Learning Center Courses

Instrument Proficiency Check Review Guide

Course Notes

Instrument Proficiency Check Review Guide

Introduction

Overview

Flying light aircraft in instrument meteorological conditions (IMC) requires you to be at the top of your game. This course offers a structured guide to reviewing IFR rules and procedures for each major phase of flight: preflight planning, taxi/takeoff, departure, en route IFR, arrival, and approach. *You will need to read the recommended portions of the regulations and the Aeronautical Information Manual, as well as the related media materials, for the quiz.*

You will find course notes in the review section, as well as "related media" material throughout the course that you will need to download and review. The course software tracks your progress with checkmarks displayed for each chapter you complete, and you may stop and start at your convenience. To receive Wings credit, however, you will need to take the quiz in a single session.

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Preflight Planning for IFR

Preflighting the Pilot

Practice is essential. To ensure *minimum* IFR proficiency, 14 CFR 61.57 permits you to act as pilot-in-command (PIC) under IFR only if you have practiced several fundamental procedures within the past 6 calendar months.

Before flying IFR, ensure that you have logged:

- At least six instrument approaches;
- Holding procedures; and
- Intercepting / tracking courses through the use of navigation systems.

If you do not meet these requirements in the prescribed time, or within 6 calendar months afterward, you will need to pass an instrument proficiency check (IPC) with a flight instructor before you can act as PIC under IFR.

Because instrument flying is very demanding – especially in single pilot IFR – your preflight process should also include a review of your fitness for flight (AIM 8-1).

Preflighting the Aircraft

To be legal for flight under IFR, 14 CFR 91.205(d) states that the aircraft must have certain instruments and equipment, with all required inspections. One way to remember the additional items required for IFR is to think in terms of what you need to aviate, navigate, and communicate.

Aviate:

- Artificial horizon (pitch and bank indicator)
- Rate-of-turn indicator or a separate attitude indicator
- Slip-skid indicator
- Altimeter adjustable for barometric pressure (accurate within +/- 75 feet of field elevation)
- Fuel (45 minute reserve for airplanes; 30 minute reserve for helicopters, per 14 CFR 91.167)

Navigate:

- Direction (heading) indicator
- Clock displaying hours, minutes, and seconds
- VOR (checked within 30 days) 14 CFR 91.171
- Altimeter/pitot-static system checks (14 CFR 91.411)
- Navigational equipment for facilities to be used

Communicate:

- Two-way radio communications
- Generator or alternator.
- Transponder (14 CFR 91.415)
- ELT (14 CFR 91.207)

Preflight Planning for IFR

IFR Environment

The regulations (14 CFR 91.103) demand that you become familiar with "all" available information before an IFR flight. The "related media" documents below offer tips on evaluating weather in terms of personal minimums and aircraft capability.

You must also ensure compliance with rules such as the alternate requirement. For airplanes, you do not have to file an alternate if these conditions exist at ETA ± 1 hour:

- At least 2,000 ceiling
- At least 3 sm visibility

If an alternate is required, weather reports/forecasts must show that the weather conditions at the ETA will be above the prescribed alternate minimums for the airport. If the airport does not have alternate minimums, then the weather must be forecast to be:

- Ceiling 600 and visibility 2 sm for precision approach.
- Ceiling 800 and visibility 2 sm for non-precision approach.

For ***helicopters***, an alternate is not required if these conditions exist at ETA ± 1 hour:

- At least 1,000 ceiling or 400' above the lowest applicable approach minimums (whichever is higher)
- At least 2 sm visibility

If an alternate is required:

- Ceiling 200' above the minimums for the approach being flown
- 1 sm visibility (but never less than the visibility for the approach being flown)

Related Media for this Section

Developing Personal Minimums
6.2 Personal Minimums MayJun06.pdf (1.15 MB)

Personal Minimums Worksheet
6.2 Personal Minimums Worksheet.pdf (35.26 KB)

Weather Decision-Making for GA Pilots
6.3 Wx Decision-Making JulAug06.pdf (175.59 KB)

IFR Clearance, Taxi, and Takeoff

IFR Clearance

To operate an aircraft in controlled airspace under IFR, you must file an IFR flight plan; and receive an appropriate ATC clearance (14 CFR 91.173). Knowing what to expect makes it easier to copy a clearance correctly and efficiently. One way to remember the components of an ATC clearance for IFR is **CRAFT**:

- **C**learance limit
- **R**oute
- **A**ltitude
- **F**requency for departure
- **T**ransponder code

Except in an emergency, you must fly in accordance with your ATC clearance unless you request and receive an amended clearance (14 CFR 91.123).

Related Media for this Section

Sample IFR Clearance/Flight Log
CRAFT & IFR Flight Log.pdf (12.02 KB)

IFR Taxi

Regulations (14 CFR 91.21) prohibit operation of any portable electronic device (PED) on aircraft operated under IFR unless you are certain that they will not interfere with your aircraft's communication and navigation systems.

Taxiing during low visibility conditions (especially if operating from a large and/or unfamiliar airport) can be a challenge. Your review of taxi procedures should include AIM 4-3-18 (taxiing), 4-3-19 (taxi during low visibility), AIM 2-1-19 (taxiway lights), and AIM 2-3 (airport marking aids and signs), especially AIM 2-3-4 (taxiway markings). A good practice is to review taxi diagrams for airports of intended use during your preflight planning process.

Related Media for this Section

Taxiway Diagram
Taxi diagram.pdf (57.93 KB)

IFR Takeoff

If you are operating under 14 CFR part 91, it is true that you can legally depart in zero-zero conditions – but legal does not mean that such operations are smart! Set and follow personal minimums, and remember that highly trained professional crews cannot even attempt an IFR departure unless conditions are at/above IFR weather takeoff minimums for that airport.

AIM 5-2-5 outlines procedures for IFR departure from a non-towered airport.

IFR Clearance & Flight Log

C			
R			
A	climb/maintain	expect	minutes after departure
F			
T			

Release time: _____ Void time: _____ Time now:_____

Altitude	Heading	Frequency

IFR Departure

Instrument Departure Procedures

Unless otherwise stated, obstacle clearance for all departure procedures (SIDs and ODPs) is based on assumptions that the aircraft will:

- Cross the departure end at least 35 feet above departure end elevation;
- Climb to 400 feet above runway departure end elevation before turning;
- Maintain climb gradient ≥ 200 ft/nm until reaching minimum IFR altitude.

Never assume that your aircraft can meet the required climb gradient! Always check the performance data in the pilot's operating handbook (POH) or aircraft flight manual (AFM) to ensure that you can meet these requirements.

SIDs

Standard Instrument Departures (SIDs) are ATC procedures designed for system enhancement and to reduce pilot/controller workload. They are printed in graphic form, and they provide both obstruction clearance and a transition from the terminal area to the en route structure.

You need to an ATC clearance to use a SID. (AIM 5-2-7)

ODPs

Obstacle Departure Procedures (ODPs) provide obstruction clearance via the least onerous route from the terminal area to the en route structure. They may be flown without an explicit ATC clearance.

Important points from AIM 5-2-7:

- Do *not* assume that "cleared as filed" or "cleared direct to" a fix means that you will be clear of terrain and/or obstacles without using the ODP.
- Do *not* assume that such a clearance prohibits you from using the published ODP. In fact, ATC assumes that you will use a published ODP when departing from a non-towered airport.

En route IFR

Communications

Always monitor the assigned ATC frequency while flying IFR in controlled airspace (14 CFR 91.183).

As described in AIM 5-3-2, reports to ATC, when required, should include time and altitude of passing each designated reporting point, any unforecast weather conditions, or any other information relating to safety of flight (e.g., equipment malfunctions).

Altitudes

Both rules and procedures spell out expectations for en route IFR altitudes:

- Maintain the altitude assigned by ATC (14 CFR 19.179).
- In uncontrolled airspace below 18,000 MSL, though, use odd thousands on a magnetic course between 0-179, and even thousands on a magnetic course between 180-359. (14 CFR 91.179)
- Stay at least 2,000 feet above the highest obstacle within a horizontal distance of 4 nautical miles from the course to be flown in mountainous terrain; or 1,000 feet above the highest obstacle within a horizontal distance of 4 nautical miles from the course to be flown in non-mountainous terrain. (14 CFR 91.177).
- If both a MEA and a MOCA are prescribed for a particular route or route segment, you may operate below the MEA down to, but not below, the MOCA, when within 22 nm of the VOR concerned.

En route IFR

Holding

IFR pilots need a thorough understanding of holding procedures. AIM 5-3-7 provides extensive detail, but the basics are as follows:

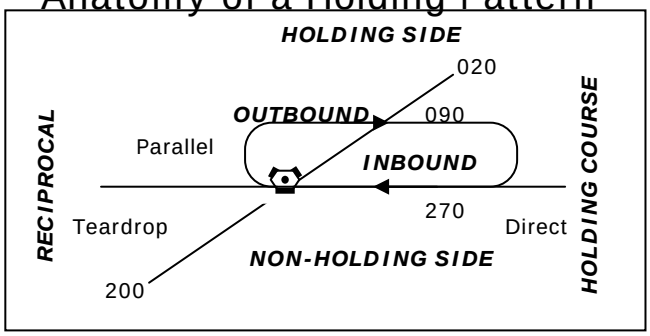
- If ATC wants you to hold at a fix with a charted holding pattern, the controller may simply instruct you to hold "as published."
- If ATC wants you to hold at a fix where the pattern is not charted, holding instructions will include the following:
  - Direction of holding (i.e., N, NE, E, SE, etc)
  - Holding fix
  - Radial, course, bearing, airway, or route on which you are to hold
  - Leg length (if DME or RNAV is to be used)
  - Direction of turn if left turns are to be made
  - Expect further clearance (EFC) time.
- Reduce speed when you are 3 minutes or less from a clearance limit.
- Report time and altitude/flight level when you reach the holding fix.
- When holding at a VOR, turn to the outbound leg at reversal of the to/from indicator.

Related Media for this Section

Holding Pattern Summary
Holding Pattern Summary.pdf (18.56 KB)

HOLDING

Anatomy of a Holding Pattern

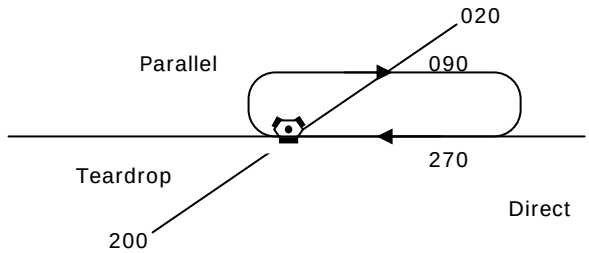


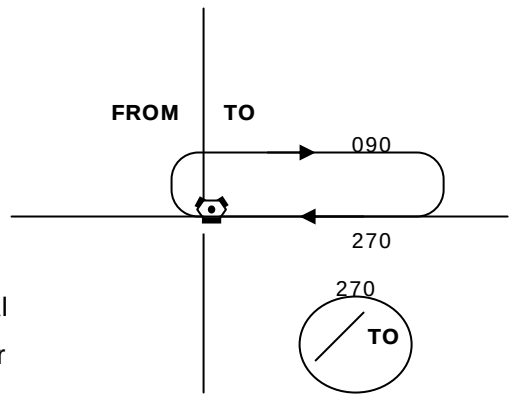
Components of hold:
- Direction from fix
- Holding fix
- Holding course
- Leg length
- Direction
- Altitude
- EFC time

Example:
- Hold EAST of the
- ARMEL VORTAC on the
- 090 radial
- one-minute legs
- (standard is right)
- Altitude
- EFC at 0040

Skills Needed for Holding:

1. Draw the pattern correctly:
   When holding at a VOR, the number given is the OUTBOUND course heading.
   INBOUND course heading is its reciprocal.
2. Determine the appropriate entry.
3. Prepare to enter the hold:
   Slow to holding speed within 3 min of holding fix
4. Enter the hold.
   Turn - Time - Twist (inbound) - Throttle - Talk***
5. Establish and maintain appropriate lateral spacing.
5. Use proper WCA to correct for wind drift.
   When outbound, triple inbound drift correction.





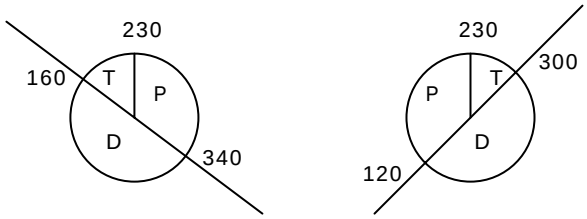
**Timing*: Inbound - wings level; 1 minute to fix is goal
Outbound - abeam or wings level, whichever occurs later. Adjust as needed.

***Talk*: Report holding pattern entry and exit to ATC.

If lateral spacing is proper, needle will be "dead" on the side of the case when the inbound turn begins. Needle should begin to move within 45 degrees of inbound course. If no movement, stop inbound turn at 45 angle and wait until needle begins to move. If needle leaves side of case before 45 degree point, continue standard rate turn and then correct into the needle.

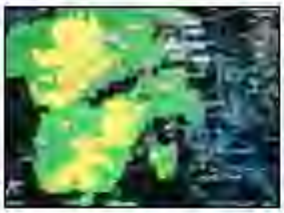
Using HI to Visualize Entry:

- Mentally draw 70 degree line - to right for right patterns; to left for left patterns.
- Visualize sectors and determine proper entry.



En route IFR

En route Weather



Aviation weather (along with traffic, airspace, and other information) may be displayed in the cockpit through use of "Flight Information Service" (FIS) datalink (AIM 7-1-11), which is more commonly known as "datalink."

Datalink can be a very valuable tool, but you must be aware of its limitations. Because of time delays, use datalink weather images only for strategic guidance - *never* for close-in tactical avoidance of adverse weather. Become familiar with the coverage limitations for the system in use. Finally, ensure that the products used conform to FAA/NWS standards, and know how information has been modified by service providers.

Another source of inflight weather information is the En Route Flight Advisory Service (EFAS), addressed as "Flight Watch." Review AIM 7-1-5 for basic information on Flight Watch services.

Two weather hazards of particular concern to IFR pilots are thunderstorms and icing. As described in the related media articles below, there have been some major changes in how ATC facilities report convective weather. Be sure to review these changes, which are detailed in AIM 7-1-15. For information related to icing, review AIM 7-1-22. NOAA's Aviation Digital Data Service (ADDS) website also includes information and tools to help you avoid icing conditions.

Related Media for this Section

Weather Radar Echoes
Weather Radar Echoes.pdf (417.97 KB)

Thunderstorm Avoidance
Thunderstorm Avoidance.pdf (572.02 KB)

Weather Decision-Making
6.3 Wx Decision-Making JulAug06.pdf (175.59 KB)

ADDS Brochure
ADDS Brochure.pdf (285.57 KB)

En route Emergencies

Report any malfunction of navigational, approach, or communication equipment to ATC. (14 CFR 91.187) Be sure to tell ATC whether your ability to operate IFR in the system is impaired, and state the nature and extent of any assistance needed.

If you experience two-way radio communications failure when operating under IFR, 14 CFR 91.185 provides the following instructions:

- In VFR conditions, remain VFR and land as soon as practicable.
- In IFR conditions, continue the flight according to the graphic below:

Related Media for this Section

IFR Lost Comm Procedures
Lost Com Graphic.pdf (12.57 KB)

Loss of Communications under IFR (14 CFR 91.185)

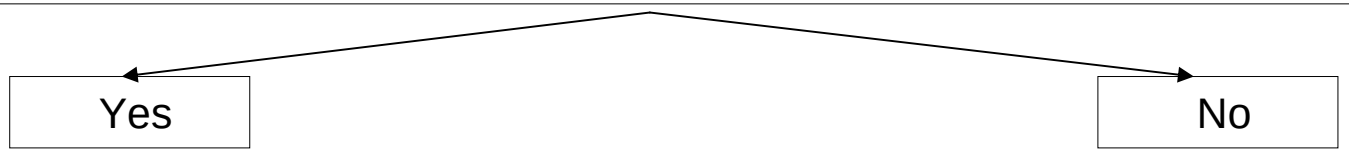
Route:
Choose from these options in the order shown

Assigned | Vectored | Expected | Filed

Altitude:
Chose highest of the following for route segment being flown

MEA | Assigned | Expected

Is the clearance limit a fix from which approach begins?



Start descent and approach as close as possible to the EFC time if one has been received, or if one has not been received, as close as possible to the ETA from the filed or amended ETE.

Leave clearance limit at the EFC time or upon arrival over the clearance limit. Proceed to a fix from which an approach begins and commence descent and approach as close as possible to the ETA as calculated from the filed or amended ETE.

Instrument Arrival

All in the STARs

A standard terminal arrival procedure (STAR) is an IFR arrival route established to simplify clearance procedures and facilitate transition between en route and instrument approach procedures.

As you review AIM 5-4-1, pay special attention to some of the nuances of navigating a STAR.

For example:

- Altitudes and speeds listed on the STAR as "**expect**" are only for planning purposes and should not be flown unless verbally assigned by ATC.
- When flying a STAR, maintain the last assigned altitude unless/until ATC clears you to "descend via" the arrival. The "descend via" clearance authorizes you to navigate the STAR both laterally and vertically.

To summarize:

Lateral & vertical clearance. *Descend via the Civit One arrival.*
Routing w/altitude. *Cleared Hadly One arrival, descend & maintain 12,000.*
Lateral only. *Cleared Hadly One arrival.*

Instrument Approach

Approach Terminology

As you review AIM 5-4-5, note especially the following points:

- The procedure title and notes identify the navigation equipment required to join and fly an instrument approach procedure (IAP).
- If the IAP is aligned with the runway ("straight-in"), it is identified by the navigational system that provides final approach guidance and the number of the runway (e.g., VOR RWY 13).
- If the IAP provides only circling minimums, it is identified by the navigational system that provides final approach guidance and a letter (e.g., VOR A).
- If the IAP requires more than one type of equipment, the title includes a slash (e.g., VOR/DME RWY 31).
- The word "or" indicates that either type of equipment may be used (e.g., VOR or GPS RWY 15).
- WAAS (LPV, LNAV/VNAV and LNAV), and GPS (LNAV) approach procedures are charted as RNAV (GPS) RWY (Number) (e.g., RNAV (GPS) RWY 21).

Approach Clearance

The instrument approach clearance provides guidance to a position from which you can execute the approach, and clears you to fly that approach. Unless there is only one published instrument approach procedure for the airport or runway to be used, the approach clearance will include the name of the approach (e.g., "cleared for the RNAV(GPS) 17 approach."

Approach Minimums

Approach minimums are based on the local altimeter setting for the airport, unless otherwise shown on the instrument approach procedure chart. Adherence to the route (course), weather minimums, and altitudes (including published approach minimums) is critical to safe operation in IMC.

For approaches with vertical guidance (i.e., some form of electronic glideslope), approach minimums are expressed as a ***decision altitude*** (DA), which is the MSL altitude at which the pilot must start a missed approach if the required visual references are not in sight. For approaches with lateral guidance only (i.e., no vertical guidance), approach minimums are expressed in terms of ***minimum descent altitude*** (MDA). MDA, also referenced to MSL, is the lowest altitude to which descent is authorized on final approach or a circle-to-land approach without having the required visual references in sight.

Remember that approach minimums are published for different aircraft categories, as described in AIM 5-4-20.

Instrument Approach

Landing

According to 14 CFR 91.175, you may not operate below MDA or continue an approach below DA unless the aircraft is continuously in a position to descend to landing on the intended runway with normal maneuvers and at a normal rate of descent, and you have the required flight visibility for the instrument approach procedure you are flying.

You must also have one of the following visual references for the intended runway:

- Approach light system.*
- Threshold, threshold markings, or threshold lights.
- Runway end identifier lights.
- VASI or PAPI
- Touchdown zone, touchdown zone markings, or touchdown zone lights.
- Runway, runway markings, or runway lights.

* You cannot descend below 100 feet above TDZE using ALS unless the red terminating bars or the red side row bars are visible and identifiable.

Missed Approach

As specified in 14 CFR 91.175, you must execute the missed approach procedure when:

- The aircraft is being operated below MDA;
- Upon arrival at the MAP; or
- Whenever an identifiable part of the airport is not distinctly visible when circling.

IFR and GPS

Use of GPS

Many pilots today use the Global Positioning System (GPS) for navigation. As described in AIM 1-1-19, authorization to use GPS for any IFR operation is based on several requirements. Some of these requirements are:

- GPS navigation equipment must be approved in accordance with TSO-C129, or equivalent, and the installation must be done in accordance with Advisory Circular AC 20-138, or Advisory Circular AC 20-130A, or equivalent.
- Aircraft using GPS navigation under IFR must have an approved and operational alternate means of navigation appropriate to the flight.
- The GPS operation must be conducted in accordance with the FAA-approved aircraft flight manual (AFM) or flight manual supplement.

GPS domestic en route and terminal IFR operations can be conducted with properly installed systems, but avionics necessary to receive the ground-based facilities appropriate for the route must be installed and operational, and facilities necessary for these routes must also be operational. Ground-based navigation equipment is not required for en route IFR RNAV operations when using GPS WAAS navigation systems.

To use GPS for IFR approaches, you must use GPS avionics that are properly approved and installed, and all approach procedures to be flown must be retrievable from the airborne navigation database. You must also be sure to check GPS NOTAMs for possible satellite outages.

Terminal Arrival Areas

You need to become familiar with the "terminal arrival area" (TAA) concept (AIM 5-4-5), which is designed for transitioning aircraft equipped with area navigation (RNAV) capability from the en route structure to the terminal environment.

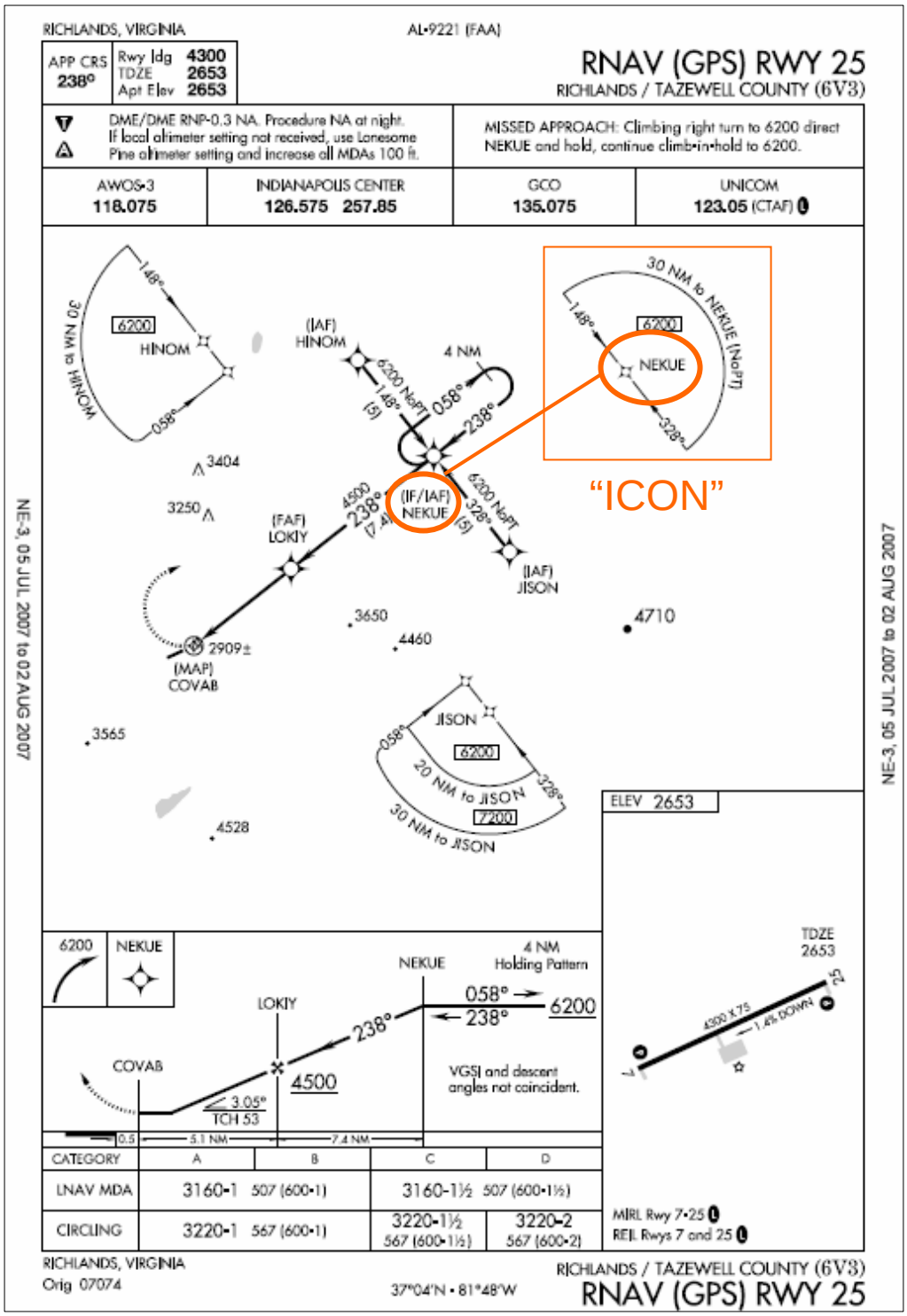
The TAA uses a "T" design, with 1 to 3 initial approach fixes (IAF); an intermediate fix; a final approach fix (FAF), and a missed approach point (MAP) usually located at the runway threshold.

When ATC clears you to enter the TAA, fly directly to the IAF associated with the area in which you enter and maintain the depicted altitude.

Related Media for this Section

Terminal Arrival Area
Terminal Arrival Area.pdf (46.34 KB)

Terminal Arrival Area



IFR and GPS

What is WAAS?

The Wide Area Augmentation System (WAAS) corrects GPS signals to enhance system accuracy. This enhanced accuracy has made it possible to develop a new class of approach procedures -- Approach with Vertical Guidance (APV). APVs provide vertical guidance based on GPS with WAAS corrections.

AIM 1-1-20 provides detailed information on WAAS, including the requirements for its use in IFR operations.

RNAV(GPS) Approach Minimums

You are probably familiar with terms for approach minimums on conventional approaches, but you will notice several new terms in the approach minimums section of RNAV(GPS) charts. These include:

- **LPV:** LPV (localizer performance with vertical guidance) denotes minimums with electronic lateral and vertical guidance provided by GPS.
- **LNAV/VNAV:** LNAV/VNAV (lateral navigation/vertical navigation) identifies minimums developed to accommodate an RNAV IAP with vertical guidance, usually provided by approach certified Baro-VNAV. Aircraft using LNAV/VNAV minimums descend via an internally generated descent path based on satellite or other approach approved VNAV systems.
- **LNAV.** LNAV (lateral navigation) is for lateral navigation only, and the approach minimum altitude is published as a minimum descent altitude (MDA). LNAV provides the same level of service as the present GPS stand alone approaches.

References and Resources

Aeronautical Information Manual

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

Instrument Procedures Handbook (FAA-H-8261-1A)

TSO C129a - Airborne Supplemental Navigation Equipment Using the Global Positioning System (GPS)

TSO C146b - Stand-Alone Airborne Navigation Equipment Using The Global Positioning System Augmented By The Satellite Based Augmentation System

Review

Chapter 1 - Preflight Planning

An important part of the IFR preflight process is ensuring compliance with requirements for pilot proficiency and currency (14 CFR 61.57), as well as for aircraft instruments and equipment (14 CFR 91.205(d)). It may be helpful to think of required instruments/equipment in terms of what you need to aviate, navigate, and communicate under IFR. In addition, you must become familiar with "all available information" concerning the IFR environment (14 CFR 91.103).

Chapter 2 - IFR Clearance, Taxi and Takeoff

An ATC clearance - usually issued in the CRAFT format - is required for IFR flight. Safe taxi, especially during low visibility conditions, requires a thorough understanding of airport signs, markings, and lighting. Although a part 91 operator can legally depart in zero-zero conditions, you should set and always follow personal minimums that provide an appropriate safety margin.

Chapter 3 - Instrument Departure

A competent instrument pilot must have a solid understanding of instrument departure procedures (DP). There are two kinds of instrument DPs. A Standard Instrument Departure (SID) is an ATC procedure designed to enhance system efficiency. An Obstacle Departure Procedure (ODP) is designed to make sure you avoid terrain and other obstacles. An ODP is typically flown without an explicit ATC clearance, but ATC expects you to use the ODP when departing IFR from a non-towered airport.

Chapter 4 - En route IFR

En route IFR procecdures to know include requirements for communication (14 CFR 91.183 and AIM 5-3-2); proper altitudes (14 CFR 91.179 and 14 CFR 91.177); and holding (AIM 5-3-7). An IFR pilot must also know how to obtain, evaluate, and act on en route weather information from Flight Watch, datalink, radar, or other sources. Knowledge of emergency procedures, such as failure of communication (14 CFR 91.185) or navigational equipment (14 CFR 91.187) is also important.

Chapter 5 - Instrument Arrival

If you are operating to an airport with published standard terminal arrival procedures (STARs), pay special attention to the nuances of navigating this procedure (AIM 5-4-1). Remember that "expect" altitudes and speeds listed on the STAR chart are for planning purposes, and that you may not fly them unless cleared to "descend via" the STAR or otherwise explictly cleared by ATC.

Chapter 6 - Instrument Approach

The instrument approach phase is perhaps the most challenging part of an IFR flight, and is often the major focus of training for an instrument rating. With the advent and rapid proliferation of RNAV(GPS) approaches, today's IFR pilot needs to understand such concepts as Terminal Arrival Areas (AIM 5-4-5); the meaning of approach terminology; how to read approach minimums (especially those for RNAV(GPS) approaches with vertical guidance); landing requirements (14 CFR 91.175), and missed approach procedures (14 CFR 91.175).

Chapter 7 - IFR and GPS

If you wish to use GPS for IFR operations, you need to be thoroughly familiar with AIM 1-1-19, which covers the requirements your equipment must meet for this purpose. Since many RNAV (GPS) approaches are now charted in the terminal arrival area (TAA) format, review AIM 5-4-5 for information. To fly GPS approaches, you will need to understand new terminology for RNAV(GPS) approach minimums.