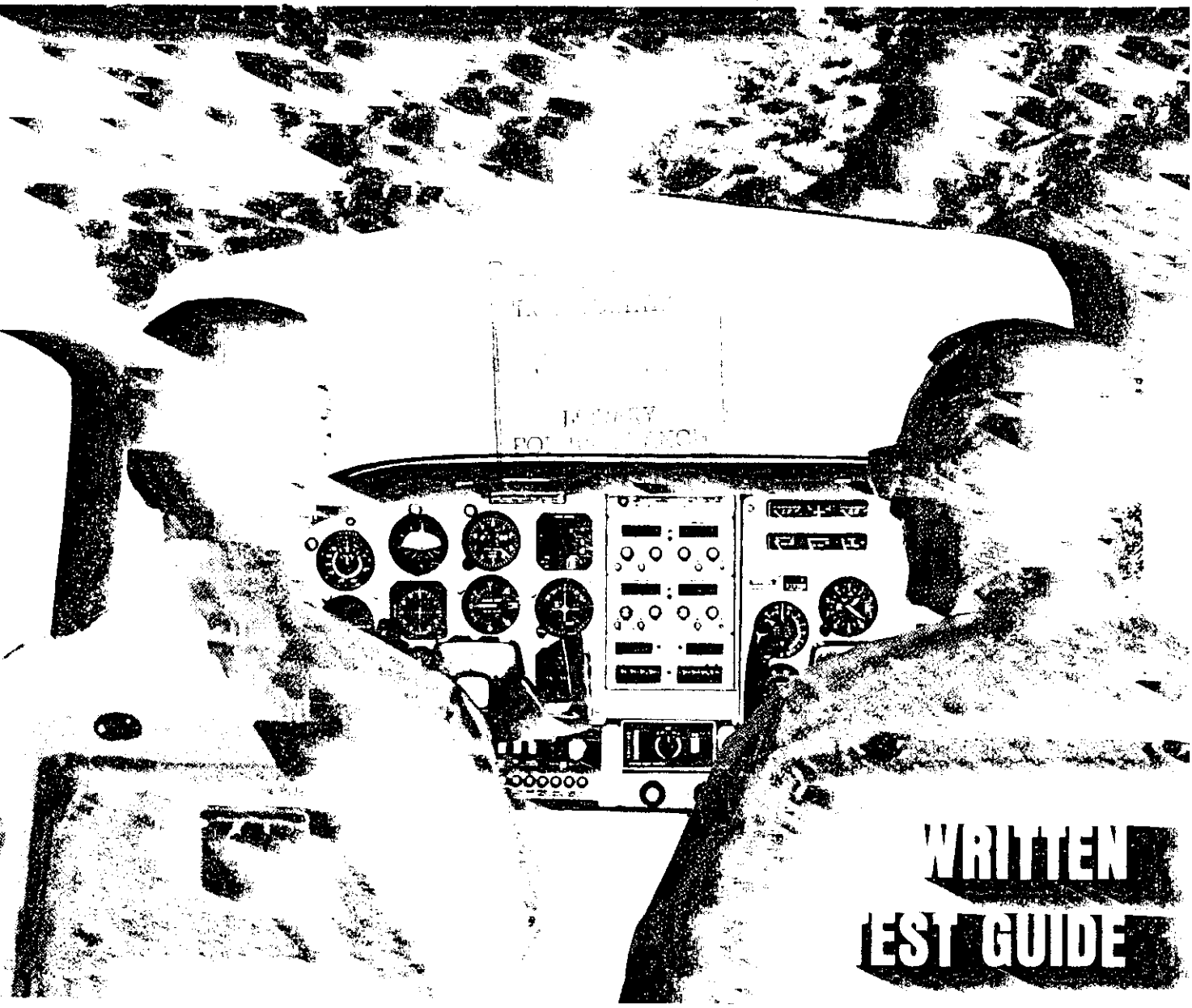

WRITTEN TEST GUIDE

GROUND INSTRUCTOR INSTRUMENT

U.S. DEPARTMENT OF TRANSPORTATION *Federal Aviation Administration*

GROUND INSTRUCTOR
INSTRUMENT
WRITTEN TEST GUIDE

AC 143-2C

Revised 1976

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Flight Standards Service

PREFACE

This written test guide has been developed by the Flight Standards Service, Federal Aviation Administration, Department of Transportation, as Advisory Circular AC 143-2C to assist applicants who are preparing for the Ground Instructor—Instrument Written Test. It supersedes the Ground Instructor—Instrument Written Test Guide, AC 143-2B, issued in 1971.

This guide outlines the scope of knowledge covered in the test, lists reference materials for study, and presents sample questions with answers and explanations.

Comments regarding this publication should be directed to the Department of Transportation, Federal Aviation Administration, Flight Standards National Field Office, P.O. Box 25082, Oklahoma City, Oklahoma 73125.

CONTENTS

Ground Instructor—Instrument—Written Test Guide

INTRODUCTION

This written test guide is not offered as a quick and easy way to gain the knowledge necessary for passing the written test. There is no substitute for diligent study in so diversified a field as aviation ground instruction. Continuous review is essential to remain current in the many areas where technological change is the rule rather than the exception.

The applicant for the Ground Instructor—Instrument Rating should make a thorough review of the "STUDY OUTLINE" given on pages 7 through 12 of this guide. If an area of weakness is found, that area should be studied thoroughly. After the review, the applicant should take the sample test without aid, then compare the answers with those in the "Analysis of Answers to Sample Test Items" found at the end of the sample test. If nearly all the answers are correct, the applicant is probably prepared to take the Ground Instructor—Instrument Written Test. It should be kept in mind, however, that the required test will cover considerably more areas of knowledge than the sample test.

CERTIFICATION REQUIREMENTS

The following excerpts from the Federal Aviation Regulations, Part 143, are given for the convenience of the applicant.

"§ 143.9 Eligibility requirements: general.

To be eligible for a certificate under this Part, a person must be at least 18 years of age, be of good moral character, and comply with § 143.11."

"§ 143.11 Knowledge requirements.

Each applicant for a ground instructor certificate must show his practical and theoretical knowledge of the subject for which he seeks a rating by passing a written test on that subject."

"§ 143.15 Tests: general procedures.

(a) Tests prescribed by or under this Part are given at times and places, and by persons, designated by the Administrator.

(b) The minimum passing grade for each test is 70 percent."

To meet the requirements of sections 143.9 and 143.11, an applicant for a Ground Instructor Certificate with an Instrument Rating must pass a Ground Instructor—Instrument Written Test and a Fundamentals of Instruction Written Test.* However, if the applicant already holds a valid FAA Flight or Ground Instructor Certificate no separate test on Fundamentals of Instructing is required when applying for an additional instructor certificate or rating.

It is not necessary to take the Fundamentals of Instructing test on the same day as the Ground Instructor Instrument Written Test. It is immaterial which test is taken first.

THE WRITTEN TEST

The Ground Instructor—Instrument Written Test emphasizes the aeronautical knowledge areas in which the instrument ground instructor should be prepared to teach. Test items require a knowledge of air traffic, communications, navigation procedures, operating principles of air navigation radio aids, and instrument flight techniques. The applicant must apply knowledge of Federal Aviation Regulations, preflight duties, aircraft performance, aerodynamics, in-flight operation, weather, navigation aids, and navigation procedures.

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* For study guidance and reference materials for the test on Fundamentals of Instructing, the applicants should consult AC 143-1D, *Ground Instructor Written Test Guide, Basic-Advanced*, available from the Superintendent of Documents, U.S. Government Printing Office.

All test items are the objective, multiple-choice type and can be answered by the selection of a single response. The items are similar to those contained in the sample test in this guide. The applicant indicates the chosen answer on a special answer sheet. Directions for taking the test and for marking the answers should be read carefully and understood by the applicant before beginning the test. Personal and other information should be accurately entered in appropriate spaces on the answer sheet. Approximately 5 hours are allowed to complete the test.

After the test is completed, the applicant's answer sheet is forwarded to the U.S. Department of Transportation, Federal Aviation Administration, Aeronautical Center, Oklahoma City, Okla., for scoring by ADP computers. Shortly thereafter, a test grade is mailed to the applicant on AC Form 8080-2, Airman Written Test Report. The report also contains coded indicators of the knowledge areas in which the applicant experienced difficulty. These knowledge areas can be determined by reference to the *Subject Matter Outline* which accompanies the report. The "Study Outline" given on pages 7 through 12 of this guide is similar to the *Subject Matter Outline.*

An applicant who successfully passes the required test should present AC Form 8080-2, Airman Written Test Report, to the Flight Standards District Office for issuance of the Ground Instructor Certificate with an instrument rating.

RETESTING AFTER FAILURE

The applicant who receives a failing grade on a written test may apply for retesting. The applicant may apply for retesting—(a) after 30 days after the date the test was failed, or (b) upon presenting a statement from an appropriately rated certificated ground instructor certifying that the applicant has been given at least 5 hours additional instruction in the areas failed and is now considered capable of passing the test.

TAKING THE TEST

The test may be taken at FAA Flight Standards District Offices and at other designated places.

Bear in mind the following points while taking the test:

1. Answer test items in accordance with latest regulations and procedures.
2. Read and thoroughly understand all instructions.
3. Read each test item carefully and work out your answer before selecting an alternative response. Comments received from applicants indicate that unsatisfactory performance on a written test is frequently the result of a failure to read carefully rather than a lack of knowledge.
4. Each test item has a specific objective and in no case has one been devised to "trick" the applicant.
5. Only one of the alternative responses given for each test item is correct and complete. The incorrect alternatives are based on incomplete knowledge of the subject, common misconceptions, or the use of incorrect procedures.
6. In solving a computer problem, select the answer closest to your solution. If you have solved the problem correctly, your solution will be nearest the correct answer because that answer is an average of the answers obtained by using several types of computers authorized for use on FAA written tests.
7. Do not spend too much time on difficult test items, but continue on to items you can answer readily. When these have been completed, return to the more difficult items.

REFERENCE MATERIALS

The following list of publications and materials is provided for the benefit of individuals who wish to prepare for the written test.

Testbooks and other reference materials are available from commercial publishers. Many public and institutional libraries offer study materials in both teaching methods and aero-

nautical subject areas. It is the responsibility of each applicant to obtain study materials.

NOTE—With the exception of the "Aviation Instructor's Handbook," the references listed were available at the time this publication went to press.

CHARTS

EN ROUTE LOW AND HIGH ALTITUDE CHARTS. These charts provide necessary aeronautical information for en route instrument navigation in the established airway structure.

AREA CHARTS. These charts are part of the En Route Low Altitude Chart series. They furnish terminal data on a larger scale in congested areas.

INSTRUMENT APPROACH PROCEDURE CHARTS. Each of these charts depict an instrument approach procedure, including all related data, and the airport diagram.

STANDARD INSTRUMENT DEPARTURES (SIDs). These charts are collated in two booklets, "East" and "West." They are designed for use with En Route High and Low Altitude and Area Charts. They furnish pilots departure routing clearance in graphic and textual form.

STANDARD TERMINAL ARRIVAL ROUTES (STARs). These charts are collated in one booklet and are designed for use with En Route High and Low Altitude Charts. They furnish pilots preplanned instrument flight rules (IFR) air traffic control arrival route procedures in graphic and textual form.

PILOT EXAM-O-GRAMS (Free-FAA). Brief discussions, using the question and answer technique, of problem areas in aeronautical knowledge, which are apparent from applicant performance on the FAA written tests and from accident and violation reports. Distribution of Exam-O-Grams is limited to one complete set of VFR and/or IFR Exam-O-Grams per individual request.

FEDERAL AVIATION REGULATIONS (FARs)

Part 1 Definitions and Abbreviations.

Part 61 Certification: Pilots and Flight Instructors.

Part 91 General Operating and Flight Rules.

Part 95 IFR Altitudes.

Part 97 Standard Instrument Approach Procedures.

Part 135 Air Taxi Operators and Commercial Operators of Small Aircraft.

Part 141 Pilot Schools.

Part 143 Ground Instructors.

AIRMAN'S INFORMATION MANUAL (AIM)

This publication presents in five parts, information necessary for the planning and conduct of a flight in the National Airspace System. It is designed to be used in the cockpit for preflight and in-flight operations by pilots and contains both instructional and procedural information. The subscription consists of:

Part 1—*Basic Flight Manual and ATC Procedures.* Issued quarterly.

Part 2—*Airport Directory.* Issued semiannually.

Part 3—*Operational Data.* Issued every 56 days.

Part 3A—*Notices to Airmen.* Issued every 14 days.

Part 4—*Graphic Notices and Supplemental Data.* Issued quarterly.

NOTE—As of April 1975, Part 3A became a separate part, which must be ordered and paid for separately. It will no longer be received automatically as an item with Part 3.

ADVISORY CIRCULARS

00-6A—*Aviation Weather*

Provides an up-to-date and expanded text for pilots and other flight operations personnel whose interest in meteorology is primarily in its application to flying. Government Printing Office (GPO).

00–45—*Aviation Weather Services*

Supplements AC 00–6A, Aviation Weather, in that it explains the weather service in general and the use and interpretation of reports, forecasts, weather maps, and prognostic charts in detail. It is an excellent source of study for pilot certification examinations. (GPO)

00–17—*Turbulence in Clear Air*

Provides information on atmospheric turbulence and wind shear, emphasizing important points pertaining to the common causes of turbulence, the hazards associated with it, and the conditions under which it is most likely to be encountered. (Free from FAA)

00–24—*Thunderstorms*

Contains information concerning flights in or near thunderstorms. (Free from FAA)

20–32B—*Carbon Monoxide (CO) Contamination in Aircraft—Detection and Prevention*

Provides information on the potential dangers of carbon monoxide contamination from faulty engine exhaust systems or cabin heaters of the exhaust gas heat exchanger type. (Free from FAA)

60–4—*Pilot's Spatial Disorientation*

Acquaints pilots flying under visual flight rules with the hazards of disorientation caused by loss of reference with the natural horizon. (Free from FAA)

60–6A—*Airplane Flight Manuals (AFM) Approved Manual Materials, Markings, and Placards—Airplanes*

Alerts pilots to regulatory requirements relating to the subject and provides information to aid pilots in complying with the provisions of FAR 91.31. (Free from FAA)

61–16A—*Flight Instructor's Handbook*

Gives guidance and information to pilots who are preparing for flight instructor certification and for use as a reference by certificated flight instructors. (GPO)

60–14—*Aviation Instructor's Handbook (Available in the near future)*

This handbook is in the process of being developed to supplant AC 61–16A, Flight Instructor Handbook. It will provide currently certificated flight and ground instructors, and applicants for such certificates, with comprehensive, accurate, and easily understood information on learning and teaching. It will relate this information to the aviation instructor's task conveying aeronautical knowledge and skill to students.

61–27B—*Instrument Flying Handbook*

Provides the pilot with basic information needed to acquire an FAA instrument rating. It is designed for the reader who holds at least a private pilot certificate and is knowledgeable in all areas covered in AC 61–23A, "Pilot's Handbook of Aeronautical Knowledge." (GPO)

90–1A—*Civil Use of U.S. Government Produced Instrument Approach Charts*

Clarifies landing minimums requirements and revises instrument approach charts. (Free from FAA)

90–12A—*Severe Weather Avoidance*

Warns all pilots concerning flight in the vicinity of known or forecasted severe weather, severe turbulence, and hail. It also advises them that air traffic control facilities, even though equipped with radar, might not always have the capability nor be in a position to provide assistance for circumnavigation of areas of severe weather. (Free from FAA)

90–14A—*Altitude—Temperature Effect on Aircraft Performance.*

Introduces the Denalt Performance Computer and reemphasizes the hazardous effects density altitude can have on aircraft. (Free from FAA)

90–23D—*Wake Turbulence*

Alerts pilots to the hazards of aircraft trailing vortex wake turbulence and recommends related operational procedures. (Free from FAA)

90-38A—*Use of Preferred IFR Routes*

Outlines the background, intent, and requested actions pertaining to the use of preferred IFR routes. (Free from FAA)

90-62—*Flying DME Arcs*

Describes procedures and techniques for intercepting DME arcs from radials, maintaining DME arcs, and intercepting radials and localizers from DME arcs. (Free from FAA)

91-8A—*Use of Oxygen by General Aviation Pilots/Passengers*

Provides general aviation personnel with information concerning the use of oxygen. (Free from FAA)

91.11-1—*Guide to Drug Hazards in Aviation Medicine*

Lists all commonly used drugs by pharmacological effect on airmen with side effects and recommendations. (GPO)

91-23—*Pilot's Weight and Balance Handbook*

Provides an easily understood text on aircraft weight and balance for pilots who need to appreciate the importance of weight and balance control for safety of flight. Progresses from an explanation of basic fundamentals to the complete application of weight and balance principles in large aircraft operations. (GPO)

91-24—*Aircraft Hydroplaning or Aquaplaning on Wet Runways*

Provides information on the problem of aircraft tires hydroplaning on wet runways. (Free from FAA)

91-25A—*Loss of Visual Cues During Low Visibility Landings*

Provides information concerning the importance of maintaining adequate visual cues during the descent below MDA or DH. (Free from FAA)

170-3B—*Distance Measuring Equipment (DME)*

Presents information on DME, and some of its uses, to pilots unfamiliar with this navigation aid. (Free from FAA)

HOW TO OBTAIN STUDY MATERIALS

The study materials listed, except for the charts, free Advisory Circulars, and Exam-O-Grams, may be obtained by remitting check or money order to the address given below. For your convenience in ordering publications from the Superintendent of Documents, an order form is included in the back of this guide.

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

To obtain the latest information regarding FAR prices, number of changes, and ordering information, send for a free copy of "Advisory Circular 00-44, Status of Federal Aviation Regulations" from the address given below. Free FAA publications may also be obtained from this office.

U.S. Department of Transportation
Publications Section, TAD-443.1
Washington, D.C. 20590

If you are presently on one of FAA's advisory circular mail lists, you will automatically receive this advisory circular. If not, and you wish to be placed on the mail list to receive revised copies as issued, send your name and address to:

U.S. Department of Transportation
Distribution Unit
TAD-482.3
Washington, D.C. 20590

NOTE—To receive the latest information on how to obtain the Airman's Information Manual, free Advisory Circulars, and other FAA material, consult the AC Checklist, AC 00-2. A copy of this checklist may be obtained free of charge by sending your request to:

U.S. Department of Transportation
Publications Section, TAD-443.1
Washington, D.C. 20590

The National Ocean Survey publishes and distributes aeronautical charts of the United States. Charts for foreign areas are published by the U.S. Air Force Aeronautical Chart and Information Center (ACIC) and are sold to civil users by the National Ocean Survey.

A "Catalog of Aeronautical Charts and Related Publications," listing their prices and instructions for ordering, may be obtained free on request from:

Department of Commerce
Distributing Division (C-44)
National Ocean Survey
Riverdale, Maryland 20840

Orders for specific charts or publications should be accompanied by check or money order made payable to, NOS, Department of Commerce.

Exam-O-Grams may be obtained free of charge (one copy per each request) and names may be added to the mailing list by writing to:

Department of Transportation
FAA Aeronautical Center
Flight Standards National Field Office
Operations Branch, AFS-590
P.O. Box 25082
Oklahoma City, Oklahoma 73125

Study Outline

This study outline indicates the areas of aeronautical knowledge that pertain to the written test. It expands the general aeronautical knowledge requirements set forth in Federal Aviation Regulations and is based on airman activity for flight under Instrument Flight Rules.

Reference Code:

AC—Advisory Circular
AW—Aviation Weather (AC 00-6A)
AWS—Aviation Weather Services (AC 00-45)
AIM—Airman's Information Manual
EOG—IFR Exam-O-Gram
IFH—Instrument Flying Handbook (AC 61-27B)
BHH—Basic Helicopter Handbook (AC 61-13A)
IAPC—Instrument Approach Procedure Charts

(FAR references will be indicated by Part number only, i.e., 91.5 means FAR 91.5.)

FLIGHT PLANNING

A10. *Certificates and Ratings*
- A11. Requirements for certificates and ratings (61.3)
- A12. Eligibility for instrument rating (61.65)
- A13. Where instrument rating required (61.3e, 91.97)
- A14. Recency of experience (61.57)

A20. *Preflight Action for Flight*
- A21. Familiarization with all available information (91.5, EOG-31, AIM-3)
- A22. Fuel requirements (91.23)

A30. *Preflight Action for Aircraft (EOG-31)*
- A31. Responsibility for airworthiness (91.29)
- A32. Equipment required
  Instruments and equipment (91.33)
  Transponder (91.24, 91.90)
  ELT (91.52)
- A33. Tests and inspections
  VOR (91.25, EOG-22, AIM 1-8)
  Altimeter system (91.170)
  Transponder (91.177)
- A34. Portable electronic devices (91.19)

A40. *Flight Plan (AIM-1)*
- A41. When required (91.97, 91.99, 91.115)
- A42. Information required (91.83)
- A43. Alternate airport requirements (91.83, EOG-29)

B10. *Route Planning*
- B11. Preferred routes (AIM-3, AC 90-38A)
  SIDs and STARs (AIM-1)
- B12. Airport/Facility Directory (AIM-3)
- B13. NOTAM (AIM-3A)
- B14. FDC NOTAMs (AIM-3A)
- B15. Special Notices (AIM-3)
- B16. Area Navigation Routes (AIM-3)
- B17. Direct Routes (AIM-1, Airspace; 91.116f, 91.119, 91.121b)
- B18. Restrictions to En Route Nav. Aids (AIM-3)
- B19. Substitute Route Structure (EOG-39)

B20. *Flight Planning Computer Operations (Ch. XII-IFII)*
- B21. Wind correction angle-heading
- B22. GS
- B23. ETE/ETA
- B24. Fuel estimates

B30. *Aircraft Performance (Aircraft Owner's Handbook, VFR EOG-33, EOG-32, AC 90-14A)*
- B31. Takeoff distance
- B32. Climb performance
- B33. Cruise performance (VFR EOG-38)
- B34. Fuel flow
- B35. Landing performance
- B36. Airspeed: IAS, CAS, EAS, TAS
- B37. Placards and instrument markings
- B38. Hovering

B40. *Aircraft Operating Limitations (documents in aircraft, AC 60-6A)*
- B41. Weight and balance (EOG-21, AC 91-23)
- B42. Instrument limit markings and placards (91.31)
- B43. Maximum safe crosswind (VFR EOG-27)
- B44. Turbulent air penetration

B50. *Aircraft Systems (Ch. IV-IFH)*
- B51. Pitot-static system (EOG-10)
- B52. Vacuum/gyroscopic (EOG-24)
- B53. Electric/gyroscopic
- B54. Compass

C10. *Fundamentals of Weather*
- C11. Composition of the atmosphere (Ch. 1-AW)
- C12. Temperature (Ch. 2-AW)
- C13. Pressure (Ch. 3-AW)
- C14. Circulation (Ch. 4-AW)
- C15. Moisture (Ch. 5-AW)
- C16. Stability and wind (Ch. 6-AW)
- C17. Clouds (Ch. 7-AW)
- C18. Airmasses and fronts (Ch. 8-AW)
- C19. Turbulence (Ch. 9-AW)

C20. *IFR Weather Hazards*
- C21. Icing (Ch. 10-AW)
- C22. Thunderstorms (Ch. 11-AW, AIM-1)
- C23. Fog and obstructions to vision (Ch. 12-AW)

C30. *Aviation Weather Observations and Reports*
- C31. Aviation weather reports (SA) (AWS-2)
- C32. Pilot weather reports (PIREPs, UA) (AWS-3)
- C33. Radar weather reports (RAREPs) (AWS-3)
  Radar summary chart (AWS-7)
- C34. Surface analysis (AWS-5)
- C35. Weather depiction chart (AWS-6)
- C36. Upper wind chart (AWS-9)
- C37. Freezing level chart (AWS-10)
- C38. Stability chart (AWS-11)
- C39. Constant pressure charts (AWS-13)

C40. *Aviation Weather Forecasts*
- C41. Terminal (FT) (AWS-4, EOG-5)
- C42. Area (FA) (AWS-4, EOG-5)
- C43. Winds and temperatures aloft (FD, AWS-4, and chart AWS-9)
- C44. Severe weather (AWS-4)
  Hurricane advisories (WH); convective outlook (AC); Weather Watch (WW); severe weather outlook chart (AWS-12)
- C45. TWEB route forecast and synopsis (AWS-4)
- C46. Inflight advisories (WS, WA, WAC) (AWS-4)
- C47. Prognostic charts:
  Surface (AWS-8); Significant Weather (AWS-8); Constant Pressure (AWS-14); Tropopause and Wind Shear (AWS-15)

C50. *Weather Tables and Conversion Graphs (AWS-16)*
- C51. Icing intensities
- C52. Turbulence intensities
- C53. Locations of probable turbulence
- C54. Standard temperature, speed, and pressure conversions
- C55. Density altitude

C60. *Weather Facilities*
- C61. FSS weather service (AIM-2, 3; EOG-19)
  Telephone numbers (AIM-2)
  Remote weather radar display (AIM-3)
  Scheduled weather broadcast (AIM-3)

C62. ATIS (AIM–1, 3)
C63. Weather Service Forecast Offices (AIM–1)
TWEB, PATWAS (AIM–3)

DEPARTURE

D10. *Authority and Limitations of Pilot*
D11. Pilot in command (91.3, 91.4)
D12. Emergency action (91.3)
Deviation from rules (91.75)
D13. Required reports
Emergency deviation (91.3c)
Malfunction of equipment (91.33c, 91.129)

D20. *Flight Plan*
D21. Where to file (AIM–3)
D22. When to file (AIM–1)

D30. *Departure Clearance (AIM–1, EOG–35)*
D31. "Cleared as filed"
D32. Amended clearance
D33. Pre-taxi clearance procedure
D34. Clearance delivery (AIM–3)

D40. *Taxi and Takeoff Procedures (AIM–1)*
D41. Taxi limits (AIM–1, EOG–26, 28)
D42. ATC control sequence (AIM–1)
D43. Airport advisory service (AIM–3)
D44. ATIS (AIM–3)

D50. *Departure Procedures (AIM–1)*
D51. Obstruction clearance minimums (approach chart book)
D52. Departure control procedures (non-radar)
D53. Departure control procedures (radar)
D54. SIDs
D55. Speed adjustments
D56. Terminal area limitations

E10. *VOR Accuracy Check (AIM–1, EOG–22, 91.25)*
E11. VOT (AIM–3, L–chart legend)
E12. VOR ground check points (AIM–3)
E13. VOR airborne check points (AIM–3)
E14. VOR dual receiver check

E20. *Pretakeoff Instrument Check (IFH, pages 68 and 249)*
E21. Pre-start instrument indications
E22. Taxi test

E30. *Transponder (EOG–25, AIM–1)*
E31. Operation
E32. Switching code
E33. Emergency use

F10. *Airport Facilities (AIM–3, 3A, charts)*
F11. Service (AIM–3, 3A)
F12. Runways (EOG–26, 28; AIM–1)
F13. Airport lighting (AIM–1, EOG–33)
F14. Communications (AIM–3)

F20. *FSS Facility (AIM–1, EOG–39)*
F21. Flight plan service
F22. Traffic advisories (AIM–3)
F23. Communications (AIM–3)
F24. Weather advisories (AIM–3, AWS–1)

F30. *Departure Control Facility*
F31. Communications (AIM–3, IAPC)
F32. Geographical area

EN ROUTE

G10. *En Route Limitations (AIM–1)*
G11. Altitude limitations (91.119, EOG–8): MEA, MOCA, MCA, MRA, MAA
G12. Cruising altitudes (91.121, 91.109)
G13. Courses to be flown (91.123, 91.67)
G14. Altimeter settings (91.81)
G15. Positive Control Airspace (91.97)
G16. Special Use Airspace (91.95, AIM–1, En Route Charts)

G20. *En Route Procedures (AIM–1, Ch. XI–IFH)*
G21. Radar environment
vectors, reporting, handoffs
G22. Non-radar environments
reporting, handoffs
G23. Altitude
cruise, maintain, climb, descend, VFR on top
G24. Delays
clearance limits, holding
G25. Securing weather information (AWS–1)

G30. *ATC clearances*
- G31. Phraseology (Ch. VIII — IFH, AIM-1, EOG-11, 34, 35)
- G32. Responses and read backs (AIM-1, 91.125)

G40. *Oxygen Requirements (91.32)*
- G41. Pilot and crew requirements
- G42. Passenger requirements

G50. *Emergencies (AIM-1, EOG-2)*
- G51. Difficulty with communications
- G52. Malfunction of equipment
- G53. Lost
- G54. Lost communications (91.127, EOGs 36, 37, 38)
- G55. Malfunction reports (91.129, 91.33e)
- G56. Deviation from clearance (91.75c)

H10. *Radio Orientation (Ch. VII—IFH)*
- H11. VOR (EOG-7 and 14)
- H12. NDB (EOG-23)
- H13. LOC (EOG-7 and 14)
- H14. RNAV (EOG-30)

H20. *Establishing Radio Fixes and Waypoints (Ch. VII—IFH)*
- H21. VOR radials
- H22. VOR-DME (Ch. VI—IFH, AC 90-62, AC 170-3B)
- H23. ADF (EOG-23)
- H24. ADF-VOR/LOC
- H25. RNAV (EOG-30)

H30. *En Route Computer Operations (Ch. XII—IFH)*
- H31. GS
- H32. ETE/ETA
- H33. Altitude or speed conversions
- H34. Fuel

H40. *Attitude Instrument Flying (Ch. V—IFH)*
- H41. Interpretation of flight instruments
- H42. Aircraft control: pitch, bank, power
- H43. Basic maneuvers
  - straight and level
  - climbs and descents
  - turns (EOG-18)
- H44. Unusual attitudes
- H45. Flight patterns

H50. *Unusual Flight Conditions (AC 90-12A)*
- H51. Thunderstorms (AC 00-24, page 111-AW)
- H52. Structural icing (Ch. 10-AW)
- H53. Induction icing (Ch. 10-AW)
- H54. Use of anti/deicing equipment
- H55. Frost
- H56. Clear air turbulence (AC 00-17)

J10. *Radio Navigation Facilities (Ch. VII—IFH, AIM-1)*
- J11. VOR/VORTAC
- J12. NDB
- J13. LOC
- J14. DF
- J15. RADAR

J20. *Airway Route System (En Route Chart Legend)*
- J21. Victor/jet airway limits
- J22. Route identification
  - military, substitute, unusable
- J23. Altitude limits: MOCA, MEA, MRA, MCA, MAA
- J24. Reporting points: compulsory, non-compulsory
- J25. Fixes, waypoints
- J26. Geographical limit: VOR change-over points, altimeter setting boundary, time zone boundary
- J27. Airspace designation

J30. *Special Use Airspace (AIM-1, chart legends)*
- J31. Prohibited area
- J32. Restricted area
- J33. Climb corridor
- J34. Warning area
- J35. Alert area, military operations area

J40. *ARTCC Facility (Ch. X—IFH, AIM-1)*
- J41. ARTCC remote frequencies (En Route Chart)
- J42. Geographical area of control (En Route Chart)
- J43. Advisories, services, assistance

J50. *En Route Weather Services (AIM-3)*
- J51. EFAS (AWS-1)
- J52. TWEB (AWS-1)
- J53. ARTCC significant weather advisories

J60. *Fixed-wing Aerodynamic Factors (Ch. III—IFH, AC 61-23A)*
- J61. Aerodynamic forces
- J62. Straight and level
- J63. Turns
- J64. Climbs
- J65. Descents
- J66. Stalls

J70. *Rotary-wing Aerodynamic Factors (BHH)*
- J71. Vibrations (Ch. 2)
- J72. Dissymmetry of lift (Ch. 2)
- J73. Translation (Ch. 2)
- J74. Rotor disc-loading, coning, and flapping (Ch. 9)
- J75. Settling with power (Ch. 9)
- J76. Ground resonance (Ch. 9)
- J77. Speed limitations (Ch. 9)
- J78. Autorotation particulars (Ch. 11)
- J79. Factors affecting performance (Ch. 11)

J80. *Physiological Factors (Ch. II—IFH, AIM-1)*
- J81. Physiologic altitude effects
  hypoxia, aerotitis, aerosinusitis (AC 91-8A)
- J82. Hypoxic effects
  alcohol, hyperventilation, drugs, carbon monoxide (AC 20-32A)
- J83. Sensations of instrument flying (AC 60-4)
- J84. Spatial disorientation (AC 60-4)

ARRIVAL

K10. *Approach Control (AIM-1, Ch. XI—IFH)*
- K11. Radar control
  STARs, vectors (AC 90-41C), approach clearances
- K12. Nonradar control
- K13. Aircraft speed (91.70)
- K14. Procedure turns/holding patterns
- K15. Visual and contact approaches

K20. *Holding Procedures*
- K21. Holding pattern entry
- K22. Shuttle
- K23. Changing altitude
- K24. Timing
- K25. Adjustments and corrections

K30. *Precision Approaches (AC 90-1A; IFH, page 161; AIM-1)*
- K31. Initial approach/procedure turn (91.116h)
- K32. Vectors to final approach (91.116f)
- K33. Intermediate approach
- K34. Final approach
- K35. Glide slope
- K36. Decision height (91.117b)
- K37. Inoperative components (91.117c)
- K38. Reports

K40. *Nonprecision Approaches (AC 90-1A, AIM-1)*
- K41. Initial approach/procedure turn (91.116h)
- K42. Vectors to final approach (91.116f)
- K43. Intermediate approach
- K44. Final approach
- K45. Minimum descent altitude (91.117b)
- K46. Inoperative components (91.117c)
- K47. Reports

K50. *Missed Approach (91.117b, AC 90-1A, AIM-1)*
- K51. Precision approach
- K52. Nonprecision approach
- K53. Loss of visual cues
- K54. Low approach (practice approaches)

K60. *Landing Procedures (AIM-1)*
- K61. Noncontrolled airport (91.89)
- K62. Controlled airport (91.87)
- K63. Landing minimums (91.116b)
- K64. Close flight plan (91.83)

L10. *Logging of Flight Time*
- L11. Instrument flight time (61.51(c)(4))
- L12. Conditions for simulated instrument flight (91.21)
- L13. Information required (61.51(c)(4))
  Instrument approaches
  Safety pilot
- L14. Pilot in command (61.51(c)(2))

L20. *Radio Orientation on Approach (Ch. VII—IFH)*

- L21. Relation to LOC on front and back course (Ch. VI—IFH; EOG-7)
- L22. Glide slope (Ch. VI—IFH)
- L23. LOC and glide slope (EOG-7, Ch. VI—IFH)
- L24. Marker beacons (Ch. VI—IFH)
- L25. Compass locators (EOG-23)
- L26. NDB (EOG-23)
- L27. VOR/VORTAC (EOG-7)
- L28. LOC type, LDA, SDF (AIM-1)

L30. *Wake turbulence (AIM-1, AC 90-23D)*

- L31. Landing hazards
- L32. Takeoff hazards
- L33. Inflight hazards
- L34. Wake turbulence theory

M10. *Terminal Area (IAPC, AIM-3)*

- M11. Approach control facility, frequencies, area
- M12. FSS (AIM-1)
  Airport advisories
  Flight plan service
  Weather service

M20. *Instrument Approach Procedure Chart—Planview (AC 90-1A, IAPC legend)*

- M21. Facility frequencies and services
- M22. Procedural tracks
- M23. Fixes and markers
- M24. Obstructions
- M25. Special use airspace
- M26. Radio aids
- M27. Minimum altitudes

M30. *Instrument Approach Procedure Chart—Profile (AC 90-1A, IAPC legend)*

- M31. Altitude limits
- M32. Descent pattern/glide slope
- M33. Facilities/fixes

M40. *Instrument Approach Procedure Chart Aerodrome Sketch (AC 90-1A, IAPC legend)*

- M41. Runway configuration and specifications
- M42. Approach light systems
- M43. Elevations
  Obstacles, TDZE, and aerodrome
- M44. Airport taxi chart

M50. *Instrument Approach Procedure Chart—Minimums Section (AC 90-1A, IAPC legend)*

- M51. Aircraft category
- M52. DH/MDA
- M53. HAT
- M54. HAA
- M55. Minimum visibility
  miles/RVR
- M56. IFR takeoff minimums and departure procedures
- M57. IFR alternate minimums
- M58. Civil RADAR instrument approach minimums

M60. *Approach Facilities (AIM-1, IFH)*

- M61. ILS
- M62. LDA
- M63. SDF
- M64. VOR/VORTAC
- M65. NDB
- M66. Marker beacons, compass locators
- M67. VASI

NOTE.—Applicants for original issuance of a Ground Instructor Certificate with an instrument rating should refer to AC 143-1D, Ground Instructor Written Test Guide, Basic-Advanced, for a study outline and sample test on Fundamentals of Instructing.

Sample Test

The following items are typical of those in the official FAA written test. Answers and explanations or references are given on the pages following the sample test.

NOTE.—The sample items, answers, and analyses are based upon procedures and regulations in effect at the time of preparation of this publication. Regulatory and procedural changes subsequent to the date of publication should be checked for their effect on the applicable item.

1. By which three methods is aeronautical information concerning the National Airspace disseminated?

1—The Airman's Information Manual, Advisory Circulars, and FSS Advisories.

2—Aeronautical Charts, the Airman's Information Manual, and National NOTAMS.

3—Parts II, III, and IV of the Airman's Information Manual.

4—FSS radio communications, telephone, and personal briefings.

2. Which documentation or entry verifies the validity of the Airworthiness Certificate?

1—Maintenance records show that an annual inspection has been performed within the last 12 calendar months.

2—The Airworthiness Certificate is still in the aircraft and has not been surrendered, suspended, or revoked.

3—The date on the Airworthiness Certificate indicates it has been reregistered within the last 12 calendar months.

4—Maintenance records show a "return to service" statement for the required inspections.

* * * * * *

Over the past 6 months, the pilot utilized all the aircraft listed in the following logbook excerpts for the furtherance of business. The pilot holds a Commercial Pilot Certificate for airplanes and rotorcraft, and also holds single and multiengine land class ratings for the airplane category and a helicopter class rating for rotorcraft. The pilot's Second-Class Medical Certificate was issued on March 26, last year. Today is March 27. Test items 3, 4, and 5 are based on the information contained in the following excerpts from the pilot's logbook.

* * * * * *

Date	*Aircraft*	*Reg. Number*	*Cat. Class*	*PIC*	*SIC*	*Day*	*Night*	*Instr.*	*No. Appr.*	*No. Lmds.*
10/18	TWINN	N22Y	AMEL	.7		.7				1 day
10/21	TWINN	N22Y	AMEL	1.0		1.0				1 day
11/1	UNIE	N101N	ASEL	2.4		2.4		1.3	4	4 day
11/7	TWINN	N22Y	AMEL	.5	1.9	.5	1.9			1 day
										3 night
11/17	WHAP	N30P	RH	1.2		1.2		1.0	1	1 day
12/3	WHAP	N30P	RH	2.0		2.0		1.4	3	3 day
12/6	TWINN	N22Y	AMEL	1.4		1.4				3 day
12/10	WHAP	N30P	RH	.9		.9		.6	1	2 day
12/21	UNIE	N101N	ASEL		1.2		2.1	1.2	2	2 night
1/2	TWINN	N22Y	AMEL	1.7		1.0	.7	1.0	1	2 day
										2 night
1/6	WHAP	N30P	RH	.4		.4				1 day
1/14	UNIE	N101N	ASEL	2.8		1.6	1.2			3 day
										1 night
1/19	TWINN	N22Y	AMEL	1.1	.5	1.1	.5	1.0	2	2 day
										1 night
3/16	WHAP	N30P	RH	.5		.5				5 day
3/22	WHAP	N30P	RH	.8		.8				3 day
3/26	TWINN	N22Y	AMEL	1.7		1.7		.5	1	1 day

3. What is the status of the pilot's Medical Certificate?

1—It is valid for this type of operation until the last day of March, next year.

2—It expires at the end of March, this year.

3—It must be renewed this month if the pilot continues flying for the furtherance of business.

4—It expires at the end of August, this year.

4. In which aircraft, if any, is the pilot current to carry passengers?

	Day	*Night*
1—	TWINN only	None
2—	TWINN only	TWINN only
3—	TWINN and WHAP only	None
4—	TWINN, UNIE, and WHAP	TWINN only

5. In which aircraft, if any, is the pilot current to fly IFR?

1—None.
2—TWINN only.
3—TWINN and UNIE only.
4—TWINN, UNIE, and WHAP.

6. Can a pilot overcome vertigo?

1—No, a pilot susceptible to vertigo should avoid instrument flight.

2—Yes, by closing the eyes and adjusting to muscular sensations.

3—Yes, by rotating the head rapidly to cancel the sensations of the inner ear.

4—Yes, by relying on the sense of sight to control the airplane.

7. A pilot is using the magnetic compass to establish and maintain a heading. If the compass is operating normally, it will indicate a turn toward

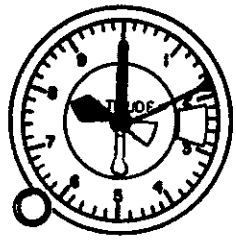
1—west when entering a right turn from a north heading.

2—north when entering a right turn from an east heading.

3—south when the airplane is accelerating on an east heading.

4—east when accelerating on a north heading.

8. Which altitude or flight level is indicated by the altimeter?



1—8,000 feet
2—FL 180
3—1,800 feet
4—FL 280

9. Why is an encounter with wake turbulence behind a heavy airplane more dangerous near the ground than at altitude?

1—Ground effect amplifies the vortices.

2—The dense air near the ground makes the vortices stronger and more effective.

3—Momentary loss of control is usually more disastrous near the ground.

4—The ground deflects vortices back into the air with unpredictable results.

10. If ATC issues you a clearance that would result in a deviation from Federal Aviation Regulations, you

1—may proceed as cleared.

2—may accept the clearance but must inform ATC of the deviation.

3—should accept the clearance but *not* comply with that portion which deviates from a rule.

4—should reject the clearance and request an amended clearance.

11. What is the pilot's responsibility with regard to the use of a SID or STAR on an IFR flight?

1—A SID may be issued without request, but a STAR will be issued only by pilot request.

2—The pilot should be prepared for and should accept a SID or STAR to simplify the task of copying the clearance.

3—A SID or STAR is *not* required and will *not* be issued unless the pilot requests one.

4—The pilot should accept a SID or STAR in the clearance to avoid delays en route.

12. An airport has *no* authorized instrument approach. It may be listed as an alternate on an IFR flight plan if the current weather forecast indicates, at the estimated time of arrival, the ceiling and visibility at that airport will

1—permit a descent from the MEA, an approach, and a landing under basic VFR.

2—be at least 800 feet and 2 miles.

3—be at least 900 feet and 2 miles.

4—be at least 1,000 feet and 1 mile.

13. You are flying a DME arc and have been cleared for an ILS approach. When should you start your turn to the localizer?

1—At the appropriate "lead radial" depicted on the instrument approach chart.

2—When the localizer needle of the receiver tuned to the localizer frequency centers.

3—One-half mile from the localizer course.

4—When the localizer needle of the receiver tuned to the localizer frequency begins to deflect.

14. What is the meaning of the term "Radar Vectoring" when it appears on an instrument approach chart?

1—All approaches must be made by radar vectors to the final approach fix.

2—Radar vectoring is available but ASR and PAR approaches are *not* available.

3—Radar vectoring and ASR approaches are available.

4—Radar vectoring, ASR, and PAR approaches are available.

15. The rate of descent required to remain on the glide path during an ILS approach will

1—increase if the groundspeed is increased.

2—remain the same regardless of true airspeed.

3—remain the same regardless of groundspeed.

4—increase if the groundspeed is decreased.

16. Which is a significant difference between an SDF approach and an ILS approach?

1—The SDF course is usually wider and offset from the runway centerline.

2—The SDF utilizes bone markers instead of fan markers for range information.

3—Landing minimums are generally lower for the SDF due to greater precision of the equipment.

4—The identification signal is prefixed with "S" instead of "I" as for ILS.

* * * * * *

Use the RMI illustrations shown below for test items 17 and 18.

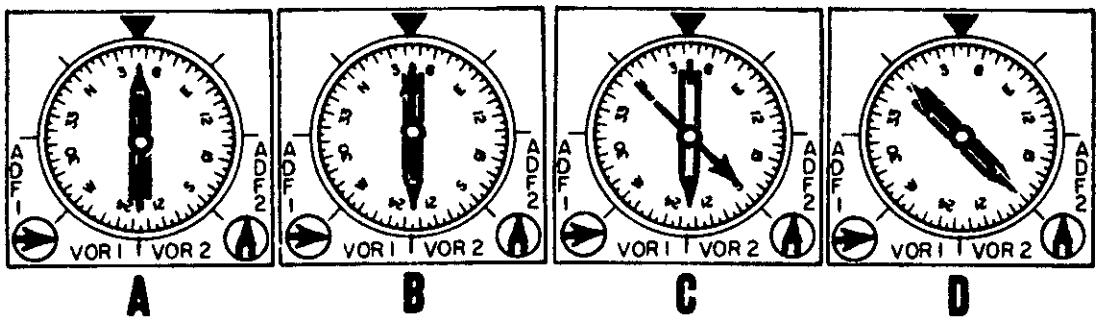
17. Which RMI depicts an accurate VOR equipment check on the VOT?

1—A
2—B
3—C
4—D

18. What is the magnetic bearing to the station as indicated by the RMI in illustration "D"?

1—135°
2—180°
3—315°
4—360°

* * * * *



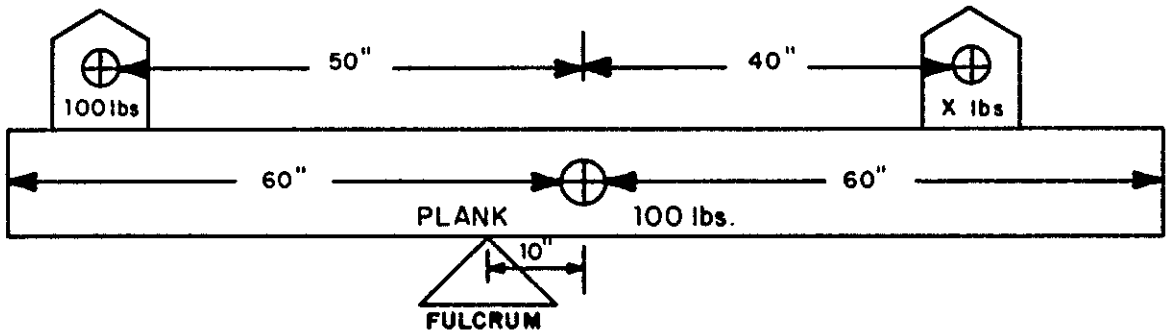
19. Above which cabin pressure altitude must each occupant of an unpressurized aircraft be provided supplemental oxygen?

1—10,000 feet
2—12,500 feet
3—14,500 feet
4—15,000 feet

20. How much weight must be placed at point "X" to balance the plank on the fulcrum? (See illustration below.)

1— 10 pounds
2—100 pounds
3— 60 pounds
4—600 pounds

* * * * *



* * * * *

21. What is the maximum moment/100 allowed at takeoff gross weight (3,300 lbs.) for this airplane so that the moment will still be within limits after a 390-pound fuel burn? (Use tables on page 17.)

1—2,494
2—2,583
3—2,787
4—2,795

22. Under which condition is an aft CG most critical?

1—During takeoff.
2—In a stall.
3—During a steep turn.
4—In high speed level flight.

23. Where will pressure change more rapidly as you move through the air vertically?

1—Air near the tropopause.
2—Saturated air.
3—Within a high pressure area.
4—More dense air near the surface.

24. What conditions exists in the troposphere when the temperature increases with altitude?

1—Adiabatic lapse rate.
2—Chinook wind.
3—Temperature inversion.
4—Katabatic wind.

25. What is the major motivating force for all weather phenomena over the earth?

1—Heat energy radiated by the sun.
2—Coriolis force combined with pressure gradient.
3—The ever changing state of moisture.
4—The instability of the wind and moisture.

26. How is moisture added to unsaturated air?

1—Adiabatic cooling.
2—Condensation, dew, or frost.
3—Sublimation or evaporation.
4—Melting or supersaturation.

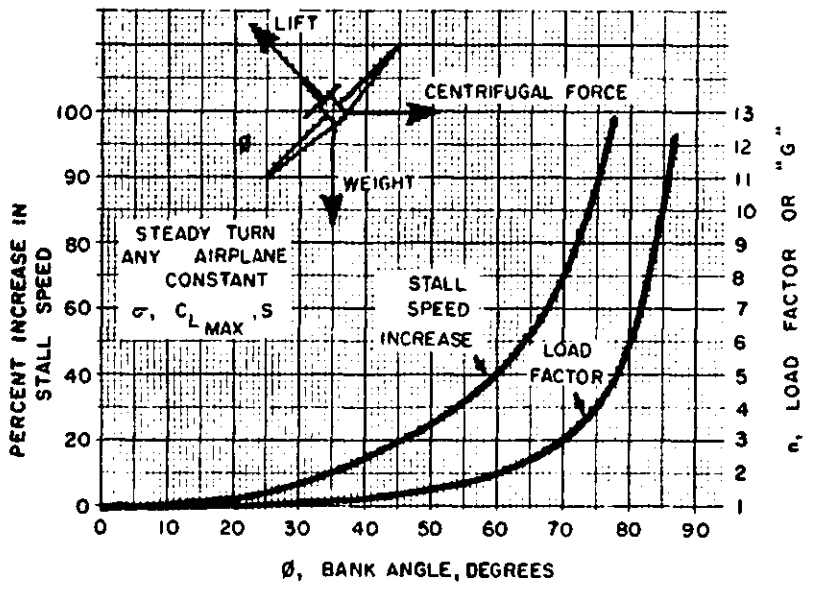
CROSS WEIGHT MOMENT LIMITS

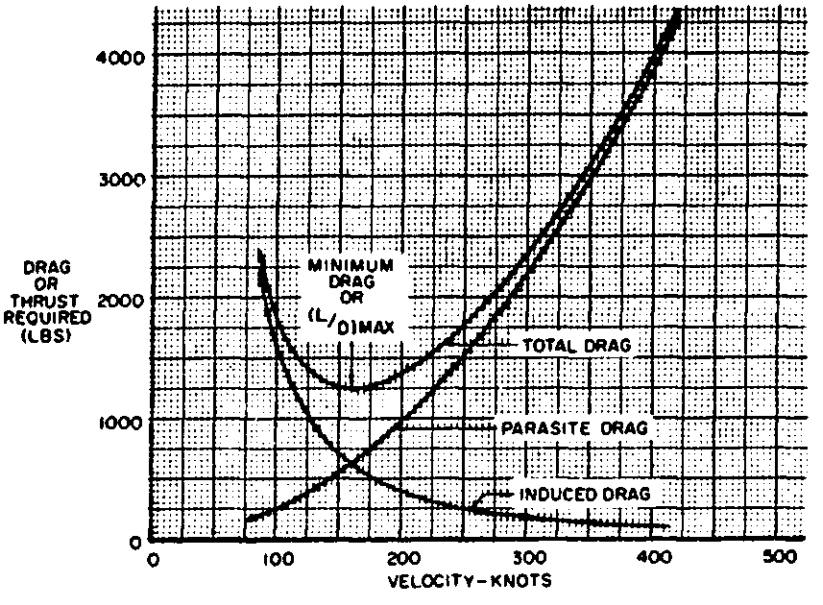
Gross Weight	Minimum Moment 100	Maximum Moment 100
2900	2263	2485
2910	2273	2494
2920	2284	2502
2930	2295	2511
2940	2306	2520
2950	2317	2528
2960	2328	2537
2970	2338	2545
2980	2349	2554
2990	2360	2562
3000	2371	2571
3010	2382	2579
3020	2393	2586
3030	2404	2594
3040	2415	2601
3050	2426	2609
3060	2437	2616
3070	2448	2624
3080	2460	2631
3090	2471	2639
3100	2482	2646
3110	2493	2654
3120	2504	2661
3130	2515	2669
3140	2527	2676
3150	2538	2684
3160	2549	2691
3170	2561	2699
3180	2572	2706
3190	2583	2714
3200	2595	2721
3210	2606	2729
3220	2617	2736
3230	2629	2743
3240	2640	2751
3250	2652	2758
3260	2663	2766
3270	2675	2773
3280	2686	2780
3290	2698	2788
3300	2709	2795

FUEL		
LEADING EDGE TANKS ARM 75		
GALLONS	WEIGHT	MOMENT/100
5	30	23
10	60	45
15	90	68
20	120	90
25	150	113
30	180	135
35	210	158
40	240	180
45	270	203
49	294	221
55	330	248
60	360	270
65	390	293
70	420	315
75	450	338
80	480	360

The above moment limits are based on the following weight and center of gravity limit data (landing gear down).

WEIGHT CONDITION	FORWARD CG LIMIT	AFT CG LIMIT
3300 lb. (max. take-off or landing)	82.1	84.7
3000 lb	79.0	85.7
2800 lb or less	77.0	85.7





27. What is the stall speed of an aircraft under a 3 "G" load factor if its unaccelerated stall speed is 60 knots? (Use upper chart.)

1— 70 knots

2— 87 knots

3—102 knots

4—140 knots

28. What is the relationship between drag and airspeed? (Use lower chart.)

1—Induced drag increases with increasing airspeed.

2—Total drag at 100 knots is almost identical to that at 250 knots.

3—Parasite drag is greater than induced drag at speeds below 150 knots.

4—L/D MAX occurs at the airspeed that gives the most total drag.

29. If icing conditions exist, why is the ice formed in unstable air usually more serious than ice formed in stable air?

1—Unstable air is able to hold more moisture.
2—The rate of freezing is greater in unstable air.
3—The larger drops of water in unstable air usually form hard clear ice.
4—Turbulence causes the drops to strike all surfaces of the airplane.

30. How are stratus clouds formed?

1—Local vertical currents over flat land carrying moisture to the condensation level.
2—Whole layers of air cooled until condensation takes place.
3—Large mass of air raised to the condensation level by a cold front.
4—Layer of cold moist air moving in from the sea over a warmer land area.

31. The four families of clouds are

1—high, middle, low, and clouds with extensive vertical development.
2—cirrus, stratus, cumulus, and nimbus.
3—alto, stratus, cumulus, and nimbus.
4—cirrus, alto, stratus, and cumulus.

32. What happens when the life cycle of a frontal wave is completed?

1—The front dissipates.
2—The low dissipates and the front returns to its original condition.
3—The front changes from a cold front to a warm front.
4—The front becomes a low pressure trough.

* * * * * *

Test items 33 through 40 are based on the following information:

Excerpt from En Route Low Altitude Chart on page 20.

Cruising altitude	11,000 feet	
Pressure altitude	11,500 feet	
Winds aloft	9,000 feet	12,000 feet
	2830–02	3139–08

* * * * * *

33. What is standard temperature at your cruising altitude?

1—+7°C.
2—+4°C.
3—−3°C.
4—−7°C.

34. What is the density altitude at your cruising altitude?

1—10,250 feet
2—10,500 feet
3—11,600 feet
4—12,000 feet

35. What is the true altitude at your cruising altitude?

1—10,800 feet
2—11,100 feet
3—11,500 feet
4—11,800 feet

36. A portion of your IFR flight as depicted on the chart is described on the flight plan as ". . . SYO direct HBR direct LAW direct DUC. . . ." Which stations are compulsory reporting points?

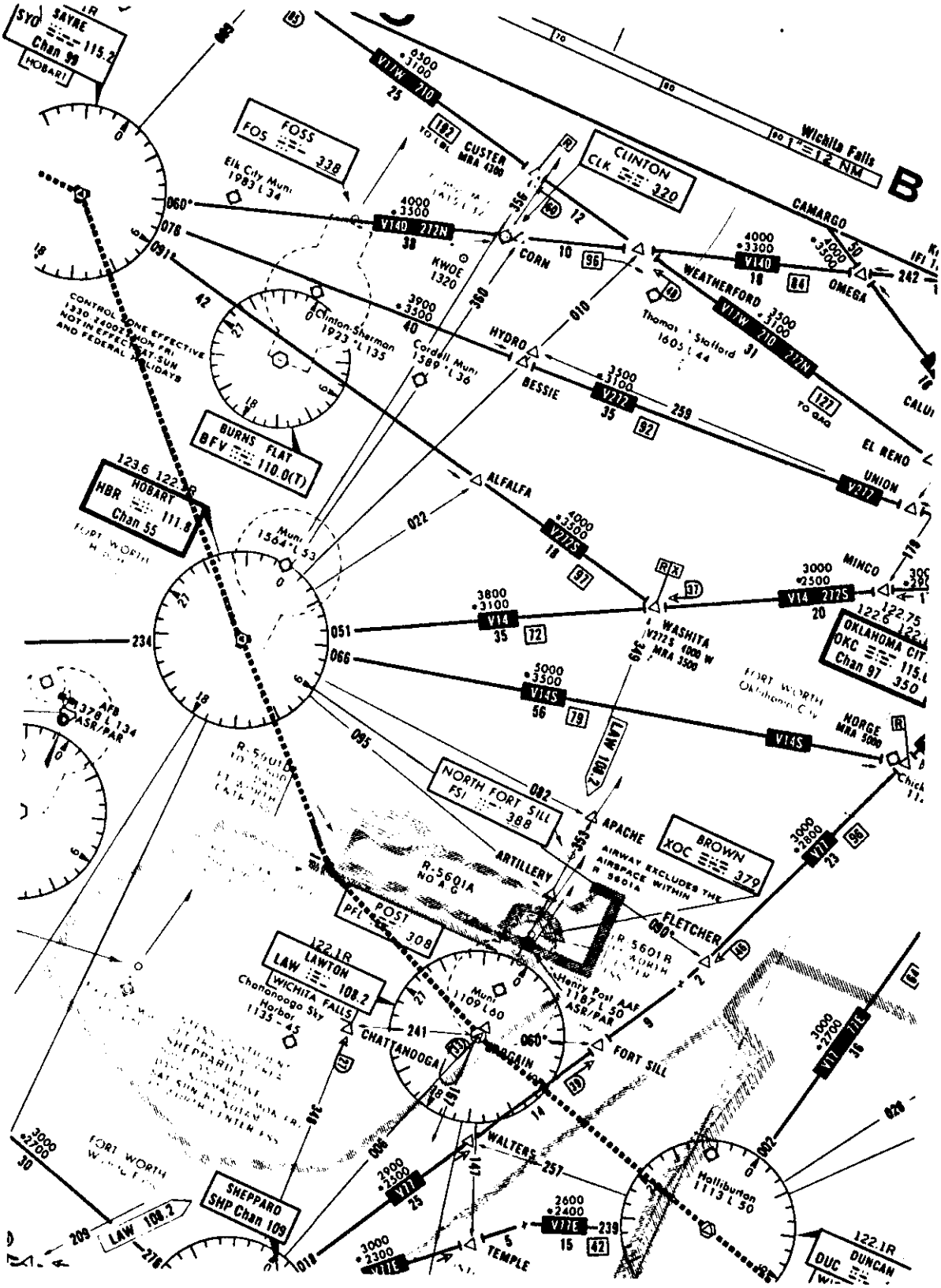
1—HBR only.
2—SYO and HBR only.
3—SYO, HBR, and DUC only.
4—SYO, HBR, LAW, and DUC.

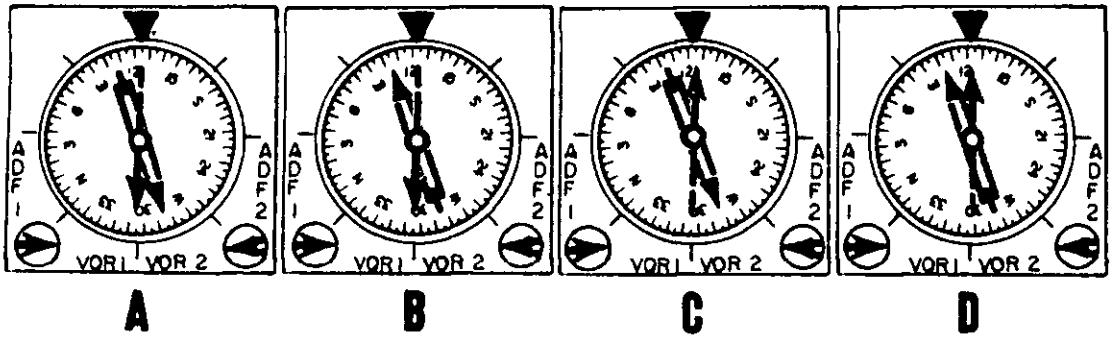
37. What is the highest IFR altitude that ATC could assign on V14?

1—10,000 feet
2—14,500 feet
3—17,000 feet
4—18,000 feet

38. What is the lowest IFR cruising altitude on V14 for the entire segment from HBR to MINCO Intersection?

1—3,100 feet
2—3,800 feet
3—4,000 feet
4—5,000 feet


SAYRE
Chan 99
HOBART
FOSS
FOS 338
CLINTON
CLK 320
Wichita Falls
12 NM
B
CAMARGO
CUSTER
MRA 4300
V14W 210
Elk City Muni
1983 L 34
V140 217N
KWOE
1320
CORN
WEATHERFORD
V14W 210 217N
OMEGA
Clinton-Sherman
1923 L 135
Cordell Muni
1589 L 36
HYDRO
BESSIE
V232
EL RENO
UNION
V317
CONTROL ZONE EFFECTIVE 1330-2400 SUN-FRI. NOTAM EFFECTIVE SAT-SUN AND FEDERAL HOLIDAYS
BURNS FLAT
BFV 110.0(T)
123.6 122.3R
HOBART
HBR 111.8
Chan 55
ALFALFA
V277S
MINCO
V14 217S
WASHITA
V272S 4000 W
MRA 3500
OKLAHOMA CITY
OKC 115.
Chan 97
V14S
MORGE
MRA 5000
NORTH FORT SILL
FSI 388
APACHE
BROWN
XOC 379
ARTILLERY
R-5601A
NO A/G
AIRWAY EXCLUDES THE AIRSPACE WITHIN R 5601A
POST
PFL 308
FLETCHER
R 5601B
122.1R
LAWTON
LAW 108.2
WICHITA FALLS
Chanonoga Sky Harbor
1133 - 45
Muni
1109 L 60
CHATTANOOGA
Henry Post AAF
1187 L 50
ASR/PAR
FORT SILL
WALTERS
Halliburton
1113 L 50
SHEPPARD
SHP Chan 109
TEMPLE
DUNCAN
DUC



39. Which RMI indication should you receive when you are in position to change course at the corner of Restricted Area R-5601A between HBR and LAW? (VOR-1 is tuned to HBR, and VOR-2 is tuned to LAW.)

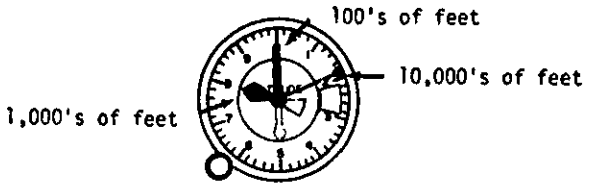
1—A
2—B
3—C
4—D

40. What is the calibrated airspeed from SYO to HBR if the groundspeed is 190 knots? (Use 10°E. Variation.)

1—130 knots
2—155 knots
3—200 knots
4—225 knots

Analysis of Answers to Sample Test Items

Item	Answer	Analysis
1	2	AIM Part 1. Aeronautical information concerning the National Airspace System is disseminated by three methods—Aeronautical Charts, Airman's Information Manual, and National NOTAMS. The primary method is Aeronautical Charts.
2	4	FAR 91.169. The Airworthiness Certificate is valid only if the "return to service" statement accompanies the inspection report in the logbooks. If an aircraft is inspected and *not* found airworthy, the inspection report will have a list of discrepancies which must be corrected before the Airworthiness Certificate is revalidated.
3	1	FAR 61.23. Any of the Medical Certificates expires on the last day of the 24th month after it was issued for operations requiring a Private Pilot Certificate. Flying for the furtherance of a business is a privilege of the Private Pilot Certificate.
4	4	FAR 61.57. The pilot needs three takeoffs and landings within the last 90 days in the same category and class aircraft for day or night, with the night landings being to a full stop. At least three day landings have been accomplished in each aircraft. Assuming the night landings were to a full stop, the pilot qualifies for night in the TWINN only. It should be remembered that night landings may be used in computing day recency of experience; however, day landings may *not* be used in computing night recency of experience.
5	4	FAR 61.57. The pilot has over 6 hours of instrument flight time in the last 6 months, including at least 3 hours in the same category of aircraft. The pilot has also logged the necessary 6 instrument approaches and therefore is current for IFR flight in all three aircraft.
6	4	AIM Part 1 and AC 61-27B, the Instrument Flying Handbook, Chapter II. Relying on the sense of sight is the only recommended method of overcoming or preventing vertigo.
7	1	AC 61-27B, Chapter IV includes a discussion of magnetic compass errors.
8	2	AC 61-27B, Instrument Flying Handbook, Chapter IV.



Item	Answer	Analysis
9	3	AIM Part 1 and Advisory Circular, AC 90-23D.
10	4	AIM Part 1, Chapter 4. "If ATC issues a clearance that would cause a pilot to deviate from a rule or regulation or, in the pilot's opinion, would place the aircraft in jeopardy, IT IS THE PILOT'S RESPONSIBILITY TO REQUEST AN AMENDED CLEARANCE."
11	2	AIM Part 1, Chapter 4. SIDs and STARs may be issued at the discretion of ATC. The use of either requires the pilot to have at least a textual description. If the pilot does not possess such a description, or for any other reason does not wish to use a SID or STAR, "NO SID" or "NO STAR" should be entered in the remarks section of the flight plan.

Item	Answer	Analysis
12	1	FAR 91.83 states that if no instrument approach procedure has been published in Part 97 for that airport (alternate), the ceiling and visibility must allow descent from the MEA, approach, and landing, under basic VFR.
13	1	Advisory Circular, AC 90–62.
14	2	Advisory Circular, AC 90–1A, paragraph 3.g.(2)(d). "RADAR VECTORING" means radar vectoring is available but radar instrument approach procedures are not available."
15	1	AIM Part 1, Chapter 2. The rate of descent required to remain on the glide slope is determined by the groundspeed.
16	1	AIM Part 1, Chapter 2.
17	3	The indication of the VOR–1 needle in illustration "C" is 180°/TO and 360°/FROM. The magnetic heading of the aircraft is 045°, but this does not influence the VOR signal. Remember that the RMI needle always points toward the station and the tail of the needle indicates the radial. Note that the single-bar needle (#1) is indicating VOR and the double-bar needle (#2) is indicating ADF.
18	2	Since the rotating compass card is controlled by a slaved gyro magnetic compass, the double-bar needle (which is set to ADF) indicates the magnetic bearing to the station. When a radio compass with a fixed compass card is used, the needle indicates the relative bearing of the station, and calculations are necessary to determine the magnetic bearing.
19	4	FAR 91.32.
20	3	The moment on the left side of the fulcrum is 4,000 inch pounds (40″ x 100 lbs.). The weight of the plank is 100 pounds and its CG is 10 inches to the right of the fulcrum; therefore, the *known* moment on the right side of the fulcrum is 1,000 inch pounds (10″ x 100 lbs.). To balance on the fulcrum, the right side needs an additional moment of 3,000 inch pounds. Since the arm of point "X" is 50 inches, 60 pounds of additional weight must be placed at that point.
21	3	After a 390 pound fuel burn, the airplane should weigh 2,910 pounds. The maximum moment/100 for 2,910 pounds is 2494. Add the moment/100 for the 390 pounds of fuel (293) to 2494 to find the maximum moment/100 (2787) at the takeoff gross weight of 3,300 pounds, if you intend to burn this much fuel.
22	2	AC 91–23, The Pilot's Weight and Balance Handbook, Chapter 1.
23	4	AC 00–6A, Aviation Weather, Chapter 3. The air is more dense near the surface due to gravity, therefore, the pressure levels are closer together in the lower atmosphere. Pressure decreases more rapidly as you move vertically through the lower atmosphere than through the upper atmosphere.
24	3	AC 00–6A, Aviation Weather, Chapter 2. Temperature in the troposphere normally decreases at the normal lapse rate (3½° F. or 2° C. per 1,000 feet) as altitude increases. If warmer air overrides colder air, the normal condition is inverted and the situation is called a "temperature inversion."
25	1	AC 00–6A, Aviation Weather, Chapter 2. The earth rotates daily about its axis and revolves yearly around the sun with a tilted axis. The uneven heating of the earth's surface causes temperature changes, which in turn cause pressure changes, winds, and changes in the state of moisture.

Item	Answer	Analysis
26	3	AC 00–6A, Aviation Weather, Chapter 5. Both evaporation and sublimation add moisture to the air. Evaporation is the change of liquid water to water vapor and sublimation is the direct change of moisture from a solid to a gas, or vice versa. Cooling limits the amount of moisture the air can hold. Condensation takes moisture from the air. Frost is a product of sublimation (gas to solid). Melting and supersaturation take place in visible moisture only.
27	3	The chart is actually two charts superimposed on one grid. In this problem, enter the right side of the chart on the load factor "3" and progress left to intersect the "load factor" curve. The intersecting point is at the 70° bank angle. From this point, progress upward to intersect the "stall speed increase" curve, then progress to the left side of the chart to 70%. The unaccelerated stall speed (60 knots) multiplied by 70% yields 42 knots. This figure added to 60 knots yields a stall speed of 102 knots under a 3 "G" load. Try several load factors or bank angles and note the stall speed increase.
28	2	Alternate 1—Incorrect; induced drag decreases with increasing airspeed. Alternate 2—Correct as stated. Alternate 3—Incorrect; parasite drag is less than induced drag at speeds below 150 knots. Alternate 4—Incorrect; L/D MAX occurs at the airspeed that gives the least total drag.
29	3	AC 00–6A, Aviation Weather, Chapter 10. Larger drops of supercooled water freeze slowly and flow back over the surface of the airplane. Air bubbles are eliminated and hard clear ice forms. This form of structural ice is the most serious of the various forms of ice because it adheres so firmly to the aircraft and is very difficult to remove.
30	2	AC 00–6A, Aviation Weather, Chapter 12. Stratus clouds are layered and exist only in stable conditions.
31	1	AC 00–6A, Aviation Weather, Chapter 7. Clouds are divided into families according to height range: high clouds —16,500 to 45,000 feet; middle clouds —6,500 to 16,500 feet; low clouds—surface to 6,500 feet; and clouds with extensive vertical development such as cumulonimbus.
32	2	AC 00–6A, Aviation Weather, Chapter 8. Read the section on frontal wave on page 69.
33	4	The standard temperature at 11,000 feet can be determined by applying the standard lapse rate (2° C. per 1,000 feet). Standard temperature at sea level is +15° C. Using the standard lapse rate, the temperature at 11,000 feet under standard conditions is 22° C. less than +15° C. or −7° C. An aeronautical computer can also be used. Set up 11,000 in the "DENSITY ALTITUDE" window and read standard temperature opposite 11,000 feet pressure altitude in the "AIRSPEED AND DENSITY ALTITUDE COMPUTATIONS" window. When the density altitude and pressure altitude are the same, standard conditions exist.
34	3	Using the "AIRSPEED AND DENSITY ALTITUDE COMPUTATIONS" window of an aeronautical computer, align pressure altitude (11,500 feet) with the temperature at the 11,000-foot cruising altitude (−6° C.). Read 11,600 feet in the DENSITY ALTITUDE" window. A density altitude chart can also be used.
35	2	Using the "ALTITUDE COMPUTATIONS" window of an aeronautical computer, align pressure altitude (11,500 feet) with temperature

Item	Answer	Analysis
		at cruising altitude (−6° C.). Opposite calibrated altitude (11,000 feet cruising altitude in this case) on the inside scale, read true altitude (approximately 11,100 feet) on the outside scale.
36	4	AIM, Part 1, Chapter 4. Under DIRECT FLIGHTS, AIM states that all radio fixes used to define the route of flight automatically become compulsory reporting points. Although LAW and DUC are not designated compulsory reporting points on the chart, they become so since they describe the route of a direct flight.
37	3	FAR 91.81. The low altitude Victor Airways extend up to, but do not include 18,000 feet; therefore, the highest usable thousand-foot level is 17,000 feet. Flight level 180 may be assigned on Jet Airways if the altimeter setting is 29.92 or higher.
38	3	The lowest IFR cruising altitude is the highest thousand-foot level above the highest MEA (3,800 feet). The odd or even thousand-foot level is a regulation for uncontrolled airspace only.
39	2	You are on the 124 Radial of HBR, which is indicated by the tail of the single-bar needle. The position for course change is at the point where the 124 Radial of HBR intersects the 284 Radial of LAW. You have reached that position when the tail of the double-bar needle indicates 284° and the needle points toward the reciprocal, 104°.
40	1	The Magnetic Course from SYO to HBR is 125°. Add 10° easterly variation for a True Course of 135°. Plot the wind vector and complete the wind triangle. Measure the length of the airspeed vector (155 knots TAS). Align the temperature (−6° C.) with the pressure altitude (11,500 feet) in the "AIRSPEED AND DENSITY ALTITUDE COMPUTATIONS" window of the computer. Opposite 155 knots on the outside TAS scale, read 130 knots on the inside CAS scale. Although this type problem is not practical from the pilot's standpoint, it is used to measure the knowledge level of an applicant.

WRITTEN TEST GUIDE

GROUND INSTRUCTOR INSTRUMENT

U.S. DEPARTMENT OF TRANSPORTATION *Federal Aviation Administration*

GROUND INSTRUCTOR
INSTRUMENT
WRITTEN TEST GUIDE

AC 143-2C

Revised 1976

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Flight Standards Service

PREFACE

This written test guide has been developed by the Flight Standards Service, Federal Aviation Administration, Department of Transportation, as Advisory Circular AC 143-2C to assist applicants who are preparing for the Ground Instructor—Instrument Written Test. It supersedes the Ground Instructor—Instrument Written Test Guide, AC 143-2B, issued in 1971.

This guide outlines the scope of knowledge covered in the test, lists reference materials for study, and presents sample questions with answers and explanations.

Comments regarding this publication should be directed to the Department of Transportation, Federal Aviation Administration, Flight Standards National Field Office, P.O. Box 25082, Oklahoma City, Oklahoma 73125.

CONTENTS

Ground Instructor—Instrument—Written Test Guide

INTRODUCTION

This written test guide is not offered as a quick and easy way to gain the knowledge necessary for passing the written test. There is no substitute for diligent study in so diversified a field as aviation ground instruction. Continuous review is essential to remain current in the many areas where technological change is the rule rather than the exception.

The applicant for the Ground Instructor—Instrument Rating should make a thorough review of the "STUDY OUTLINE" given on pages 7 through 12 of this guide. If an area of weakness is found, that area should be studied thoroughly. After the review, the applicant should take the sample test without aid, then compare the answers with those in the "Analysis of Answers to Sample Test Items" found at the end of the sample test. If nearly all the answers are correct, the applicant is probably prepared to take the Ground Instructor—Instrument Written Test. It should be kept in mind, however, that the required test will cover considerably more areas of knowledge than the sample test.

CERTIFICATION REQUIREMENTS

The following excerpts from the Federal Aviation Regulations, Part 143, are given for the convenience of the applicant.

"§ 143.9 Eligibility requirements: general.

To be eligible for a certificate under this Part, a person must be at least 18 years of age, be of good moral character, and comply with § 143.11."

"§ 143.11 Knowledge requirements.

Each applicant for a ground instructor certificate must show his practical and theoretical knowledge of the subject for which he seeks a rating by passing a written test on that subject."

"§ 143.15 Tests: general procedures.

(a) Tests prescribed by or under this Part are given at times and places, and by persons, designated by the Administrator.

(b) The minimum passing grade for each test is 70 percent."

To meet the requirements of sections 143.9 and 143.11, an applicant for a Ground Instructor Certificate with an Instrument Rating must pass a Ground Instructor—Instrument Written Test and a Fundamentals of Instruction Written Test.* However, if the applicant already holds a valid FAA Flight or Ground Instructor Certificate no separate test on Fundamentals of Instructing is required when applying for an additional instructor certificate or rating.

It is not necessary to take the Fundamentals of Instructing test on the same day as the Ground Instructor Instrument Written Test. It is immaterial which test is taken first.

THE WRITTEN TEST

The Ground Instructor—Instrument Written Test emphasizes the aeronautical knowledge areas in which the instrument ground instructor should be prepared to teach. Test items require a knowledge of air traffic, communications, navigation procedures, operating principles of air navigation radio aids, and instrument flight techniques. The applicant must apply knowledge of Federal Aviation Regulations, preflight duties, aircraft performance, aerodynamics, in-flight operation, weather, navigation aids, and navigation procedures.

* For study guidance and reference materials for the test on Fundamentals of Instructing, the applicants should consult AC 143-1D, *Ground Instructor Written Test Guide, Basic-Advanced,* available from the Superintendent of Documents, U.S. Government Printing Office.

All test items are the objective, multiple-choice type and can be answered by the selection of a single response. The items are similar to those contained in the sample test in this guide. The applicant indicates the chosen answer on a special answer sheet. Directions for taking the test and for marking the answers should be read carefully and understood by the applicant before beginning the test. Personal and other information should be accurately entered in appropriate spaces on the answer sheet. Approximately 5 hours are allowed to complete the test.

After the test is completed, the applicant's answer sheet is forwarded to the U.S. Department of Transportation, Federal Aviation Administration, Aeronautical Center, Oklahoma City, Okla., for scoring by ADP computers. Shortly thereafter, a test grade is mailed to the applicant on AC Form 8080–2, Airman Written Test Report. The report also contains coded indicators of the knowledge areas in which the applicant experienced difficulty. These knowledge areas can be determined by reference to the *Subject Matter Outline* which accompanies the report. The "Study Outline" given on pages 7 through 12 of this guide is similar to the *Subject Matter Outline.*

An applicant who successfully passes the required test should present AC Form 8080–2, Airman Written Test Report, to the Flight Standards District Office for issuance of the Ground Instructor Certificate with an instrument rating.

RETESTING AFTER FAILURE

The applicant who receives a failing grade on a written test may apply for retesting. The applicant may apply for retesting—(a) after 30 days after the date the test was failed, or (b) upon presenting a statement from an appropriately rated certificated ground instructor certifying that the applicant has been given at least 5 hours additional instruction in the areas failed and is now considered capable of passing the test.

TAKING THE TEST

The test may be taken at FAA Flight Standards District Offices and at other designated places.

Bear in mind the following points while taking the test:

1. Answer test items in accordance with latest regulations and procedures.
2. Read and thoroughly understand all instructions.
3. Read each test item carefully and work out your answer before selecting an alternative response. Comments received from applicants indicate that unsatisfactory performance on a written test is frequently the result of a failure to read carefully rather than a lack of knowledge.
4. Each test item has a specific objective and in no case has one been devised to "trick" the applicant.
5. Only one of the alternative responses given for each test item is correct and complete. The incorrect alternatives are based on incomplete knowledge of the subject, common misconceptions, or the use of incorrect procedures.
6. In solving a computer problem, select the answer closest to your solution. If you have solved the problem correctly, your solution will be nearest the correct answer because that answer is an average of the answers obtained by using several types of computers authorized for use on FAA written tests.
7. Do not spend too much time on difficult test items, but continue on to items you can answer readily. When these have been completed, return to the more difficult items.

REFERENCE MATERIALS

The following list of publications and materials is provided for the benefit of individuals who wish to prepare for the written test.

Testbooks and other reference materials are available from commercial publishers. Many public and institutional libraries offer study materials in both teaching methods and aero-

nautical subject areas. It is the responsibility of each applicant to obtain study materials.

NOTE—With the exception of the "Aviation Instructor's Handbook," the references listed were available at the time this publication went to press.

CHARTS

EN ROUTE LOW AND HIGH ALTITUDE CHARTS. These charts provide necessary aeronautical information for en route instrument navigation in the established airway structure.

AREA CHARTS. These charts are part of the En Route Low Altitude Chart series. They furnish terminal data on a larger scale in congested areas.

INSTRUMENT APPROACH PROCEDURE CHARTS. Each of these charts depict an instrument approach procedure, including all related data, and the airport diagram.

STANDARD INSTRUMENT DEPARTURES (SIDs). These charts are collated in two booklets, "East" and "West." They are designed for use with En Route High and Low Altitude and Area Charts. They furnish pilots departure routing clearance in graphic and textual form.

STANDARD TERMINAL ARRIVAL ROUTES (STARs). These charts are collated in one booklet and are designed for use with En Route High and Low Altitude Charts. They furnish pilots preplanned instrument flight rules (IFR) air traffic control arrival route procedures in graphic and textual form.

PILOT EXAM-O-GRAMS (Free-FAA). Brief discussions, using the question and answer technique, of problem areas in aeronautical knowledge, which are apparent from applicant performance on the FAA written tests and from accident and violation reports. Distribution of Exam-O-Grams is limited to one complete set of VFR and/or IFR Exam-O-Grams per individual request.

FEDERAL AVIATION REGULATIONS (FARs)

Part 1 Definitions and Abbreviations.

Part 61 Certification: Pilots and Flight Instructors.

Part 91 General Operating and Flight Rules.

Part 95 IFR Altitudes.

Part 97 Standard Instrument Approach Procedures.

Part 135 Air Taxi Operators and Commercial Operators of Small Aircraft.

Part 141 Pilot Schools.

Part 143 Ground Instructors.

AIRMAN'S INFORMATION MANUAL (AIM)

This publication presents in five parts, information necessary for the planning and conduct of a flight in the National Airspace System. It is designed to be used in the cockpit for preflight and in-flight operations by pilots and contains both instructional and procedural information. The subscription consists of:

Part 1—*Basic Flight Manual and ATC Procedures.* Issued quarterly.

Part 2—*Airport Directory.* Issued semiannually.

Part 3—*Operational Data.* Issued every 56 days.

Part 3A—*Notices to Airmen.* Issued every 14 days.

Part 4—*Graphic Notices and Supplemental Data.* Issued quarterly.

NOTE—As of April 1975, Part 3A became a separate part, which must be ordered and paid for separately. It will no longer be received automatically as an item with Part 3.

ADVISORY CIRCULARS

00-6A—*Aviation Weather*

Provides an up-to-date and expanded text for pilots and other flight operations personnel whose interest in meteorology is primarily in its application to flying. Government Printing Office (GPO).

00-45—*Aviation Weather Services*

Supplements AC 00-6A, Aviation Weather, in that it explains the weather service in general and the use and interpretation of reports, forecasts, weather maps, and prognostic charts in detail. It is an excellent source of study for pilot certification examinations. (GPO)

00-17—*Turbulence in Clear Air*

Provides information on atmospheric turbulence and wind shear, emphasizing important points pertaining to the common causes of turbulence, the hazards associated with it, and the conditions under which it is most likely to be encountered. (Free from FAA)

00-24—*Thunderstorms*

Contains information concerning flights in or near thunderstorms. (Free from FAA)

20-32B—*Carbon Monoxide (CO) Contamination in Aircraft—Detection and Prevention*

Provides information on the potential dangers of carbon monoxide contamination from faulty engine exhaust systems or cabin heaters of the exhaust gas heat exchanger type. (Free from FAA)

60-4—*Pilot's Spatial Disorientation*

Acquaints pilots flying under visual flight rules with the hazards of disorientation caused by loss of reference with the natural horizon. (Free from FAA)

60-6A—*Airplane Flight Manuals (AFM) Approved Manual Materials, Markings, and Placards—Airplanes*

Alerts pilots to regulatory requirements relating to the subject and provides information to aid pilots in complying with the provisions of FAR 91.31. (Free from FAA)

61-16A—*Flight Instructor's Handbook*

Gives guidance and information to pilots who are preparing for flight instructor certification and for use as a reference by certificated flight instructors. (GPO)

60-14—*Aviation Instructor's Handbook (Available in the near future)*

This handbook is in the process of being developed to supplant AC 61-16A, Flight Instructor Handbook. It will provide currently certificated flight and ground instructors, and applicants for such certificates, with comprehensive, accurate, and easily understood information on learning and teaching. It will relate this information to the aviation instructor's task conveying aeronautical knowledge and skill to students.

61-27B—*Instrument Flying Handbook*

Provides the pilot with basic information needed to acquire an FAA instrument rating. It is designed for the reader who holds at least a private pilot certificate and is knowledgeable in all areas covered in AC 61-23A, "Pilot's Handbook of Aeronautical Knowledge." (GPO)

90-1A—*Civil Use of U.S. Government Produced Instrument Approach Charts*

Clarifies landing minimums requirements and revises instrument approach charts. (Free from FAA)

90-12A—*Severe Weather Avoidance*

Warns all pilots concerning flight in the vicinity of known or forecasted severe weather, severe turbulence, and hail. It also advises them that air traffic control facilities, even though equipped with radar, might not always have the capability nor be in a position to provide assistance for circumnavigation of areas of severe weather. (Free from FAA)

90-14A—*Altitude—Temperature Effect on Aircraft Performance.*

Introduces the Denalt Performance Computer and reemphasizes the hazardous effects density altitude can have on aircraft. (Free from FAA)

90-23D—*Wake Turbulence*

Alerts pilots to the hazards of aircraft trailing vortex wake turbulence and recommends related operational procedures. (Free from FAA)

90-38A—*Use of Preferred IFR Routes*

Outlines the background, intent, and requested actions pertaining to the use of preferred IFR routes. (Free from FAA)

90-62—*Flying DME Arcs*

Describes procedures and techniques for intercepting DME arcs from radials, maintaining DME arcs, and intercepting radials and localizers from DME arcs. (Free from FAA)

91-8A—*Use of Oxygen by General Aviation Pilots/Passengers*

Provides general aviation personnel with information concerning the use of oxygen. (Free from FAA)

91.11-1—*Guide to Drug Hazards in Aviation Medicine*

Lists all commonly used drugs by pharmacological effect on airmen with side effects and recommendations. (GPO)

91-23—*Pilot's Weight and Balance Handbook*

Provides an easily understood text on aircraft weight and balance for pilots who need to appreciate the importance of weight and balance control for safety of flight. Progresses from an explanation of basic fundamentals to the complete application of weight and balance principles in large aircraft operations. (GPO)

91-24—*Aircraft Hydroplaning or Aquaplaning on Wet Runways*

Provides information on the problem of aircraft tires hydroplaning on wet runways. (Free from FAA)

91-25A—*Loss of Visual Cues During Low Visibility Landings*

Provides information concerning the importance of maintaining adequate visual cues during the descent below MDA or DH. (Free from FAA)

170-3B—*Distance Measuring Equipment (DME)*

Presents information on DME, and some of its uses, to pilots unfamiliar with this navigation aid. (Free from FAA)

HOW TO OBTAIN STUDY MATERIALS

The study materials listed, except for the charts, free Advisory Circulars, and Exam-O-Grams, may be obtained by remitting check or money order to the address given below. For your convenience in ordering publications from the Superintendent of Documents, an order form is included in the back of this guide.

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

To obtain the latest information regarding FAR prices, number of changes, and ordering information, send for a free copy of "Advisory Circular 00-44, Status of Federal Aviation Regulations" from the address given below. Free FAA publications may also be obtained from this office.

U.S. Department of Transportation
Publications Section, TAD-443.1
Washington, D.C. 20590

If you are presently on one of FAA's advisory circular mail lists, you will automatically receive this advisory circular. If not, and you wish to be placed on the mail list to receive revised copies as issued, send your name and address to:

U.S. Department of Transportation
Distribution Unit
TAD-482.3
Washington, D.C. 20590

NOTE—To receive the latest information on how to obtain the Airman's Information Manual, free Advisory Circulars, and other FAA material, consult the AC Checklist, AC 00-2. A copy of this checklist may be obtained free of charge by sending your request to:

U.S. Department of Transportation
Publications Section, TAD-443.1
Washington, D.C. 20590

The National Ocean Survey publishes and distributes aeronautical charts of the United States. Charts for foreign areas are published by the U.S. Air Force Aeronautical Chart and Information Center (ACIC) and are sold to civil users by the National Ocean Survey.

A "Catalog of Aeronautical Charts and Related Publications," listing their prices and instructions for ordering, may be obtained free on request from:

Department of Commerce
Distributing Division (C–44)
National Ocean Survey
Riverdale, Maryland 20840

Orders for specific charts or publications should be accompanied by check or money order made payable to, NOS, Department of Commerce.

Exam-O-Grams may be obtained free of charge (one copy per each request) and names may be added to the mailing list by writing to:

Department of Transportation
FAA Aeronautical Center
Flight Standards National Field Office
Operations Branch, AFS–590
P.O. Box 25082
Oklahoma City, Oklahoma 73125

Study Outline

This study outline indicates the areas of aeronautical knowledge that pertain to the written test. It expands the general aeronautical knowledge requirements set forth in Federal Aviation Regulations and is based on airman activity for flight under Instrument Flight Rules.

Reference Code:

AC—Advisory Circular
AW—Aviation Weather (AC 00-6A)
AWS—Aviation Weather Services (AC 00-45)
AIM—Airman's Information Manual
EOG—IFR Exam-O-Gram
IFH—Instrument Flying Handbook (AC 61-27B)
BHH—Basic Helicopter Handbook (AC 61-13A)
IAPC—Instrument Approach Procedure Charts

(FAR references will be indicated by Part number only, i.e., 91.5 means FAR 91.5.)

FLIGHT PLANNING

A10. *Certificates and Ratings*
- A11. Requirements for certificates and ratings (61.3)
- A12. Eligibility for instrument rating (61.65)
- A13. Where instrument rating required (61.3e, 91.97)
- A14. Recency of experience (61.57)

A20. *Preflight Action for Flight*
- A21. Familiarization with all available information (91.5, EOG-31, AIM-3)
- A22. Fuel requirements (91.23)

A30. *Preflight Action for Aircraft (EOG-31)*
- A31. Responsibility for airworthiness (91.29)
- A32. Equipment required
  Instruments and equipment (91.33)
  Transponder (91.24, 91.90)
  ELT (91.52)
- A33. Tests and inspections
  VOR (91.25, EOG-22, AIM 1-8)
  Altimeter system (91.170)
  Transponder (91.177)
- A34. Portable electronic devices (91.19)

A40. *Flight Plan (AIM-1)*
- A41. When required (91.97, 91.99, 91.115)
- A42. Information required (91.83)
- A43. Alternate airport requirements (91.83, EOG-29)

B10. *Route Planning*
- B11. Preferred routes (AIM-3, AC 90-38A)
  SIDs and STARs (AIM-1)
- B12. Airport/Facility Directory (AIM-3)
- B13. NOTAM (AIM-3A)
- B14. FDC NOTAMs (AIM-3A)
- B15. Special Notices (AIM-3)
- B16. Area Navigation Routes (AIM-3)
- B17. Direct Routes (AIM-1, Airspace; 91.116f, 91.119, 91.121b)
- B18. Restrictions to En Route Nav. Aids (AIM-3)
- B19. Substitute Route Structure (EOG-39)

B20. *Flight Planning Computer Operations (Ch. XII-IFH)*
- B21. Wind correction angle-heading
- B22. GS
- B23. ETE/ETA
- B24. Fuel estimates

B30. *Aircraft Performance (Aircraft Owner's Handbook, VFR EOG-33, EOG-32, AC 90-14A)*
- B31. Takeoff distance
- B32. Climb performance
- B33. Cruise performance (VFR EOG-38)
- B34. Fuel flow
- B35. Landing performance
- B36. Airspeed: IAS, CAS, EAS, TAS
- B37. Placards and instrument markings
- B38. Hovering

B40. *Aircraft Operating Limitations (documents in aircraft, AC 60-6A)*
- B41. Weight and balance (EOG-21, AC 91-23)
- B42. Instrument limit markings and placards (91.31)
- B43. Maximum safe crosswind (VFR EOG-27)
- B44. Turbulent air penetration

B50. *Aircraft Systems (Ch. IV-IFH)*
- B51. Pitot-static system (EOG-10)
- B52. Vacuum/gyroscopic (EOG-24)
- B53. Electric/gyroscopic
- B54. Compass

C10. *Fundamentals of Weather*
- C11. Composition of the atmosphere (Ch. 1-AW)
- C12. Temperature (Ch. 2-AW)
- C13. Pressure (Ch. 3-AW)
- C14. Circulation (Ch. 4-AW)
- C15. Moisture (Ch. 5-AW)
- C16. Stability and wind (Ch. 6-AW)
- C17. Clouds (Ch. 7-AW)
- C18. Airmasses and fronts (Ch. 8-AW)
- C19. Turbulence (Ch. 9-AW)

C20. *IFR Weather Hazards*
- C21. Icing (Ch. 10-AW)
- C22. Thunderstorms (Ch. 11-AW, AIM-1)
- C23. Fog and obstructions to vision (Ch. 12-AW)

C30. *Aviation Weather Observations and Reports*
- C31. Aviation weather reports (SA) (AWS-2)
- C32. Pilot weather reports (PIREPs, UA) (AWS-3)
- C33. Radar weather reports (RAREPs) (AWS-3)
  Radar summary chart (AWS-7)
- C34. Surface analysis (AWS-5)
- C35. Weather depiction chart (AWS-6)
- C36. Upper wind chart (AWS-9)
- C37. Freezing level chart (AWS-10)
- C38. Stability chart (AWS-11)
- C39. Constant pressure charts (AWS-13)

C40. *Aviation Weather Forecasts*
- C41. Terminal (FT) (AWS-4, EOG-5)
- C42. Area (FA) (AWS-4, EOG-5)
- C43. Winds and temperatures aloft (FD, AWS-4, and chart AWS-9)
- C44. Severe weather (AWS-4)
  Hurricane advisories (WH); convective outlook (AC); Weather Watch (WW); severe weather outlook chart (AWS-12)
- C45. TWEB route forecast and synopsis (AWS-4)
- C46. Inflight advisories (WS, WA, WAC) (AWS-4)
- C47. Prognostic charts:
  Surface (AWS-8); Significant Weather (AWS-8); Constant Pressure (AWS-14); Tropopause and Wind Shear (AWS-15)

C50. *Weather Tables and Conversion Graphs (AWS-16)*
- C51. Icing intensities
- C52. Turbulence intensities
- C53. Locations of probable turbulence
- C54. Standard temperature, speed, and pressure conversions
- C55. Density altitude

C60. *Weather Facilities*
- C61. FSS weather service (AIM-2, 3; EOG-19)
  Telephone numbers (AIM-2)
  Remote weather radar display (AIM-3)
  Scheduled weather broadcast (AIM-3)

C62. ATIS (AIM-1, 3)
C63. Weather Service Forecast Offices (AIM-1)
TWEB, PATWAS (AIM-3)

DEPARTURE

D10. *Authority and Limitations of Pilot*
D11. Pilot in command (91.3, 91.4)
D12. Emergency action (91.3)
Deviation from rules (91.75)
D13. Required reports
Emergency deviation (91.3c)
Malfunction of equipment (91.33c, 91.129)

D20. *Flight Plan*
D21. Where to file (AIM-3)
D22. When to file (AIM-1)

D30. *Departure Clearance (AIM-1, EOG-35)*
D31. "Cleared as filed"
D32. Amended clearance
D33. Pre-taxi clearance procedure
D34. Clearance delivery (AIM-3)

D40. *Taxi and Takeoff Procedures (AIM-1)*
D41. Taxi limits (AIM-1, EOG-26, 28)
D42. ATC control sequence (AIM-1)
D43. Airport advisory service (AIM-3)
D44. ATIS (AIM-3)

D50. *Departure Procedures (AIM-1)*
D51. Obstruction clearance minimums (approach chart book)
D52. Departure control procedures (non-radar)
D53. Departure control procedures (radar)
D54. SIDs
D55. Speed adjustments
D56. Terminal area limitations

E10. *VOR Accuracy Check (AIM-1, EOG-22, 91.25)*
E11. VOT (AIM-3, L-chart legend)
E12. VOR ground check points (AIM-3)
E13. VOR airborne check points (AIM-3)
E14. VOR dual receiver check

E20. *Pretakeoff Instrument Check (IFH, pages 68 and 249)*
E21. Pre-start instrument indications
E22. Taxi test

E30. *Transponder (EOG-25, AIM-1)*
E31. Operation
E32. Switching code
E33. Emergency use

F10. *Airport Facilities (AIM-3, 3A, charts)*
F11. Service (AIM-3, 3A)
F12. Runways (EOG-26, 28; AIM-1)
F13. Airport lighting (AIM-1, EOG-33)
F14. Communications (AIM-3)

F20. *FSS Facility (AIM-1, EOG-39)*
F21. Flight plan service
F22. Traffic advisories (AIM-3)
F23. Communications (AIM-3)
F24. Weather advisories (AIM-3, AWS-1)

F30. *Departure Control Facility*
F31. Communications (AIM-3, IAPC)
F32. Geographical area

EN ROUTE

G10. *En Route Limitations (AIM-1)*
G11. Altitude limitations (91.119, EOG-8): MEA, MOCA, MCA, MRA, MAA
G12. Cruising altitudes (91.121, 91.109)
G13. Courses to be flown (91.123, 91.67)
G14. Altimeter settings (91.81)
G15. Positive Control Airspace (91.97)
G16. Special Use Airspace (91.95, AIM-1, En Route Charts)

G20. *En Route Procedures (AIM-1, Ch. XI-IFH)*
G21. Radar environment
vectors, reporting, handoffs
G22. Non-radar environments
reporting, handoffs
G23. Altitude
cruise, maintain, climb, descend, VFR on top
G24. Delays
clearance limits, holding
G25. Securing weather information (AWS-1)

G30. *ATC clearances*
- G31. Phraseology (Ch. VIII — IFH, AIM-1, EOG-11, 34, 35)
- G32. Responses and read backs (AIM-1, 91.125)

G40. *Oxygen Requirements (91.32)*
- G41. Pilot and crew requirements
- G42. Passenger requirements

G50. *Emergencies (AIM-1, EOG-2)*
- G51. Difficulty with communications
- G52. Malfunction of equipment
- G53. Lost
- G54. Lost communications (91.127, EOGs 36, 37, 38)
- G55. Malfunction reports (91.129, 91.33e)
- G56. Deviation from clearance (91.75c)

H10. *Radio Orientation (Ch. VII—IFH)*
- H11. VOR (EOG-7 and 14)
- H12. NDB (EOG-23)
- H13. LOC (EOG-7 and 14)
- H14. RNAV (EOG-30)

H20. *Establishing Radio Fixes and Waypoints (Ch. VII—IFH)*
- H21. VOR radials
- H22. VOR-DME (Ch. VI—IFH, AC 90-62, AC 170-3B)
- H23. ADF (EOG-23)
- H24. ADF-VOR/LOC
- H25. RNAV (EOG-30)

H30. *En Route Computer Operations (Ch. XII—IFH)*
- H31. GS
- H32. ETE/ETA
- H33. Altitude or speed conversions
- H34. Fuel

H40. *Attitude Instrument Flying (Ch. V—IFH)*
- H41. Interpretation of flight instruments
- H42. Aircraft control: pitch, bank, power
- H43. Basic maneuvers
  - straight and level
  - climbs and descents
  - turns (EOG-18)
- H44. Unusual attitudes
- H45. Flight patterns

H50. *Unusual Flight Conditions (AC 90-12A)*
- H51. Thunderstorms (AC 00-24, page 111-AW)
- H52. Structural icing (Ch. 10-AW)
- H53. Induction icing (Ch. 10-AW)
- H54. Use of anti/deicing equipment
- H55. Frost
- H56. Clear air turbulence (AC 00-17)

J10. *Radio Navigation Facilities (Ch. VII—IFH, AIM-1)*
- J11. VOR/VORTAC
- J12. NDB
- J13. LOC
- J14. DF
- J15. RADAR

J20. *Airway Route System (En Route Chart Legend)*
- J21. Victor/jet airway limits
- J22. Route identification
  - military, substitute, unusable
- J23. Altitude limits: MOCA, MEA, MRA, MCA, MAA
- J24. Reporting points: compulsory, non-compulsory
- J25. Fixes, waypoints
- J26. Geographical limit: VOR change-over points, altimeter setting boundary, time zone boundary
- J27. Airspace designation

J30. *Special Use Airspace (AIM-1, chart legends)*
- J31. Prohibited area
- J32. Restricted area
- J33. Climb corridor
- J34. Warning area
- J35. Alert area, military operations area

J40. *ARTCC Facility (Ch. X—IFH, AIM-1)*
- J41. ARTCC remote frequencies (En Route Chart)
- J42. Geographical area of control (En Route Chart)
- J43. Advisories, services, assistance

J50. *En Route Weather Services (AIM-3)*
- J51. EFAS (AWS-1)
- J52. TWEB (AWS-1)
- J53. ARTCC significant weather advisories

J60. *Fixed-wing Aerodynamic Factors (Ch. III—IFH, AC 61-23A)*
- J61. Aerodynamic forces
- J62. Straight and level
- J63. Turns
- J64. Climbs
- J65. Descents
- J66. Stalls

J70. *Rotary-wing Aerodynamic Factors (BHH)*
- J71. Vibrations (Ch. 2)
- J72. Dissymmetry of lift (Ch. 2)
- J73. Translation (Ch. 2)
- J74. Rotor disc-loading, coning, and flapping (Ch. 9)
- J75. Settling with power (Ch. 9)
- J76. Ground resonance (Ch. 9)
- J77. Speed limitations (Ch. 9)
- J78. Autorotation particulars (Ch. 11)
- J79. Factors affecting performance (Ch. 11)

J80. *Physiological Factors (Ch. II—IFH, AIM-1)*
- J81. Physiologic altitude effects
  hypoxia, aerotitis, aerosinusitis (AC 91-8A)
- J82. Hypoxic effects
  alcohol, hyperventilation, drugs, carbon monoxide (AC 20-32A)
- J83. Sensations of instrument flying (AC 60-4)
- J84. Spatial disorientation (AC 60-4)

ARRIVAL

K10. *Approach Control (AIM-1, Ch. XI—IFH)*
- K11. Radar control
  STARs, vectors (AC 90-41C), approach clearances
- K12. Nonradar control
- K13. Aircraft speed (91.70)
- K14. Procedure turns/holding patterns
- K15. Visual and contact approaches

K20. *Holding Procedures*
- K21. Holding pattern entry
- K22. Shuttle
- K23. Changing altitude
- K24. Timing
- K25. Adjustments and corrections

K30. *Precision Approaches (AC 90-1A; IFH, page 161; AIM-1)*
- K31. Initial approach/procedure turn (91.116h)
- K32. Vectors to final approach (91.116f)
- K33. Intermediate approach
- K34. Final approach
- K35. Glide slope
- K36. Decision height (91.117b)
- K37. Inoperative components (91.117c)
- K38. Reports

K40. *Nonprecision Approaches (AC 90-1A, AIM-1)*
- K41. Initial approach/procedure turn (91.116h)
- K42. Vectors to final approach (91.116f)
- K43. Intermediate approach
- K44. Final approach
- K45. Minimum descent altitude (91.117b)
- K46. Inoperative components (91.117c)
- K47. Reports

K50. *Missed Approach (91.117b, AC 90-1A, AIM-1)*
- K51. Precision approach
- K52. Nonprecision approach
- K53. Loss of visual cues
- K54. Low approach (practice approaches)

K60. *Landing Procedures (AIM-1)*
- K61. Noncontrolled airport (91.89)
- K62. Controlled airport (91.87)
- K63. Landing minimums (91.116b)
- K64. Close flight plan (91.83)

L10. *Logging of Flight Time*
- L11. Instrument flight time (61.51(c)(4))
- L12. Conditions for simulated instrument flight (91.21)
- L13. Information required (61.51(c)(4))
  Instrument approaches
  Safety pilot
- L14. Pilot in command (61.51(c)(2))

L20. *Radio Orientation on Approach (Ch. VII—IFH)*

- L21. Relation to LOC on front and back course (Ch. VI—IFH; EOG-7)
- L22. Glide slope (Ch. VI—IFH)
- L23. LOC and glide slope (EOG-7, Ch. VI—IFH)
- L24. Marker beacons (Ch. VI—IFH)
- L25. Compass locators (EOG-23)
- L26. NDB (EOG-23)
- L27. VOR/VORTAC (EOG-7)
- L28. LOC type, LDA, SDF (AIM-1)

L30. *Wake turbulence (AIM-1, AC 90-23D)*

- L31. Landing hazards
- L32. Takeoff hazards
- L33. Inflight hazards
- L34. Wake turbulence theory

M10. *Terminal Area (IAPC, AIM-3)*

- M11. Approach control facility, frequencies, area
- M12. FSS (AIM-1)
  - Airport advisories
  - Flight plan service
  - Weather service

M20. *Instrument Approach Procedure Chart—Planview (AC 90-1A, IAPC legend)*

- M21. Facility frequencies and services
- M22. Procedural tracks
- M23. Fixes and markers
- M24. Obstructions
- M25. Special use airspace
- M26. Radio aids
- M27. Minimum altitudes

M30. *Instrument Approach Procedure Chart—Profile (AC 90-1A, IAPC legend)*

- M31. Altitude limits
- M32. Descent pattern/glide slope
- M33. Facilities/fixes

M40. *Instrument Approach Procedure Chart Aerodrome Sketch (AC 90-1A, IAPC legend)*

- M41. Runway configuration and specifications
- M42. Approach light systems
- M43. Elevations
  - Obstacles, TDZE, and aerodrome
- M44. Airport taxi chart

M50. *Instrument Approach Procedure Chart—Minimums Section (AC 90-1A, IAPC legend)*

- M51. Aircraft category
- M52. DH/MDA
- M53. HAT
- M54. HAA
- M55. Minimum visibility
  - miles/RVR
- M56. IFR takeoff minimums and departure procedures
- M57. IFR alternate minimums
- M58. Civil RADAR instrument approach minimums

M60. *Approach Facilities (AIM-1, IFH)*

- M61. ILS
- M62. LDA
- M63. SDF
- M64. VOR/VORTAC
- M65. NDB
- M66. Marker beacons, compass locators
- M67. VASI

NOTE.—Applicants for original issuance of a Ground Instructor Certificate with an instrument rating should refer to AC 143-1D, Ground Instructor Written Test Guide, Basic-Advanced, for a study outline and sample test on Fundamentals of Instructing.

Sample Test

The following items are typical of those in the official FAA written test. Answers and explanations or references are given on the pages following the sample test.

NOTE.—The sample items, answers, and analyses are based upon procedures and regulations in effect at the time of preparation of this publication. Regulatory and procedural changes subsequent to the date of publication should be checked for their effect on the applicable item.

1. By which three methods is aeronautical information concerning the National Airspace disseminated?

1—The Airman's Information Manual, Advisory Circulars, and FSS Advisories.
2—Aeronautical Charts, the Airman's Information Manual, and National NOTAMS.
3—Parts II, III, and IV of the Airman's Information Manual.
4—FSS radio communications, telephone, and personal briefings.

2. Which documentation or entry verifies the validity of the Airworthiness Certificate?

1—Maintenance records show that an annual inspection has been performed within the last 12 calendar months.
2—The Airworthiness Certificate is still in the aircraft and has not been surrendered, suspended, or revoked.
3—The date on the Airworthiness Certificate indicates it has been reregistered within the last 12 calendar months.
4—Maintenance records show a "return to service" statement for the required inspections.

* * * * * *

Over the past 6 months, the pilot utilized all the aircraft listed in the following logbook excerpts for the furtherance of business. The pilot holds a Commercial Pilot Certificate for airplanes and rotorcraft, and also holds single and multiengine land class ratings for the airplane category and a helicopter class rating for rotorcraft. The pilot's Second-Class Medical Certificate was issued on March 26, last year. Today is March 27. Test items 3, 4, and 5 are based on the information contained in the following excerpts from the pilot's logbook.

* * * * * *

Date	*Aircraft*	*Reg. Number*	*Cat. Class*	*PIC*	*SIC*	*Day*	*Night*	*Instr.*	*No. Appr.*	*No. Lnds.*
10/18	TWINN	N22Y	AMEL	.7		.7				1 day
10/21	TWINN	N22Y	AMEL	1.0		1.0				1 day
11/1	UNIE	N101N	ASEL	2.4		2.4		1.3	4	4 day
11/7	TWINN	N22Y	AMEL	.5	1.9	.5	1.9			1 day
										3 night
11/17	WHAP	N30P	RH	1.2		1.2		1.0	1	1 day
12/3	WHAP	N30P	RH	2.0		2.0		1.4	3	3 day
12/6	TWINN	N22Y	AMEL	1.4		1.4				3 day
12/10	WHAP	N30P	RH	.9		.9		.6	1	2 day
12/21	UNIE	N101N	ASEL		1.2		2.1	1.2	2	2 night
1/2	TWINN	N22Y	AMEL	1.7		1.0	.7	1.0	1	2 day
										2 night
1/6	WHAP	N30P	RH	.4		.4				1 day
1/14	UNIE	N101N	ASEL	2.8		1.6	1.2			3 day
										1 night
1/19	TWINN	N22Y	AMEL	1.1	.5	1.1	.5	1.0	2	2 day
										1 night
3/16	WHAP	N30P	RH	.5		.5				5 day
3/22	WHAP	N30P	RH	.8		.8				3 day
3/26	TWINN	N22Y	AMEL	1.7		1.7		.5	1	1 day

3. What is the status of the pilot's Medical Certificate?

1—It is valid for this type of operation until the last day of March, next year.

2—It expires at the end of March, this year.

3—It must be renewed this month if the pilot continues flying for the furtherance of business.

4—It expires at the end of August, this year.

4. In which aircraft, if any, is the pilot current to carry passengers?

	Day	*Night*
1—	TWINN only	None
2—	TWINN only	TWINN only
3—	TWINN and WHAP only	None
4—	TWINN, UNIE, and WHAP	TWINN only

5. In which aircraft, if any, is the pilot current to fly IFR?

1—None.
2—TWINN only.
3—TWINN and UNIE only.
4—TWINN, UNIE, and WHAP.

6. Can a pilot overcome vertigo?

1—No, a pilot susceptible to vertigo should avoid instrument flight.

2—Yes, by closing the eyes and adjusting to muscular sensations.

3—Yes, by rotating the head rapidly to cancel the sensations of the inner ear.

4—Yes, by relying on the sense of sight to control the airplane.

7. A pilot is using the magnetic compass to establish and maintain a heading. If the compass is operating normally, it will indicate a turn toward

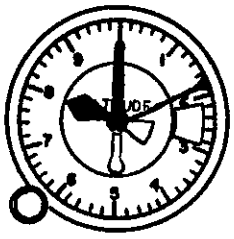
1—west when entering a right turn from a north heading.

2—north when entering a right turn from an east heading.

3—south when the airplane is accelerating on an east heading.

4—east when accelerating on a north heading.

8. Which altitude or flight level is indicated by the altimeter?



1—8,000 feet
2—FL 180
3—1,800 feet
4—FL 280

9. Why is an encounter with wake turbulence behind a heavy airplane more dangerous near the ground than at altitude?

1—Ground effect amplifies the vortices.

2—The dense air near the ground makes the vortices stronger and more effective.

3—Momentary loss of control is usually more disastrous near the ground.

4—The ground deflects vortices back into the air with unpredictable results.

10. If ATC issues you a clearance that would result in a deviation from Federal Aviation Regulations, you

1—may proceed as cleared.

2—may accept the clearance but must inform ATC of the deviation.

3—should accept the clearance but *not* comply with that portion which deviates from a rule.

4—should reject the clearance and request an amended clearance.

11. What is the pilot's responsibility with regard to the use of a SID or STAR on an IFR flight?

1—A SID may be issued without request, but a STAR will be issued only by pilot request.

2—The pilot should be prepared for and should accept a SID or STAR to simplify the task of copying the clearance.

3—A SID or STAR is *not* required and will *not* be issued unless the pilot requests one.

4—The pilot should accept a SID or STAR in the clearance to avoid delays en route.

12. An airport has *no* authorized instrument approach. It may be listed as an alternate on an IFR flight plan if the current weather forecast indicates, at the estimated time of arrival, the ceiling and visibility at that airport will

1—permit a descent from the MEA, an approach, and a landing under basic VFR.

2—be at least 800 feet and 2 miles.

3—be at least 900 feet and 2 miles.

4—be at least 1,000 feet and 1 mile.

13. You are flying a DME arc and have been cleared for an ILS approach. When should you start your turn to the localizer?

1—At the appropriate "lead radial" depicted on the instrument approach chart.

2—When the localizer needle of the receiver tuned to the localizer frequency centers.

3—One-half mile from the localizer course.

4—When the localizer needle of the receiver tuned to the localizer frequency begins to deflect.

14. What is the meaning of the term "Radar Vectoring" when it appears on an instrument approach chart?

1—All approaches must be made by radar vectors to the final approach fix.

2—Radar vectoring is available but ASR and PAR approaches are *not* available.

3—Radar vectoring and ASR approaches are available.

4—Radar vectoring, ASR, and PAR approaches are available.

15. The rate of descent required to remain on the glide path during an ILS approach will

1—increase if the groundspeed is increased.

2—remain the same regardless of true airspeed.

3—remain the same regardless of groundspeed.

4—increase if the groundspeed is decreased.

16. Which is a significant difference between an SDF approach and an ILS approach?

1—The SDF course is usually wider and offset from the runway centerline.

2—The SDF utilizes bone markers instead of fan markers for range information.

3—Landing minimums are generally lower for the SDF due to greater precision of the equipment.

4—The identification signal is prefixed with "S" instead of "I" as for ILS.

* * * * * *

Use the RMI illustrations shown below for test items 17 and 18.

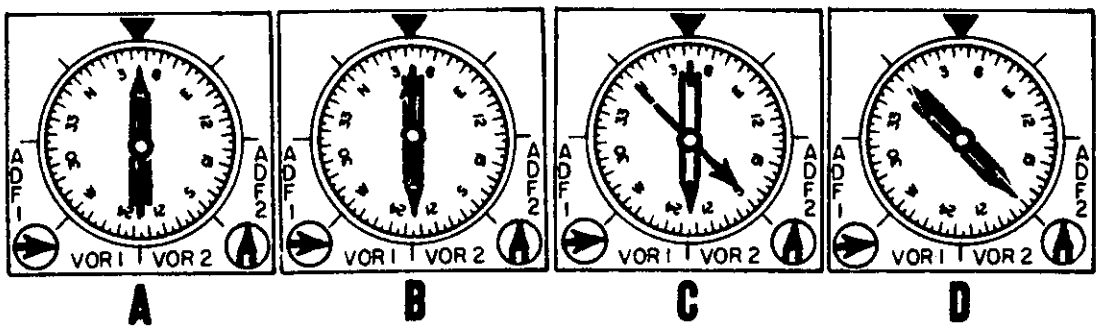
17. Which RMI depicts an accurate VOR equipment check on the VOT?

1—A
2—B
3—C
4—D

18. What is the magnetic bearing to the station as indicated by the RMI in illustration "D"?

1—135°
2—180°
3—315°
4—360°

* * * * *



19. Above which cabin pressure altitude must each occupant of an unpressurized aircraft be provided supplemental oxygen?

1—10,000 feet
2—12,500 feet
3—14,500 feet
4—15,000 feet

20. How much weight must be placed at point "X" to balance the plank on the fulcrum? (See illustration below.)

1— 10 pounds
2—100 pounds
3— 60 pounds
4—600 pounds

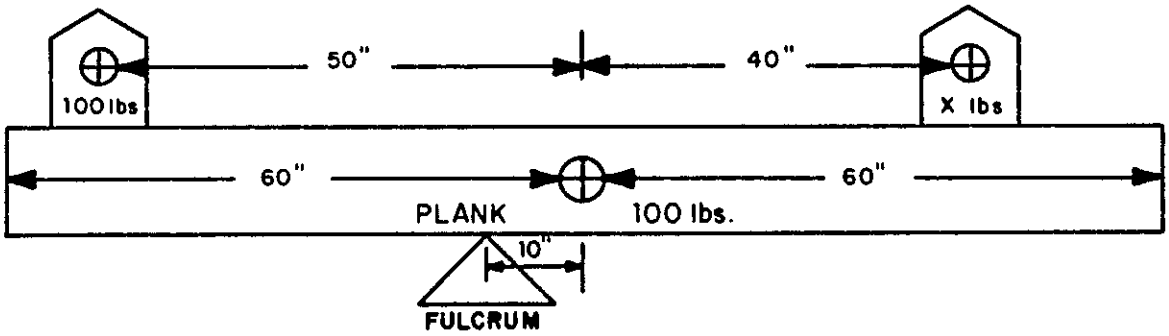
23. Where will pressure change more rapidly as you move through the air vertically?

1—Air near the tropopause.
2—Saturated air.
3—Within a high pressure area.
4—More dense air near the surface.

24. What conditions exists in the troposphere when the temperature increases with altitude?

1—Adiabatic lapse rate.
2—Chinook wind.
3—Temperature inversion.
4—Katabatic wind.

* * * * *



* * * * *

21. What is the maximum moment/100 allowed at takeoff gross weight (3,300 lbs.) for this airplane so that the moment will still be within limits after a 390-pound fuel burn? (Use tables on page 17.)

1—2,494
2—2,583
3—2,787
4—2,795

22. Under which condition is an aft CG most critical?

1—During takeoff.
2—In a stall.
3—During a steep turn.
4—In high speed level flight.

25. What is the major motivating force for all weather phenomena over the earth?

1—Heat energy radiated by the sun.
2—Coriolis force combined with pressure gradient.
3—The ever changing state of moisture.
4—The instability of the wind and moisture.

26. How is moisture added to unsaturated air?

1—Adiabatic cooling.
2—Condensation, dew, or frost.
3—Sublimation or evaporation.
4—Melting or supersaturation.

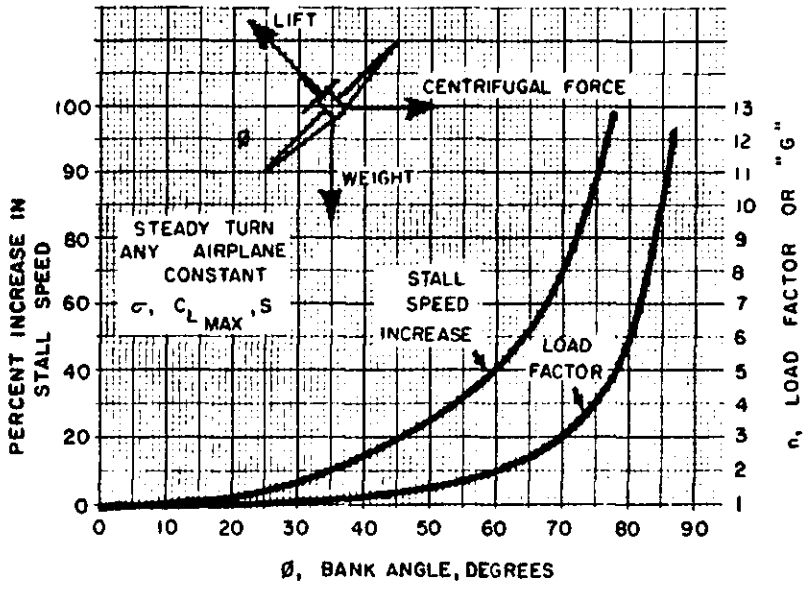
GROSS WEIGHT MOMENT LIMITS

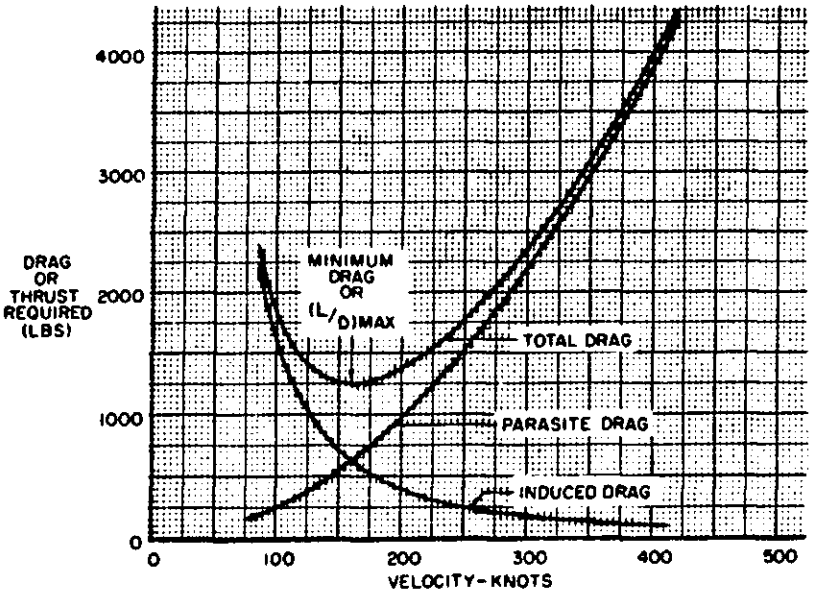
Gross Weight	Minimum Moment 100	Maximum Moment 100
2900	2263	2485
2910	2273	2494
2920	2284	2502
2930	2295	2511
2940	2306	2520
2950	2317	2528
2960	2328	2537
2970	2338	2545
2980	2349	2554
2990	2360	2562
3000	2371	2571
3010	2382	2579
3020	2393	2586
3030	2404	2594
3040	2415	2601
3050	2426	2609
3060	2437	2616
3070	2448	2624
3080	2460	2631
3090	2471	2639
3100	2482	2646
3110	2493	2654
3120	2504	2661
3130	2515	2669
3140	2527	2676
3150	2538	2684
3160	2549	2691
3170	2561	2699
3180	2572	2706
3190	2583	2714
3200	2595	2721
3210	2606	2729
3220	2617	2736
3230	2629	2743
3240	2640	2751
3250	2652	2758
3260	2663	2765
3270	2675	2773
3280	2686	2780
3290	2698	2788
3300	2709	2795

FUEL		
LEADING EDGE TANKS ARM 75		
GALLONS	WEIGHT	MOMENT/100
5	30	23
10	60	45
15	90	68
20	120	90
25	150	113
30	180	135
35	210	158
40	240	180
45	270	203
49	294	221
55	330	248
60	360	270
65	390	293
70	420	315
75	450	338
80	480	360

The above moment limits are based on the following weight and center of gravity limit data (landing gear down).

WEIGHT CONDITION	FORWARD CG LIMIT	AFT CG LIMIT
3300 lb. (max. take-off or landing)	82.1	84.7
3000 lb	79.0	85.7
2800 lb or less	77.0	85.7





27. What is the stall speed of an aircraft under a 3 "G" load factor if its unaccelerated stall speed is 60 knots? (Use upper chart.)

1— 70 knots

2— 87 knots

3—102 knots

4—140 knots

28. What is the relationship between drag and airspeed? (Use lower chart.)

1—Induced drag increases with increasing airspeed.

2—Total drag at 100 knots is almost identical to that at 250 knots.

3—Parasite drag is greater than induced drag at speeds below 150 knots.

4—L/D MAX occurs at the airspeed that gives the most total drag.

29. If icing conditions exist, why is the ice formed in unstable air usually more serious than ice formed in stable air?

1—Unstable air is able to hold more moisture.
2—The rate of freezing is greater in unstable air.
3—The larger drops of water in unstable air usually form hard clear ice.
4—Turbulence causes the drops to strike all surfaces of the airplane.

30. How are stratus clouds formed?

1—Local vertical currents over flat land carrying moisture to the condensation level.
2—Whole layers of air cooled until condensation takes place.
3—Large mass of air raised to the condensation level by a cold front.
4—Layer of cold moist air moving in from the sea over a warmer land area.

31. The four families of clouds are

1—high, middle, low, and clouds with extensive vertical development.
2—cirrus, stratus, cumulus, and nimbus.
3—alto, stratus, cumulus, and nimbus.
4—cirrus, alto, stratus, and cumulus.

32. What happens when the life cycle of a frontal wave is completed?

1—The front dissipates.
2—The low dissipates and the front returns to its original condition.
3—The front changes from a cold front to a warm front.
4—The front becomes a low pressure trough.

* * * * * *

Test items 33 through 40 are based on the following information:

Excerpt from En Route Low Altitude Chart on page 20.

Cruising altitude	11,000 feet	
Pressure altitude	11,500 feet	
Winds aloft	9,000 feet	12,000 feet
	2830–02	3139–08

* * * * * *

33. What is standard temperature at your cruising altitude?

1—+7°C.
2—+4°C.
3—−3°C.
4—−7°C.

34. What is the density altitude at your cruising altitude?

1—10,250 feet
2—10,500 feet
3—11,600 feet
4—12,000 feet

35. What is the true altitude at your cruising altitude?

1—10,800 feet
2—11,100 feet
3—11,500 feet
4—11,800 feet

36. A portion of your IFR flight as depicted on the chart is described on the flight plan as ". . . SYO direct HBR direct LAW direct DUC. . . ." Which stations are compulsory reporting points?

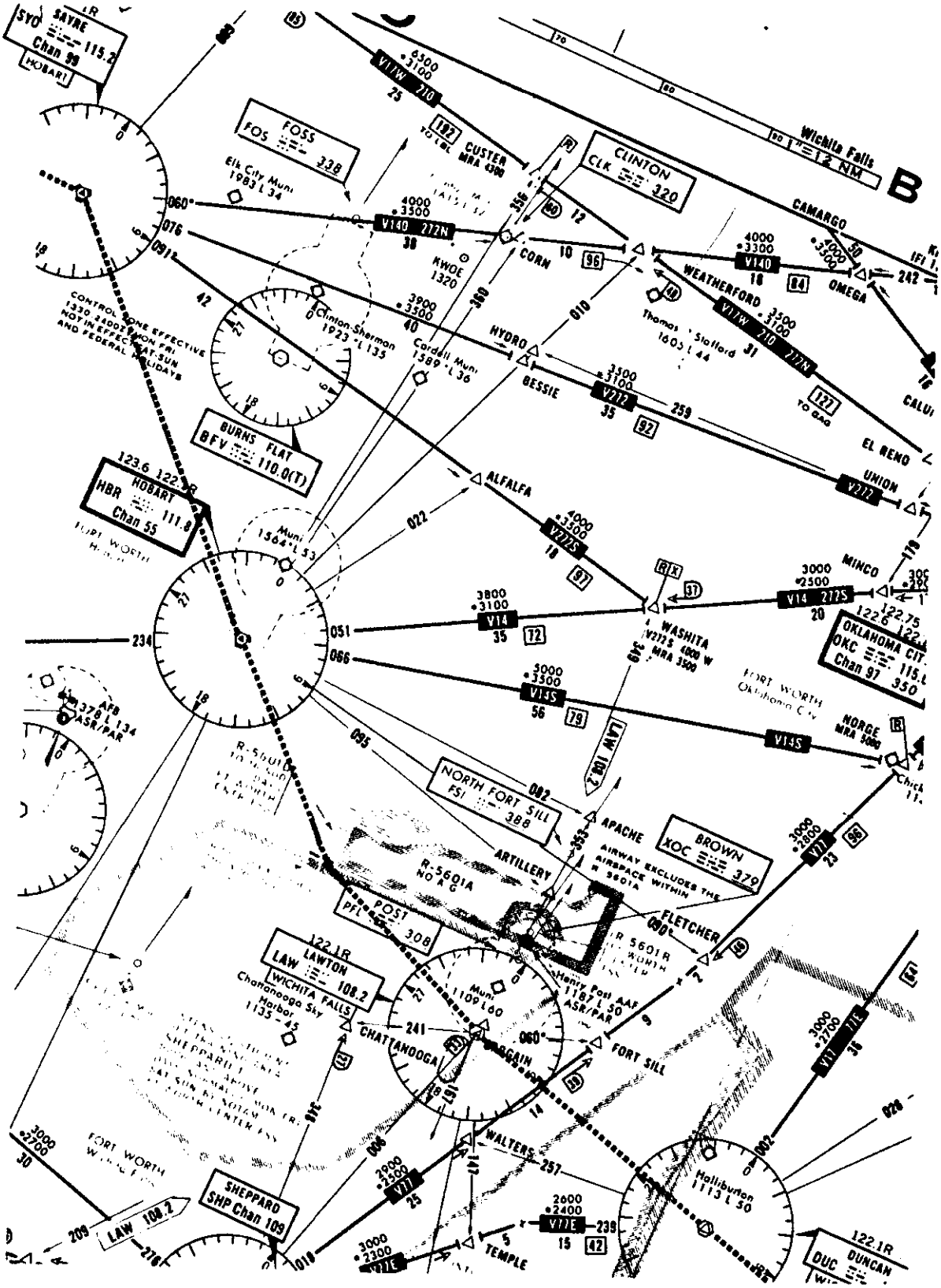
1—HBR only.
2—SYO and HBR only.
3—SYO, HBR, and DUC only.
4—SYO, HBR, LAW, and DUC.

37. What is the highest IFR altitude that ATC could assign on V14?

1—10,000 feet
2—14,500 feet
3—17,000 feet
4—18,000 feet

38. What is the lowest IFR cruising altitude on V14 for the entire segment from HBR to MINCO Intersection?

1—3,100 feet
2—3,800 feet
3—4,000 feet
4—5,000 feet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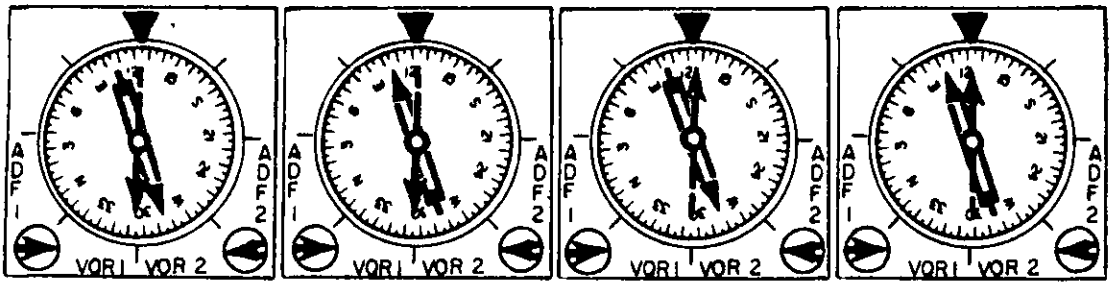


39. Which RMI indication should you receive when you are in position to change course at the corner of Restricted Area R-5601A between HBR and LAW? (VOR-1 is tuned to HBR, and VOR-2 is tuned to LAW.)

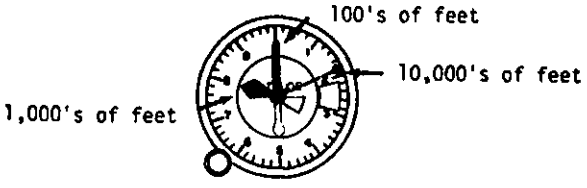
1—A
2—B
3—C
4—D

40. What is the calibrated airspeed from SYO to HBR if the groundspeed is 190 knots? (Use 10°E. Variation.)

1—130 knots
2—155 knots
3—200 knots
4—225 knots

Analysis of Answers to Sample Test Items

Item	*Answer*	*Analysis*
1	2	AIM Part 1. Aeronautical information concerning the National Airspace System is disseminated by three methods—Aeronautical Charts, Airman's Information Manual, and National NOTAMS. The primary method is Aeronautical Charts.
2	4	FAR 91.169. The Airworthiness Certificate is valid only if the "return to service" statement accompanies the inspection report in the logbooks. If an aircraft is inspected and *not* found airworthy, the inspection report will have a list of discrepancies which must be corrected before the Airworthiness Certificate is revalidated.
3	1	FAR 61.23. Any of the Medical Certificates expires on the last day of the 24th month after it was issued for operations requiring a Private Pilot Certificate. Flying for the furtherance of a business is a privilege of the Private Pilot Certificate.
4	4	FAR 61.57. The pilot needs three takeoffs and landings within the last 90 days in the same category and class aircraft for day or night, with the night landings being to a full stop. At least three day landings have been accomplished in each aircraft. Assuming the night landings were to a full stop, the pilot qualifies for night in the TWINN only. It should be remembered that night landings may be used in computing day recency of experience; however, day landings may *not* be used in computing night recency of experience.
5	4	FAR 61.57. The pilot has over 6 hours of instrument flight time in the last 6 months, including at least 3 hours in the same category of aircraft. The pilot has also logged the necessary 6 instrument approaches and therefore is current for IFR flight in all three aircraft.
6	4	AIM Part 1 and AC 61-27B, the Instrument Flying Handbook, Chapter II. Relying on the sense of sight is the only recommended method of overcoming or preventing vertigo.
7	1	AC 61-27B, Chapter IV includes a discussion of magnetic compass errors.
8	2	AC 61-27B, Instrument Flying Handbook, Chapter IV.



9	3	AIM Part 1 and Advisory Circular, AC 90-23D.
10	4	AIM Part 1, Chapter 4. "If ATC issues a clearance that would cause a pilot to deviate from a rule or regulation or, in the pilot's opinion, would place the aircraft in jeopardy, IT IS THE PILOT'S RESPONSIBILITY TO REQUEST AN AMENDED CLEARANCE."
11	2	AIM Part 1, Chapter 4. SIDs and STARs may be issued at the discretion of ATC. The use of either requires the pilot to have at least a textual description. If the pilot does not possess such a description, or for any other reason does not wish to use a SID or STAR, "NO SID" or "NO STAR" should be entered in the remarks section of the flight plan.

Item	Answer	Analysis
12	1	FAR 91.83 states that if no instrument approach procedure has been published in Part 97 for that airport (alternate), the ceiling and visibility must allow descent from the MEA, approach, and landing, under basic VFR.
13	1	Advisory Circular, AC 90–62.
14	2	Advisory Circular, AC 90–1A, paragraph 3.g.(2)(d). "RADAR VECTORING" means radar vectoring is available but radar instrument approach procedures are not available."
15	1	AIM Part 1, Chapter 2. The rate of descent required to remain on the glide slope is determined by the groundspeed.
16	1	AIM Part 1, Chapter 2.
17	3	The indication of the VOR–1 needle in illustration "C" is 180°/TO and 360°/FROM. The magnetic heading of the aircraft is 045°, but this does not influence the VOR signal. Remember that the RMI needle always points toward the station and the tail of the needle indicates the radial. Note that the single-bar needle (#1) is indicating VOR and the double-bar needle (#2) is indicating ADF.
18	2	Since the rotating compass card is controlled by a slaved gyro magnetic compass, the double-bar needle (which is set to ADF) indicates the magnetic bearing to the station. When a radio compass with a fixed compass card is used, the needle indicates the relative bearing of the station, and calculations are necessary to determine the magnetic bearing.
19	4	FAR 91.32.
20	3	The moment on the left side of the fulcrum is 4,000 inch pounds (40″ x 100 lbs.). The weight of the plank is 100 pounds and its CG is 10 inches to the right of the fulcrum; therefore, the *known* moment on the right side of the fulcrum is 1,000 inch pounds (10″ x 100 lbs.). To balance on the fulcrum, the right side needs an additional moment of 3,000 inch pounds. Since the arm of point "X" is 50 inches, 60 pounds of additional weight must be placed at that point.
21	3	After a 390 pound fuel burn, the airplane should weigh 2,910 pounds. The maximum moment/100 for 2,910 pounds is 2494. Add the moment/100 for the 390 pounds of fuel (293) to 2494 to find the maximum moment/100 (2787) at the takeoff gross weight of 3,300 pounds, if you intend to burn this much fuel.
22	2	AC 91–23, The Pilot's Weight and Balance Handbook, Chapter 1.
23	4	AC 00–6A, Aviation Weather, Chapter 3. The air is more dense near the surface due to gravity, therefore, the pressure levels are closer together in the lower atmosphere. Pressure decreases more rapidly as you move vertically through the lower atmosphere than through the upper atmosphere.
24	3	AC 00–6A, Aviation Weather, Chapter 2. Temperature in the troposphere normally decreases at the normal lapse rate (3½° F. or 2° C. per 1,000 feet) as altitude increases. If warmer air overrides colder air, the normal condition is inverted and the situation is called a "temperature inversion."
25	1	AC 00–6A, Aviation Weather, Chapter 2. The earth rotates daily about its axis and revolves yearly around the sun with a tilted axis. The uneven heating of the earth's surface causes temperature changes, which in turn cause pressure changes, winds, and changes in the state of moisture.

Item	Answer	Analysis
26	3	AC 00–6A, Aviation Weather, Chapter 5. Both evaporation and sublimation add moisture to the air. Evaporation is the change of liquid water to water vapor and sublimation is the direct change of moisture from a solid to a gas, or vice versa. Cooling limits the amount of moisture the air can hold. Condensation takes moisture from the air. Frost is a product of sublimation (gas to solid). Melting and supersaturation take place in visible moisture only.
27	3	The chart is actually two charts superimposed on one grid. In this problem, enter the right side of the chart on the load factor "3" and progress left to intersect the "load factor" curve. The intersecting point is at the 70° bank angle. From this point, progress upward to intersect the "stall speed increase" curve, then progress to the left side of the chart to 70%. The unaccelerated stall speed (60 knots) multiplied by 70% yields 42 knots. This figure added to 60 knots yields a stall speed of 102 knots under a 3 "G" load. Try several load factors or bank angles and note the stall speed increase.
28	2	Alternate 1—Incorrect; induced drag decreases with increasing airspeed. Alternate 2—Correct as stated. Alternate 3—Incorrect; parasite drag is less than induced drag at speeds below 150 knots. Alternate 4—Incorrect; L/D MAX occurs at the airspeed that gives the least total drag.
29	3	AC 00–6A, Aviation Weather, Chapter 10. Larger drops of supercooled water freeze slowly and flow back over the surface of the airplane. Air bubbles are eliminated and hard clear ice forms. This form of structural ice is the most serious of the various forms of ice because it adheres so firmly to the aircraft and is very difficult to remove.
30	2	AC 00–6A, Aviation Weather, Chapter 12. Stratus clouds are layered and exist only in stable conditions.
31	1	AC 00–6A, Aviation Weather, Chapter 7. Clouds are divided into families according to height range: high clouds —16,500 to 45,000 feet; middle clouds —6,500 to 16,500 feet; low clouds — surface to 6,500 feet; and clouds with extensive vertical development such as cumulonimbus.
32	2	AC 00–6A, Aviation Weather, Chapter 8. Read the section on frontal wave on page 69.
33	4	The standard temperature at 11,000 feet can be determined by applying the standard lapse rate (2° C. per 1,000 feet). Standard temperature at sea level is +15° C. Using the standard lapse rate, the temperature at 11,000 feet under standard conditions is 22° C. less than +15° C. or −7° C. An aeronautical computer can also be used. Set up 11,000 in the "DENSITY ALTITUDE" window and read standard temperature opposite 11,000 feet pressure altitude in the "AIRSPEED AND DENSITY ALTITUDE COMPUTATIONS" window. When the density altitude and pressure altitude are the same, standard conditions exist.
34	3	Using the "AIRSPEED AND DENSITY ALTITUDE COMPUTATIONS" window of an aeronautical computer, align pressure altitude (11,500 feet) with the temperature at the 11,000-foot cruising altitude (−6° C.). Read 11,600 feet in the DENSITY ALTITUDE" window. A density altitude chart can also be used.
35	2	Using the "ALTITUDE COMPUTATIONS" window of an aeronautical computer, align pressure altitude (11,500 feet) with temperature

Item	Answer	Analysis
		at cruising altitude (−6° C.). Opposite calibrated altitude (11,000 feet cruising altitude in this case) on the inside scale, read true altitude (approximately 11,100 feet) on the outside scale.
36	4	AIM, Part 1, Chapter 4. Under DIRECT FLIGHTS, AIM states that all radio fixes used to define the route of flight automatically become compulsory reporting points. Although LAW and DUC are not designated compulsory reporting points on the chart, they become so since they describe the route of a direct flight.
37	3	FAR 91.81. The low altitude Victor Airways extend up to, but do not include 18,000 feet; therefore, the highest usable thousand-foot level is 17,000 feet. Flight level 180 may be assigned on Jet Airways if the altimeter setting is 29.92 or higher.
38	3	The lowest IFR cruising altitude is the highest thousand-foot level above the highest MEA (3,800 feet). The odd or even thousand-foot level is a regulation for uncontrolled airspace only.
39	2	You are on the 124 Radial of HBR, which is indicated by the tail of the single-bar needle. The position for course change is at the point where the 124 Radial of HBR intersects the 284 Radial of LAW. You have reached that position when the tail of the double-bar needle indicates 284° and the needle points toward the reciprocal, 104°.
40	1	The Magnetic Course from SYO to HBR is 125°. Add 10° easterly variation for a True Course of 135°. Plot the wind vector and complete the wind triangle. Measure the length of the airspeed vector (155 knots TAS). Align the temperature (−6° C.) with the pressure altitude (11,500 feet) in the "AIRSPEED AND DENSITY ALTITUDE COMPUTATIONS" window of the computer. Opposite 155 knots on the outside TAS scale, read 130 knots on the inside CAS scale. Although this type problem is not practical from the pilot's standpoint, it is used to measure the knowledge level of an applicant.

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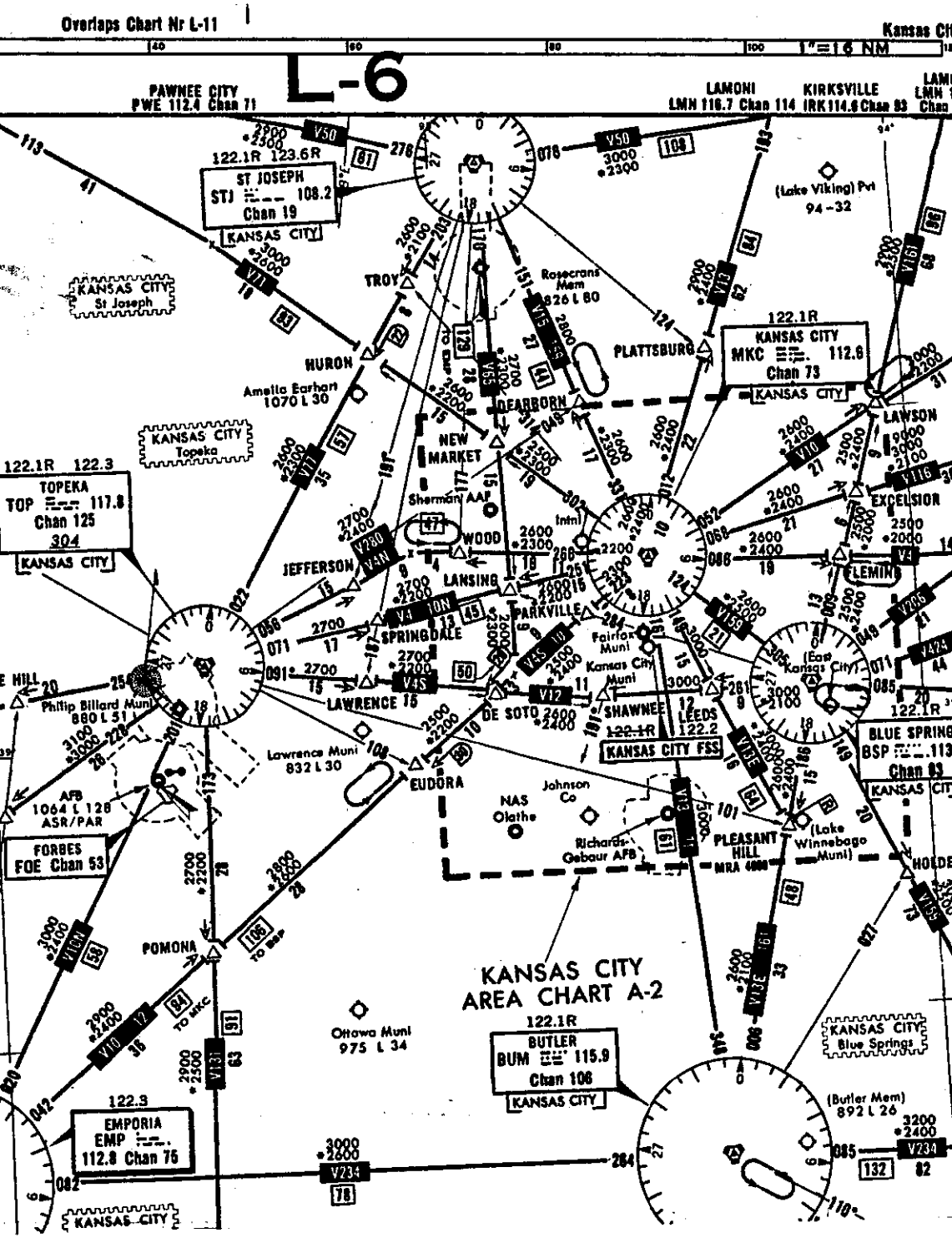
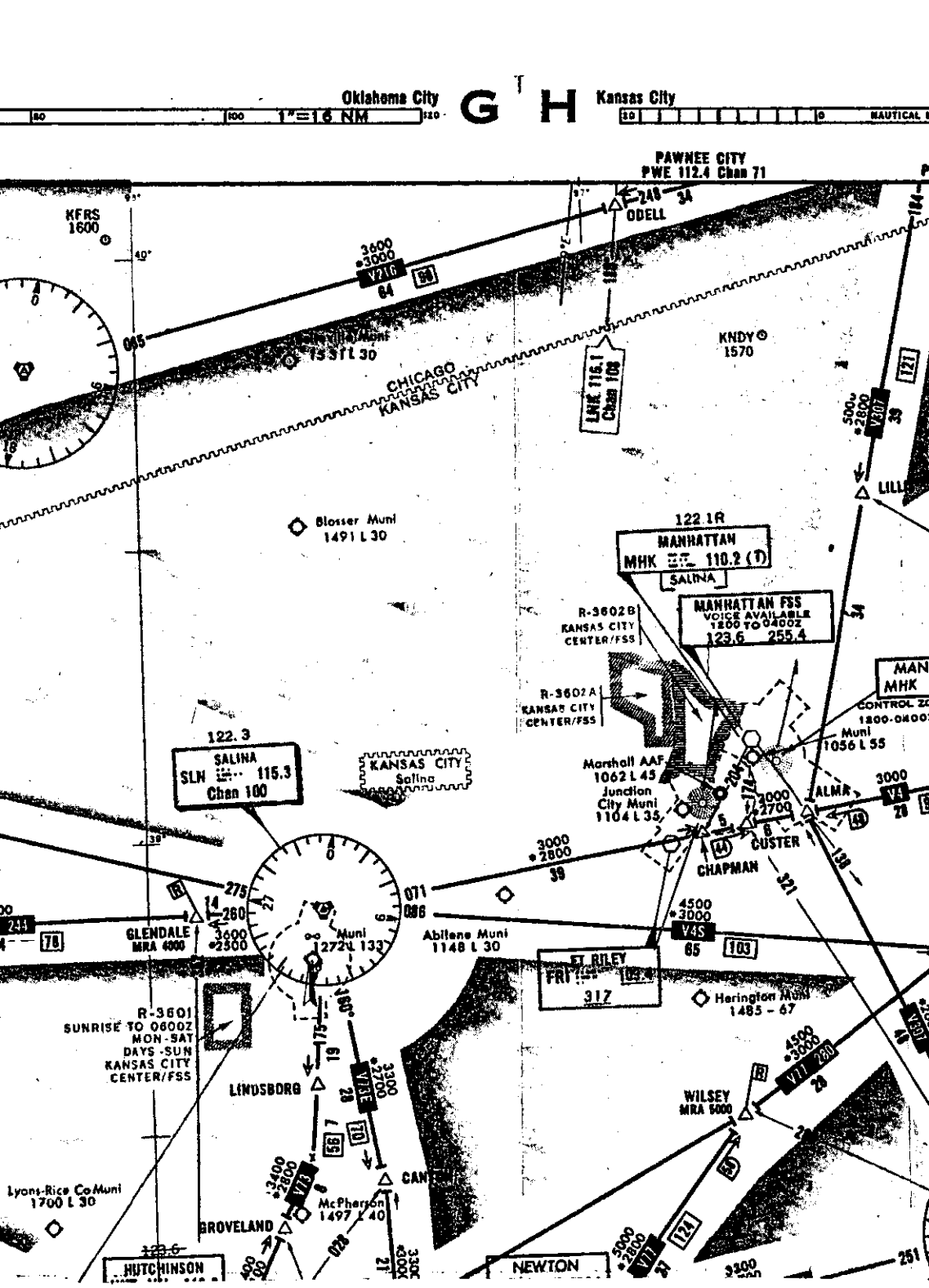


FIGURE 15. Segment of low altitude enroute chart L–6.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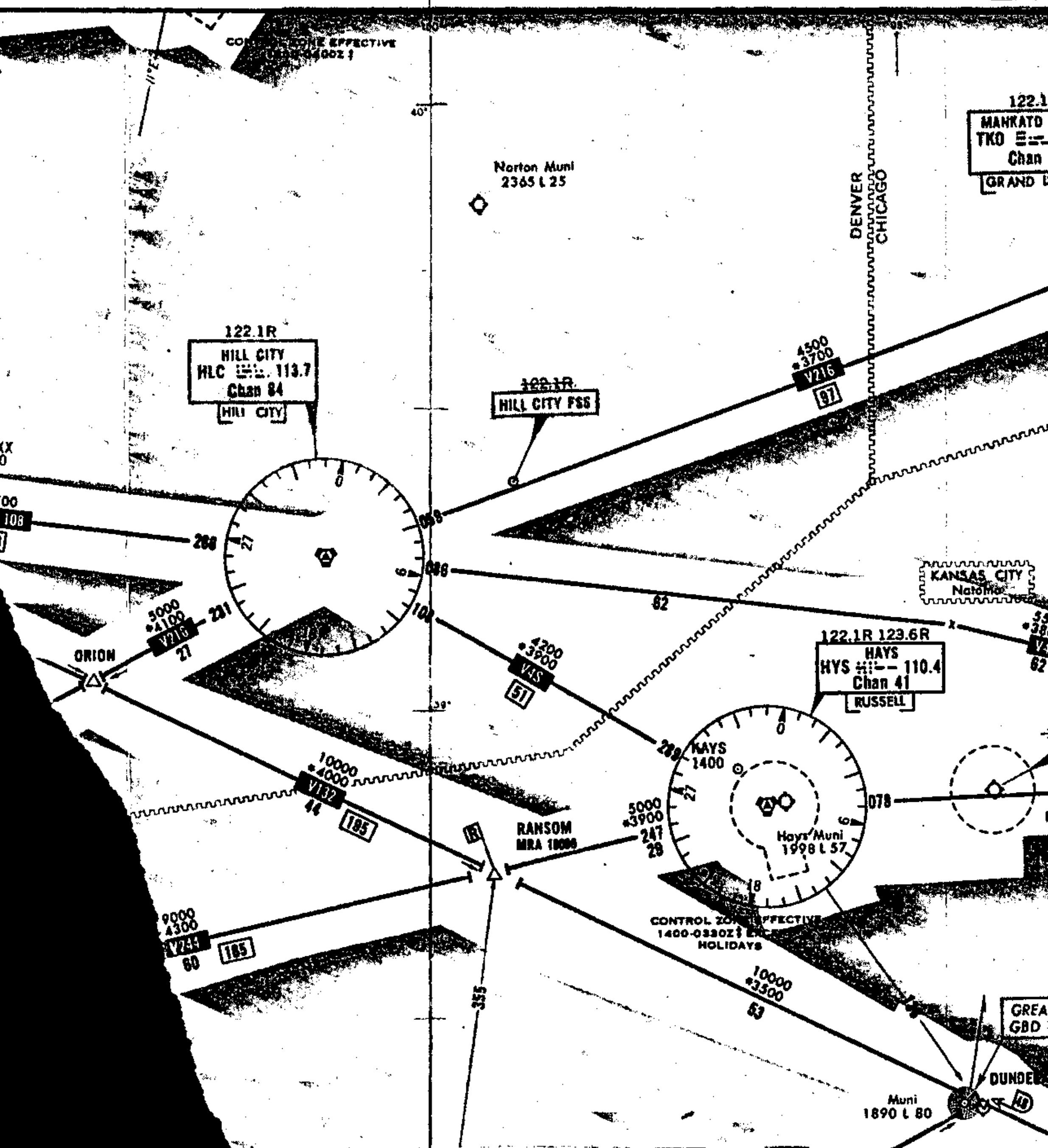
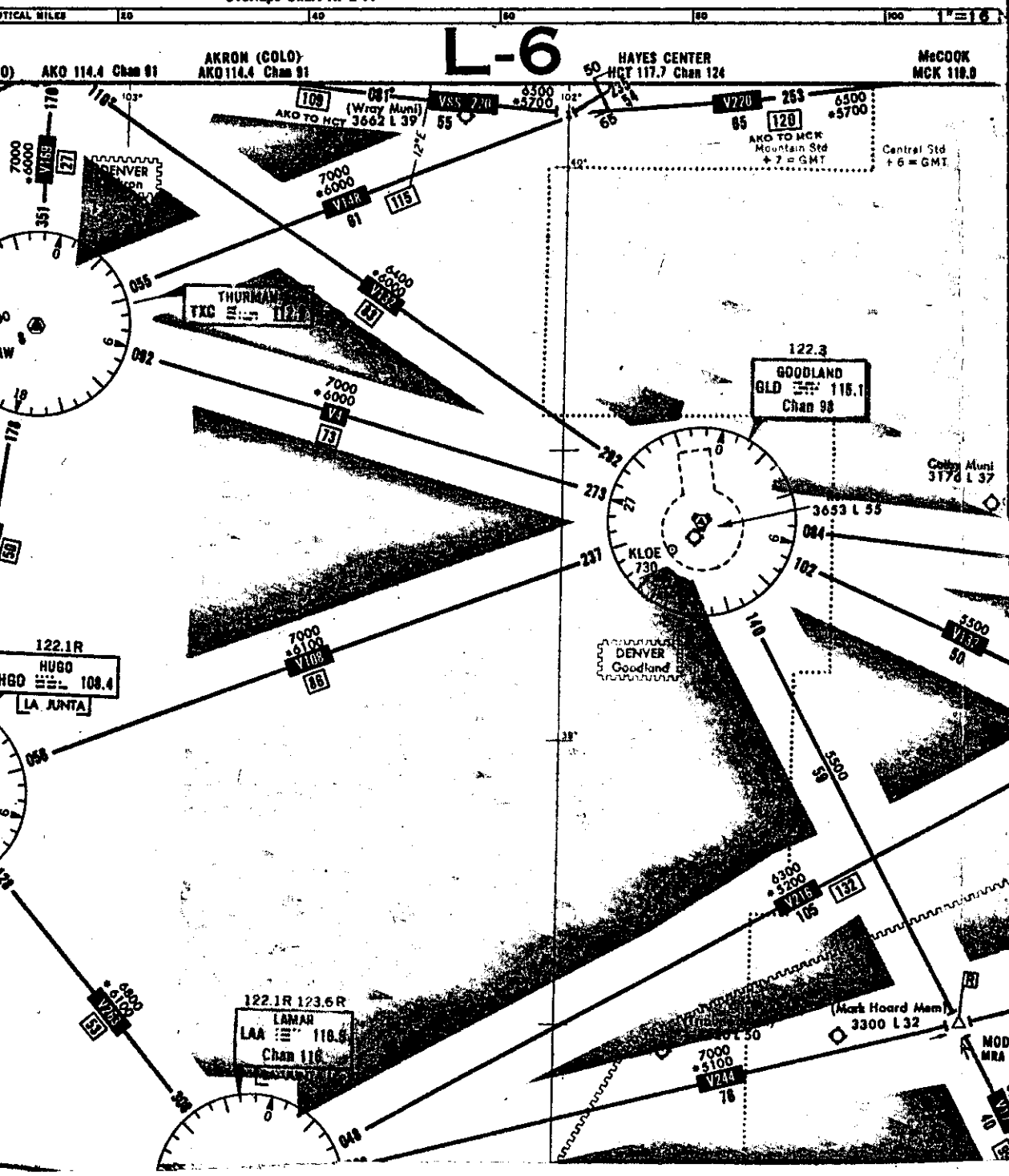
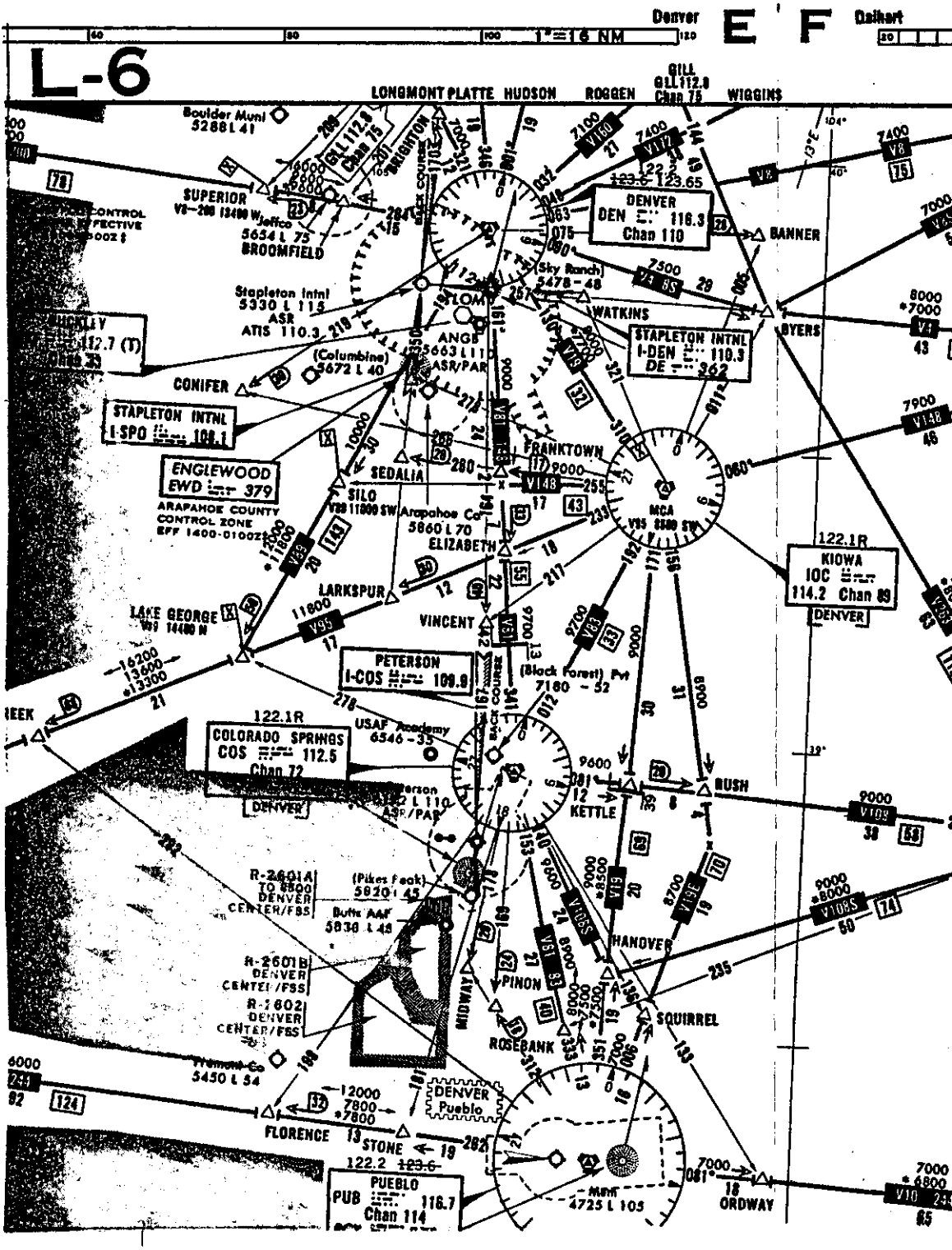


Overlaps Chart Nr L-11




L-6
Denver
E
F
Oakhart
1"=16 NM
LONGMONT
PLATTE
HUDSON
ROGGEN
GILL
GLL 112.8
Chan 75
WIGGINS
Boulder Muni
5288 L 41
SUPERIOR
BROOMFIELD
Jeffco
5654 L 75
DENVER
DEN 116.3
Chan 110
BANNER
Stapleton Intnl
5330 L 115
ASR
ATIS 110.3
LOM
ANGE
(Columbine)
5672 L 40
(Sky Ranch)
5478 - 48
WATKINS
BYERS
STAPLETON INTNL
I-DEN 110.3
DE 362
CONIFER
STAPLETON INTNL
I-SPO 108.1
ENGLEWOOD
EWD 379
ARAPAHOE COUNTY
CONTROL ZONE
EFF 1400-0100Z
SEDALIA
FRANKTOWN
SILO
Arapahoe Co
5860 L 70
ELIZABETH
MCA
LARKSPUR
LAKE GEORGE
VINCENT
PETERSON
I-COS 109.9
(Black Forest) Pvt
7160 - 52
122.1R
KIOWA
IOC 114.2 Chan 89
DENVER
122.1R
COLORADO SPRNGS
COS 112.5
Chan 72
DENVER
USAF Academy
6546 - 35
KETTLE
BUSH
R-2601A
TO 8800
DENVER
CENTER/FSS
(Pikes Peak)
5920 L 45
Butts AAF
5836 L 48
R-2601B
DENVER
CENTER/FSS
R-2602
DENVER
CENTER/FSS
HANOVER
PINON
MIDWAY
ROSEBANK
SQUIRREL
Fremont Co
5450 L 54
DENVER
Pueblo
FLORENCE
STONE
PUEBLO
PUB 116.7
Chan 114
Mem
4725 L 105
ORDWAY

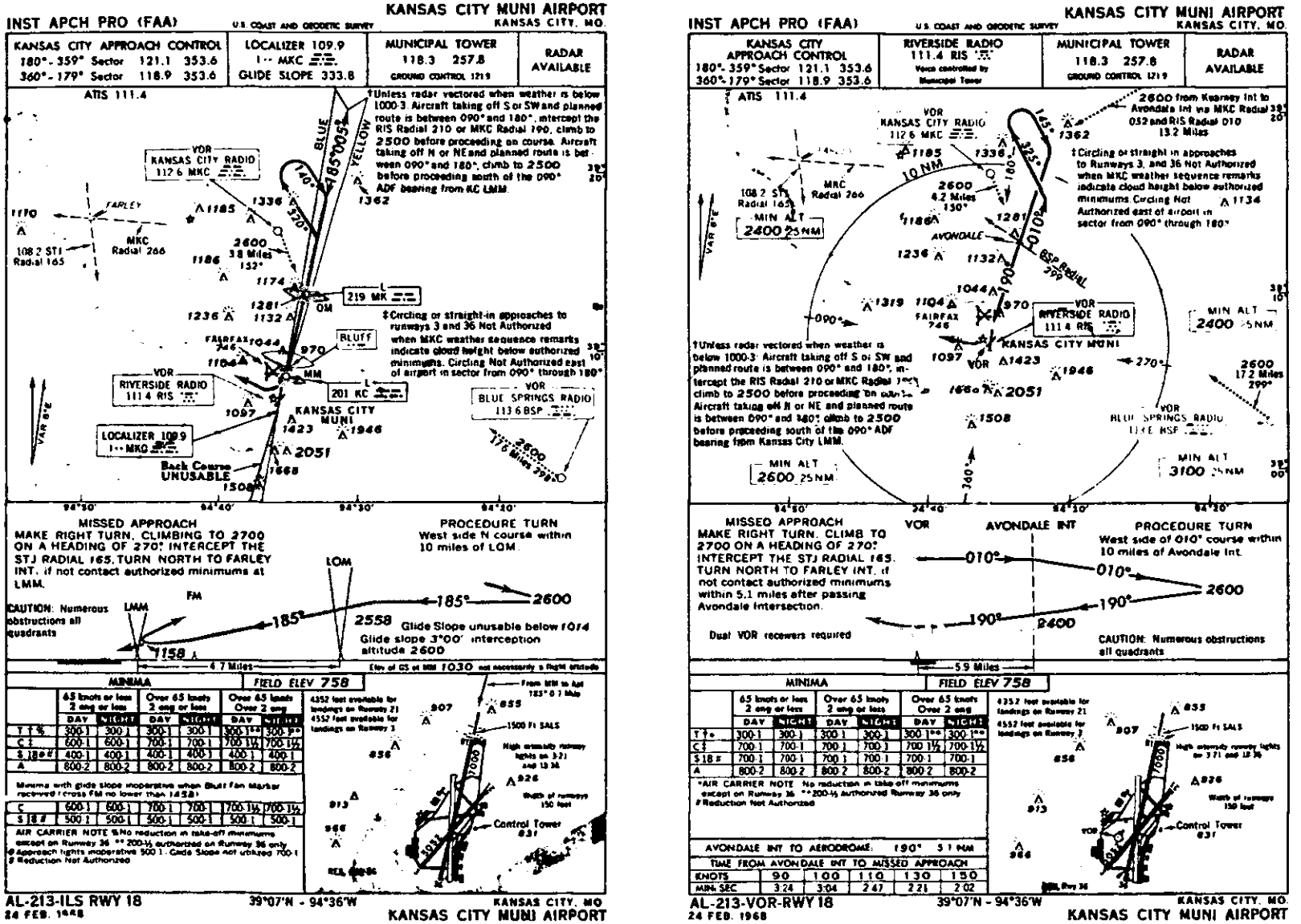


FIGURE 17. Instrument approach procedure charts—Kansas City, Mo.

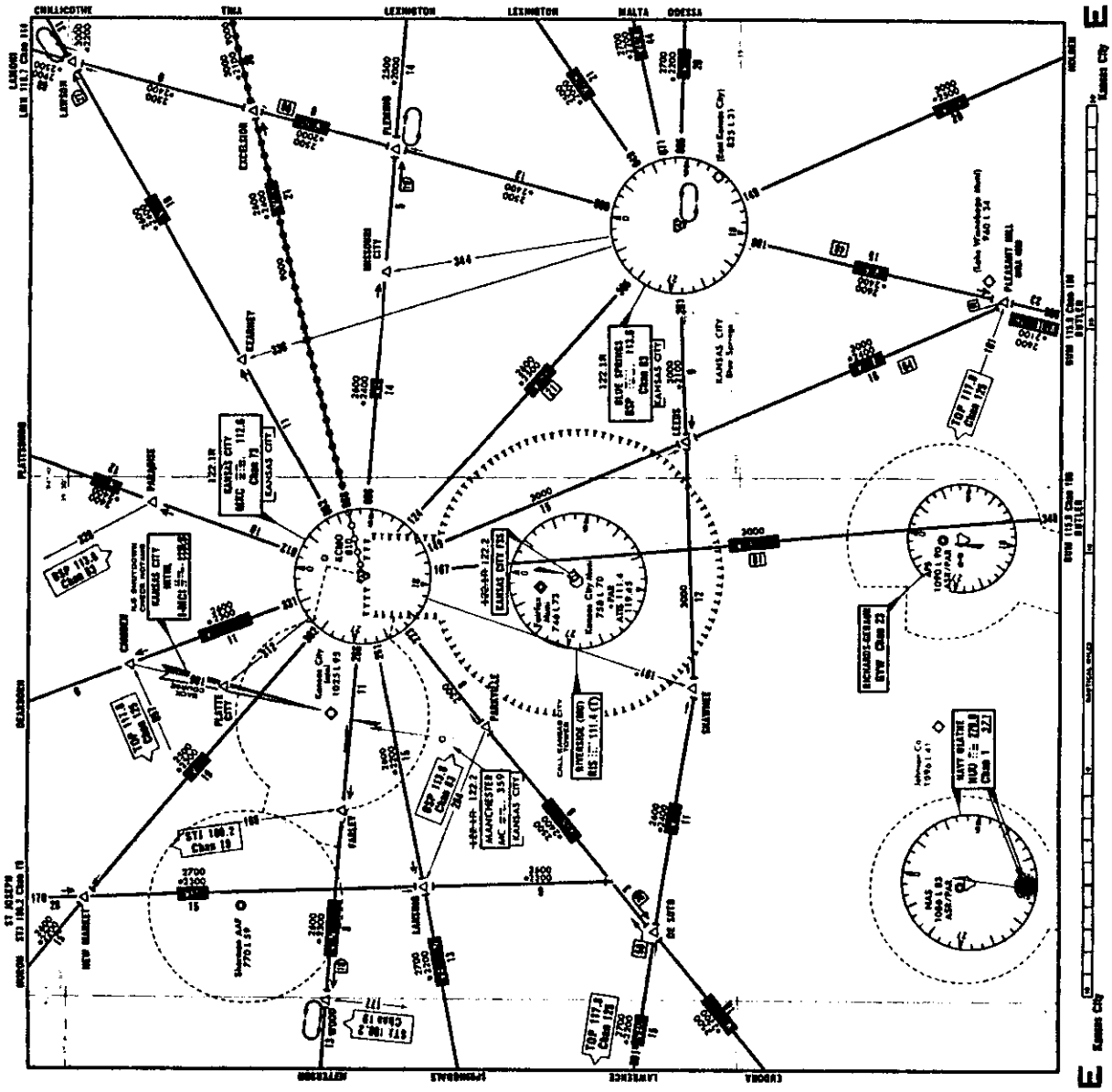


FIGURE 16. Kansas City area chart.

UNITED STATES GOVERNMENT
FLIGHT INFORMATION PUBLICATION

AREA CHARTS–U.S.

For use up to but not including 18,000' MSL

EFFECTIVE 0001Z **22 JUN 1967**
TO 0001Z 20 JUL 1967

[illegible]
DEPARTMENT OF DEFENSE • FEDERAL AVIATION ADMINISTRATION • DEPARTMENT OF COMMERCE

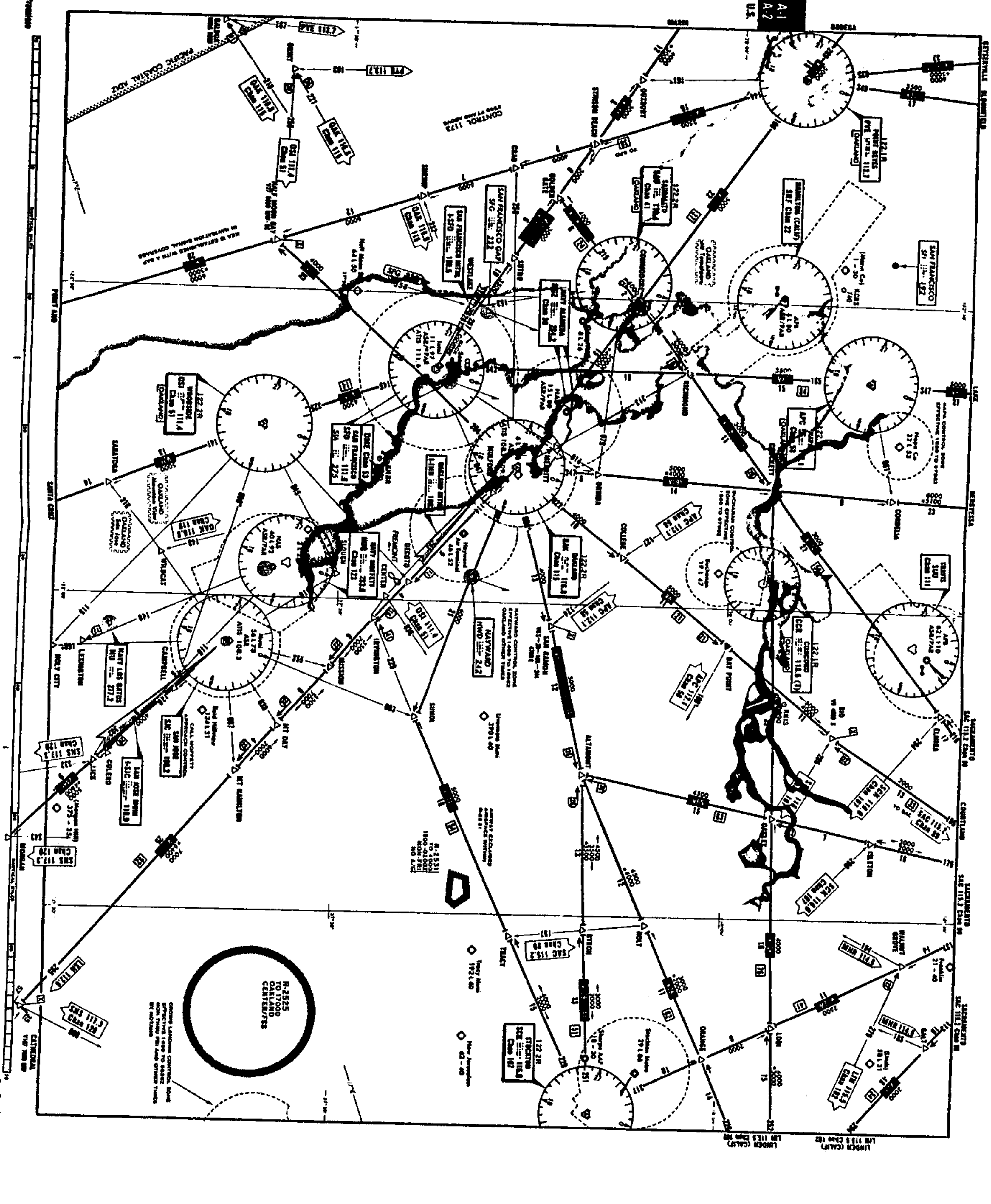
Published at Washington, D.C.
U.S. Department of Commerce
Environmental Science Services Administration
Coast and Geodetic Survey

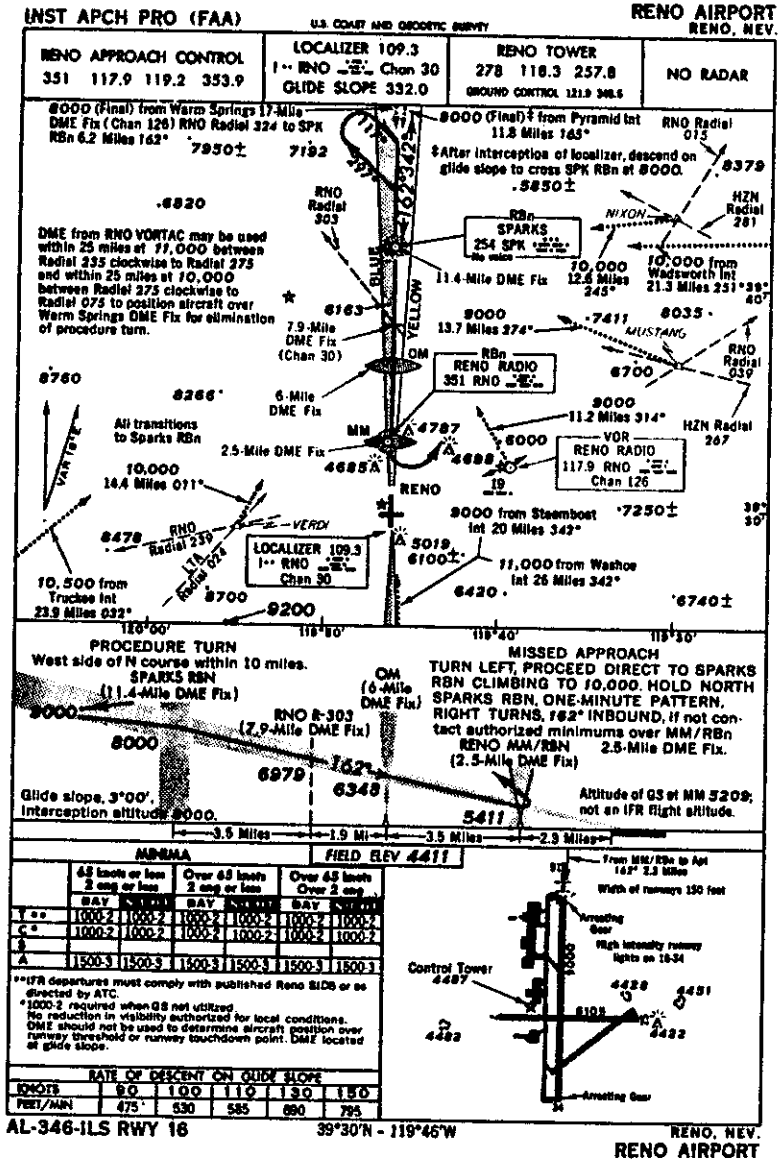
Consult ENROUTE CHARTS for LEGEND information

A/G VOICE COMMUNICATIONS

[illegible] Twr–[illegible] [illegible] 122.4R [illegible] Gnd Con–121.9	PALO ALTO [illegible] 122.8R [illegible]
HAYWARD AIR TERMINAL Twr–[illegible] 122.5R [illegible] Oakland App Con–[illegible] Gnd Con–[illegible] Oakland Dep Con–[illegible] 124.4	SAN FRANCISCO INTL [illegible] Twr–[illegible] 122.7R App Con–[illegible] Gnd Con–[illegible] Oakland Dep Con–[illegible]
[illegible] Twr–[illegible] 122.7R Gnd Con–121.7 [illegible] App and Dep Con–[illegible]	SAN JOSE Oakland App Con–[illegible] Twr–[illegible] 122.4R Gnd Con–[illegible] Oakland Dep Con–[illegible]
OAKLAND INTL Twr–[illegible] 122.7R [illegible] App Con–[illegible] Gnd Con–[illegible] Dep Con–[illegible] 124.4 [illegible]	STOCKTON METROPOLITAN Gnd Con–121.9 App Con–[illegible] Twr–[illegible] 122.5R

SAN FRANCISCO 1"=6 NM (On Chart L-2)





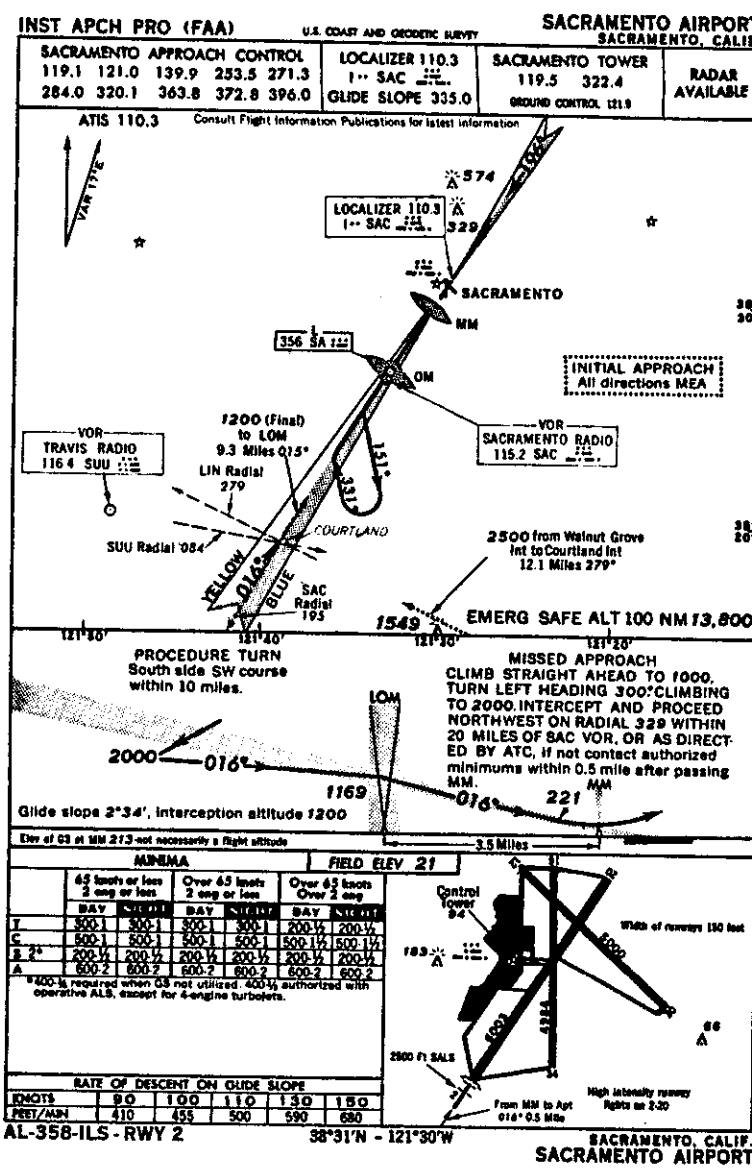


FIGURE 11. *Instrument approach procedure charts (Reno and Sacramento).*

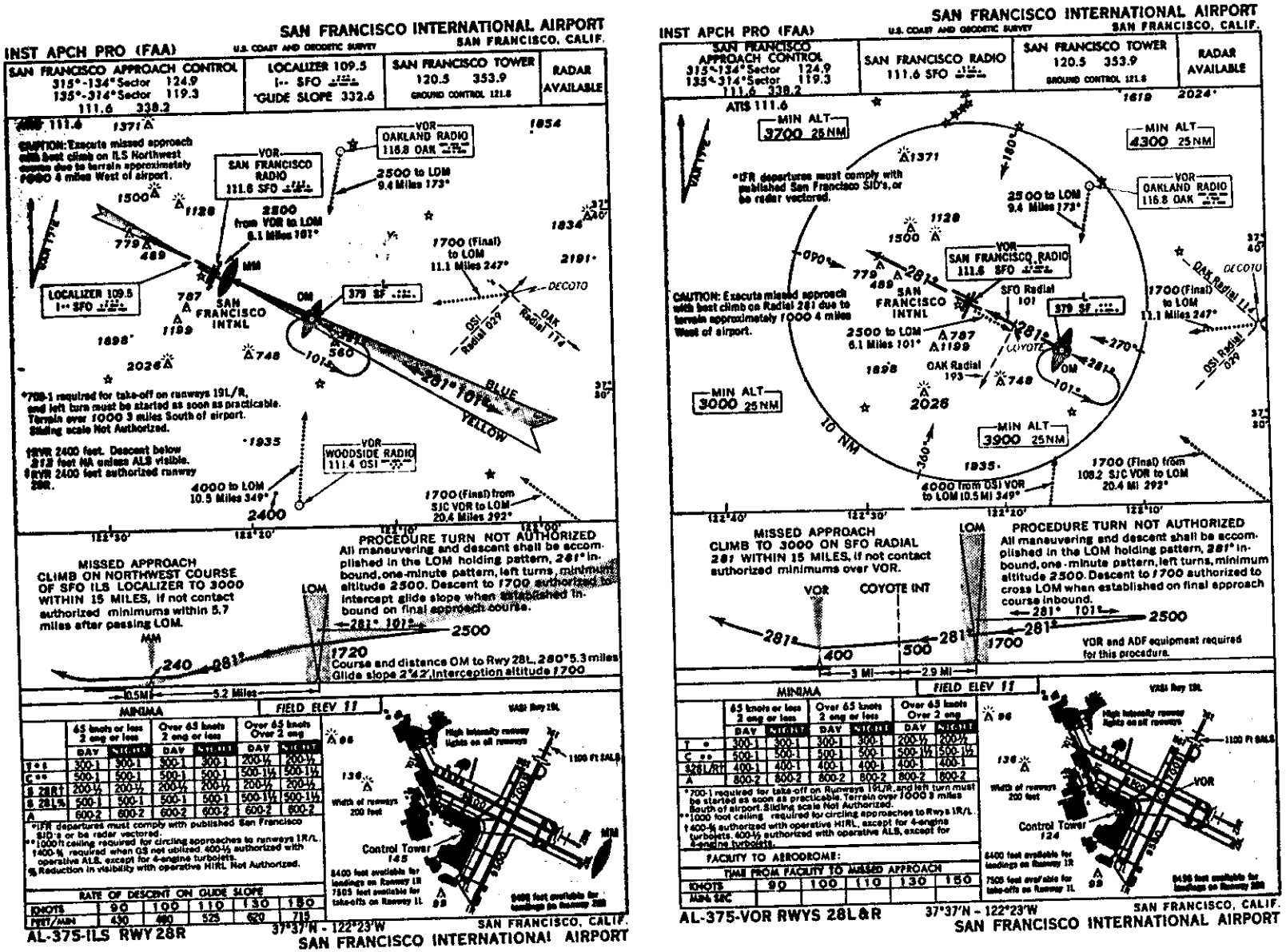


FIGURE 12. *Instrument approach procedure charts (San Francisco).*

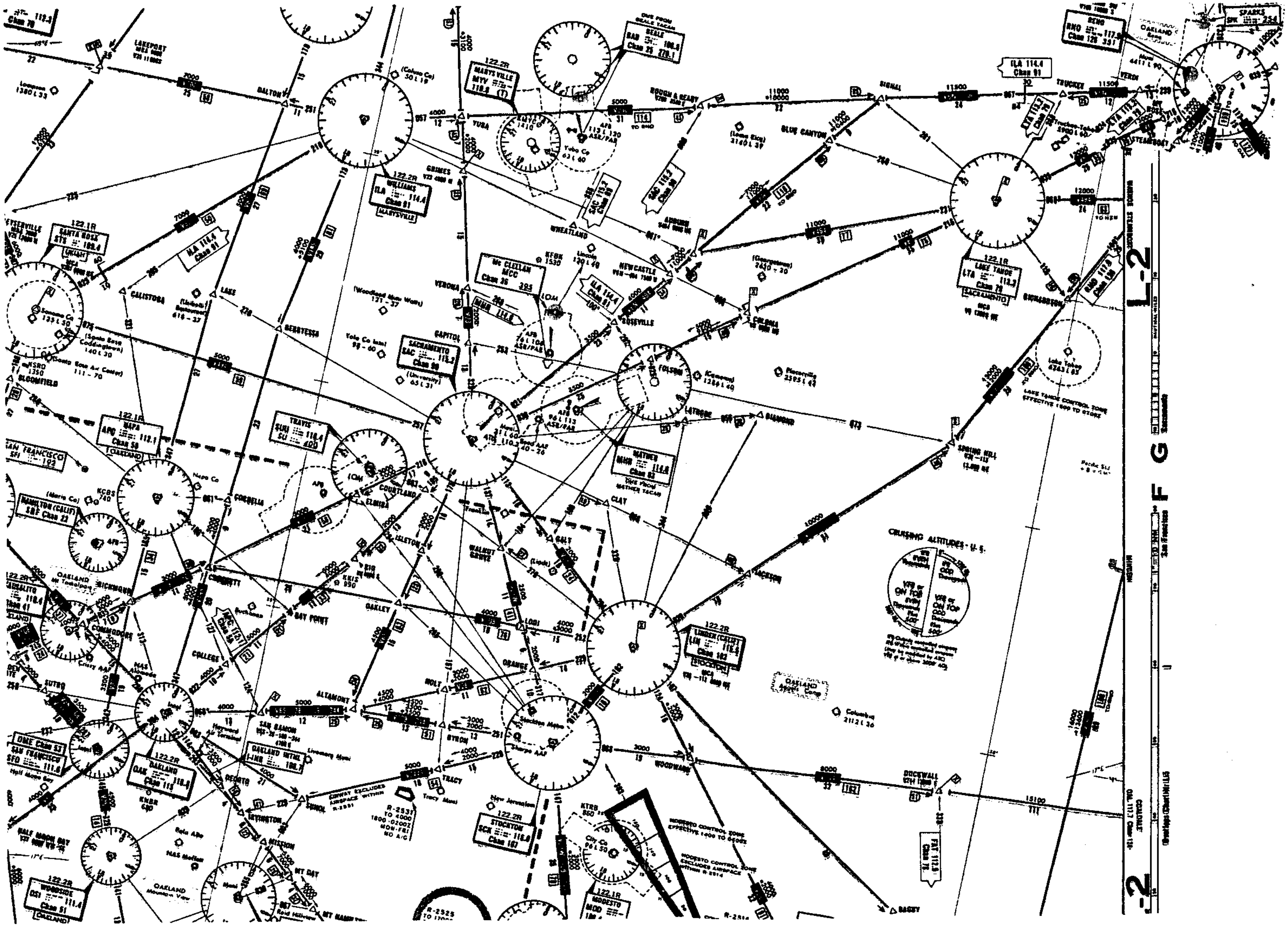


FIGURE 9. *Low-altitude enroute chart.*

10-88 (Face p. 24) No. 1

RENO MUNI SID's

Overlaps Enroute Chart Nr L-7, L-5, L-2 & H-1

COMMUNICATIONS FREQUENCIES

OAKLAND CENTER—128.8 127.5 343.7 285.5
RENO MUNI
GND CON—121.9 348.6
TWR—118.3 257.8

WASHOE FIVE DEPARTURE

Climb clear of clouds within 3 miles of **Reno Airport** to cross the airport at or above **6300'**. Thence via a **162** magnetic bearing from **Reno** RBn to **Washoe** Intersection. Cross **Washoe** Intersection at or above **10,000'**. Thence via (transition) or (assigned route).

Lake Tahoe Transition - Hold **south** of **Washoe** Intersection on the **Reno 180** radial right turns until reaching (minimum **12,000'**). Thence proceed inbound via **Lake Tahoe 060** radial to intercept (**V28/V113/V494/V6**).

Wabuska Transition - Via heading **085** to intercept **V105**.

NOTE: This SID requires a ceiling of at least 2500', visibility 2 miles and a minimum climb rate of 225' per mile to 10,000'.

CARSON CITY FOUR DEPARTURE

Climb clear of clouds within 3 miles of **Reno Airport** to cross the airport at or above **5400'**. Thence via **Reno ILS localizer** south course to **Washoe** Intersection. Cross **Washoe** Intersection at or above **10,000'**. Thence via (transition) or (assigned route).

Lake Tahoe Transition - Hold **south** of **Washoe** Intersection on the **Reno 180** radial right turns until reaching (minimum **12,000'**). Thence proceed inbound via **Lake Tahoe 060** radial to intercept (**V28/V113/V494/V6**).

Wabuska Transition - Via heading **085** to intercept **V105**.

NOTE: This SID requires a ceiling of at least 1000', visibility 2 miles and a minimum climb rate of 330' per mile to 10,000'.

Climb below 6600' not authorized south of the Reno VORTAC 230 radial and east of the back course of the Reno ILS due to high terrain southeast of the airport.

SPARKS SIX DEPARTURE

Climb clear of clouds within **3** miles of **Reno Airport** to cross the airport at or above **5400'**. Thence via **Reno ILS localizer** north course/a course of **342** degrees magnetic to **Sparks** RBn. Cross **Sparks** RBn at or above **6500'**. Thence via (transition) or (assigned route).

Nixon Transition - Via **066** degrees magnetic from **Sparks** RBn to intercept **V113**.

Pyramid Transition - Via **Reno ILS localizer** north course/a course **342** degrees magnetic from **Sparks** RBn to intercept **V185**.

Reno Transition - Via **Reno 314** radial to **Reno**.

Verdi Transition - Via **Lake Tahoe 020** radial to intercept (**V6N/V200/V6**). This transition requires hold north of **Sparks** RBn on the **ILS localizer** course/a course of **162** degrees magnetic to the **Sparks** RBn right turns until reaching (minimum **9000'** to **V6N/V200**, minimum **10,500'** to **V6**).

NOTE: This SID requires a ceiling of at least 1000', visibility 2 miles and a minimum climb rate of 280' per mile to 9000'.

Climb below 6600' not authorized south of the Reno VORTAC 230 radial and east of the back course of the Reno ILS due to high terrain southeast of the airport.

VISTA FIVE DEPARTURE

Climb clear of clouds within 3 miles of **Reno Airport** to cross the airport at or above **6400'**. Thence via **Reno 230** radial to **Reno**. Thence via (transition) or (assigned route).

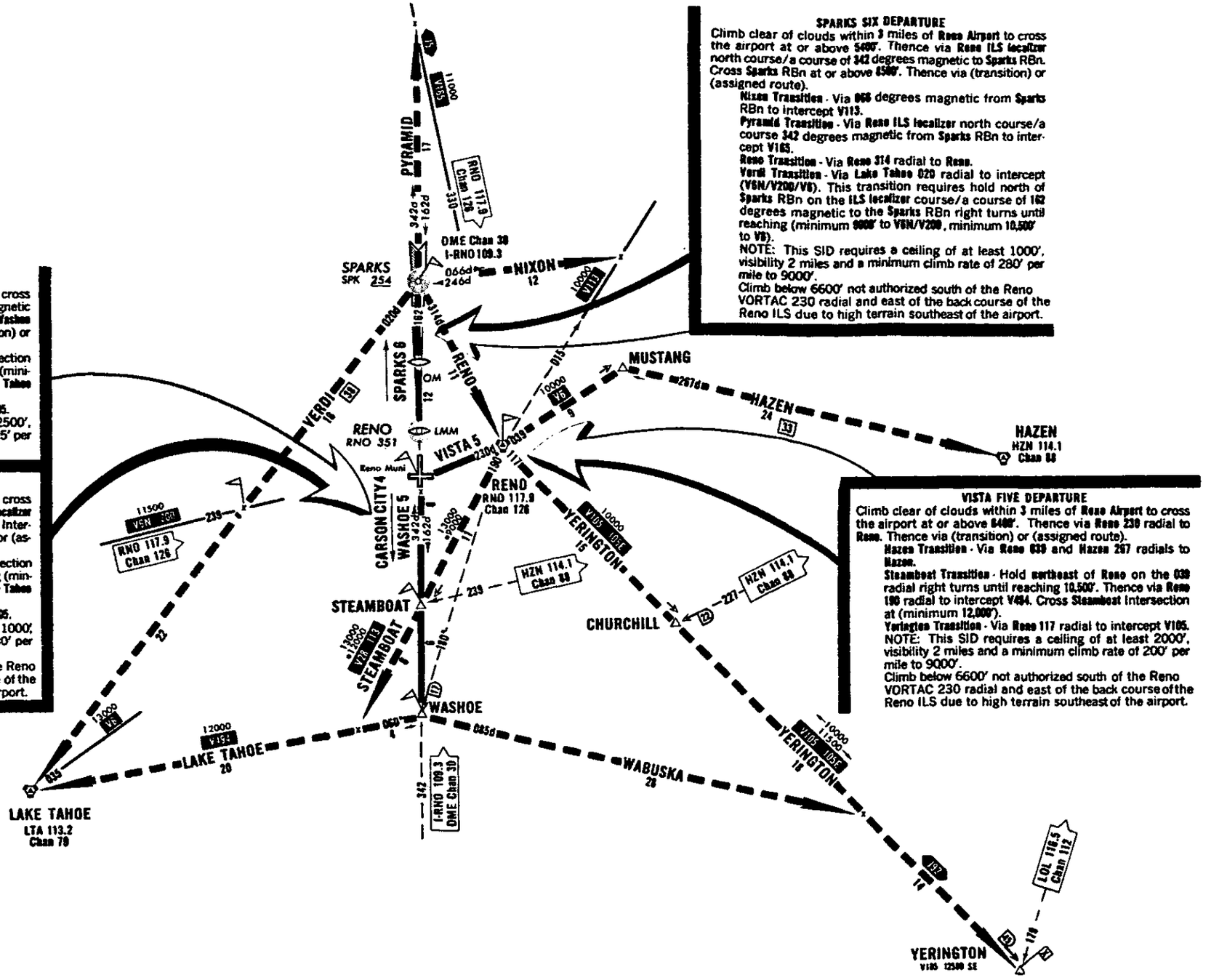
Hazen Transition - Via **Reno 039** and **Hazen 267** radials to **Hazen**.

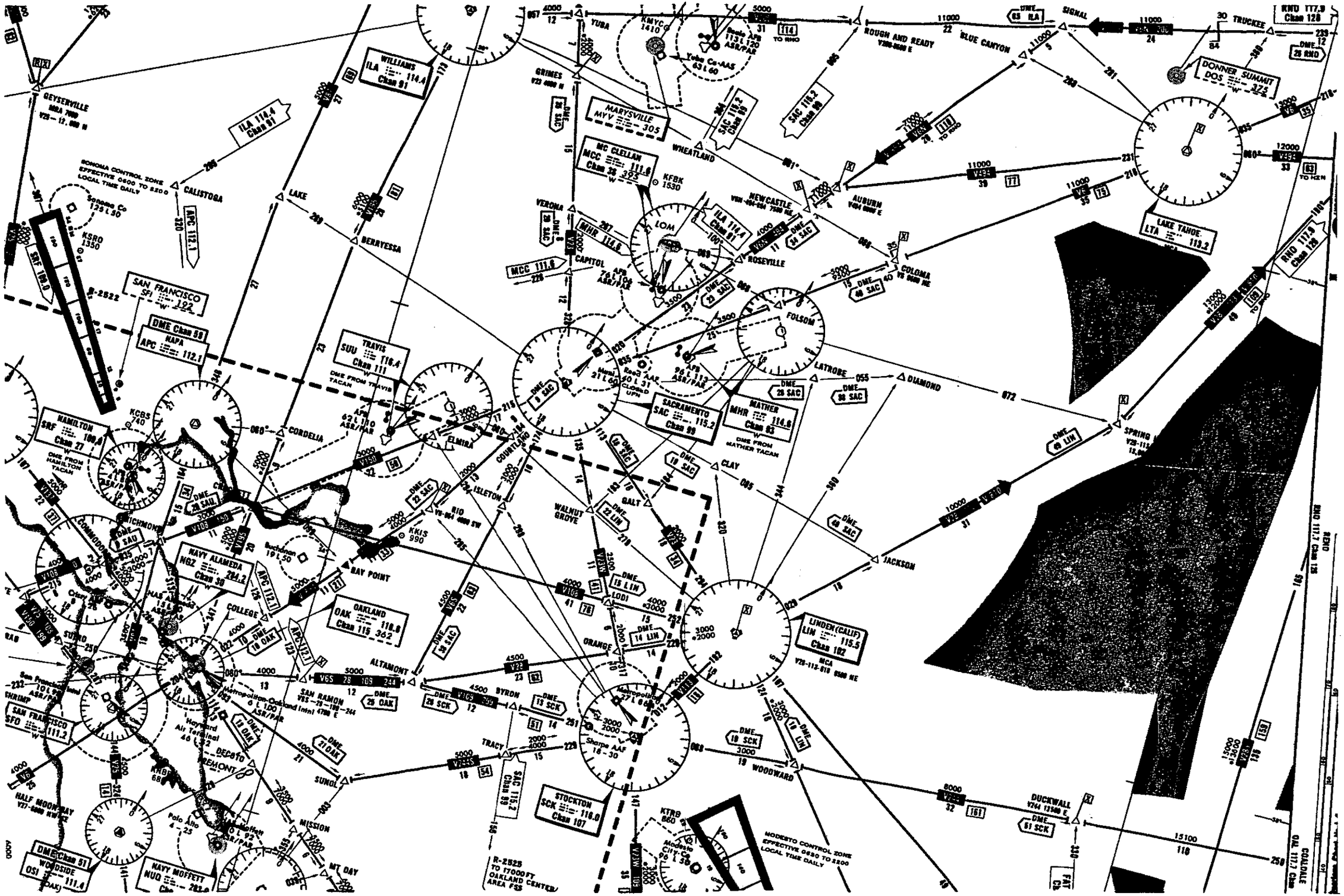
Steamboat Transition - Hold **northeast** of **Reno** on the **039** radial right turns until reaching **10,500'**. Thence via **Reno 190** radial to intercept **V494**. Cross **Steamboat** Intersection at (minimum **12,000'**).

Yerington Transition - Via **Reno 117** radial to intercept **V105**.

NOTE: This SID requires a ceiling of at least 2000', visibility 2 miles and a minimum climb rate of 200' per mile to 9000'.

Climb below 6600' not authorized south of the Reno VORTAC 230 radial and east of the back course of the Reno ILS due to high terrain southeast of the airport.





786-745 O - 65 (Face p. 30) No. 1

FIGURE 10.—*Low-altitude enroute chart.*

SFC

FLIGHT INFORMATION PUBLICATION

LOW ALTITUDE AREA CHART - U.S.

SAN FRANCISCO

1" = 6 NM

EFFECTIVE 0501Z **22 JUL 1965**

TO 0501Z **19 AUG 1965**

PUBLISHED IN ACCORDANCE WITH FAA SPECIFICATIONS BY U.S. DEPARTMENT OF COMMERCE, COAST AND GEODETIC SURVEY

LEGEND

ARRIVAL ROUTES
VIA AIRWAYS
287dme DIRECT - OFF AIRWAYS
287d
ROUTE TERMINATING FIX

AERODROMES
ARRIVAL

DME 10 CHS (16)
HOLDING PATTERNS
DME FIX DISTANCE, IDENT AND TURNING POINT OF OUTBOUND LEG
BOX POINTS TO FACILITY

COMMUNICATIONS FREQUENCIES

@OAKLAND CENTER—128.7 127.8 127.2 125.9 125.5 124.2 120.4 343.9 335.6 323.0 307.8 307.0 291.7 263.1

ALAMEDA NAS
NAVY ALAMEDA TWR—126.2 360.2

BUCHANAN
TWR—119.7 257.8 GND CON—121.9

CRISSY AAF
TWR—126.2 241.0

HAMILTON AFB
TWR—126.2 295.7

HAYWARD AIR TERMINAL
@OAKLAND APP CON—
118.1 (271°-089° Outbound)
120.9 (090°-270° Outbound) 354.1
TWR—118.9 257.8 GND CON—121.7 348.6

METROPOLITAN-OAKLAND INTNL
@OAKLAND APP CON—
118.1 (271°-089° Outbound)
120.9 (090°-270° Outbound) 354.1
OAKLAND TWR—118.3 256.9
OAKLAND GND CON—121.9 379.1

MOFFETT NAS
NAVY MOFFETT TWR—123.7 353.2

PALO ALTO
@MOFFETT APP CON—121.3 322.0

SAN FRANCISCO INTNL
@APP CON—124.9 317.6 (315°-134° Outbound)
119.3 338.2 (135°-314° Outbound)
TWR—120.5 353.9 GND CON—121.8

SAN JOSE MUNI
@MOFFETT APP CON—120.1 348.6
TWR—120.7 257.8 GND CON—121.7

STOCKTON METROPOLITAN
APP CON—125.1 363.2
TWR—120.3 257.8 GND CON—121.9

TRAVIS AFB
TWR—126.2 255.9

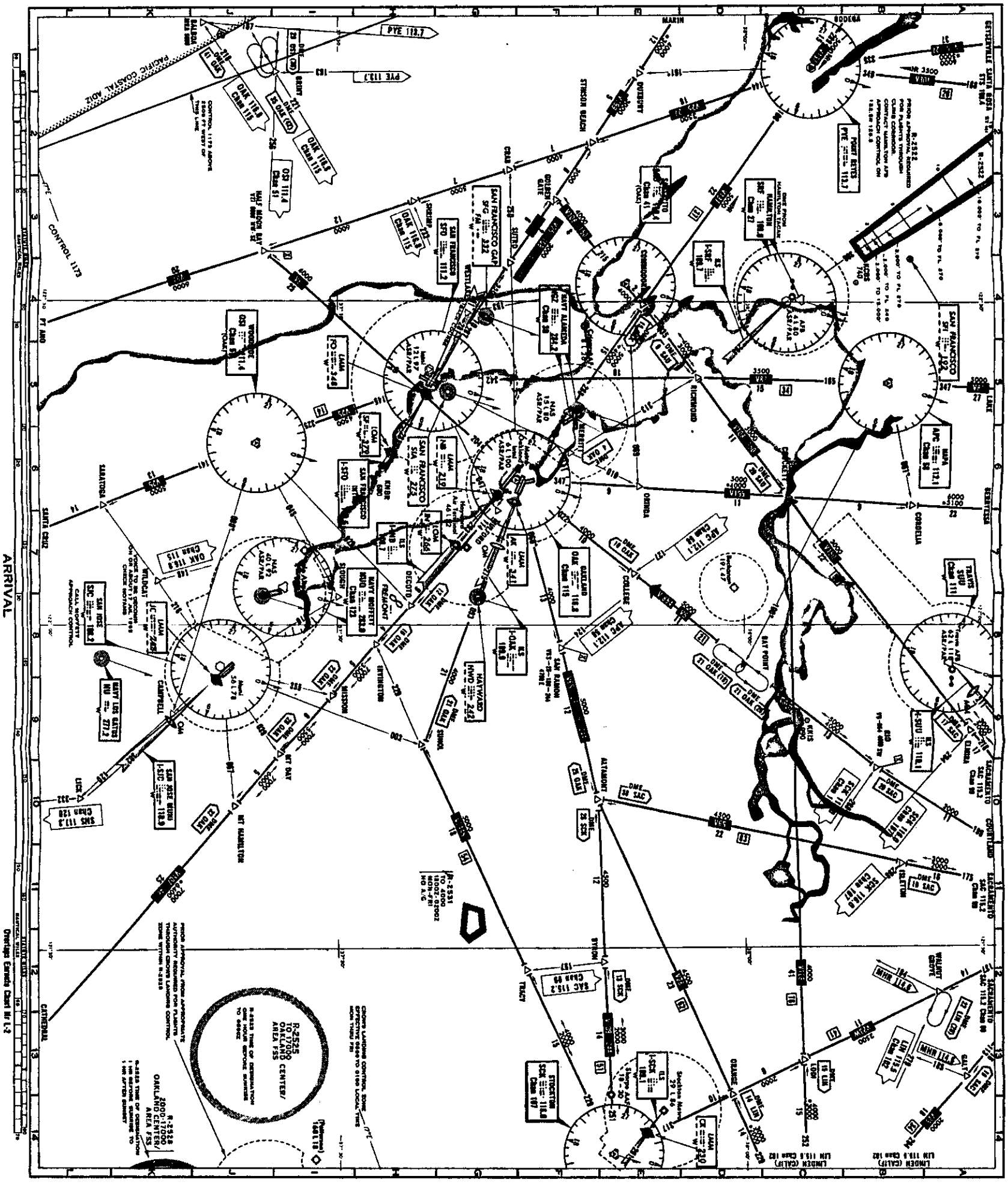


FIGURE 11.—*Low-altitude area chart.*