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Instrument Flying Handbook

U.S. Department
of Transportation
**FEDERAL AVIATION
ADMINISTRATION**



Instrument Flying Handbook

2012

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U.S. Department of Transportation
FEDERAL AVIATION ADMINISTRATION
Flight Standards Service

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2012
FAA-H-8083-15B

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Preface

This Instrument Flying Handbook is designed for use by instrument flight instructors and pilots preparing for instrument rating tests. Instructors may find this handbook a valuable training aid as it includes basic reference material for knowledge testing and instrument flight training. Other Federal Aviation Administration (FAA) publications should be consulted for more detailed information on related topics.

This handbook conforms to pilot training and certification concepts established by the FAA. There are different ways of teaching, as well as performing, flight procedures and maneuvers and many variations in the explanations of aerodynamic theories and principles. This handbook adopts selected methods and concepts for instrument flying. The discussion and explanations reflect the most commonly used practices and principles. Occasionally the word "must" or similar language is used where the desired action is deemed critical. The use of such language is not intended to add to, interpret, or relieve a duty imposed by Title 14 of the Code of Federal Regulations (14 CFR).

All of the aeronautical knowledge and skills required to operate in instrument meteorological conditions (IMC) are detailed. Chapters are dedicated to human and aerodynamic factors affecting instrument flight, the flight instruments, attitude instrument flying for airplanes, basic flight maneuvers used in IMC, attitude instrument flying for helicopters, navigation systems, the National Airspace System (NAS), the air traffic control (ATC) system, instrument flight rules (IFR) flight procedures, and IFR emergencies. Clearance shorthand and an integrated instrument lesson guide are also included.

This handbook supersedes FAA-H-8081-15A, Instrument Flying Handbook, dated 2007.

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Introduction

Is an Instrument Rating Necessary?

The answer to this question depends entirely upon individual needs. Pilots may not need an instrument rating if they fly in familiar uncongested areas, stay continually alert to weather developments, and accept an alternative to their original plan. However, some cross-country destinations may take a pilot to unfamiliar airports and/or through high activity areas in marginal visual or instrument meteorological conditions (IMC). Under these conditions, an instrument rating may be an alternative to rerouting, rescheduling, or canceling a flight. Many accidents are the result of pilots who lack the necessary skills or equipment to fly in marginal visual meteorological conditions (VMC) or IMC and attempt flight without outside references.

Pilots originally flew aircraft strictly by sight, sound, and feel while comparing the aircraft's attitude to the natural horizon. As aircraft performance increased, pilots required more inflight information to enhance the safe operation of their aircraft. This information has ranged from a string tied to a wing strut, to development of sophisticated electronic flight information systems (EFIS) and flight management systems (FMS). Interpretation of the instruments and aircraft control have advanced from the "one, two, three" or "needle, ball, and airspeed" system to the use of "attitude instrument flying" techniques.

Navigation began by using ground references with dead reckoning and has led to the development of electronic navigation systems. These include the automatic direction finder (ADF), very-high frequency omnidirectional range (VOR), distance measuring equipment (DME), tactical air navigation (TACAN), long range navigation (LORAN), global positioning system (GPS), instrument landing system (ILS), microwave landing system (MLS), and inertial navigation system (INS).

Perhaps you want an instrument rating for the same basic reason you learned to fly in the first place—because you like flying. Maintaining and extending your proficiency, once you have the rating, means less reliance on chance and more on skill and knowledge. Earn the rating—not because you might need it sometime, but because it represents achievement and provides training you will use continually and build upon as long as you fly. But most importantly it means greater safety in flying.

Instrument Rating Requirements

A private or commercial pilot must have an instrument rating and meet the appropriate currency requirements if that pilot operates an aircraft using an instrument flight rules (IFR) flight plan in conditions less than the minimums prescribed for visual flight rules (VFR), or in any flight in Class A airspace.

You will need to carefully review the aeronautical knowledge and experience requirements for the instrument rating as outlined in Title 14 of the Code of Federal Regulations (14 CFR) part 61. After completing the Federal Aviation Administration (FAA) Knowledge Test issued for the instrument rating, and all the experience requirements have been satisfied, you are eligible to take the practical test. The regulations specify minimum total and pilot-in-command time requirements. This minimum applies to all applicants regardless of ability or previous aviation experience.

Training for the Instrument Rating

A person who wishes to add the instrument rating to his or her pilot certificate must first make commitments of time, money, and quality of training. There are many combinations of training methods available. Independent studies may be adequate preparation to pass the required FAA Knowledge Test for the instrument rating. Occasional periods of ground and flight instruction may provide the skills necessary to pass the required test. Or, individuals may choose a training facility that provides comprehensive aviation education and the training necessary to ensure the pilot will pass all the required tests and operate safely in the National Airspace System (NAS). The aeronautical knowledge may be administered by educational institutions, aviation-oriented schools, correspondence courses, and appropriately rated instructors. Each person must decide for themselves which training program best meets his or her needs and at the same time maintain a high quality of training. Interested persons

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should make inquiries regarding the available training at nearby airports, training facilities, in aviation publications, and through the FAA Flight Standards District Office (FSDO).

Although the regulations specify minimum requirements, the amount of instructional time needed is determined not by the regulation, but by the individual's ability to achieve a satisfactory level of proficiency. A professional pilot with diversified flying experience may easily attain a satisfactory level of proficiency in the minimum time required by regulation. Your own time requirements will depend upon a variety of factors, including previous flying experience, rate of learning, basic ability, frequency of flight training, type of aircraft flown, quality of ground school training, and quality of flight instruction, to name a few. The total instructional time you will need, the scheduling of such time, is up to the individual most qualified to judge your proficiency—the instructor who supervises your progress and endorses your record of flight training.

You can accelerate and enrich much of your training by informal study. An increasing number of visual aids and programmed instrument courses is available. The best course is one that includes a well-integrated flight and ground school curriculum. The sequential nature of the learning process requires that each element of knowledge and skill be learned and applied in the right manner at the right time.

Part of your instrument training may utilize a flight simulator, flight training device, basic aviation training device (BATD), or an advanced aviation training device (AATD). This ground-based flight training equipment is a valuable tool for developing your instrument cross-check and learning procedures, such as intercepting and tracking, holding patterns, and instrument approaches. Once these concepts are fully understood, you can then continue with inflight training and refine these techniques for full transference of your new knowledge and skills.

Holding the instrument rating does not necessarily make you a competent all-weather pilot. The rating certifies only that you have complied with the minimum experience requirements, that you can plan and execute a flight under IFR, that you can execute basic instrument maneuvers, and that you have shown acceptable skill and judgment in performing these activities. Your instrument rating permits you to fly into instrument weather conditions with no previous instrument weather experience. Your instrument rating is issued on the assumption that you have the good judgment to avoid situations beyond your capabilities. The instrument training program you undertake should help you to develop not only essential flying skills but also the judgment necessary to use the skills within your own limits.

Regardless of the method of training selected, the curriculum in Appendix B, Instrument Training Lesson Guide, provides guidance as to the minimum training required for the addition of an instrument rating to a private or commercial pilot certificate.

Maintaining the Instrument Rating

Once you hold the instrument rating, you may not act as pilot-in-command under IFR or in weather conditions less than the minimums prescribed for VFR, unless you meet the recent flight experience requirements outlined in 14 CFR part 61. These procedures must be accomplished within the preceding 6 months and include six instrument approaches, holding procedures, and intercepting and tracking courses through the use of navigation systems. If you do not meet the experience requirements during these 6 months, you have another 6 months to meet these minimums. If the requirements are still not met, you must pass an instrument proficiency check, which is an inflight evaluation by a qualified instrument flight instructor using tasks outlined in the instrument rating practical test standards (PTS).

The instrument currency requirements must be accomplished under actual or simulated instrument conditions. You may log instrument flight time during the time for which you control the aircraft solely by reference to the instruments. This can be accomplished by wearing a view-limiting device, such as a hood, flying an approved flight-training device, or flying in actual IMC.

It takes only one harrowing experience to clarify the distinction between minimum practical knowledge and a thorough understanding of how to apply the procedures and techniques used in instrument flight. Your instrument training is never complete; it is adequate when you have absorbed every foreseeable detail of knowledge and skill to ensure a solution will be available if and when you need it.

SAMPLE

Table of Contents

Preface iii
Acknowledgments v
Introduction vii
Is an Instrument Rating Necessary? vii
Instrument Rating Requirements vii
Training for the Instrument Rating vii
Maintaining the Instrument Rating viii
Table of Contents ix

Chapter 1
The National Airspace System 1-1
Introduction 1-1
Airspace Classification 1-2
Special Use Airspace 1-2
Federal Airways 1-4
Other Routing 1-5
IFR En Route Charts 1-6
Airport Information 1-6
Charted IFR Altitudes 1-6
Navigation Features 1-7
Types of NAVAIDs 1-7
Identifying Intersections 1-7
Other Route Information 1-10
Weather Information and Communication Features 1-10
New Technologies 1-10
Terminal Procedures Publications 1-12
Departure Procedures 1-12
Standard Terminal Arrival Routes 1-12
Instrument Approach Procedure Charts 1-12
Margin Identification 1-12
The Pilot Briefing 1-16
The Plan View 1-16
Terminal Arrival Area (TAA) 1-18
Course Reversal Elements in Plan View and Profile View 1-20
Procedure Turns 1-20
Holding in Lieu of Procedure Turn 1-20
Teardrop Procedure 1-21
The Profile View 1-21
Landing Minimums 1-23
Airport Sketch /Airport Diagram 1-27
Inoperative Components 1-27
RNAV Instrument Approach Charts 1-30

Chapter 2
The Air Traffic Control System 2-1
Introduction 2-1
Communication Equipment 2-2
Navigation/Communication Equipment 2-2
Radar and Transponders 2-3
Mode C (Altitude Reporting) 2-3
Communication Procedures 2-4
Communication Facilities 2-4
Flight Service Stations (FSS) 2-4
ATC Towers 2-5
Terminal Radar Approach Control (TRACON) 2-6
Tower En Route Control (TEC) 2-7
Air Route Traffic Control Center (ARTCC) 2-7
Center Approach/Departure Control 2-7
ATC Inflight Weather Avoidance Assistance 2-11
ATC Radar Weather Displays 2-11
Weather Avoidance Assistance 2-11
Approach Control Facility 2-12
Approach Control Advances 2-12
Precision Runway Monitor (PRM) 2-12
PRM Radar 2-12
PRM Benefits 2-13
Control Sequence 2-13
Letters of Agreement (LOA) 2-14

Chapter 3
Human Factors 3-1
Introduction 3-1
Sensory Systems for Orientation 3-2
Eyes 3-2
Vision Under Dim and Bright Illumination 3-3

SAMPLE

Ears....3-4
Nerves....3-5
Illusions Leading to Spatial Disorientation....3-5
Vestibular Illusions....3-5
The Leans....3-5
Coriolis Illusion....3-6
Graveyard Spiral....3-6
Somatogravic Illusion....3-6
Inversion Illusion....3-6
Elevator Illusion....3-6
Visual Illusions....3-7
False Horizon....3-7
Autokinesis....3-7
Postural Considerations....3-7
Demonstration of Spatial Disorientation....3-7
Climbing While Accelerating....3-8
Climbing While Turning....3-8
Diving While Turning....3-8
Tilting to Right or Left....3-8
Reversal of Motion....3-8
Diving or Rolling Beyond the Vertical Plane....3-8
Coping with Spatial Disorientation....3-8
Optical Illusions....3-9
Runway Width Illusion....3-9
Runway and Terrain Slopes Illusion....3-9
Featureless Terrain Illusion....3-9
Water Refraction....3-9
Haze....3-9
Fog....3-9
Ground Lighting Illusions....3-9
How To Prevent Landing Errors Due to Optical Illusions....3-9

Chapter 4
Aerodynamic Factors....4-1
Introduction....4-1
The Wing....4-2
Review of Basic Aerodynamics....4-2
The Four Forces....4-2
Lift....4-2
Weight....4-3
Thrust....4-3
Drag....4-3
Newton's First Law, the Law of Inertia....4-4
Newton's Second Law, the Law of Momentum....4-4
Newton's Third Law, the Law of Reaction....4-4
Atmosphere....4-4
Layers of the Atmosphere....4-5
International Standard Atmosphere (ISA)....4-5
Pressure Altitude....4-5
Density Altitude....4-6
Lift....4-6
Pitch/Power Relationship....4-6
Drag Curves....4-6
Regions of Command....4-7
Control Characteristics....4-7
Speed Stability....4-8
Normal Command....4-8
Reversed Command....4-8
Trim....4-8
Slow-Speed Flight....4-8
Small Airplanes....4-9
Large Airplanes....4-10
Climbs....4-10
Acceleration in Cruise Flight....4-10
Turns....4-10
Rate of Turn....4-11
Radius of Turn....4-11
Coordination of Rudder and Aileron Controls....4-11
Load Factor....4-12
Icing....4-13
Types of Icing....4-13
Structural Icing....4-13
Induction Icing....4-13
Clear Ice....4-13
Rime Ice....4-14
Mixed Ice....4-14
General Effects of Icing on Airfoils....4-14
Piper PA-34-200T (Des Moines, Iowa)....4-16
Tailplane Stall Symptoms....4-16
Propeller Icing....4-16
Effects of Icing on Critical Aircraft Systems....4-16
Flight Instruments....4-16
Stall Warning Systems....4-17
Windshields....4-17
Antenna Icing....4-17
Summary....4-17

Chapter 5
Flight Instruments....5-1
Introduction....5-1
Pitot/Static Systems....5-2
Static Pressure....5-2
Blockage of the Pitot-Static System....5-2
Blocked Pitot System....5-2
Blocked Static System....5-3
Effects of Flight Conditions....5-3
Pitot/Static Instruments....5-3
Sensitive Altimeter....5-3
Principle of Operation....5-3
Altimeter Errors....5-4
Cold Weather Altimeter Errors....5-5

SAMPLE

ICAO Cold Temperature Error Table 5-5
Nonstandard Pressure on an Altimeter 5-6
Altimeter Enhancements (Encoding) 5-7
Reduced Vertical Separation Minimum (RVSM) .. 5-7
Vertical Speed Indicator (VSI) 5-8
Dynamic Pressure Type Instruments 5-8
Airspeed Indicator (ASI) 5-8
Types of Airspeed 5-9
Airspeed Color Codes 5-10
Magnetism 5-10
The Basic Aviation Magnetic Compass 5-10
Magnetic Compass Overview 5-10
Magnetic Compass Errors 5-12
The Vertical Card Magnetic Compass 5-15
The Flux Gate Compass System 5-15
Remote Indicating Compass 5-15
Gyroscopic Systems 5-16
Power Sources 5-17
Pneumatic Systems 5-17
Vacuum Pump Systems 5-17
Electrical Systems 5-17
Gyroscopic Instruments 5-19
Attitude Indicators 5-19
Heading Indicators 5-19
Turn Indicators 5-20
Turn-and-Slip Indicator 5-20
Turn Coordinator 5-21
Flight Support Systems 5-22
Attitude and Heading Reference System (AHRS) ... 5-22
Air Data Computer (ADC) 5-22
Analog Pictorial Displays 5-23
Horizontal Situation Indicator (HSI) 5-23
Attitude Direction Indicator (ADI) 5-23
Flight Director System (FDS) 5-23
Integrated Flight Control System 5-25
Autopilot Systems 5-25
Flight Management Systems (FMS) 5-26
Electronic Flight Instrument Systems 5-27
Primary Flight Display (PFD) 5-27
Synthetic Vision 5-28
Multi-Function Display (MFD) 5-28
Advanced Technology Systems 5-28
Automatic Dependent Surveillance—Broadcast (ADS-B) 5-28
Safety Systems 5-29
Radio Altimeters 5-29
Traffic Advisory Systems 5-29
Traffic Information System 5-29
Traffic Alert Systems 5-30
Traffic Avoidance Systems 5-30
Terrain Alerting Systems 5-34
Required Navigation Instrument System Inspection ... 5-36
Systems Preflight Procedures 5-36
Before Engine Start 5-36
After Engine Start 5-37
Taxiing and Takeoff 5-37
Engine Shut Down 5-38

Chapter 6, Section I
Airplane Attitude Instrument Flying Using Analog Instrumentation 6-1
Introduction 6-1
Learning Methods 6-2
Attitude Instrument Flying Using the Control and Performance Method 6-2
Control Instruments 6-2
Performance Instruments 6-2
Navigation Instruments 6-2
Procedural Steps in Using Control and Performance 6-2
Aircraft Control During Instrument Flight 6-3
Attitude Instrument Flying Using the Primary and Supporting Method 6-4
Pitch Control 6-4
Bank Control 6-7
Power Control 6-8
Trim Control 6-8
Airplane Trim 6-8
Helicopter Trim 6-10
Example of Primary and Support Instruments 6-10
Fundamental Skills 6-10
Instrument Cross-Check 6-10
Common Cross-Check Errors 6-11
Instrument Interpretation 6-13

Chapter 6, Section II
Airplane Attitude Instrument Flying Using an Electronic Flight Display 6-15
Introduction 6-15
Learning Methods 6-16
Control and Performance Method 6-18
Control Instruments 6-18
Performance Instruments 6-19
Navigation Instruments 6-19
The Four-Step Process Used to Change Attitude 6-19
Establish 6-19
Trim 6-20
Cross-Check 6-20
Adjust 6-20

SAMPLE

Applying the Four-Step Process....6-20
Pitch Control....6-20
Bank Control....6-20
Power Control....6-21
Attitude Instrument Flying—Primary and Supporting Method....6-21
Pitch Control....6-22
Straight-and-Level Flight....6-22
Primary Pitch....6-22
Primary Bank....6-23
Primary Yaw....6-23
Primary Power....6-24
Fundamental Skills of Attitude Instrument Flying....6-24
Instrument Cross-Check....6-24
Scanning Techniques....6-24
Selected Radial Cross-Check....6-24
Starting the Scan....6-24
Trend Indicators....6-26
Common Errors....6-27
Fixation....6-27
Omission....6-28
Emphasis....6-28

Chapter 7, Section I
Airplane Basic Flight Maneuvers Using Analog Instrumentation....7-1
Introduction....7-1
Straight-and-Level Flight....7-2
Pitch Control....7-2
Attitude Indicator....7-2
Altimeter....7-3
Vertical Speed Indicator (VSI)....7-4
Airspeed Indicator (ASI)....7-6
Bank Control....7-6
Attitude Indicator....7-6
Heading Indicator....7-7
Turn Coordinator....7-7
Turn-and-Slip Indicator (Needle and Ball)....7-8
Power Control....7-8
Power Settings....7-9
Airspeed Changes in Straight-and-Level Flight....7-11
Trim Technique....7-12
Common Errors in Straight-and-Level Flight....7-12
Pitch....7-12
Heading....7-13
Power....7-13
Trim....7-13
Straight Climbs and Descents....7-14
Climbs....7-14
Entry....7-14
Leveling Off....7-16
Descents....7-16
Entry....7-17
Leveling Off....7-17
Common Errors in Straight Climbs and Descents....7-17
Turns....7-19
Standard Rate Turns....7-19
Turns to Predetermined Headings....7-20
Timed Turns....7-21
Compass Turns....7-21
Steep Turns....7-22
Climbing and Descending Turns....7-24
Change of Airspeed During Turns....7-24
Common Errors in Turns....7-25
Pitch....7-25
Bank....7-25
Power....7-26
Trim....7-26
Errors During Compass Turns....7-26
Approach to Stall....7-26
Unusual Attitudes and Recoveries....7-26
Recognizing Unusual Attitudes....7-27
Recovery from Unusual Attitudes....7-27
Nose-High Attitudes....7-27
Nose-Low Attitudes....7-28
Common Errors in Unusual Attitudes....7-28
Instrument Takeoff....7-29
Common Errors in Instrument Takeoffs....7-29
Basic Instrument Flight Patterns....7-30
Racetrack Pattern....7-30
Procedure Turn....7-30
Standard 45° Procedure Turn....7-30
80/260 Procedure Turn....7-31
Teardrop Patterns....7-31
Circling Approach Patterns....7-32
Pattern I....7-32
Pattern II....7-32

Chapter 7, Section II
Airplane Basic Flight Maneuvers Using an Electronic Flight Display....7-33
Introduction....7-33
Straight-and-Level Flight....7-34
Pitch Control....7-34
Attitude Indicator....7-34
Altimeter....7-36
Partial Panel Flight....7-36
VSI Tape....7-36

SAMPLE

Airspeed Indicator (ASI) 7-37
Bank Control 7-37
Attitude Indicator 7-37
Horizontal Situation Indicator (HSI) 7-38
Heading Indicator 7-38
Turn Rate Indicator 7-38
Slip/Skid Indicator 7-39
Power Control 7-39
Power Settings 7-39
Airspeed Changes in Straight-and-Level Flight ... 7-40
Trim Technique 7-43
Common Errors in Straight-and-Level Flight 7-43
Pitch 7-43
Heading 7-44
Power 7-45
Trim 7-45
Straight Climbs and Descents 7-46
Entry 7-46
Constant Airspeed Climb From Cruise Airspeed 7-46
Constant Airspeed Climb from Established Airspeed 7-47
Constant Rate Climbs 7-47
Leveling Off 7-48
Descents 7-49
Entry 7-49
Leveling Off 7-50
Common Errors in Straight Climbs and Descents 7-50
Turns 7-51
Standard Rate Turns 7-51
Establishing A Standard Rate Turn 7-51
Common Errors 7-51
Turns to Predetermined Headings 7-52
Timed Turns 7-53
Compass Turns 7-53
Steep Turns 7-53
Unusual Attitude Recovery Protection 7-55
Common Errors Leading to Unusual Attitudes 7-58
Instrument Takeoff 7-60
Common Errors in Instrument Takeoffs 7-61
Basic Instrument Flight Patterns 7-61

Chapter 8
Helicopter Attitude Instrument Flying 8-1
Introduction 8-1
Flight Instruments 8-2
Instrument Flight 8-2
Instrument Cross-Check 8-2
Instrument Interpretation 8-3
Aircraft Control 8-3
Straight-and-Level Flight 8-3
Pitch Control 8-3
Attitude Indicator 8-3
Altimeter 8-4
Vertical Speed Indicator (VSI) 8-5
Airspeed Indicator 8-5
Bank Control 8-5
Attitude Indicator 8-5
Heading Indicator 8-6
Turn Indicator 8-7
Common Errors During Straight-and-Level Flight 8-7
Power Control During Straight-and-Level Flight 8-7
Common Errors During Airspeed Changes 8-10
Straight Climbs (Constant Airspeed an Constant Rate) 8-10
Entry 8-10
Level Off 8-12
Straight Descents (Constant Airspeed and Constant Rate) 8-12
Entry 8-12
Level Off 8-13
Common Errors During Straight Climbs and Descents 8-13
Turns 8-13
Turn to a Predetermined Heading 8-13
Timed Turns 8-13
Change of Airspeed in Turns 8-14
Compass Turns 8-15
30° Bank Turn 8-15
Climbing and Descending Turns 8-15
Common Errors During Turns 8-15
Unusual Attitudes 8-16
Common Errors During Unusual Attitude Recoveries 8-16
Emergencies 8-16
Autorotations 8-17
Common Errors During Autorotations 8-17
Servo Failure 8-17
Instrument Takeoff 8-17
Common Errors During Instrument Takeoffs 8-18
Changing Technology 8-18

Chapter 9
Navigation Systems 9-1
Introduction 9-1
Basic Radio Principles 9-2
How Radio Waves Propagate 9-2
Ground Wave 9-2
Sky Wave 9-2
Space Wave 9-2

SAMPLE

Disturbances to Radio Wave Reception....9-3
Traditional Navigation Systems....9-3
Nondirectional Radio Beacon (NDB)....9-3
NDB Components....9-3
ADF Components....9-3
Function of ADF....9-4
Operational Errors of ADF....9-8
Very High Frequency Omnidirectional Range (VOR)....9-8
VOR Components....9-10
Function of VOR....9-11
VOR Operational Errors....9-14
VOR Accuracy....9-16
VOR Receiver Accuracy Check....9-16
VOR Test Facility (VOT)....9-16
Certified Checkpoints....9-16
Distance Measuring Equipment (DME)....9-17
DME Components....9-17
Function of DME....9-17
DME Arc....9-17
Intercepting Lead Radials....9-18
DME Errors....9-19
Area Navigation (RNAV)....9-19
VOR/DME RNAV....9-22
VOR/DME RNAV Components....9-23
Function of VOR/DME RNAV....9-23
VOR/DME RNAV Errors....9-24
Advanced Technologies....9-24
Global Navigation Satellite System (GNSS)....9-24
Global Positioning System (GPS)....9-25
GPS Components....9-25
Function of GPS....9-26
GPS Substitution....9-27
GPS Substitution for ADF or DME....9-27
To Determine Aircraft Position Over a DME Fix....9-27
To Fly a DME Arc....9-27
To Navigate TO or FROM an NDB/Compass Locator....9-28
To Determine Aircraft Position Over an NDB/Compass Locator....9-28
To Determine Aircraft Position Over a Fix Made up of an NDB/Compass Locator Bearing Crossing a VOR/LOC Course....9-28
To Hold Over an NDB/Compass Locator:....9-28
IFR Flight Using GPS....9-28
GPS Instrument Approaches....9-29
Departures and Instrument Departure Procedures (DPs)....9-31
GPS Errors....9-31
System Status....9-31
GPS Familiarization....9-31
Differential Global Positioning Systems (DGPS)....9-32
Wide Area Augmentation System (WAAS)....9-32
General Requirements....9-32
Instrument Approach Capabilities....9-32
Local Area Augmentation System (LAAS)....9-33
Inertial Navigation System (INS)....9-34
INS Components....9-34
INS Errors....9-34
Instrument Approach Systems....9-35
Instrument Landing Systems (ILS)....9-35
ILS Components....9-35
Approach Lighting Systems (ALS)....9-38
ILS Airborne Components....9-38
ILS Function....9-40
ILS Errors....9-40
Marker Beacons....9-40
Operational Errors....9-42
Simplified Directional Facility (SDF)....9-42
Localizer Type Directional Aid (LDA)....9-43
Microwave Landing System (MLS)....9-43
Approach Azimuth Guidance....9-43
Required Navigation Performance....9-44
Flight Management Systems (FMS)....9-44
Function of FMS....9-46
Head-Up Display (HUD)....9-46
Radar Navigation (Ground-Based)....9-46
Functions of Radar Navigation....9-47
Airport Surface Detection Equipment....9-48
Radar Limitations....9-48

Chapter 10
IFR Flight....10-1
Introduction....10-1
Sources of Flight Planning Information....10-2
Aeronautical Information Manual (AIM)....10-2
Airport/Facility Directory (A/FD)....10-2
Notices to Airmen Publication (NTAP)....10-2
POH/AFM....10-2
IFR Flight Plan....10-2
Filing in Flight....10-2
Cancelling IFR Flight Plans....10-3
Clearances....10-3
Examples....10-4
Clearance Separations....10-4
Departure Procedures (DPs)....10-5
Obstacle Departure Procedures (ODP)....10-5
Standard Instrument Departures....10-5

SAMPLE

Radar-Controlled Departures 10-5
Departures From Airports Without an Operating Control Tower 10-7
En Route Procedures 10-7
ATC Reports 10-7
Position Reports 10-7
Additional Reports 10-7
Planning the Descent and Approach 10-8
Standard Terminal Arrival Routes (STARs) 10-9
Substitutes for Inoperative or Unusable Components 10-10
Holding Procedures 10-10
Standard Holding Pattern (No Wind) 10-10
Standard Holding Pattern (With Wind) 10-10
Holding Instructions 10-10
Standard Entry Procedures 10-11
Time Factors 10-12
DME Holding 10-13
Approaches 10-13
Compliance With Published Standard Instrument Approach Procedures 10-13
Instrument Approaches to Civil Airports 10-13
Approach to Airport Without an Operating Control Tower 10-13
Approach to Airport With an Operating Tower, With No Approach Control 10-15
Approach to an Airport With an Operating Tower, With an Approach Control 10-15
Radar Approaches 10-15
Radar Monitoring of Instrument Approaches 10-18
Timed Approaches From a Holding Fix 10-18
Approaches to Parallel Runways 10-20
Side-Step Maneuver 10-20
Circling Approaches 10-20
IAP Minimums 10-21
Missed Approaches 10-21
Landing 10-22
Instrument Weather Flying 10-22
Flying Experience 10-22
Recency of Experience 10-22
Airborne Equipment and Ground Facilities 10-22
Weather Conditions 10-22
Turbulence 10-22
Structural Icing 10-23
Fog 10-24
Volcanic Ash 10-24
Thunderstorms 10-24
Wind Shear 10-25
VFR-On-Top 10-26
VFR Over-The-Top 10-26
Conducting an IFR Flight 10-26
Preflight 10-26
Departure 10-31
En Route 10-32
Arrival 10-33

Chapter 11
Emergency Operations 11-1
Introduction 11-1
Unforecast Adverse Weather 11-2
Inadvertent Thunderstorm Encounter 11-2
Inadvertent Icing Encounter 11-2
Precipitation Static 11-3
Aircraft System Malfunctions 11-3
Electronic Flight Display Malfunction 11-4
Alternator/Generator Failure 11-4
Techniques for Electrical Usage 11-5
Master Battery Switch 11-5
Operating on the Main Battery 11-5
Loss of Alternator/Generator for Electronic Flight Instrumentation 11-5
Techniques for Electrical Usage 11-6
Standby Battery 11-6
Operating on the Main Battery 11-6
Analog Instrument Failure 11-7
Pneumatic System Failure 11-7
Pitot/Static System Failure 11-8
Communication/Navigation System Malfunction 11-8
GPS Nearest Airport Function 11-9
Nearest Airports Using the PFD 11-9
Additional Information for a Specific Airport 11-10
Nearest Airports Using the MFD 11-10
Navigating the MFD Page Groups 11-10
Nearest Airport Page Group 11-10
Nearest Airports Page Soft Keys 11-10
Situational Awareness 11-11
Traffic Avoidance 11-12

Appendix A A-1
Clearance Shorthand

Appendix B B-1
Instrument Training Lesson Guide

Glossary G-1

Index I-1

SAMPLE



Chapter 1

The National Airspace System

Introduction

The National Airspace System (NAS) is the network of United States airspace: air navigation facilities, equipment, services, airports or landing areas, aeronautical charts, information/services, rules, regulations, procedures, technical information, manpower, and material. Included are system components shared jointly with the military. The system's present configuration is a reflection of the technological advances concerning the speed and altitude capability of jet aircraft, as well as the complexity of microchip and satellite-based navigation equipment. To conform to international aviation standards, the United States adopted the primary elements of the classification system developed by the International Civil Aviation Organization (ICAO).

This chapter is a general discussion of airspace classification; en route, terminal, and approach procedures; and operations within the NAS. Detailed information on the classification of airspace, operating procedures, and restrictions is found in the Aeronautical Information Manual (AIM).

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Airspace Classification

Airspace in the United States *[Figure 1-1]* is designated as follows:

1. Class A. Generally, airspace from 18,000 feet mean sea level (MSL) up to and including flight level (FL) 600, including the airspace overlying the waters within 12 nautical miles (NM) of the coast of the 48 contiguous states and Alaska. Unless otherwise authorized, all pilots must operate their aircraft under instrument flight rules (IFR).
2. Class B. Generally, airspace from the surface to 10,000 feet MSL surrounding the nation's busiest airports in terms of airport operations or passenger enplanements. The configuration of each Class B airspace area is individually tailored, consists of a surface area and two or more layers (some Class B airspace areas resemble upside-down wedding cakes), and is designed to contain all published instrument procedures once an aircraft enters the airspace. An air traffic control (ATC) clearance is required for all aircraft to operate in the area, and all aircraft that are so cleared receive separation services within the airspace.
3. Class C. Generally, airspace from the surface to 4,000 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower are serviced by a radar approach control and have a certain number of IFR operations or passenger enplanements. Although the configuration of each Class C area is individually tailored, the airspace usually consists of a surface area with a 5 NM radius, an outer circle with a 10 NM radius that extends from 1,200 feet to 4,000 feet above the airport elevation and an outer area. Each aircraft must establish two-way radio communications with the ATC facility providing air traffic services prior to entering the airspace and thereafter maintain those communications while within the airspace.
4. Class D. Generally, airspace from the surface to 2,500 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower. The configuration of each Class D airspace area is individually tailored and, when instrument procedures are published, the airspace normally designed to contain the procedures. Arrival extensions for instrument approach procedures (IAPs) may be Class D or Class E airspace. Unless otherwise authorized, each aircraft must establish two-way radio communications with the ATC facility providing air traffic services prior to entering the airspace and thereafter maintain those communications while in the airspace.
5. Class E. Generally, if the airspace is not Class A, B, C, or D, and is controlled airspace, then it is Class E airspace. Class E airspace extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace. When designated as a surface area, the airspace is configured to contain all instrument procedures. Also in this class are federal airways, airspace beginning at either 700 or 1,200 feet above ground level (AGL) used to transition to and from the terminal or en route environment, and en route domestic and offshore airspace areas designated below 18,000 feet MSL. Unless designated at a lower altitude, Class E airspace begins at 14,500 MSL over the United States, including that airspace overlying the waters within 12 NM of the coast of the 48 contiguous states and Alaska, up to but not including 18,000 feet MSL, and the airspace above FL 600.
6. Class G. Airspace not designated as Class A, B, C, D, or E. Class G airspace is essentially uncontrolled by ATC except when associated with a temporary control tower.

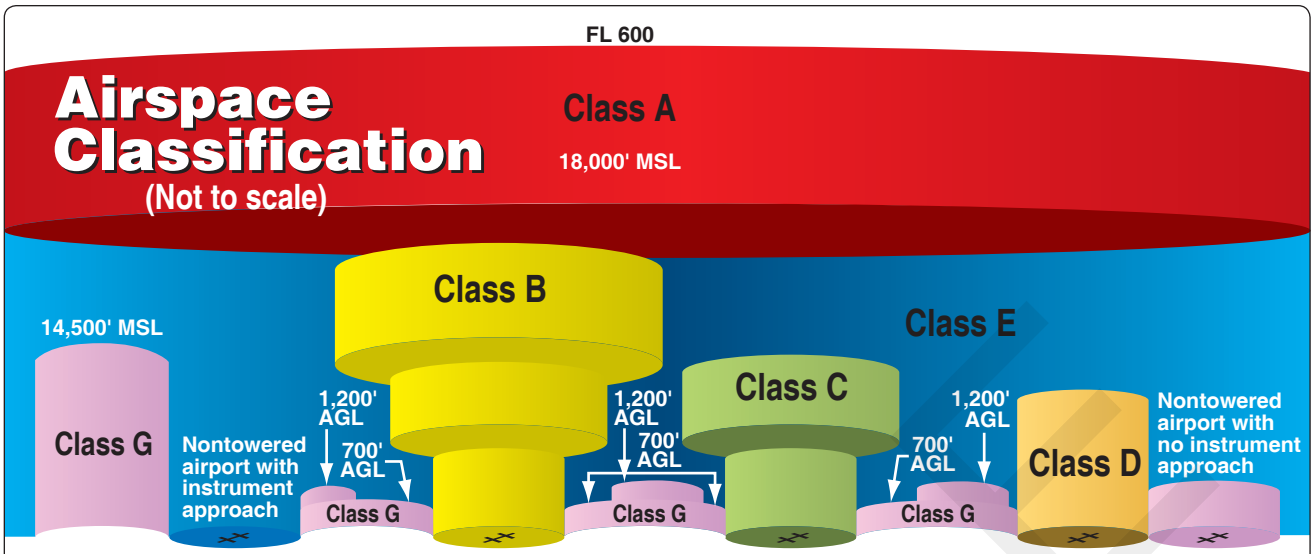
Special Use Airspace

Special use airspace is the designation for airspace in which certain activities must be confined or where limitations may be imposed on aircraft operations that are not part of those activities. Certain special use airspace areas can create limitations on the mixed use of airspace. The special use airspace depicted on instrument charts includes the area name or number, effective altitude, time and weather conditions of operation, the controlling agency, and the chart panel location. On National Aeronautical Navigation Products (AeroNav Products) en route charts, this information is available on one of the end panels.

Prohibited areas contain airspace of defined dimensions within which the flight of aircraft is prohibited. Such areas are established for security or other reasons associated with the national welfare. These areas are published in the Federal Register and are depicted on aeronautical charts. The area is charted as a "P" followed by a number (e.g., "P-123").

Restricted areas are areas where operations are hazardous to nonparticipating aircraft and contain airspace within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Activities within these areas must be confined because of their nature, or limitations may be imposed upon aircraft operations that are not a part of those activities, or both. Restricted areas denote the existence of unusual, often invisible, hazards to aircraft (e.g., artillery firing, aerial gunnery, or guided missiles). IFR flights may be authorized to transit the airspace and are routed accordingly. Penetration

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	Class A	Class B	Class C	Class D	Class E	Class G
Entry Requirements	ATC clearance	ATC clearance	Prior two-way communications	Prior two-way communications	Prior two-way communications*	None
Minimum Pilot Qualifications	Instrument Rating	Private or Student certification—local restrictions apply.	Student certificate	Student certificate	Student certificate	Student certificate
Two-Way Radio Communications	Yes	Yes	Yes	Yes	Yes, under IFR flight plan*	None
Special VFR Allowed	No	Yes	Yes	Yes	Yes	N/A
VFR Visibility Minimum	N/A	3 statute miles	3 statute miles	3 statute miles	3 statute miles**	1 statute mile†
VFR Minimum Distance from Clouds	N/A	Clear of clouds	500' below, 1,000' above, 2,000' horizontal	500' below, 1,000' above, 2,000' horizontal	500' below,** 1,000' above, 2,000' horizontal	Clear of clouds†
VFR Aircraft Separation	N/A	All	IFR aircraft	Runway operations	None	None
Traffic Advisories	Yes	Yes	Yes	Workload permitting	Workload permitting	Workload permitting
Airport Application	N/A	• Radar • Instrument approaches • Weather • Control tower • High density	• Radar • Instrument approaches • Weather • Control tower	• Instrument approaches • Weather • Control tower	• Instrument approaches • Weather	• Control tower

*Exception: temporary tower or control tower present
**True only below 10,000 feet
† True only during day at or below 1,200 feet AGL (see 14 CFR part 91)

AGL—above ground level
FL—flight level
MSL—mean sea level

SAMPLE

Figure 1-1. *Airspace classifications.*

of restricted areas without authorization from the using or controlling agency may be extremely hazardous to the aircraft and its occupants. ATC facilities apply the following procedures when aircraft are operating on an IFR clearance (including those cleared by ATC to maintain visual flight rules (VFR)-On-Top) via a route that lies within joint-use restricted airspace:

1. If the restricted area is not active and has been released to the Federal Aviation Administration (FAA), the ATC facility will allow the aircraft to operate in the restricted airspace without issuing specific clearance for it to do so.
2. If the restricted area is active and has not been released to the FAA, the ATC facility will issue a clearance that will ensure the aircraft avoids the restricted airspace.

Restricted areas are charted with an "R" followed by a number (e.g., "R-5701") and are depicted on the en route chart appropriate for use at the altitude or FL being flown.

Warning areas are similar in nature to restricted areas; however, the U.S. Government does not have sole jurisdiction over the airspace. A warning area is airspace of defined dimensions, extending from 12 NM outward from the coast of the United States, containing activity that may be hazardous to nonparticipating aircraft. The purpose of such areas is to warn nonparticipating pilots of the potential danger. A warning area may be located over domestic or international waters or both. The airspace is designated with a "W" followed by a number (e.g., "W-123").

Military operations areas (MOAs) consist of airspace with defined vertical and lateral limits established for the purpose of separating certain military training activities from IFR traffic. Whenever an MOA is being used, nonparticipating IFR traffic may be cleared through an MOA if IFR separation can be provided by ATC. Otherwise, ATC will reroute or restrict nonparticipating IFR traffic. MOAs are depicted on sectional, VFR terminal area, and en route low altitude charts and are not numbered (e.g., "Boardman MOA").

Alert areas are depicted on aeronautical charts with an "A" followed by a number (e.g., "A-123") to inform nonparticipating pilots of areas that may contain a high volume of pilot training or an unusual type of aerial activity. Pilots should exercise caution in alert areas. All activity within an alert area shall be conducted in accordance with regulations, without waiver, and pilots of participating aircraft, as well as pilots transiting the area, shall be equally responsible for collision avoidance.

Military Training Routes (MTRs) are routes used by military aircraft to maintain proficiency in tactical flying. These routes are usually established below 10,000 feet MSL for operations at speeds in excess of 250 knots. Some route segments may be defined at higher altitudes for purposes of route continuity. Routes are identified as IFR (IR) and VFR (VR) followed by a number. MTRs with no segment above 1,500 feet AGL are identified by four number characters (e.g., IR1206, VR1207). MTRs that include one or more segments above 1,500 feet AGL are identified by three number characters (e.g., IR206, VR207). IFR low altitude en route charts depict all IR routes and all VR routes that accommodate operations above 1,500 feet AGL. IR routes are conducted in accordance with IFR regardless of weather conditions.

Temporary flight restrictions (TFRs) are put into effect when traffic in the airspace would endanger or hamper air or ground activities in the designated area. For example, a forest fire, chemical accident, flood, or disaster-relief effort could warrant a TFR, which would be issued as a Notice to Airmen (NOTAM).

National Security Areas (NSAs) consist of airspace with defined vertical and lateral dimensions established at locations where there is a requirement for increased security and safety of ground facilities. Flight in NSAs may be temporarily prohibited by regulation under the provisions of Title 14 of the Code of Federal Regulations (14 CFR) part 99 and prohibitions will be disseminated via NOTAM.

Federal Airways

The primary means for routing aircraft operating under IFR is the Federal Airways System. Each Federal airway is based on a centerline that extends from one navigational aid (NAVAID)/waypoint/fix/intersection to another NAVAID/waypoint/fix/intersection specified for that airway. A Federal airway includes the airspace within parallel boundary lines 4 NM to each side of the centerline. As in all instrument flight, courses are magnetic, and distances are in NM. The airspace of a Federal airway has a floor of 1,200 feet AGL, unless otherwise specified. A Federal airway does not include the airspace of a prohibited area.

Victor airways include the airspace extending from 1,200 feet AGL up to, but not including 18,000 feet MSL. The airways are designated on sectional and IFR low altitude en route charts with the letter "V" followed by a number (e.g., "V23"). Typically, Victor airways are given odd numbers when oriented north/south and even numbers when oriented east/west. If more than one airway coincides on a route segment, the numbers are listed serially (e.g., "V287-495-500"). *[Figure 1-2]*

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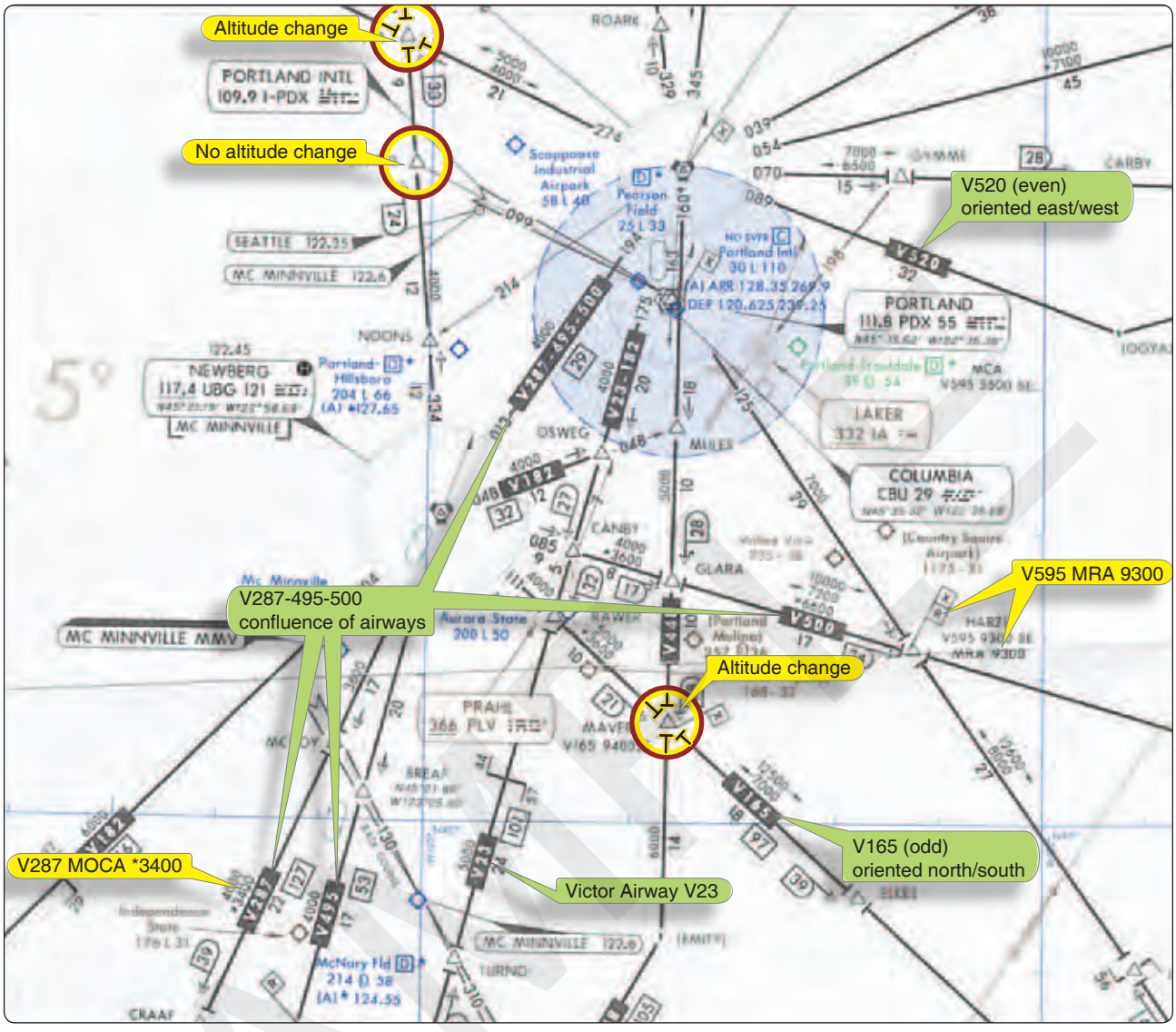


Figure 1-2. *Victor airways and charted IFR altitudes.*

Jet routes exist only in Class A airspace, from 18,000 feet MSL to FL 450, and are depicted on high-altitude en route charts. The letter "J" precedes a number to label the airway (e.g., J12).

Area navigation (RNAV) routes have been established in both the low-altitude and the high-altitude structures in recent years and are depicted on the en route low and high chart series. High altitude RNAV routes are identified with a "Q" prefix (except the Q-routes in the Gulf of Mexico) and low altitude RNAV routes are identified with a "T" prefix. RNAV routes and data are depicted in aeronautical blue.

In addition to the published routes, a random RNAV route may be flown under IFR if it is approved by ATC. Random RNAV routes are direct routes, based on RNAV capability, between waypoints defined in terms of latitude/longitude coordinates, degree-distance fixes, or offsets from established routes/airways at a specified distance and direction.

Radar monitoring by ATC is required on all random RNAV routes. These routes can only be approved in a radar environment. Factors that are considered by ATC in approving random RNAV routes include the capability to provide radar monitoring and compatibility with traffic volume and flow. ATC will radar monitor each flight; however, navigation on the random RNAV route is the responsibility of the pilot.

Other Routing

Preferred IFR routes have been established between major terminals to guide pilots in planning their routes of flight, minimizing route changes, and aiding in the orderly management of air traffic on Federal airways. Low and high altitude preferred routes are listed in the Airport/Facility Directory (A/FD). To use a preferred route, reference the departure and arrival airports; if a routing exists for your flight, then airway instructions are listed.

Tower En Route Control (TEC) is an ATC program that uses overlapping approach control radar services to provide IFR clearances. By using TEC, a pilot is routed by airport control towers. Some advantages include abbreviated filing procedures and reduced traffic separation requirements. TEC is dependent upon the ATC's workload, and the procedure varies among locales.

The latest version of Advisory Circular (AC) 90-91, North American Route Program (NRP), provides guidance to users of the NAS for participation in the NRP. All flights operating at or above FL 290 within the conterminous United States and Canada are eligible to participate in the NRP, the primary purpose of which is to allow operators to plan minimum time/cost routes that may be off the prescribed route structure. NRP aircraft are not subject to route-limiting restrictions (e.g., published preferred IFR routes) beyond a 200 NM radius of their point of departure or destination.

IFR En Route Charts

The objective of IFR en route flight is to navigate within the lateral limits of a designated airway at an altitude consistent with the ATC clearance. Your ability to fly instruments safely and competently in the system is greatly enhanced by understanding the vast array of data available to the pilot on instrument charts. AeroNav Products maintains and produces the charts for the U.S. Government.

En route high-altitude charts provide aeronautical information for en route instrument navigation at or above 18,000 feet MSL. Information includes the portrayal of Jet and RNAV routes, identification and frequencies of radio aids, selected airports, distances, time zones, special use airspace, and related information. Established jet routes from 18,000 feet MSL to FL 450 use NAVAIDs not more than 260 NM apart. The charts are revised every 56 days.

To effectively depart from one airport and navigate en route under instrument conditions, a pilot needs the appropriate IFR en route low-altitude chart(s). The IFR low altitude en route chart is the instrument equivalent of the sectional chart. When folded, the cover of the AeroNav Products en route chart displays an index map of the United States showing the coverage areas. Cities near congested airspace are shown in black type and their associated area chart is listed in the box in the lower left-hand corner of the map coverage box. Also noted is an explanation of the off-route obstruction clearance altitude (OROCA). The effective date of the chart is printed on the other side of the folded chart. Information concerning MTRs is also included on the chart cover. The en route charts are revised every 56 days.

When the AeroNav Products en route chart is unfolded, the legend is displayed and provides information concerning airports, NAVAIDs, communications, air traffic services, and airspace.

Airport Information

Airport information is provided in the legend, and the symbols used for the airport name, elevation, and runway length are similar to the sectional chart presentation. Associated city names are shown for public airports only. FAA identifiers are shown for all airports. ICAO identifiers are also shown for airports outside of the contiguous United States. Instrument approaches can be found at airports with blue or green symbols, while the brown airport symbol denotes airports that do not have instrument approaches. Stars are used to indicate the part-time nature of tower operations, Automatic Terminal Information Service (ATIS) frequencies, part-time or on request lighting facilities, and part-time airspace classifications. A box after an airport name with a "C" or "D" inside (e.g., D) indicates Class C and D airspace, respectively, per *Figure 1-3*.

Charted IFR Altitudes

The minimum en route altitude (MEA) ensures a navigation signal strong enough for adequate reception by the aircraft navigation (NAV) receiver and obstacle clearance along the airway. Communication is not necessarily guaranteed with MEA compliance. The obstacle clearance, within the limits of the airway, is typically 1,000 feet in non-mountainous areas and 2,000 feet in designated mountainous areas. MEAs can be authorized with breaks in the signal coverage; if this is the case, the AeroNav Products en route chart notes "MEA GAP" parallel to the affected airway. MEAs are usually bidirectional; however, they can be single-directional. Arrows are used to indicate the direction to which the MEA applies.

The minimum obstruction clearance altitude (MOCA), as the name suggests, provides the same obstruction clearance as an MEA; however, the NAV signal reception is ensured only within 22 NM of the closest NAVAID defining the route. The MOCA is listed below the MEA and indicated on AeroNav Products charts by a leading asterisk (e.g., "*3400"—see *Figure 1-2*, V287 at bottom left).

The minimum reception altitude (MRA) identifies the lowest altitude at which an intersection can be determined from an off-course NAVAID. If the reception is line-of-sight based, signal coverage only extends to the MRA or above. However, if the aircraft is equipped with distance measuring equipment (DME) and the chart indicates the intersection can be identified with such equipment, the pilot could define the

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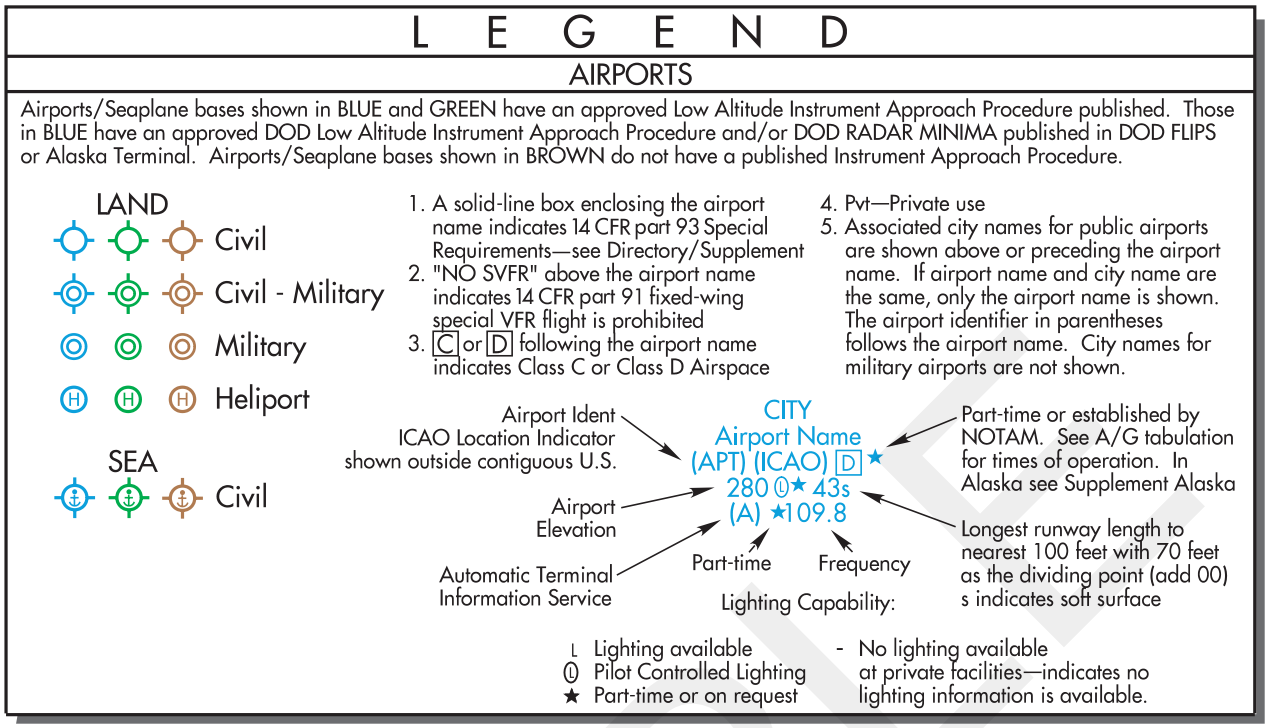


Figure 1-3. *En route airport legend.*

fix without attaining the MRA. On AeroNav Products charts, the MRA is indicated by the symbol and the altitude preceded by "MRA" (e.g., "MRA 9300"). *[Figure 1-2]*

The minimum crossing altitude (MCA) is charted when a higher MEA route segment is approached. The MCA is usually indicated when a pilot is approaching steeply rising terrain and obstacle clearance and/or signal reception is compromised. In this case, the pilot is required to initiate a climb so the MCA is reached by the time the intersection is crossed. On AeroNav Products charts, the MCA is indicated by the symbol , and the Victor airway number, altitude, and the direction to which it applies (e.g. "V24 8000 SE").

The maximum authorized altitude (MAA) is the highest altitude at which the airway can be flown with assurance of receiving adequate navigation signals. Chart depictions appear as "MAA-15000."

When an MEA, MOCA, and/or MAA change on a segment other than at a NAVAID, a sideways "T" (⊣) is depicted on the chart. If there is an airway break without the symbol, one can assume the altitudes have not changed (see the upper left area of *Figure 1-2*). When a change of MEA to a higher MEA is required, the climb may commence at the break, ensuring obstacle clearance. *[Figure 1-4]*

Navigation Features

Types of NAVAIDs

Very high frequency omnidirectional ranges (VORs) are the principal NAVAIDs that support the Victor and Jet airways. Many other navigation tools are also available to the pilot. For example, nondirectional beacons (NDBs) can broadcast signals accurate enough to provide stand-alone approaches, and DME allows the pilot to pinpoint a reporting point on the airway. Though primarily navigation tools, these NAVAIDs can also transmit voice broadcasts.

Tactical air navigation (TACAN) channels are represented as the two- or three-digit numbers following the three-letter identifier in the NAVAID boxes. The AeroNav Products terminal procedures provide a frequency-pairing table for the TACAN-only sites. On AeroNav Products charts, very-high frequencies and ultra-high frequencies (VHF/UHF) NAVAIDs (e.g., VORs) are depicted in black, while low frequencies and medium frequencies (LF/MF) are depicted as brown. *[Figure 1-5]*

Identifying Intersections

Intersections along the airway route are established by a variety of NAVAIDs. An open triangle △ indicates the location of an ATC reporting point at an intersection. If the triangle is solid ▲, a report is compulsory. *[Figure 1-4]* NDBs, localizers,

SAMPLE

Instrument Flying Handbook

FAA-H-8083-15B



U.S. Department
of Transportation
FEDERAL AVIATION ADMINISTRATION

This is the FAA's primary pilot resource for instrument flight rules (IFR) covering everything pertinent to operating an aircraft in instrument meteorological conditions (IMC) or without reference to outside visuals, relying solely on the information gleaned from the cockpit. Readers will find chapters on the national airspace system, the air traffic control system, human factors, aerodynamics, flight instruments, flight maneuvers for IFR operations, navigation, emergency operations, as well as helicopter operations and more.

The material in this manual applies to both conventional "steam-gauge" analog instrumentation and the "glass cockpit" electronic flight displays found in advanced aircraft. Information is well organized into separate coverage of the traditional "6-pack" and discussions of pictorial "tape" displays. Advanced systems are covered, including flight management systems, the primary flight display (PFD) and multi-function display (MFD), synthetic vision, and traffic advisory systems. The book also features a synopsis of instrument clearance shorthand, as well as an instrument training lesson guide.

The *Instrument Flying Handbook* is designed for use by flight instructors, pilots preparing for the Instrument Rating FAA Knowledge and Practical Exams, and instrument-rated pilots looking for a refresher or preparing for an Instrument Proficiency Check (IPC). Illustrated throughout with detailed, full-color drawings and photographs; comprehensive glossary and index.

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