Instrument Airplane Syllabus

Lou Dietz, September 2018

Stage I: Instrument scanning and interpretation, aircraft control, radio navigation

Introduction and Instrument Systems (Ground)

Instrument scan, basic attitude instrument flight

Instrument Scan, Aircraft Control, Practice Maneuvers, Aircraft Gaits

Intercepting and Tracking VOR Navigation Aids, HSI, Autopilot Usage

Holding Patterns and Workload Management

GPS Navigation and Automation Management

Stage II: IFR charts, weather, holding patterns, instrument approaches

Airspace, Charts, Flight Planning and Enroute Operations

Communications, Clearances, Lost Communications Procedures

Cockpit Organization, Workload Management, Checklists

Precision Approaches

IFR Weather and Weather Services

Non-Precision Approaches

IFR Departure Procedures and Terminal Arrival Procedures

Partial Panel Maneuvers and Approaches

Unusual Attitude Recoveries

Stage III: Cross-Country and checkride prep

Enroute and Cross-Country Instrument Flight

Review and Checkride Prep

Appendices:

Appendix A – IFR Regulations Quick Reference from AOPA

Appendix B – Lost Communications

Appendix C – IFR Endorsements

Appendix D – Instrument rating Flight Experience Requirements

Appendix E – Important References to Study

Appendix F – Kneeboard Cheatsheets

Appendix G - KSQL IFR Departure Procedure:

Appendix H – Garmin Guidance for DPEs and CFIS for simulation system failures with G1000:

Appendix I – GPS Approach types and CDI Sensitivity:

Stage I: Instrument scanning and interpretation, aircraft control, radio navigation

Introduction and Instrument Systems (Ground)

Objective: Develop understanding of IFR flight training process, and detailed knowledge of instrument systems and pre-flight checks.
References: Appendix D (IFR experience requirements)**,** IFH Ch. 5-6, POH, AFM
Schedule: Ground 1.5 hours
Lesson Elements:

1. Overview of IFR flight training process, syllabus overview
    a. Aircraft choice, high performance, traditional vs technically advanced
    b. Time and cost commitment and scheduling
        i. Private: 60-80 hours, about $20k
        ii. Instrument 40-60 hours, about $15k
        iii. Simulation software and PC tools
    c. Stages of training, Phase checks
    d. Airman Certification Standards (ACS) and Knowledge (written) test
    e. Pilot Qualifications, recency of experience, logbook records, personal minimums
    f. Risk avoidance and management
        i. Intro to multi-tasking, workload management, checklists
        ii. Personal minimums, “get-there-itis”, proficiency vs currency, PAVE
2. Instrument systems and power sources, flight characteristics, limitations, errors, pre-flight check methods
    a. Required equipment for IFR flight, and IFR airworthiness requirements
    b. Mnemonic GRABCARDD: Generator, Rate of Turn, Attitude, Ball, Clock, Altimeter (sensitive), Radios, DG, DME (above FL240)
    c. Inoperative equipment – MEL, placarding
    d. Pitot-Static instruments: Altimeter (+/- 75’), Airspeed Indicator, Vertical Speed Indicator, pitot heat (use below 10C or 50F, in visible moisture)
    e. Gyro instruments: Attitude indicator, Heading Indicator, Horizontal Situation Indicator, Turn Coordinator, vacuum systems
    f. Magnetic Compass: Northerly turning errors, acceleration errors, deviation card. Mnemonics: ANDS, OSUN
    g. Transponder and altitude encoders
    h. G1000 specific topics:
        i. AHRS vs ADC – what are they, what do you do if they fail?

ii. Electrical system – how do you know if the alternator has failed?
iii. If you are running on Standby battery – what still functions?
1. PFD, AHRS, ADC, Com1, Nav1, stby inst lights, stby bus voltmeter. (NOTHING ELSE, like flaps, transponder, lights, etc)

i. Power Instruments: Engine gauges, Electronic engine instruments
j. Electrical instruments: ammeter, voltmeter, alternator
k. Navigation radios and databases (30-day VOR check, 28-day GPS cycle)
l. Electronic displays: PFD, MFD, TAA definition, ADS-B weather/traffic
m. Autopilot systems, including preflight procedures and common failure modes
n. Electronic flight bags (EFBs) and automation management
o. Anti-icing systems
p. Procedures and documentation for flying with inoperative equipment

Completion Standards: Student must demonstrate understanding of: flight training process, risk management, instrument systems and power sources, pre-flight check procedures, and operation and management of installed instruments and navigation equipment.

Instrument scan, basic attitude instrument flight

Objective: To understand and practice instrument scan procedures, instrument interpretation, common errors, and partial panel procedures in case of system failure
References: IFH Ch. 6-7
Schedule: Ground 1 hour; simulator and/or airplane, 1.5 hours

Lesson Elements:

1. Introduction to Instrument Scan (ground portion)
    a. Primary and supporting instruments
    b. Instrument Scan
        i. Control and performance instruments
        ii. Instrument cross check, types of scans
        iii. 4-step scan procedure to initiate any maneuver:
            1. Set approximate attitude and power
            2. Inverted V-scan to check trends
            3. Scan primary instruments
            4. Scan all instruments
        iv. Instrument interpretation
        v. Diagnosing system failures
            1. Bank triangle (most critical): A/I, TC, Compass (H/I)
            2. Pitch triangle: A/I, Altimeter, VSI (A/S, vacuum gauge)
        vi. Partial panel techniques
2. Attitude Instrument Flight Basics (simulator and/or airplane)
    a. Power-Pitch-Trim sequence to initiate climb, Pitch-Power-Trim for descent.
    b. Straight and Level flight (IFH 7-2)
    c. Straight climbs and descents (IFH 7-14)
    d. Turns (IFH 7-19)
3. Common Errors:
    a. Spatial disorientation
    b. Distraction
    c. Fixation or omission
    d. While turning – do nothing else
    e. Heavy touch, over-controlling
    f. Improper trim control

Completion Standards: Student must demonstrate understanding of: primary and supporting instruments for various phases of flight; instrument scan methods and ability to diagnose and respond to system failures. Student should become proficient in S&L

flight by reference to instruments, and transitions to straight climbs, descents, and turns. (ACS standards: +/- 10 kts, +/- 10°s, +- 100 feet)

Instrument Scan, Aircraft Control, Practice Maneuvers, Aircraft Gaits

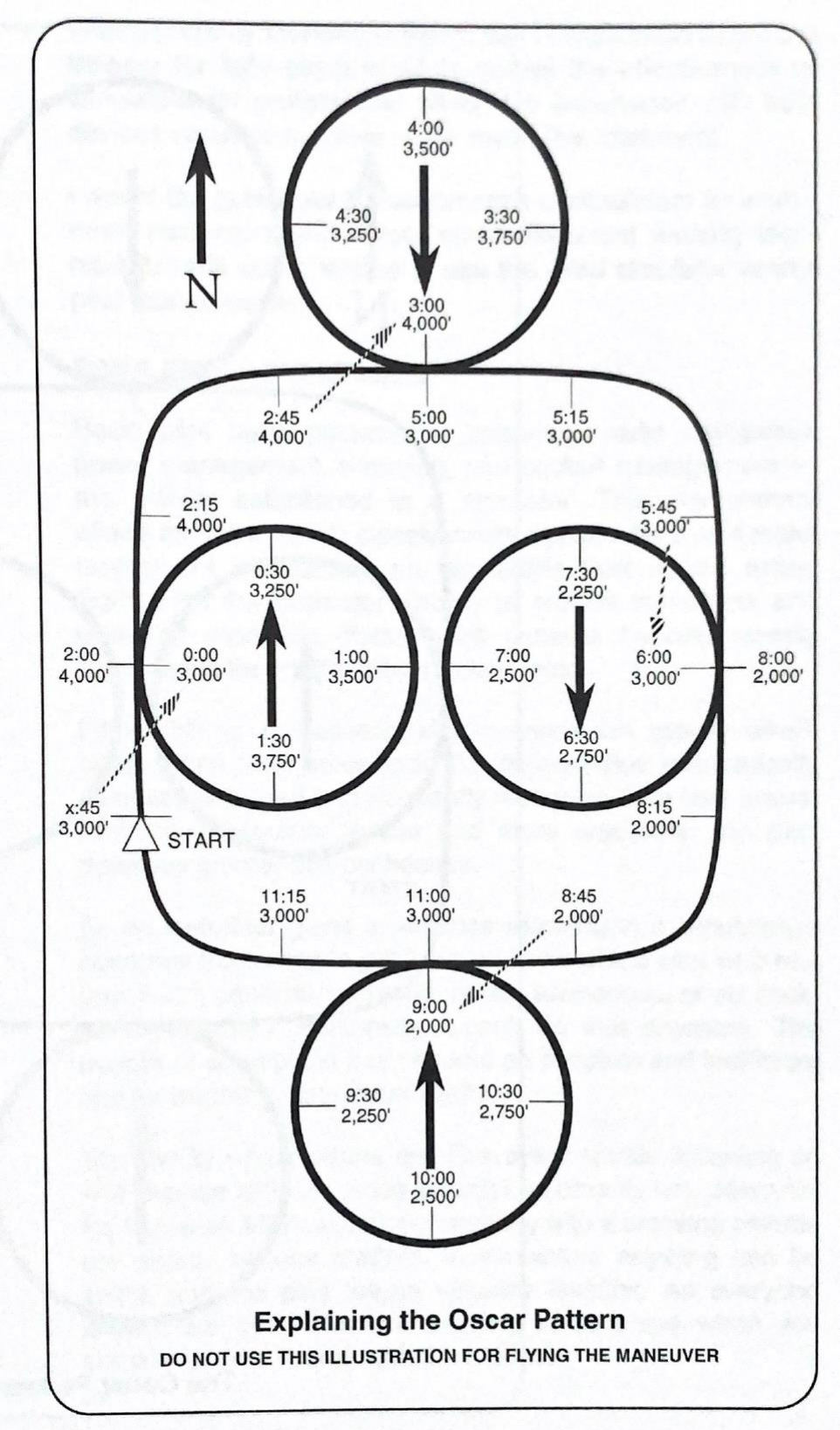
Objective: To further develop instrument scan procedures, and practice all phases of IFR flight, with transitions between the various maneuvers. Develop and document "gait" chart for the aircraft in use.
References: IFH Ch. 6-7
Schedule: Simulator and/or airplane, 1.5 hours

Lesson Elements:

1. Attitude Instrument Flight practice maneuvers (simulator and/or airplane)
    a. Straight and Level flight
    b. Straight climbs and descents
    c. Turns – standard rate (IFH 7-19) and steep turns (IFH 7-22)
    d. Constant rate climbs and descents
    e. Combinations of turns during other maneuvers (such as "Oscar Pattern", shown next page)
    f. Simulated IFR flight example
        i. Climb Vy to specific altitude, with vectoring turns
        ii. Transition to cruise climb, with vectoring turns
        iii. Level off, cruise configuration, vectoring turns
        iv. Cruise descents, vectoring turns
        v. Level off, slow cruise, vectoring turns
        vi. Slow cruise descent, vectoring turns
        vii. Simulated MAP, climb, turn, level off, hold at fix
    g. Aircraft Gaits, Learn and make table of following values:
        i. Make rows of table for Vx, Vy, cruise climb, cruise, cruise descent, slow cruise (holding, initial approach), slow descent (final approach)
        ii. Make columns of table for pitch (# bars on A/I), Manifold Pressure, RPM, airspeed
2. Common Errors:
    a. Fixation or omission
    b. Forgetting to check HSI vs compass (non-slaved systems)
    c. While turning – do nothing else until turn is complete
    d. Heavy touch, over-controlling
    e. Improper trim control

Completion Standards: Student must become proficient at transitioning between the phases of flight used on a typical IFR flight. Maintain heading within 10°s, altitude within 100 feet, airspeed within 10 kts. Student should memorize the "Gait" table and/or have printed on kneeboard.

The ”Oscar Pattern” from Ralph Butcher’s book IFR manual. This is hard to do!



[<-- Back to TOC](#)

Intercepting and Tracking VOR Navigation Aids, HSI, Autopilot Usage

Objective: VOR orientation, course intercepts and tracking, and use of HSI, if available. DME arcs. Autopilot systems and operation.
References: ACS section V; IFH Ch 9; POH, AFM
Schedule: Ground 1 hour, simulator and/or airplane, 1.5 hours
Lesson Elements:

1. VOR introduction, service volumes, charting
2. VOR, OBS, CDI, To/From indicator, HSI, tuning, identification, and receiver check (logged in last 30 days)
3. VOR orientation
    a. Where are you relative to the station? (Center CDI with FROM)
    b. Where are you relative to assigned course? (Parallel course, set OBS to course, CDI needle points toward the course)
    c. Where are you relative to intersection defined by VOR radial? (Set OBS to radial, confirm FROM, if CDI needle deflected toward station, you're not there yet. For HSI, CDI needle ahead, you're not there yet.)
4. VOR intercepts
    a. Use 45° intercept heading if CDI fully deflected.
    b. Use 20° intercept if CDI is alive.
5. VOR course tracking
    a. Wind correction angle – start with 20°s, at intercept, reduce to 10°s, keep reducing or increasing by half until it works.
    b. Once tracking, use small heading adjustments (few degrees) to chase the needle.
6. DME arcs (see notes below for intercepting and tracking DME arcs)
7. Autopilot systems and usage
    a. POH and AFM supplements pertaining to Autopilot
    b. Preflight check of autopilot
    c. Autopilot usage, modes, GPS integration, altitude functions
8. Common Errors
    a. Incorrect tuning and identification procedures
    b. Failure to set navigation selector for the course to be intercepted (GPS vs VOR/VLOC switch)

Completion Standards: Student must be able to tune and ID VOR navaid, detect failures; check receiver for proper operation; orient to a VOR station or course; intercept assigned course; track course to or from VOR, with crosswind correction; Maintain heading within 10°s, altitude within 100 feet, airspeed within 10 kts. Student must know how to check autopilot operation during preflight, and how to use autopilot during enroute flight.

<-- Back to TOC

Notes for flying DME Arcs (without benefit of GPS/Moving map display):

- Interception:
    a. Lead turn by ½ mile to heading which puts the original radial 10°s behind the outer wing on the HI.
    b. Check DME
        i. If inside the arc - continue present heading and go to tracking procedure.
        ii. If outside the arc - check current radial and put that radial 20°s behind outer wing on the HI. Go to tracking procedure.
        iii. If on the arc - go to tracking procedure

- Tracking:
    a. Upon reaching the DME arc
        i. Center CDI needle with FROM indication
        ii. Turn so that indicated radial is 10°s behind outer wing on HI
        iii. Go to step a.
    b. Outside the arc?
        i. center CDI needle with FROM indication
        ii. turn so that indicated radial is behind outer wing by 10°s plus 10°s for each half mile outside the arc.
        iii. Go to step a. above

Holding Patterns and Workload Management

Objective: Develop proficiency in flying holding patterns, including recommended entry procedures, while satisfying ACS standards.

References: POH, AFM, GPS manual, AIM 5-3-8; IFH, Ch. 10

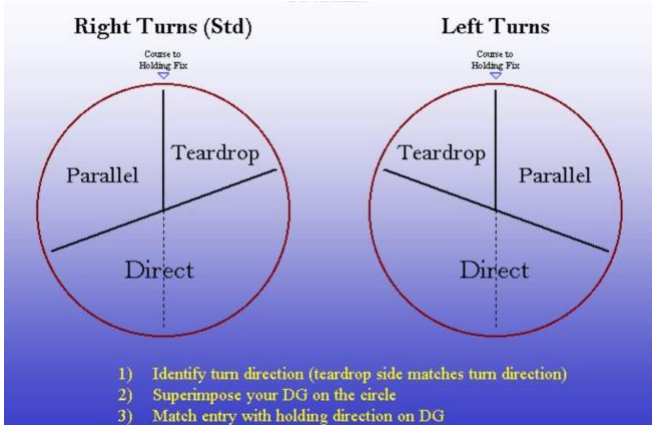
Schedule: Ground 1 hour, simulator and/or airplane, 1.5 hours

Lesson Elements:

1. Review manuals and procedures for GPS installation as necessary
2. Workload management with the 7 T's:
    a. 7 T's: Time, Turn, Throttle, Tune, Twist, Talk, 'Ticipate
    b. Or 5 T's: Time, Turn, Throttle, Tune, Talk
3. Holding patterns – regulations (speed limits) and ATC reporting requirements
4. Holding instructions: (IFH 10-10)
    a. Direction from the fix
    b. Name of the fix
    c. Radial or bearing of the inbound leg
    d. Leg length in miles (or time)
    e. Direction of turn (right turns unless left is specified)
    f. Expect further clearance (EFC) time

Note which sector the holding side of the fix (or OUTBOUND heading) falls into, on the graphic below.

5. Standard entry procedures – visualize entry on HI when flying towards the fix. (See diagram)
    a. Direct (turn to outbound heading)
    b. Teardrop (turn with 30° offset from outbound leg)
    c. Parallel (first turn direction is OPPOSITE of hold turns.)



6. Crosswind correction during pattern
    a. Determine cross-wind correction on inbound leg, and TRIPLE it on outbound leg (AIM recommendation)
7. Types of fixes: VOR, intersection, VOR/DME, GPS waypoint
8. Fuel monitoring and "minimum fuel" situations
9. Common errors – Wasting fuel - use slow cruise or even max endurance speed if fuel is a factor; GPS confusion; incorrect entry choice; insufficient wind correction

Completion Standards: Student must demonstrate proficiency in planning, entering, and flying holding patterns, while maintaining +- 10 kts, +- 100 feet, +- 10°s, with < ¾ scale deflection of CDI.

GPS Navigation and Automation Management

Objective: Develop detailed understanding of GPS system and navigation; become proficient with particular GPS installation, displays, and autopilot interfaces; become proficient at using GPS in-flight, including modifying flight plan and changing approaches.

References: AIM Ch 1; IFH Ch 7; POH/Airplane Flight Manual; GPS manual

Schedule: Ground 1.5-hour, simulator and/or airplane, 1.5 hours

Lesson Elements:

1. GPS installation and autopilot interface and automation management
    a. Type of installation, including differential GPS (WAAS) capability
    b. Preflighting GPS – database currency and operational tests
    c. Switching autopilot between GPS, VOR, heading bug, etc.
    d. GPS annunciations and CDI sensitivity (see Appendix)
    e. GPS simulation software for home practice
    f. Risk management - New or unfamiliar GPS demands significant practice with VFR conditions before using in IMC! GPS brings impressive capabilities and situational awareness, but at the risk of significant complexity and variability between systems!
2. GPS approach minima
    a. LNAV or LNAV+V – original GPS non-precision approach, with MDA
    b. LNAV/VNAV - requires WAAS, provides vertical guidance, lower DA
    c. LPV – requires WAAS, similar precision to ILS, with lowest DA
3. Managing risk of various GPS idiosyncrasies:
    a. How to suspend GPS sequencing for multiple turns in a hold?
    b. How to resume approach after holding?
    c. Pop-up or other method to resume sequencing to missed approach point
    d. Use of vectors to final (VTF) with GPS (don't do it!)
    e. Using GPS for guidance on ILS and VOR approaches – how and when to transition from GPS guidance to VOR or Localizer? Auto or manual?
4. Common errors
    a. Use of expired databases
    b. GPS confusion caused by varying types, installations and interfaces

Completion Standards: Student must understand the different types of GPS installations and "flavors" of GPS approaches. Student must become proficient at

creating GPS flight plans, navigating with GPS, and modifying flight plans and approach selections. Student must understand particular GPS techniques for holding and flying missed approaches and using autopilot interfaces (if installed).

Stage II: IFR charts, weather, holding patterns, instrument approaches

Airspace, Charts, Flight Planning and Enroute Operations

Objective: To develop working IFR knowledge of the airspace system, IFR charts, flight planning, and enroute operations

References: AIM Ch 4; IFH Ch 1, 2, 10;

Schedule: Ground 2 hours

Lesson Elements:

1. Airspace and Regulations
    a. Airspace classification
    b. VFR minimums
    c. IFR minimums for departure, approach, alternates
2. Charts
    a. Enroute charts – low-altitude
        i. Airports, airways, COPs, mileage
        ii. MEAs, MCAs, MOCAs
        iii. Finding airport and ARTCC frequencies
    b. DPs, STARs
    c. Approach plates
3. Flight planning
    a. Navigation logs, plotters, computers (E6B, etc.), wind computations
    b. Flight plan forms and filing
    c. Fuel planning and requirements
4. ATC system
    a. Communication and Navigation facilities (Approach, Departure, Center)
    b. Radar and transponders
    c. ADS-B
    d. FSS
5. Alternates and Diversions
    a. Alternate requirement (123 rule)
    b. Non-standard Alternate minimums
    c. Non-standard Takeoff minimums

Completion Standards: The student must be able to plan a cross country flight, including routing, fuel planning, and filing an IFR flight plan, and receiving weather briefings (in person and on-line).

Communications, Clearances, Lost Communications Procedures

Objective: To learn proper IFR communications techniques, include copying clearances, normal communications, and lost communication procedures

References: Appendix A, AIM Ch 6-4; FAR 91.185 (lost communications), IFH Appendix A (clearance shorthand)

Schedule: Ground 1.5 hours

Lesson Elements:

1. Communications
    a. Priorities: Aviate, Navigate, Communicate
    b. Required position reports
    c. Position report structure (PTATEN mnemonic)
2. Clearances
    a. CRAFT mnemonic
        i. Clearance limit
        ii. Route
        iii. Altitude
        iv. Frequency
        v. Transponder code
    b. Clearance shorthand
    c. VFR on top
    d. Void time clearances
3. Lost Communications
    a. Squawk 7600
    b. If VMC, continue VFR, land as soon as practicable.
    c. If IMC:
        i. For Route, use mnemonic AVEF – Assigned (if Vectored then direct to fix), Expected, then Filed (in that order of priority)
        ii. For Altitude, use highest of mnemonic MEA – Minimum (MEA), Expected, Assigned
        iii. If clearance limit is an IAF, begin approach from clearance limit at ETA, otherwise leave clearance limit at EFC and/or start approach from IAF at ETA.

Completion Standards: The student must become proficient at typical IFR communications using standard phraseology and demonstrate an understanding of lost

communication procedures. Student must comply with clearances within +/- 10 kts, +/- 10°s, and +/- 100 feet.

Cockpit Organization, Workload Management, Checklists

Objective: To memorize common mental checklists and learn to use mental checklists and flow patterns backed up by written checklists.
References:
Schedule: Ground 1 hour

Lesson Elements:

1. Aviate, Navigate, Communicate
2. Digital charts vs. paper charts
3. Chart and database currency
4. Use of BOTH written and mental checklists
    a. Use mental checklists and flow patterns
    b. Double check and back-up with written checklists
5. Mental checklists
    a. Before takeoff: CIGARS – Controls, Instruments, Gas, Attitude, Runup, Seatbelts and Switches
    b. Before taking runway: – Lights, Camera (transponder), Action
    c. Before landing: GUMPS – Gas, Undercarriage, Mixture, Prop, Seatbelts and Switches
    d. Approach briefing: MARTHA – Missed approach procedure, ATIS and Altimeter setting, Radios, Time (for timed approach), Headings, Altitudes (MDA, DH, missed approach)
    e. 5 Ts: Time (start timer), Throttle, Turn, Tune and/or Twist (nav freq and OBS), Talk
    f. Non-radar position reports: PTATEN – Position, Time and Type of flight plan, Altitude, ETA to next fix, Next fix
6. Preflight equipment checks
    a. Autopilot and GPS – see AFMs for mandatory pre-flight check procedures
    b. Gyro instruments – verify proper function during taxi
7. Common Errors
    a. Forgetting to use mental checklists
    b. Rushing to keep up with the plane
    c. Diverting attention during maneuvers like turning, or before reaching altitude.

Completion Standards: The student must demonstrate the ability to prioritize tasks during IFR flight, “stay ahead” of the airplane by using mental checklists and written checklists.

Precision Approaches

Objective: Develop proficiency in flying precision approaches, and demonstrate understanding of landing minimums and missed approach procedures

References: AIM Ch 5-4, IFH Ch 10, IPH Ch. 4, FAR 91.175

Schedule: Ground 1.5 hours, flight 3 hours

Lesson Elements:

1. Types of precision approaches
    a. ILS
    b. PAR
    c. GPS LPV (technically, not precision approach, but included here because of similarity)
2. Components of ILS: localizer, glide slope, outer marker, sometimes inner marker
3. Nav equipment considerations:
    a. Use of GPS maps and guidance for initial approach
    b. Methods for switching CDI from GPS to VOR/LOC
    c. CDI sensitivity changes during approach
    d. Missed approach guidance – GPS guidance for missed approach
4. At DA – what is required to descend below DA or MDA? (FAR 91.175)
    a. Continuously in position to land, with normal descent rate and maneuvers
    b. AND Flight visibility >= minimum
    c. AND approach light system (-100') OR threshold OR REIL OR runway
5. When is missed approach required? ((FAR 91.175
    a. At DA, if references above are not visible
    b. If below MDA, visibility < min OR lost view of airport references
    c. During circling maneuver at or above MDA, airport not visible
6. Missed approach
    a. Briefing and MARTHA checklist
    b. When to execute missed approach? Report MAP to ATC!
    c. How to handle MA before MAP, or during circling approach?
7. Common errors
    a. Getting "behind" the airplane, not ready for missed approach, failing to accomplish checklist items
    b. Overcontrolling during final phase of approach, with high CDI sensitivity
    c. Using wrong navigation source during approach
    d. Unstable approach, failure to configure for approach and landing
    e. Descent below DA (slight dip is allowed)

Completion Standards: Student must demonstrate proficiency at flying precision approaches to ACS standards to landing, including circling approaches, and missed approach procedures. Maintain +-100', +- 100 kts, +- 10°s, <3/4 CDI deflection.

IFR Weather and Weather Services

Objective: To develop satisfactory knowledge, risk management, and skills associated with obtaining, understanding, and applying weather information for a flight under IFR.

References: AIM Ch 7, Aviation Weather Services, Aviation Weather, Risk Management Handbook, Instrument Flying Handbook, AC 91-74B “Pilot Guide: Flight in Icing Conditions”

Schedule: Ground 1.5 hours

Lesson Elements:

1. Meteorology for IFR flight planning
    a. Weather system formation, including air masses and fronts
    b. Cloud types and hazards
    c. Turbulence
    d. Thunderstorms and microbursts
    e. Fog
    f. Type and hazards of icing, including frost, conditions conducive to icing
    g. Wind
    h. Moisture and precipitation
2. Current and forecast weather for departure, enroute, and arrival
    a. Sources of weather information
    b. Weather briefing and contents
    c. Graphical weather products
    d. Electronic Flight Bags (EFBs, e.g. Foreflight, Garmin Pilot)
3. Enroute weather Services
    a. Onboard weather information
    b. Inflight FSS weather
4. Weather risks for IFR flight
    a. Limitations of forecasts and inflight weather resources
    b. Hazardous weather
    c. Know or forecast icing conditions
    d. How to identify alternates, when to divert to alternate
    e. Establishing personal minimums

Completion Standards: The student must demonstrate the ability to use weather resources to obtain a weather briefing, make a competent go/no-go decision, determine if an alternate is required, ensure the alternate meets regulatory requirements, and obtain weather updates during flight.

Non-Precision Approaches

Objective: Develop proficiency in flying non-precision approaches, and demonstrate understanding of landing minimums and missed approach procedures.

References: FAR 91.175, AIM Ch 5-4, IFH Ch 10, IPH Ch. 4, POH/AFM, GPS manual

Schedule: Ground 1 hour, simulator and/or airplane – 3 hours

Lesson Elements:

1. Types of approaches:
    a. Traditional non-precision approaches, including ASR. These use an MDA: NDB, VOR, GPS LNAV, LOC, SDF
    b. APV (approach with vertical guidance), using DA: GPS LNAV/VNAV, GPS LPV, LDA + glidepath
2. Parts of approach: Initial, Intermediate (starts at IAF), Final, Missed Approach
3. Approach categories: A <91 kts, B <121 kts, C <141 kts, D <166 kts, E >166 kts
4. Visual and Contact approaches:
    a. Visual approach (AIM 5-4-23) – must have airport or preceding aircraft in sight, ceiling > 1000' AGL, vis >3 SM
    b. Contact approach (AIM 5-4-25) – pilot must request, vis >1 SM, clear of clouds
5. At MDA or DA – what is required to continue descent?
6. VDP – when published, do not descend below MDA until past.
7. Circle to land approaches
    a. Approach chart named with letter instead of runway number
    b. Review circling minimums and notes on approach chart
    c. Loss of flight visibility or airport, execute missed
8. GPS considerations:
    a. Different generations of GPS equipment non-WAAS vs WAAS (TSO C-129 or -196 vs TSO C-145 or -146)
    b. CDI sensitivity during approach phases (ENR, TERM, APR)
    c. GPS – when can it be used for alternate airport?
    d. RAIM prediction with old-style GPS (Website: sapt.faa.gov)
    e. CDI switch for GPS versus VOR/VLOC
    f. Missed approach guidance – how to resume guidance at MAP?
    g. Missed approach during circle-to-land procedure
9. Common errors
    a. Unstable approaches
    b. Failure to configure aircraft for approach and landing
    c. Failure to manage automation

d. Descent below MDA (+100’ -0’ at MDA)
e. Using wrong navigation source during approach
f. Loss of sequencing with GPS during missed approach
g. Loss of situational awareness during missed approach or circling approach

Completion Standards: Student must demonstrate proficiency at flying non-precision approaches to ACS standards to landing, including circling approaches, and missed approach procedures.

IFR Departure Procedures and Terminal Arrival Procedures

Objective: Develop proficiency in using SIDS, STARs, ODPs. Understand takeoff minimums and required aircraft performance for Departure Procedures.

References: AIM Ch 5-4, IFH Ch 10, IPH Ch. 4, FAR 91.175

Schedule: Ground 1.5 hours, flight 3 hours

Lesson Elements:

1. Standard Terminal Arrivals (STARS)
    a. Use of No STARS or No SIDS in comments of flight plan
2. Standard Instrument Departures
    a. Provide obstacle clearance, and are charted to reduce pilot/controller workload
3. Obstacle Departure Procedures
    a. These are developed when obstacles exist such that a diverse departure (see below) will not provide obstacle protection.
    b.
4. Diverse Departures
    a. If no ODP or SID exists for an airport with an instrument approach, then Diverse Departure standard performance as described in AIM 5-2-6 is assumed for IFR departures:
        i. Cross departure end of runway >=35 AGL
        ii. No turns below 400 AGL
        iii. Climb at >=200 ft/nm (must convert to fpm at your climb speed!)
5. Common errors
    a. Accepting a SID or STAR without charts available!

    b. Overcontrolling during final phase of approach, with high CDI sensitivity
    c. Using wrong navigation source during approach
    d. Unstable approach, failure to configure for approach and landing
    e. Descent below DA (slight dip is allowed)

Partial Panel Maneuvers and Approaches

Objective: Review instrument systems and diagnosis of instrument or system failures. To develop student knowledge and skill in partial panel attitude instrument flight (including instrument approaches), timed turns and magnetic compass turns.
References: IFH Ch 3, 5, 7
Schedule: Ground 1 hour, simulator and/or airplane, 1 hour
Lesson Elements:

1. Review instrument systems and power sources
    a. Vacuum pump drives A/I and HI (or HSI)
    b. Electrical system drives T/C (turn coordinator)
    c. Pitot-static system
    d. Autopilot – rate based (uses turn coordinator) or attitude based?
2. Diagnosing system failures
    a. Bank triangle (most critical): A/I, TC, Compass (H/I)
    b. Pitch triangle: A/I, Altimeter, VSI (A/S, vacuum gauge)
3. Partial Panel operations
    a. Lost vacuum – no A/I or HI (HSI)
        i. Use T/C and compass for bank,
        ii. Use VSI, altimeter, and A/S for pitch
        iii. Use of rate-based autopilot for no-gyro operation
        iv. Timed turns – 3°s per second at standard rate
        v. Compass turns (OSUN mnemonic), 30°s offset in NorCal.
    b. Electrical failure – loss of T/C and rate-based autopilots
        i. Use A/I and DG to replace turn coordinator
        ii. Bank angle for standard rate turn: 5 kts + airspeed/10 (120 knots gives requires 17°s bank angle)
    c. Blocked pitot or static system, affecting A/S, VSI, altimeter
        i. Alternate static source
    d. G1000 partial panel operations: See Garmin guidance doc (next page)
4. ATC notification
5. No-gyro PAR approaches and ASR approaches
6. Common errors:
    a. Slow to recognize failure could result in unusual attitude
    b. Overcontrolling with partial panel

Completion Standards: Student must demonstrate understanding of instrument systems and ability to diagnose instrument and system failures. Student must become proficient in partial panel procedures, including enroute and instrument approaches (to be practiced frequently in future lessons).

Unusual Attitude Recoveries

Objective: To develop student knowledge and skill in recognition of and recovery from unusual attitudes, with full- and partial-panel operations.
References: IFH Ch 7
Schedule: Ground 1.5-hour, simulator and/or airplane, 1.5 hours
Lesson Elements:

1. Causes of unusual flight attitudes
    a. Failure to properly trim the controls
    b. Distraction, or fixation
    c. Turbulence and Wake Turbulence
2. Unusual Attitude Recoveries (IFH 7-26)
    a. Unusual attitudes are those not normally required during instrument flight. Recovery includes prompt return to straight-and-level flight
    b. Full panel recoveries
    c. Partial panel recoveries
3. Recognize nose-high unusual attitude:
    a. ASI slow or decreasing rapidly
    b. VSI shows climb, altimeter shows climb
    c. TC shows turn
    d. Recovery:
        i. Power-Pitch-Bank (must become 2nd nature!)
        ii. **Full-power - Pitch Down - Level Wings**
4. Recognize nose-low unusual attitude:
    a. ASI fast or increasing rapidly
    b. VSI negative rate, altimeter shows descent
    c. TC shows turn
    d. Recovery:
        i. Power-Bank-Pitch (must become 2nd nature!)
        ii. **Reduce power - Level Wings - Pitch Up**
5. Common errors
    a. Failure to recognize unusual attitude
    b. Dependence on senses other than instrument indications
    c. Failure to use proper recovery sequence, i.e. power-pitch-bank for nose-high, and power-bank-pitch for nose low

Completion Standards: Student demonstrates the ability to recognize, confirm, and recover from unusual attitudes, applying the appropriate pitch, bank, and power corrections in the correct sequence to return the aircraft to a stabilized level flight attitude.

Stage III: Cross-Country and checkride prep

Enroute and Cross-Country Instrument Flight

Objective: To develop the pilot's knowledge, skill and risk management associated with planning an IFR cross-country and filing a flight plan. Plan and fly instrument cross-country flight to satisfy aeronautical experience in FAR 61.65.
References: FAR 61.65, 91.167-187, Risk Management Handbook, AIM 5-1, IFH, IPH
Schedule: Ground 1.5 hours, Flight 3 hours
Lesson Elements:

1. IFR cross-country requirement before checkride
    a. IFR flight of 250 nm minimum
    b. An instrument approach at each airport
    c. 3 different kinds of approaches (VOR, GPS, ILS)
2. IFR cross country flight planning:
    a. Symbology on IFR enroute and approach charts
    b. Preparing navigation log (paper and EFB) and using preferred IFR routing.
    c. Fuel planning and monitoring, and definitions of minimum and emergency fuel
    d. Alternate airport selection and planning
    e. Obtaining weather briefings, including NOTAMS and adverse conditions such as icing, wind shear and turbulence.
    f. Personal minimums and go/no-go decisions.
    g. Filing IFR flight plan, and procedures for activating and closing IFR flight plans.
    h. Knowledge of GPS and RAIM capability and prediction, if necessary.
3. Enroute procedures:
    a. Required reports and position report format
    b. Fuel planning and monitoring, re-calculating fuel reserves
    c. Weather updates
    d. Route changes
    e. Diversion to alternate
4. Common errors
    a. Inadequate preflight planning and briefings
    b. Incorrect understanding of non-standard takeoff minimums and alternate minimums

Completion Standards: To demonstrate knowledge, skill, and judgment in IFR cross-country planning to meet the applicable ACS standards. Completion of the instrument cross-country flight to satisfy aeronautical experience in FAR 61.65.

Review and Checkride Prep

Objective: Review emergency procedures, review knowledge test items, practice and prepare for checkride, including phase check and/or practice checkride.
References: N/A
Schedule: Ground 1 hour, Flight 3 hours

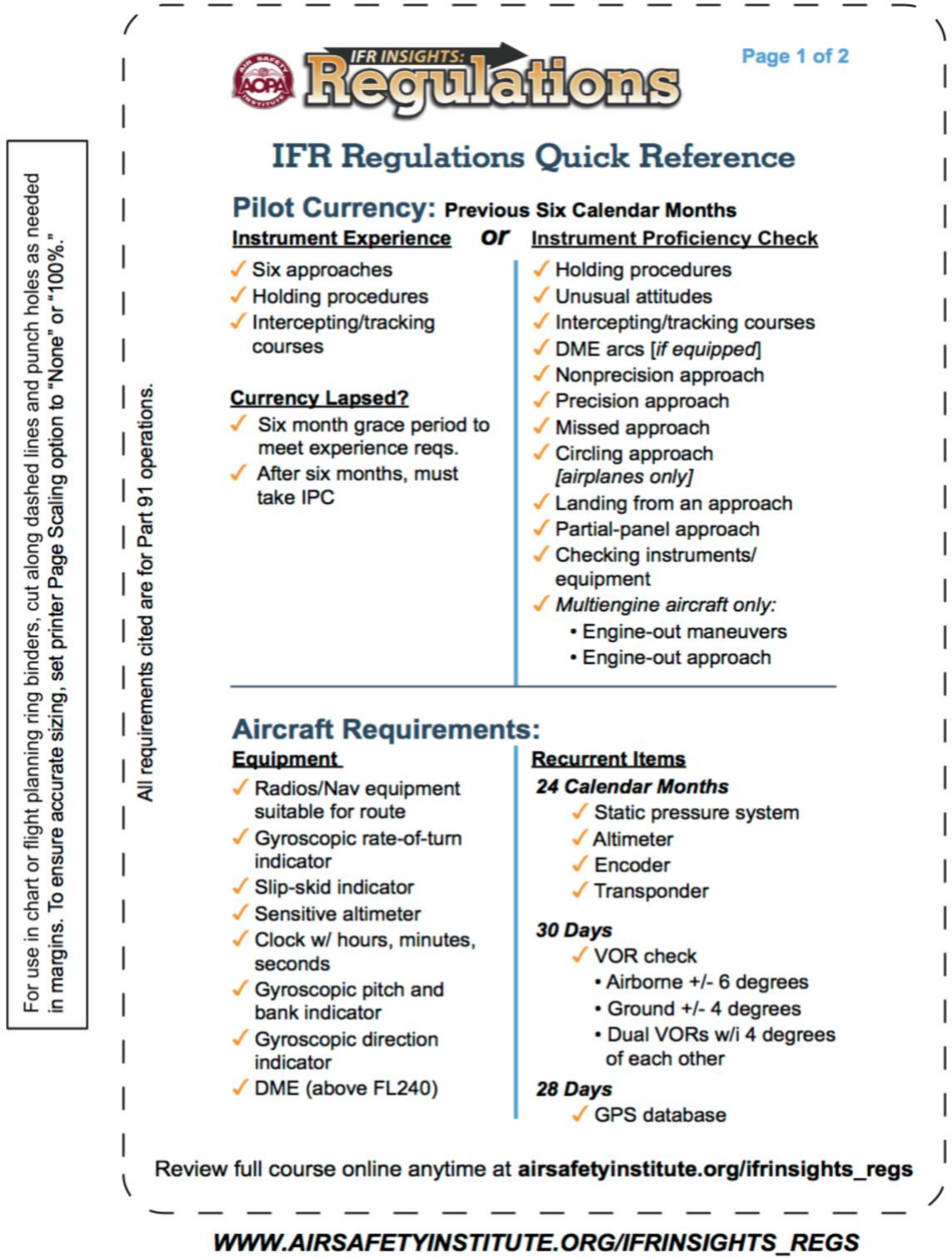
Lesson Elements:

1. Emergencies
    a. Instrument or system failures
    b. Partial panel, no-gyro approaches (ASR, PAR)
    c. Lost communications review (see Appendix B). Recognizing loss of communications and attempting to re-establish.
    d. Weather emergencies: Icing, thunderstorms
    e. Electrical system failures, EFD or MFD failure
    f. "Minimum fuel" vs "Fuel Emergency"
        i. Fuel reserves are required at takeoff, it is not illegal to use part of that reserve.
        ii. Declare "Minimum fuel" when in your judgment, you can accept no undue delay. This is NOT an emergency declaration
        iii. Declare fuel emergency when in your judgment, it is necessary to proceed directly to your destination airport. ATC will give priority.
2. Review and practice:
    a. Review knowledge test items
    b. ACS requirements and standards
    c. DPs, STARs
    d. Holding patterns and entries
    e. Non-precision and precision approaches to ACS standards
    f. Circle to land approaches, risks, and how to fly MAP after circling
    g. "Devil's triangle" approach practices (SCK/TCY/LVK or OAK/OAK/HWD, etc.) multiple approaches, missed approaches, holding patterns, etc.
    h. Practice checkride including phase check as appropriate
    i. Logbook entries and endorsements
    j. Aircraft prep for checkride, tab MX records, POH/AFM, etc.
3. Video, showing DPE's perspectives on Instrument Practical Test
    a. Andy Munnis (specifically on oral part of exam): https://www.youtube.com/watch?v=EUzR8f1Npss

Completion Standards: The student must demonstrate proficiency at IFR flight planning and all phases of IFR flight, to ACS standards, including ability to complete no-precision approach without use of primary flight instruments.

Appendices:

Appendix A – IFR Regulations Quick Reference from AOPA



IFR INSIGHTS: Regulations

Page 1 of 2

IFR Regulations Quick Reference

Pilot Currency: Previous Six Calendar Months

Instrument Experience *or* **Instrument Proficiency Check**

- ✓ Six approaches
- ✓ Holding procedures
- ✓ Intercepting/tracking courses

Currency Lapsed?

- ✓ Six month grace period to meet experience reqs.
- ✓ After six months, must take IPC

- ✓ Holding procedures
- ✓ Unusual attitudes
- ✓ Intercepting/tracking courses
- ✓ DME arcs [*if equipped*]
- ✓ Nonprecision approach
- ✓ Precision approach
- ✓ Missed approach
- ✓ Circling approach *[airplanes only]*
- ✓ Landing from an approach
- ✓ Partial-panel approach
- ✓ Checking instruments/ equipment
- ✓ *Multiengine aircraft only:*
  - Engine-out maneuvers
  - Engine-out approach

Aircraft Requirements:

Equipment

- ✓ Radios/Nav equipment suitable for route
- ✓ Gyroscopic rate-of-turn indicator
- ✓ Slip-skid indicator
- ✓ Sensitive altimeter
- ✓ Clock w/ hours, minutes, seconds
- ✓ Gyroscopic pitch and bank indicator
- ✓ Gyroscopic direction indicator
- ✓ DME (above FL240)

Recurrent Items

24 Calendar Months

- ✓ Static pressure system
- ✓ Altimeter
- ✓ Encoder
- ✓ Transponder

30 Days

- ✓ VOR check
  - Airborne +/- 6 degrees
  - Ground +/- 4 degrees
  - Dual VORs w/i 4 degrees of each other

28 Days

- ✓ GPS database

Review full course online anytime at **airsafetyinstitute.org/ifrinsights_regs**

All requirements cited are for Part 91 operations.

For use in chart or flight planning ring binders, cut along dashed lines and punch holes as needed in margins. To ensure accurate sizing, set printer Page Scaling option to "None" or "100%."

WWW.AIRSAFETYINSTITUTE.ORG/IFRINSIGHTS_REGS

IFR INSIGHTS: Regulations

Alternate Requirements:

1-2-3 Method

ETA +/- **1 hour**
Ceiling at least **2,000'**?
Visibility at least **3 sm**?

If "no," alternate is required

Weather Minimums

If alternate has:

- ✓ Precision approach
  - *At least 600' – 2sm*
- ✓ Nonprecision approach
  - *At least 800' – 2sm*
- ✓ No approach
  - *Basic VFR*

Fuel Requirements:

Alternate Required

Departure to destination
+ Destination to alternate
+ 45 mins at cruise speed

Alternate *Not* Required

Departure to destination
+ 45 mins at cruise speed

ASI RECOMMENDATION

At any point in the flight, be able to say that you will have at least ONE HOUR of fuel when you land.

ATC Reports:

At All Times

- ✓ *Vacating an altitude*
- ✓ *Reaching/leaving holding fix*
- ✓ *VFR-on-top altitude change*
- ✓ *Missed approach*
- ✓ *TAS change 10 kts or 5%*
- ✓ *Unable to maintain 500 fpm*
- ✓ *Safety of flight info*
- ✓ *Unforecast weather*
- ✓ *Equipment malfunctions*

Nonradar

- ✓ *Leaving FAF or OM inbound*
- ✓ *Revised ETA > 3 minutes*
- ✓ *Position reports at compulsory reporting points*

Lost Comm:

Transponder: **7600**
Route: **Cleared**, then **Expected**, then **Filed**
Altitude: **Highest** of assigned, minimum or expected
Leave clearance limit: At **EFC**, or absent that, to arrive at **ETA**

Review full course online anytime at **airsafetyinstitute.org/ifrinsights_regs**

WWW.AIRSAFETYINSTITUTE.ORG/IFRINSIGHTS_REGS

[<-- Back to TOC]

Appendix B – Lost Communications

Clearance Components

Most IFR clearances consist of five basic components ("CRAFT"):

- **Clearance limit:** Your destination airport or an intermediate fix.
- **Route of flight:** Hopefully the route you filed, unless traffic conditions dictate otherwise.
- **Altitude:** If not as requested, typically followed by when to expect climb or descent clearance.
- **Frequency:** The radio frequency for departure control.
- **Transponder:** Your four-digit squawk code.

Position Report Components

Include the following items when making a position report ("IPATTEN"):

- Identification
- Position
- Altitude
- Time
- Type of flight plan*
- ETA to next reporting point
- Name of next reporting point

** Not required in IFR position reports made directly to ATC centers or approach control.*

Lost Comm Route and Altitude

If two-way IFR communication is lost, select a route and altitude based on the acronyms below, or follow the simple flowchart on the reverse side of this reference.

Route (choose based on "AVEF" hierarchy):

1. Assigned—the route assigned in the last ATC clearance
2. Vectored—if being radar vectored, direct to the fix, route, or airway specified
3. Expected—the route ATC said to expect in a further clearance
4. Filed—the route filed in your flight plan

Altitude (fly the highest of "MEA"):

- Minimum—the minimum en route altitude
- Expected—the altitude ATC said to expect in a further clearance
- Assigned—the altitude ATC assigned in the last clearance

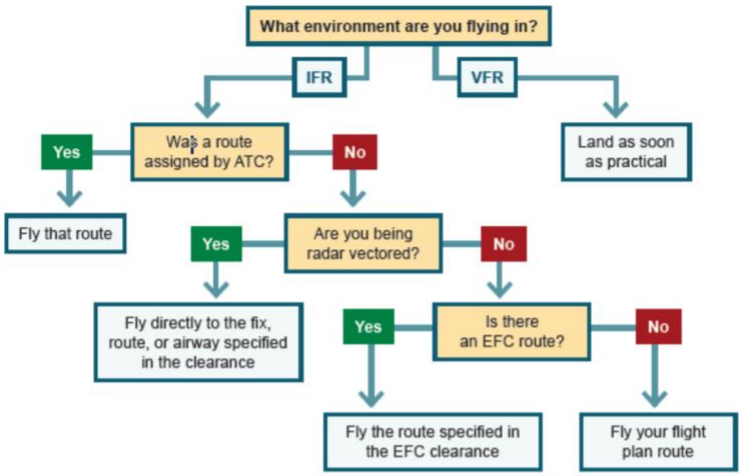
SAY IT RIGHT
Mastering Radio Communication

Review full course online anytime at
airsafetyinstitute.org/radiocomm

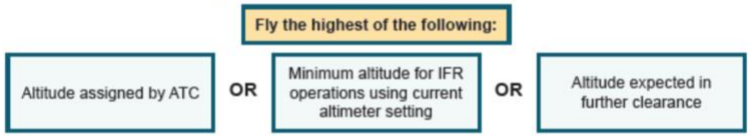
WWW.AIRSAFETYINSTITUTE.ORG/RADIOCOMM

IFR Two-Way Radio Communications Failure Procedures: FAR 91.185

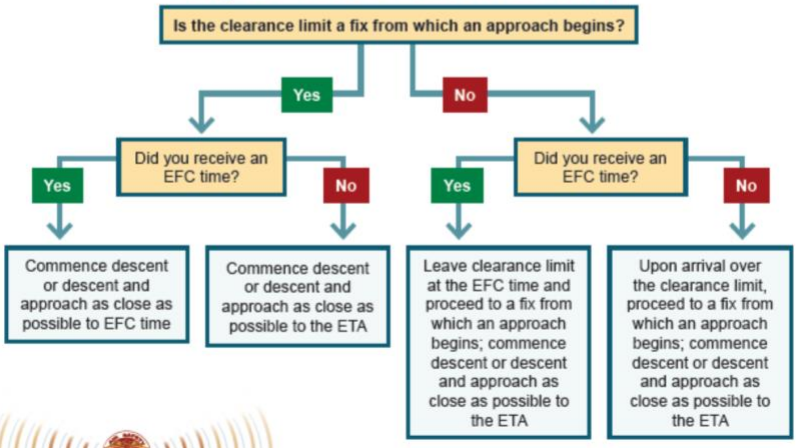
Step 1: Route Procedures



Step 2: Altitude Procedures



Step 3: Leave Clearance Limit



SAY IT RIGHT
Mastering Radio Communication

Review full course online anytime at
airsafetyinstitute.org/radiocomm

WWW.AIRSAFETYINSTITUTE.ORG/RADIOCOMM

<-- Back to TOC

Appendix C – IFR Endorsements

Copied from AC 61-65F:

38. Aeronautical knowledge test: §§ 61.35(a)(1), 61.65(a) and 61.65(b).

I certify that (First name, MI, Last name) has received the required training of § 61.65(b). I have determined that he/she is prepared for the Instrument—(airplane, helicopter, or powered-lift) knowledge test.

/s/ [date] J. J. Jones 987654321CFI Exp. 12-31-19

39. Flight proficiency/practical test: § 61.65(a)(6).

I certify that (First name, MI, Last name) has received the required training of § 61.65(c) and 61.65(d). I have determined he/she is prepared for the Instrument—(airplane, helicopter, or powered-lift) practical test.

/s/ [date] J. J. Jones 987654321CFI Exp. 12-31-19

40. Prerequisites for instrument practical tests.

I certify that (First name, MI, Last name) has received and logged the required flight time/training of § 61.39(a) in preparation for the practical test within 2 calendar-months preceding the date of the test and has satisfactory knowledge of the subject areas in which he/she was shown to be deficient by the FAA airman knowledge test report. I have determined he/she is prepared for the Instrument—(airplane, helicopter, or powered-lift) practical test.

/s/ [date] J. J. Jones 987654321CFI Exp. 12-31-19

2. Review of deficiencies identified on airman knowledge test: § 61.39(a)(6)(iii) as required.

I certify that (First name, MI, Last name) has demonstrated satisfactory knowledge of the subject areas in which he/she was deficient on the (applicable) airman knowledge test.

/s/ [date] J. J. Jones 987654321CFI Exp. 12-31-19

Appendix D – Instrument rating Flight Experience Requirements

From FAR 61.65:

(d) *Aeronautical experience for the instrument-airplane rating.* A person who applies for an instrument-airplane rating must have logged:

(1) Except as provided in paragraph (g) of this section, 50 hours of cross-country flight time as pilot in command, of which 10 hours must have been in an airplane; and

(2) Forty hours of actual or simulated instrument time in the areas of operation listed in paragraph (c) of this section, of which 15 hours must have been received from an authorized instructor who holds an instrument-airplane rating, and the instrument time includes:

(i) Three hours of instrument flight training from an authorized instructor in an airplane that is appropriate to the instrument-airplane rating within 2 calendar months before the date of the practical test; and

(ii) Instrument flight training on cross country flight procedures, including one cross country flight in an airplane with an authorized instructor, that is performed under instrument flight rules, when a flight plan has been filed with an air traffic control facility, and that involves—

(A) A flight of 250 nautical miles along airways or by directed routing from an air traffic control facility;

(B) An instrument approach at each airport; and

(C) Three different kinds of approaches with the use of navigation systems.

Appendix E – Important References to Study

Required Reading!

1. "IFH" - Instrument Flying Handbook
2. "IPF" - Instrument Procedures Handbook
3. Instrument Rating Airplane – Airman Certification Standards
4. Optional: Max Trescott's "GPS and WAAS Instrument Flying Handbook" – helps with particular types of GPS navigators
5. Digital TPPS (terminal procedure publication supplemental) – study the TOC, and know what material is to be found in this publication, like airport diagrams, SIDS, STARS, ODPS, alternate minima, etc.
6. Chart Supplements – study the TOC, and know where to find things like: Preferred IFR Routes, VOR test facilities, FSS Frequencies, etc.
7. FAR part 91, especially 91.167 – 91.187
8. AIM - all
9. IFR Low Chart Legend
10. Weather
    a. FAA Advisory Circular - Aviation Weather
    b. AFAA Advisory Circular - Aviation Weather Services
    c. Pilot Weather – from Solo to the Airlines (published 2018)
11. For G1000 pilots:
    a. Max Trescott's "G1000 and Perspective Glass Cockpit Handbook"
    b. Article about G1000 failure modes: http://www.fredonflying.com/Articles/IFR_Refresher/1004-G1000-Failure-Modes.pdf
    c. G1000 failure mode guidance for CFIs and DPEs: https://www.faa.gov/training_testing/training/fits/guidance/media/G1000.pdf

Appendix F – Kneeboard Cheatsheets

These should be on your kneeboard, and accessible during flight!

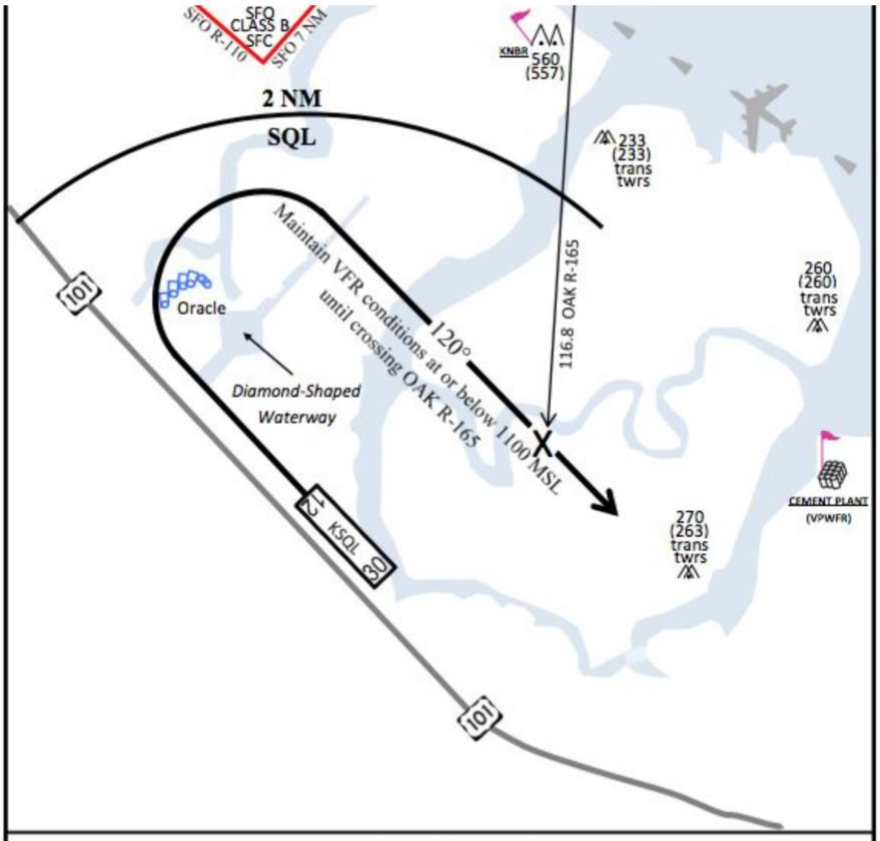
1. Scratchpad for clearances
2. Until memorized: 5Ts and MARTHAS or WRIMTMS approach briefing reminders
3. Gait Chart – specifically for the aircraft in use, with configuration for all phases of IFR flight. See example C172S gait chart below.
4. Digital TPPS reference pages. Especially the Climb/Descent table, but other pages may also be desirable.
5. Lost Comms cheat sheet
6. METAR/TAF decoder

Example Gait Chart:

C172S Gaits	Flaps	Pitch	RPM	A/S (kts)	VSI (fpm)
Initial Climb Vy		+10°	max	76	+600
Cruise Climb		+5°	max	90	+500
Cruise		0°	2500	115	0
Cruise Descent		-5°	2500	125	-500
Level (IAF inbound)		+2°	2200	90	0
Descent (IAF inbound)		-1°	1700	90	-800
ILS Descent to DA	10°	-3°	1700	90	-450
GPS Approach to MDA	10°	-3°	1500	90	-800

Appendix G - KSQL IFR Departure Procedure:

Cessna XXXX, Cleared to KSNS via Fly runway heading to the diamond shaped waterway, turn right heading 120 within two miles of the airport, radar vectors Woodside, Victor 25, Salinas, direct, maintain VFR at or below 1,100 until crossing the Oakland 165 Radial, then climb and maintain 2,000, expect 5,000 after five minutes, Departure frequency XXX.X, Squawk XXXX



DEPARTURE ROUTE DESCRIPTION

DEPART RUNWAY 30: Fly runway heading until past the Diamond-Shaped Waterway, then turn right heading 120°. Keep turn within 2 NM of San Carlos Airport for vectors to [assigned route/fix]. Maintain VFR at or below 1,100' until crossing the OAK R-165*, then maintain [assigned altitude] (typically 2,000' or 2,100'). Expect [assigned altitude] 5 minutes after departure.

Appendix H – Garmin Guidance for DPEs and CFIS for simulation system failures with G1000:

AREAS OF OPERATION SECTION IV: RECOMMENDATIONS FOR FAILURE SIMULATION (Cessna Nav III)

Cessna does not recommend pulling circuit breakers as a means of simulating failures on the Garmin G1000. Pulling circuit breakers—or using them as switches—has the potential to weaken the circuit breaker to a point at which it may not perform its intended function. Using circuit breakers as switches is also discouraged in Advisory Circulars 120-80, 23-17B, and 43.13-1B. Additionally, a circuit breaker may be powering other equipment (such as avionics cooling fans) that could affect the safe operation of other equipment.

Failure to Be Simulated	Examiner Action	Applicant Action
Loss of AHRS and ADC* (simulates the loss of all primary flight instruments)	Press the **MENU** key on the PFD. AUTO is highlighted in the PFD DSPL field. If AUTO is not highlighted, activate the cursor by pressing the small **FMS** knob. Turn the large **FMS** knob to move the cursor to the AUTO field. Turn the small **FMS** knob, select 'MANUAL' from the Setup Menu window and press the **ENT** key. The cursor moves to the backlighting percentage field. Turn the small **FMS** knob counterclockwise; adjust the backlighting value to the lowest value (0.14%).	Control the aircraft by reference to the backup attitude, altitude and airspeed indicators; engage the autopilot in roll mode.
Loss of PFD	Press the **DISPLAY BACKUP** button on the lower portion of the audio panel. Press the **MENU** key on the MFD and use the method described above to dim the PFD.	Control the aircraft by reference to the MFD in reversionary mode (this mode also removes all moving map presentations).
Loss of MFD	Press the **DISPLAY BACKUP** button on the lower portion of the audio panel. Press the **MENU** key on the MFD. Use the large **FMS** knob to move the cursor to the AUTO field adjacent to the MFD DSPL field. Use the procedures above to dim the MFD.	Control the aircraft by reference to the PFD in reversionary mode (this mode also removes all moving map presentations).

***NOTE:** * The simulated loss of AHRS and ADC cannot be accomplished individually in the Cessna Nav III aircraft. In this case, the applicant must simulate navigation on a desired course during en-route or approach operations by using the moving map display. In order to determine more precisely the horizontal distance from the desired active leg, the applicant or the examiner may select the cross-track (XTK) data bar field option on the MFD.*

AREA OF OPERATION SECTION VII, D: RECOMMENDATIONS FOR FAILURE SIMULATION

According to the PTS, this area only applies both to Task D and unless weather and other circumstances dictate that a precision approach be used. The table presented on the previous page can be used to create a realistic scenario. As noted in the "Designee Update, Special Edition on Testing in Technologically Advanced Aircraft" by the AFS-600 (the FAA Regulatory Support Division), appropriate use of the autopilot should be evaluated either via verbal questioning or, in the case of an AHRS failure, via actual demonstration by the applicant.

***NOTE:** The use of the autopilot during an AHRS failure typically limits the autopilot to operation in roll mode.*

[<-- Back to TOC](#)

Appendix I – GPS Approach types and CDI Sensitivity:

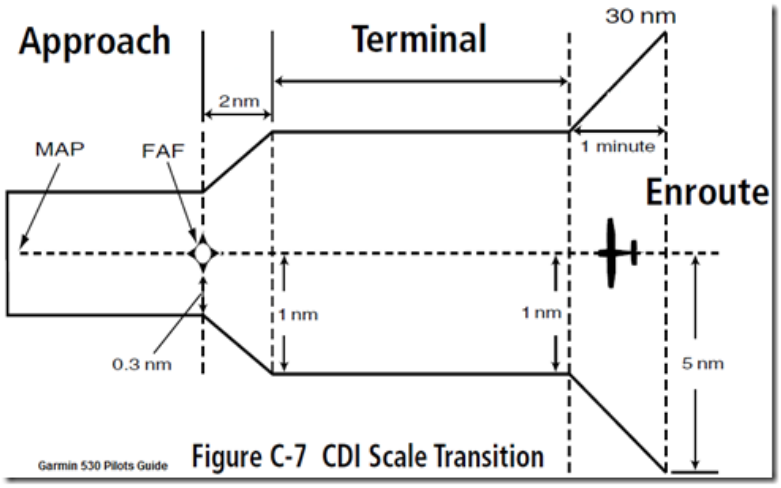
Note: For G1000 MFD-only approaches, you must MEMORIZE the sensitivity for the final approach segment (+- 0.3 nm), so that you can use XTE (cross-track error) to know that you are established on the approach:

From: https://allaboutairplanes.wordpress.com/2011/10/22/gps-approach-types-and-needle-sensitivity/

LNAV Minima

This is the most used GPS approach type as it can be used by both GPS (TSO-c129) and WAAS (TSO-c145) receivers. Technically, there are no vertical limits defined for this approach minima but Garmin has provided a pseudo-VNAV course that is used for **advisory purposes only**. When Garmin provides it, the GPS will show LNAV+V instead of LNAV. Even when you see the LNAV+V on the Garmin GPS you can only descend to LNAV minimums.

Starting 30NM from the airport reference point (ARP), the horizontal scaling will change from enroute (ENR) to terminal (TERM) or from ±2 NM to ±1NM. At the capture fix or two miles from the final approach fix the GPS will change from TERM to approach (APP) or ±2SM to ±0.3 SM. Once the GPS goes past and is selected for the missed approach, the scaling increases instantly to ±1 SM.



LNAV/VNAV vertical sensitivity on Garmin navigators:
+- 492 ft at FAF, down to +- 148 at Threshold

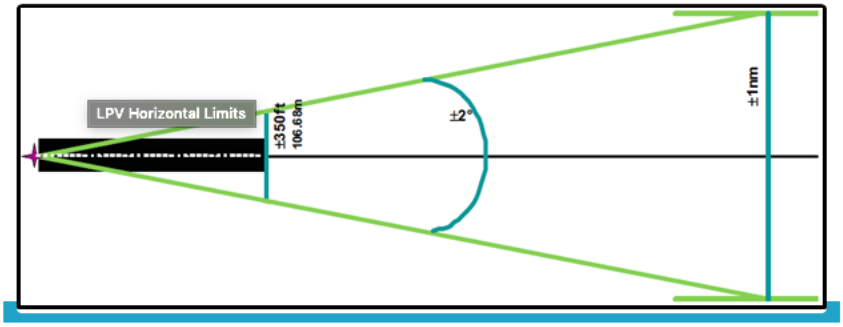
LPV Approaches

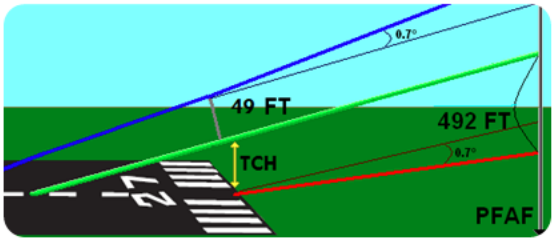
This approach is the best a WAAS enabled receiver can get. The approach is not technically classified as a precision approach but an APV approach or approach with vertical guidance.

The angular horizontal scaling for a WAAS LPV approach is like an ILS in that it attempts to maintain 2° horizontal course from the PFAF to a point determined in the approach (but is also past the runway). The horizontal limits will switch from angular to linear at the end of approach (also called the beginning of the runway) to ± 350 FT from each edge of the runway.

From FAA Order 8260.54 shows the design of an LPV approach. In this order, the approach designers have developed a GARP or geometric approach reference point. This point is the start of the 2° splay used for the approach. On a runway that is less than 9,023 FT, the splay is exactly 2°. On longer runways the splay is decreased so that the splay is exactly ± 350 FT at the runway beginning. On these runways the splay is something less than 2° or more accurate than a regular LPV approach.

A LP approach is the same as an LPV approach and needs a WAAS capable receiver. The only difference is that it does not have a vertical glidepath associated with it.





The vertical limits of an LPV approach starts out just like the LNAV/VNAV except at the end of the approach the vertical limits decreases to ± 49 FT. This time the vertical limits will place the aircraft on the runway.