- Colder than standard temperature will give a reading higher than actual

## **Lost Communications? ( IFH 11-5) FAR § 91.185 AIM 6-4-1**

### **Radio Failure (Squawk 7600)**

- First actions:
  - Check volume on headset, radio volume, correct frequency, comm selection, and circuit breakers
  - Try last frequency
  - check charts for ARTC freq
  - try emergency 121.5
  - Try to contact FSS

*use cell phone you can text another pilot and have them relay intentions most FBOs on the field have access to the tower. Use AFD phone numbers to contact center, approach, etc.*

If operating in VFR conditions at the time of the failure, the pilot should continue the flight under VFR and land as soon as practicable.

If the failure occurs in IFR conditions, or if VFR conditions cannot be maintained, the pilot must continue the flight according to 91.185: *returning to land at original airport, will trigger emergency response.*

### **Altitude for route segment (highest of)**

**M**= Minimum IFR for route filed

**E**= Expected altitude to be assigned

**A**= Assigned Altitude

### **Route**

**A**= Assigned Route

**V**= Vectors “ direct to fix,route,or airway specified in vector clearance”

**E**= Expected, proceed as expected in absence of other clearance

**F**= Filed “route filed in flight plan”

Approach and descent at clearance limit:

1. If the clearance limit is an initial approach fix: commence descent or descent and approach at the expect-further-clearance time if one has been received;
  - a. if no “expect-further-clearance time”, commence descent or descent and approach at the estimated time of arrival as calculated from the filed or amended (with ATC) estimated time en route.
2. If the clearance limit is not a fix from which an approach begins, leave the clearance limit at the expect-further clearance time if one has been received; or if none has been received, upon arrival over the clearance limit, and proceed to a fix from which an approach begins and commence descent or descent and approach as close as possible to the estimated time of arrival as calculated from the filed or amended (with ATC) estimated time en route. While following these procedures, set the transponder to code 7600 and use all means possible to re-establish two-way radio communication with ATC. This includes monitoring navigational aids (NAVAIDs), attempting radio contact with other aircraft, and attempting contact with a nearby automated flight service station (AFSS).



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## PROCEDURES

### Proper Scan

Primary and secondary instruments

### Partial Panel

Simulated lost vacuum pump or suction. No gyro instruments (Att Ind, DG)

### DMC Arcing

½ mile prior begin turn, turn 10\_ in bound, twist VOR 10 degrees, once VOR aligns, repeat

## Airspace Review

### Classes of Airspace and VFR Visibility and cloud clearance requirements

- A FL180 to FL 600  
na
- B 30 nm, 10,000 AGL, shaped to fit  
3 mi, COC
- C 10 nm, 4000 AGL  
3 mi, 2 1/5
- D 4 nm, 2500 AGL  
3 mi, 2 1/5
- E 700AGL or 1200 AGL to the underlying airspace  
3 mi, 2 1/5, above 10K 5 1 1/1
- G SFC to 700 AGL or 1200 AGL  
above 10K 5 1 1/1  
Day 1200-10K – 1, 2 1/5  
Night 1200-10K – 3 2 1/5  
Day Below 1200 – 1, COC  
Night Below 1200 – 3 2 1/5

### Special Use Airspace (7 Types)

- Prohibited Area
- Restricted Area
- Alert Area
- Warning Area
- MOA
- PJA
- NSA
- (TRSA)

### Other Airspace (5 Types)

- MTR
- Airport Alert Areas
- TFR
- Parachute Jump Areas
- PVFR Routes





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## **Weather Review**

Thunderstorm formation  
Fog formation and types  
Frontal Activity  
Cloud Formations and types  
Winds

## **FAR's**

- Airspeeds Class C and D airspace below 2500 and W/I 4-NM from primary airport reduce to below 200 knots.
- Airspeed is 250 in Class B and 200 below class B.
- CFII may log actual while instructing under actual conditions
- ATC must be complied with unless you declare an emergency, may be asked to submit a report in 48 hours by airport manager if declared an emergency.
- Instrument clearance required above FL 180
- DME required above FL 240

### **Oxygen Requirements**

- Above 15,000 feet
- 14,000 to 15,000 feet
- 12,500 to 14,000 feet -
- below 12,500 feet – none required

## **Glossary**

**Minimum Safe Altitude (MSA)** Is the safe altitude within 25NM of the airport or navaid and provides 1000' obstacle clearance *in both mountainous and non-mountainous terrain*. It is usually located within 30 miles of airport and is for emergency use only.

**Minimum Vectoring Altitude (MVA)** Is the minimum altitude in which ATC can vector an aircraft. This guarantees 1000' obstacle clearance in non-mountainous, 2000' in mountainous, and 300' within airspace.

**Minimum Enroute Altitude (MEA)** Is usually the lowest published altitude between radio fixes that guarantees adequate navigation signal reception and obstruction clearance (2000' mountainous within 4NM, 1000' elsewhere) Adequate communication can be expected but not guaranteed. There may be gaps up to 65 miles as indicated by "MEA GAP."

**Minimum Obstruction Clearance Altitude (MOCA)** guarantees obstacle clearance (2000' mountainous within 4NM, 1000' elsewhere), but only guarantees navigation signal coverage for 22 NM from the navigation facility. It is preceded by a \* on NOS charts and a "T" on Jeppesen charts

**Minimum Crossing Altitude** is the lowest altitude at certain fixes at which an aircraft must cross when proceeding in the direction of a higher minimum enroute IFR altitude

**Minimum Reception Altitude** is the lowest altitude at which an intersection can be determined.

**Off-Route Obstruction Clearance Altitude (OROCA)** gives 2000' obstruction clearance in mountainous areas and 1000' elsewhere within a latitude and longitude grid area.



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**Non-Precision Approach** is a standard instrument approach procedure in which no electronic glide slope is provided; for example NDB, VOR, TACAN, ASR, LDA, or SDF

**Precision Approach** is an IAP in which an electronic glideslope is provided such as a ILS, MLS, or PAR approaches.

**Procedure Turn (PT) 5-4-9** is a maneuver prescribed when it is necessary to reverse direction in order to establish an aircraft on the intermediate approach segment or on the final approach course. A procedure turn begins by overflying a facility or fix. The maximum speed for a PT is 200 KIAS 5-4-9,

**Final Approach Fix (FAF)** is at the glideslope intercept (lighting bolt) on a precision approach. If ATC directs a glideslope intercept altitude which is lower than that published, the actual point of glideslope intercept becomes the FAF. The Maltese cross indicates the FAF on a non-precision approach.

**Final Approach Point (FAP)** applies only to non-precision with no designated FAF such as on-airport VOR or NDB. It is the point at which an aircraft has completed the procedure turn, is established inbound on the final approach course, and may start the final descent. The FAP serves at the FAF and identifies the beginning of the final approach segment.

**Glideslope** is a glide path that provides vertical guidance for an aircraft during approach and landing. Applying the glideslope angle and the ground speed to the rate of descent table gives a recommended vertical speed.

**Height Above Touchdown (HAT)** is the height above the highest point within the first 3000' of the runway. It is published in conjunction with straight-in approaches and appears next to the MDA or DH of the approach plate.

**Height Above Airport (HAA)** is the height above the highest point on any of the landing surfaces. It is published in conjunction with circling approaches and appears next to the MDA of the approach plate.

**Threshold Crossing Height (TCH)** is the height above the threshold of the runway for a given glideslope.

**Touchdown Zone Elevation (TDZE)** is the highest point within the first 3000' of runway

**Field Elevation** is the highest point on any of the landing surfaces. It is not the highest point on the field, *just the landing surface.*

**Minimum Descent Altitude (MDA)** is the altitude on a non-precision approach in which you must go missed or land visually and guarantees 300' obstacle clearance. Pilot can only go below MDA when within 30<sup>0</sup> of the runway.  
Field Elevation + HAA = MDA

**Decision Height (DH)** is the altitude on a precision approach while following a glideslope in which you must go missed or land visually.  $HAT + TDZE = DH$

## Mnemonics

VFR Equipment Required (part 91) "Tomato Flames"

**T** = Tachometer



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- O**= Oil Pressure Gauge
- M**= magnetic Compass
- A**= Airspeed Indicator
- T**= Temperature Indicator for Liquid cooled engines
- O**= Oil Temperature for Air Cooled engines
- E**= ELT

- F**= Fuel Quantity Indicator
- L**= Landing gear Position Indicator
- A**= Altimeter
- M**= Manifold pressure Gauge for altitude engine
- E**= Equipment for floatation if flying out of glide to land
- S**= Seat Belts

#### Required Additional Instruments for Instrument IFR Flight “GRAB CARD”

- G**= Generator
  - R**= Radios
  - A**= Altimeter
  - B**= Ball of Turn Coordinator
- 
- C**= Clock
  - A**= Attitude Indicator
  - R**= Rate of Turn Indicator (Turn Coordinator)
  - D**= Directional Gyro

#### A LOVAR DG MAN” Approach Checklist

- A**= ATIS / Altimeter Set
- L**= Localizer Freq & Course
- O**= Outer Marker
- V**= VOR Freq & Course
- A**= ADF
- R**= Radios
- D**= DME
- G**= GPS
- M**= Missed Approach Procedure briefed
- A**= Altitudes / Approach brief
- N**= Name of Outer Marker

#### Station Passage 5 T’s

- T**= Time
- T**= Turn
- T**= Twist
- T**= Throttle
- T**= Talk

Wave fronts

Occluded fronts

Temperature inversions

Dry adiabatic lapse rate

Ice pellets indicate that a warm front is about to pass

WFO weather forecast office

In a convective current temp and dewpoint converge at 2.5 deg per 1000 ft

TAFs are issued 4 times a day valid for 24 or 30 hours



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Aviation Weather Service (AWS) prepares FAs (Aviation Area Forecast) 3 times a day

They must be wise enough, educated enough to understand the risks involved, and most importantly willing to participate

## Questions

Q: What's the difference between SID and DP?

A: *A SID gives obstacle clearance, but is mostly used to simplify clearance procedures. A DP is used when obstacles penetrate the 152-ft/NM slope that is assessed for obstacles during departure and gives specific departure procedures.*

Q: When given a turn as part of the departure, where should you start your turn?

A: *Above 400 ft. AGL and when past the end of the runway. Climb at least 200-ft/NM and cross the departure end of the runway at least 35 ft. AGL.*

Q: Is the controller providing obstacle clearance when he says: N72B, radar contact.?" ?

A: *No, not until he gives you a heading or any other navigational guidance.*

Q: If LIT has a VOR-A and a VOR-C approach, why doesn't it have a VOR-B approach?

A: *An adjacent airport (IMI) probably has the VOR-B approach.*

Q: You are flying from Fort Smith to Little Rock in IFR conditions and have filed Stuttgart as an alternate. Enroute, you find out that Little Rock is socked-in yet North Little Rock is within minimums. Can you fly to NLR even though you filed Stuttgart as your alternate?

A: *Yes! Having an alternate is for planning and radio failure purposes only. You may coordinate with ATC to land at any airport when it is above or equal to minimums.*

Q: You are going to shooting an approach into LIT ILS 22R and ATIS is reporting 1600 RVR. Can you shoot the approach? If so, can you land?

A: *Under Part 91 Regulations: you may shoot the approach even though the weather is below the minimums published for the approach. You may land if you have the **flight** visibility. So, legally, you could land even if ATIS is reporting slightly below minimums. For example: If you had a ragged cloud base that maybe prevented one pilot from landing, but allowed the next to land.*

Q: When an ILS exists on both sides of the runway, will both of them be working at the same time?

A: No.

Q: Can you as an instrument pilot legally take off in a C172 in zero-zero conditions?

A: *Yes. If you are operating under Part 91 regulations you may legally do so, however, if you had an emergency, you would not be able to land safely or legally. A rule of thumb is to abide by landing weather minimums before takeoff.*

Q: You are setting up an approach to an uncontrolled field, which is at its weather minimums, what do you need to do inside the plane to be able to see the runway?

A: *If it has pilot controlled lighting, it needs to be activated. This is indicated by the negative symbology on the approach plate.*

Q: Is the 10-mile circle on an approach plate the radius or diameter? What does this circle represent?

A: *It is the radius and represents that within that circle, everything is drawn to scale.*

Q: On an approach chart, what does 5500 with a line above it, below it, or above and below at the same time mean?



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*A: Maximum Altitude, minimum altitude, or mandatory altitude.*

Q: If cleared for an approach that has only circling minimums, do you have to circle or may he land straight-in?

*A: He can land straight-in, but he should advise ATC if going to circle.*

Q: In IMC, can a pilot fly to the FAF and drop immediately to the MDA without regard to decent gradient?

*A: No, to ensure safe obstacle clearance you must not exceed an 8<sup>0</sup> glideslope. This means no more than 1' vertical decent for every 7' horizontally. For example: At 75kts, don't exceed 1055 FPM. At 105kts, don't exceed 1480 FPM. The decent table can be found in the back cover of the NOS charts.*

Q: What does a sideways "8" indicate on an approach plate airport diagram?

A: A displaced threshold.