AC 143-2B

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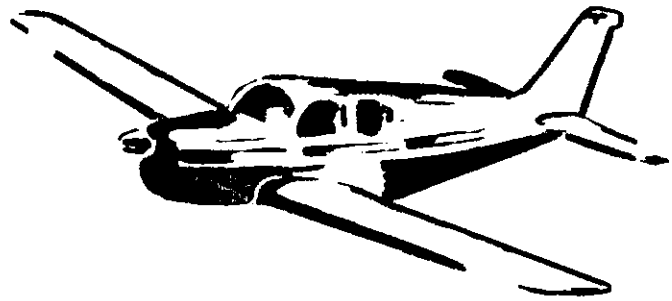

GROUND INSTRUCTOR INSTRUMENT

Written Test Guide

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

GROUND INSTRUCTOR
INSTRUMENT
WRITTEN TEST GUIDE

AC 143-2B

Revised 1971

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

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Ground Instructor—Instrument—Written Test Guide

Introduction

This written test guide has been prepared by the Flight Standards Service of the Federal Aviation Administration to assist applicants preparing for the Ground Instructor–Instrument–Written Test. It outlines the scope of aeronautical knowledge covered in the test for the Instrument Ground Instructor Rating and suggests the subject areas in which the applicant should be well informed.

This 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 to attain basic knowledge. Neither is there an alternative to persistent effort for developing competence. Continuous review is essential to remain current in the many areas where technological change is the rule rather than the exception.

An applicant for the Instrument Ground Instructor Rating should make a thorough review of the "Study Outline" given in this guide. If an area of weakness is found, he should study that area until he has confidence in his ability to teach the material to students. After the review, he should take the sample test *without aid*, and then compare his answers with those in the "Analysis of Answers to Sample Test Items" found at the end of the sample test. If nearly all of his answers are correct, he is probably prepared to take the Ground Instructor–Instrument–Written Test. The applicant should keep in mind, however, that the required test will cover considerably more areas of knowledge than found in the sample test.

Requirements for Certificates and Ratings

Eligibility requirements for ground instructor certificates are outlined in Volume IX, Part 143 of Federal Aviation Regulations. Ratings are as follows:

Ground Instructor Basic—Qualifies the holder to instruct in a basic pilot ground school.

Ground Instructor Advanced—Qualifies the holder to instruct in basic or advanced pilot ground school.

Ground Instructor Instrument—Qualifies the holder for ground instruction in an instrument flying school, and for the operation of instrument procedures training devices.

Applicants who do not hold a ground instructor certificate must take a written test on "Fundamentals of Instructing," as well as a written test for the rating desired.* Holders of a ground instructor certificate, with one or more ratings, are not required to retake the Fundamentals of Instructing test to obtain additional ratings. An applicant who holds a currently effective teacher certificate issued by a State, county, or city authorizing him to instruct in a junior or senior high school, or who is regularly employed as an instructor in an accredited college or university, shall be relieved from taking the written test on the "Fundamentals of Instructing."

The Written Test

The Ground Instructor Instrument Written Test emphasizes aeronautical knowledge areas in which the instrument ground instructor should be prepared to teach. Test items require a knowledge of air traffic, communications, and navigation procedures; operating principles of air navigation radio aids; and instrument flight techniques. The applicant

* For study guidance and reference materials for the test on "Fundamentals of Instructing," the applicant should consult the Ground Instructor Examination Guide, Basic–Advanced, AC 143–1B, available from the Superintendent of Documents, Government Printing Office for $1.00.

must apply his knowledge of regulations, preflight duties, inflight operation, weather, navigation aids and procedures. The official test booklets include appropriate planning materials similar to those which appear in the appendix of this guide.

The Ground Instructor–Instrument–Written Test consists of multiple-choice questions similar to those shown in the sample test in this guide. The applicant indicates his choice of answers 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 he begins the test. Incomplete or erroneous personal information on the answer sheet may delay the scoring process. Approximately 5 hours are allowed to complete the test.

The applicant is notified of his grade on Airman Written Test Report, AC Form 8060–37. The report also contains coded indications of the subject matter involved in items missed by the applicant on the test. A Written Test Subject Matter Outline is provided to relate the codes to specific areas of knowledge. The Study Outline contained in this guide is similar to the Subject Matter Outline the applicant receives with AC Form 8060–37. An applicant who has successfully passed the required test should present AC Form 8060–37 to the Flight Standards District Office for issuance of the Ground Instructor Certificate with the appropriate rating.

An applicant who receives a failing grade must present the AC Form 8060–37 when appearing for retesting. He may apply for retesting—(a) after 30 days after the date he failed the test; or (b) upon presenting a statement from an appropriately rated certificated ground instructor certifying that he has given the applicant at least 5 hours additional instruction in the areas failed and now considers that he can pass the test.

Taking the Test

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

Bear in mind the following points when taking the test:

1. Answer test items in accordance with the latest regulations and procedures.
2. Read every question thoroughly. Comments received from applicants indicate that unsatisfactory performance on the written test is frequently the result of failure to read carefully rather than lack of knowledge. Do not try to solve the problem before understanding the question.
3. Do not consider a complicated problem a "trick" question; each question has a specific objective. There is no deliberate attempt to trick applicants.
4. There is only one correct and complete answer for each item.
5. Do not waste too much time on problems that confuse you. Go on to the questions that you can answer readily, then return to the more difficult items.
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 to the correct answer because the correct answer is an average of the answers obtained by using several types of computers.

Reference Materials

Persons studying for the Ground Instructor–Instrument–Written Test will find the publications listed in this section most helpful. The list identifies material essential to preparing for the test but does not include all material available in the subject areas. Textbooks and reference materials are available from various commercial publishers. Many public and institutional libraries offer study materials in both teaching methods and aeronautical subject areas. It is the responsibility of each applicant to obtain study material appropriate to his need.

Airman's Information Manual (*AIM*)

This publication presents, in four parts, information necessary for the planning and conduct of flights in the National Airspace System. Besides providing frequently updated airport and NAVAID data, the AIM includes instructional and procedural informa-

tion, and is designed for use in the cockpit. Each part is available by annual subscription at the prices shown.

	Price	Additional for Foreign Mailing
Part 1, *Basic Flight Manual and ATC Procedures.* (Issued quarterly)	$ 4.00	$1.00
Part 2, *Airport Directory.* (Issued semiannually)	$ 4.00	$1.00
Part 3 and 3A, *Operational Data and Notices to Airmen.* (Operational data issued every 28 days; Notices to Airmen issued every 14 days)	$20.00	$5.00
Part 4, *Graphic Notices and Supplemental Data* (Issued semiannually)	$ 1.50	$0.50

Federal Aviation Regulations

The subscription prices listed include automatic revision service to all Parts contained in the Volume ordered. The FAR Parts contained in each Volume are listed in the "Advisory Circular Checklist and Status of Federal Aviation Regulations."

	Price	Additional for Foreign Mailing
Vol. I, Part 1, *Definitions and Abbreviations*	$ 1.50	$0.50
Vol. IX, Part 61, *Certification: Pilots and Flight Instructors*	$ 6.00	$1.50
Vol. VI, Part 91, *General Operating and Flight Rules*	$ 5.00	$1.25
Vol. XI, Part 95, *IFR Altitudes*	$ 2.75	$0.75
Part 97, *Standard Instrument Approach Procedures*		
Vol. VII, Part 135, *Air Taxi Operators and Commercial Operators of Small Aircraft*	$ 6.50	$1.75
Vol. IX, Part 141, *Pilot Schools*	$ 6.00	$1.50
Part 143, *Ground Instructors*		

Handbooks

Flight Instructor's Handbook, AC 61-16 ($1.25—GPO—FAA 5.8/2:F 64/7. This handbook has been prepared for the information and guidance of pilots preparing for the flight instructor certificate and for use as a reference by certificated flight and ground instructors. This handbook will be most useful to those preparing for the Fundamentals of Instructing Section of the Ground Instructor Written Test.

Instrument Flying Handbook, AC 61-27 ($2.50—GPO—TD 4.408:In 7/3). This is a basic text for instrument pilots. It deals with training considerations, aerodynamic factors, physiological factors, flight instruments and their use, air navigation aids, communications, the air traffic system, and flight planning.

Aviation Weather, AC 00-6 ($4.00—GPO—FAA 5.8/2:W 37). An excellent reference treating phases of meteorology of interest to the instructor. Aviation weather reports and forecasts are also covered with respect to format and content.

Pilot's Weight and Balance Handbook, AC 91-23 (70¢—GPO—TD 4.408:P 64/3). Presented from the viewpoint of the pilot, this handbook pays particular attention to the aircraft loading problems of general aviation pilots when operating light aircraft, including twin-engine and air-taxi types. The text progresses from an explanation of basic fundamentals to the complex application of weight and balance principles in large aircraft operations.

Charts

Instrument Approach Procedure Charts. Individual charts give detailed information on procedures for specific airports.

Enroute Charts: Low-Altitude and High-Altitude. These charts provide the necessary aeronautical information for en route instrument navigation.

Low-Altitude Area Charts. These charts supplement the Enroute Charts by providing departure, arrival, and holding procedures at principal airports.

Advisory Circulars

The following Advisory Circulars pertain to areas of knowledge listed in the Study Outline and are free of charge: 00-17, 00-24, 20-32A, 60-4, 60-6, 90-1A, 90-12, 90-14A, 90-22B, 90-23A, 90-35, 90-36, 90-38A, 90-41, 90-46, 91-8A, 91-19, 91-30, 170-3B.

EXAM-O-GRAMS

VFR Exam-O-Grams and IFR Exam-O-Grams are nondirective in nature and are issued solely as an information service to individuals interested in airman written tests.

How To Obtain Study Materials

The study materials listed, except the charts, free Advisory Circulars, and Exam-O-Grams, may be obtained by remitting check or money order to:

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

To expedite your order when ordering publications from the Superintendent of Documents, be sure to include with the title of single publications the GPO catalog number given in the price line (e.g., TD 4.408:In 7/3 or FAA 5/8:W 37). Order subscription and single publications separately.

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:

Distribution Division (C-44)
National Ocean Survey
Washington, D.C. 20235

Orders for specific charts or publications should be accompanied by check or money order made payable to, "NOS, Dept 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 Technical Division
Operations Branch, AC-240
P.O. Box 25082
Oklahoma City, Okla. 73125

Advisory Circular titles and a summary of what each contains may be obtained by requesting an "Advisory Circular Checklist and Status of Federal Aviation Regulations," from:

Department of Transportation
Federal Aviation Administration
Distribution Unit, TAD-484.3
Washington, D.C. 20590

Study Outline

This study outline indicates the areas of aeronautical knowledge which 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:

AIM—Airman's Information Manual
EOG—IFR Exam-O-Gram
AC—Advisory Circular
AW—Aviation Weather (AC 00-6)
FAR—Federal Aviation Regulations
IFH—Instrument Flying Handbook

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  - written test unauthorized conduct (61.20)
  - retesting after failure (61.27)
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  - pilot logbooks (61.39)
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A04. Preflight Action for Aircraft
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B02. Aerodynamic Factors (Ch. III–IFH Private Pilot's Handbook of Aeronautical Knowledge)
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manner of notification
reports

F01. Aeronautical Terms (FAR 1 and AIM–1, Glossary)

NOTE.—Applicants for original issuance of a Ground Instructor Certificate with an instrument rating should refer to the Ground Instructor Examination 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 pages 00 and 00.

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. An instrument rated pilot meets the recency of experience requirements for daylight instrument flight. Which statement is correct regarding additional recency of experience requirements for this pilot to carry passengers on an instrument flight at night?

1—Within the preceding 6 months, the pilot must have made at least 3 takeoffs and landings to a full stop between 1 hour after sunset and 1 hour before sunrise in an aircraft to be flown on the instrument flight.

2—Within the preceding 90 days, the pilot is required only to have made 5 takeoffs and landings to a full stop between 1 hour after sunset and 1 hour before sunrise in any aircraft.

3—Within the preceding 6 months, the pilot must have made at least 5 takeoffs and landings to a full stop between 1 hour after sunset and 1 hour before sunrise in an aircraft of the same category, class, and type as the aircraft to be flown.

4—Within the preceding 90 days the pilot is required only to have made 3 takeoffs and landings to a full stop between 1 hour after sunset and 1 hour before sunrise in any aircraft.

2. Normally, a VOR marked (T) on the enroute charts should not be used for navigation when flying at altitudes above 12,000 ft. An aircraft at this altitude may receive undependable navigation signals because

1—transmitter signal strength is under 25 watts.

2—course azimuth is not accurate above 12,000 feet.

3—atmosphere conditions may affect the signals.

4—signals from another VOR may interfere.

3. Students should be taught that a pilot departing an airport in uncontrolled airspace under instrument weather conditions

1—has no assurance of separation from other traffic.

2—must stay clear of clouds until he has received an IFR clearance.

3—must file a flight plan before takeoff.

4—will be controlled by Air Route Traffic Control.

4. Which is a true statement regarding the indications of the needle and ball of a properly calibrated 2-minute turn and slip indicator?

1—The turn needle gives a direct indication of the aircraft's angle of bank.

2—The position of the ball does not affect the accuracy of the turn needle.

3—A one-needle width deflection indicates a turn of 3° per second only if the ball is centered.

4—The rate of turn is too great for the angle of bank when the ball is on the low side of the turn.

5. Unreliable course guidance information may be indicated on a Nav/Com system during which of the following situations?

1—When using the Nav/Com transmitter.

2—During reception of voice transmissions.

3—When approaching a radio beacon on an LOC back course approach.

4—When making an ILS front course approach with the OBS set at some value other than the front course inbound bearing.

6. When using the magnetic compass to establish and maintain a heading, the pilot should remember that, due to the normal characteristics of a compass, it will usually indicate a turn toward

1—south when the airplane is accelerating on a heading of east.

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

3—east when accelerating on a heading of north.

4—west when entering a right turn from a heading of north.

7. Your students should know that the primary purpose of the elevator trim tab is to

1—keep the elevator streamlined.

2—relieve elevator control pressures.

3—reduce control pressures while changing the aircraft pitch attitude.

4—increase longitudinal stability.

8. An instrument student should know that on any simulated instrument flight outside the vicinity of an airport, the pilot-in-command must familiarize himself with all available information concerning that flight. Which of the following must the pilot accomplish?

A. Check available weather reports and forecasts.

B. File a flight plan.

C. Determine fuel requirements.

D. Determine runway lengths and takeoff and landing distances required at airports of intended use.

1—A, B, and C

2—A and C only

3—A, C, and D

4—B and D only

9. Pressure altitude is obtained by

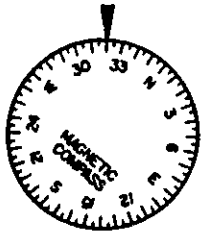
1—correcting terrain clearance altitude for temperature.

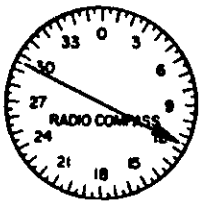
2—setting the altimeter to standard sea level pressure.

3—setting the altimeter to a station pressure in inches of mercury which has been corrected to sea level.

4—correcting the altimeter for temperature deviation from standard.

10. A pilot tunes his ADF receiver to a radio beacon. Refer to the following illustration:





VAR—10° E. TAS—170 knots
DEV—5° W. Wind—360°/30 (true)

The aircraft is located on a magnetic bearing from the station of

1—250°.
2—255°.
3—260°.
4—075°.

11. Abrupt control movement when changing aircraft attitude

1—helps to eliminate instrument lag.
2—results in erroneous indications on the attitude indicator.
3—results in less error in stabilizing the aircraft.
4—may result in overcontrolling and unnecessary stress on the aircraft.

12. If a student is making a timed turn to the right and the turn needle indicates the correct rate of turn, but the ball is to the left of center, the student should

1—apply left rudder pressure and maintain the same degree of bank.
2—decrease right rudder pressure if holding right rudder or apply left rudder and steepen the bank.
3—decrease right rudder pressure and shallow the bank.
4—use same rudder pressure and steepen the bank.

13. Choose all the statements which are true when the gross weight of the airplane is increased.

A. Stalling speed will decrease.
B. Takeoff distance will increase.
C. Recommended approach speed will remain the same.
D. Maximum rate of climb will decrease.
E. Horizontal stabilizer will carry a greater percent of the total weight.

1—A, B, and D
2—B and E
3—C, D, and E
4—B and D

14. If you are cleared to a fix short of your destination airport and not given an "expect further clearance time," normally you may expect to receive further clearance

1—at least 3 minutes before your ETA at the fix.
2—at least 10 minutes before your ETA at the fix.
3—when you notify ATC that you are at the clearance limit.
4—before reaching the fix.

15. In the Northern Hemisphere above the friction layer, the air flows

1—at right angles to the isobars from a high pressure area to a low pressure area.
2—counterclockwise around a low pressure area, clockwise around a high pressure area, and parallel to the isobars.
3—clockwise around a low pressure area, counterclockwise around a high pressure area, and parallel to the isobars.
4—from a high pressure area to a low pressure area at 45° to the isobars.

16. Choose the true statements regarding the formation of frost on an airplane's wings.

A. Frost can form in flight when an airplane descends from a zone of subzero temperatures to a zone of above freezing temperatures and high humidity.
B. Frost occurs when dew forms on the wings and the surrounding air is below freezing.
C. Frost cannot form on the wings of an airplane unless the temperature of the air surrounding the wings is at least 2° below freezing.

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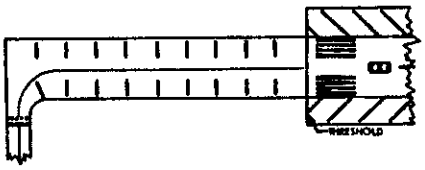
D. The surface of an airplane's wings must be below freezing before frost will form on the wings.

1—A and C
2—A and D
3—B and C
4—B and D

17. Which statement regarding the stability of the air is true?

1—If very stable moist air is forced to ascend a mountain slope, clouds will be layerlike with little vertical development.
2—If air is subsiding (sinking), the heat of compression causes the air to become unstable and usually sets off considerable vertical development of clouds.
3—When an area of poor visibility due to smoke and haze persists, it is usually due to the air being saturated and unstable.
4—When an unsaturated air mass is heated from below, the air tends to become more stable.

18.



In the figure above, the area to the left of the threshold is

1—an "over-run" with sufficient strength for all aircraft operations.
2—an abandoned runway area which may not be used for any aircraft operations.
3—a "deceptive area" with a marked centerline usable only for taxiing.
4—a stabilized blast-pad, no part of which may be used for taxiing, takeoff, or landing.

19. Students should understand that during a level turn, the stalling speed and load factor of an airplane increase as the bank increases. Which statement regarding load factor and stalling speed is true on an airplane with a V_{so} of 65 knots? (See Appendix, Figure 2.)

1—The lift required for a 60° bank is twice that required in straight and level flight.
2—The stalling speed when in a 60° bank is twice as much as when in straight-and-level flight.
3—After reaching a 60° bank the load factor and stalling speed increase at the same rate.
4—An airplane in normal category at full gross weight would not exceed the limit load (3.8) unless it reached a bank of 85°.

20. According to Figure 3, which statements concerning power and drag are true?

A. Maximum endurance is obtained at an airspeed of approximately 120 knots.
B. Minimum drag occurs at an airspeed of 160 knots, which is the best speed for maximum endurance.
C. L/D max occurs at the airspeed which also gives the least total drag.
D. Total drag always increases with an increase in airspeed.

1—A and C only
2—A, B, and C
3—B, C, and D
4—B and D only

Test items 21 through 40 are based on the planning and execution of an IFR training flight, covering some elements of preflight and inflight procedures.

Aircraft Data and Flight Conditions

This flight is assumed to be made in a light twin-engine aircraft typical of those used in general aviation. Aircraft data will be given as needed for particular test items. The flight is from Denver Stapleton International Airport to Kansas City Municipal Airport. The flight time analysis found in the Appendix (Figure 1), contains information to be used in the planning of this flight. It may be removed from the booklet and used for your calculations. The Appendix also includes data for use in solving various test items.

ROUTE OF FLIGHT: See partially completed flight plan below.

FEDERAL AVIATION AGENCY

FLIGHT PLAN

Form Approved.
Budget Bureau No. 04-R072.3

1. TYPE OF FLIGHT PLAN: [ ] FVFR [ ] VFR [XX] IFR [ ] DVFR

2. AIRCRAFT IDENTIFICATION: N 1234P

3. AIRCRAFT TYPE/SPECIAL EQUIPMENT 1/	4. TRUE AIRSPEED	5. POINT OF DEPARTURE	6. DEPARTURE TIME		7. INITIAL CRUISING ALTITUDE
			PROPOSED (Z)	ACTUAL (Z)	
ASTRO/A	170 KNOTS	DEN	1930		9,000

8. ROUTE OF FLIGHT

Radar Vector Byers V4 MKC

9. DESTINATION (Name of airport and city)	10. REMARKS
Kansas City Muni. Kansas City, Mo.	

11. ESTIMATED TIME EN ROUTE		12. FUEL ON BOARD		13. ALTERNATE AIRPORT(S)	14. PILOT'S NAME
HOURS	MINUTES	HOURS	MINUTES		
				SLN	

15. PILOT'S ADDRESS AND TELEPHONE NO. OR AIRCRAFT HOME BASE	16. NO. OF PERSONS ABOARD	17. COLOR OF AIRCRAFT	18. FLIGHT WATCH STATIONS

CLOSE FLIGHT PLAN UPON ARRIVAL

1/ SPECIAL EQUIPMENT SUFFIX
A—DME & 4096 Code transponder
B—DME & 64 Code transponder
D—DME
L—DME & transponder—no code
T—64 Code transponder
U—4096 Code transponder
X—Transponder—no code

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21. According to the weather depiction chart (Figure 4),

1—the lowest ceiling along the proposed route of flight is at Kansas City (MKC).

2—VFR conditions exist for more than half of the route.

3—stations between SLN and MKC have scattered clouds.

4—VFR conditions exist in Kansas south of Salina (SLN).

22. After checking the area forecasts (Figures 5 and 6) and the 12-hour upper wind prog (Figure 7), you determine that during the proposed flight you

1—will encounter moderate icing in eastern Kansas.

2—are not likely to encounter icing conditions.

3—are likely to encounter moderate CAT in Colorado.

4—are likely to encounter moderate turbulence in northwest Kansas.

23. Which statement is a correct interpretation of the SA report (Figure 8)?

1—Denver (DEN) has scattered clouds at 1,700 feet.

2—Topeka (TOP) does not have a ceiling, but the visibility is 2 miles with very light rain.

3—Wichita (ICT) has a temperature of 34° F.

4—Kansas City (MKC) has a wind from 140° at 7 knots.

24. From the Power setting table and Fuel consumption chart (Figures 9 and 10), determine the power setting that will give the best fuel economy at 65%. (Pressure altitude of 9,000 feet—air induction temperature 0° C.)

1—2100 r.p.m. 22.4″ manifold pressure.

2—2200 r.p.m. 21.13″ manifold pressure.

3—2300 r.p.m. 20.6″ manifold pressure.

4—Any of the above will give 65% power and have the same fuel burn.

25. If the left engine fails after you start the climb, what rate of climb should be obtainable according to Figure 11?

1—20′ per minute
2—0′ per minute
3—50′ per minute
4—200′ per minute

(Use gross weight of 5,200 lbs.-standard altitude of 6,000 feet–IAS of 97 m.p.h. or 84 knots.)

26. At a standard altitude of 9,000 feet, 65% power should produce a true airspeed of (Figure 12)

1—174 knots.
2—178 knots.
3—185 knots.
4—200 knots.

27. Determine the density altitude for Stapleton International Airport from the Pressure altitude density chart (Figure 13).

(Obtain temperature and altimeter setting from the SA 1900Z report, Figure 3—elevation of Stapleton is 5,330 feet.)

1—5,125 feet.
2—6,625 feet.
3—6,300 feet.
4—5,525 feet.

28. If you decide to use a true airspeed of 175 knots at a pressure altitude of 9,000 feet and a temperature of 6° C., you would need an indicated airspeed of (see airspeed correction table below)

1—165 knots.
2—148 knots.
3—152 knots.
4—160 knots.

Airspeed Correction Table
Flaps–0

IAS (knots)	CAS (knots
140	138
150	148
160	158

29. The computed flight time from takeoff to Kansas City Municipal Airport is

1—2:41.
2—2:46.
3—2:36.
4—2:51.

30. The fuel required for this IFR flight is approximately

1—520 lbs.
2—643 lbs.
3—553 lbs.
4—655 lbs.

31. Determine the c.g. in inches aft of datum with a loading as shown below.

	Weight (lbs.)	*Arm (in.)*	*Moment (lb.-in.)*
Empty weight (includes 4 gal. unusable fuel)	3,147		283,746
Oil	45	55.0	2,475
Pilot & co-pilot seat	340	89.0	30,260
Middle seats	410	126.0	51,660
Rear seats	345	157.0	54,165
Fuel (4 tanks)	720	113.0	
Baggage (front)	113	10.0	1,130
Baggage (rear)	80	183.0	14,640
	5,200 lbs.		

1—91.5
2—90.2
3—99.9
4—96.9

32. Assume that after takeoff at Stapleton, you lost your VOR navigation receivers and you elect to return to Stapleton. You are cleared for an NDB (ADF) approach to runway 26L (Figure 14). You turn outbound from the LOM on a heading of 077° and the ADF needle indicates 180° on roll out, but deflects to the left (clockwise) while you maintain a magnetic heading of 077, a correct procedure is to

1—turn right 20° and fly a magnetic heading of 097° until the ADF needle deflects 20° to the left. At that time you are back on course and should allow for a wind from your right.

2—turn left 20° and fly a magnetic heading of 057° until the ADF needle shows a deflection of 20° to the right. Then, turn right to 072° and if the wind correction you made was satisfactory, the ADF needle will remain on 180°.

3—turn right 20° and hold that heading until the ADF needle indicates 200°,

then turn to a heading of 082° to allow a 5° correction for the wind.

4—turn left 20 degrees to 057° and fly until the ADF needle indicates 200°, then turn right to a heading of 072° to allow a 5° correction for wind drift.

33. What is a correct sequence for tuning the DME on this flight from DEN to GLD? (See enroute chart, Figure 15.)

1—Set DME on 110.3 (Stapleton) until reaching Byers; tune to TXC (112.9) until about 36.5 miles from GLD; then tune to GLD.

2—Before takeoff, tune to DEN (116.3); when at TXC tune to GLD.

3—Tune the DME to the same facility as you tune your No. 1 navigation receiver, and as soon as you change your navigation receiver to another facility, change the DME to that facility.

4—Tune your DME to the navigation facility you are approaching unless it is over 100 miles between facilities.

* * * * * * * * *

After takeoff, Stapleton tower instructs you to contact Departure Control on 124.8. You contact Departure Control and they confirm radar contact and vector you to intercept V4. You are also instructed to report reaching 9,000. You report reaching 9,000. Upon intercepting V4, Departure Control instructs you to contact Denver Center on 119.8.

* * * * * * * * *

34. The recommended phraseology for making contact with Denver Center is

1—Denver Center—this is ASTRO 1234P 40 miles west of Thurman—9,000—Thurman at 2000Z—MKC—over.

2—Denver Center—ASTRO 1234P—Thurman 2000Z—9,000—MKC—over.

3—Denver Center—ASTRO 34P—MKC—over.

4—Denver Center—ASTRO 1234P—9,000—over.

35. Assume that about 10 minutes after passing Thurman (TXC), you are told to contact Denver Center on 142.5. As you attempt to change your communication receiver to this frequency, you realize it only goes to 129.9. You are unable to reestablish contact with Denver Center on 119.8. In this situation, you should attempt to contact

1—Denver Center on any other frequency listed on the enroute chart for Denver Center.

2—Goodland Radio on any standard FSS frequency or 122.3.

3—any ATC facility on 121.5.

4—Departure Control on 126.9.

36. The communication box at Goodland (Figure 15), indicates that

1—all standard frequencies except 122.3 are available.

2—only 122.3 is available.

3—all standard frequencies and also 122.3 are available.

4—all standard frequencies are available, but 122.3 is the best frequency to use.

37. At Topeka, you receive the following amended clearance: ASTRO 1234P CLEARED TO WOOD INTERSECTION V4N—DESCEND TO AND MAINTAIN 7000—EXPECT FURTHER CLEARANCE AT 2210Z. Upon arrival at Wood Intersection (still in radar environment), you should (area chart, Figure 16)

1—call Kansas City Center and tell them you have arrived at Wood Intersection.

2—go into a standard holding pattern with a direct entry to the pattern.

3—hold at Wood Intersection until 2210, and then, if you have not received further clearance, continue to MKC.

4—make a direct entry into a nonstandard holding pattern.

38. Before reaching Wood Intersection, you are instructed to contact Kansas City Approach Control. After contact, you are given a radar vector for an ILS approach to runway 18. While on a heading of 150°, you are cleared for an ILS approach. In this situation, you should

1—turn onto the localizer upon interception and make the approach as shown on the approach plate.

2—continue on a heading of 150° through the localizer as Approach Control may want to bring you back from the other side for spacing.

3—call Approach Control when you intercept the localizer for permission to track inbound.

4—turn onto the localizer upon interception and immediately call Kansas City Tower.

39. Which statement is correct regarding minimums for this approach (Figure 17)?

1—Since this is a straight-in approach, the MDA is 400 ft.

2—The MDA is 1,160 ft.

3—The DH is 1,158 ft.

4—Since this plate does not have the new format, a ceiling of 400 ft. and a visibility of 1 mile are required.

40. If you had to go to your alternate (Salina) and your DME was inoperative, which statement is true regarding your approach (Figure 18)?

1—Although the wind is out of the south, you would have a lower MDA by circling to land from an ILS approach to runway 35 than by making a VOR runway 17 straight-in approach.

2—Should you be cleared for a VOR approach to runway 17, you would have to make this approach to land at Salina.

3—With a visibility of ¾ mile, you could make either a VOR approach to runway 17 or an ILS approach to runway 35, even though the control tower was not in operation.

4—If you were cleared for an approach while holding at the Salina VORTAC, you could make a straight-in approach.

Analysis of Answers to Sample Test Items

Item	*Answer*	
1	2	To be current, a pilot must have made 5 takeoffs and 5 landings to a full stop in the category, class, and type aircraft he is to fly. He can meet the requirements of FAR 61.47 for carrying passengers at night by making the 5 takeoffs and landings in any aircraft.
2	4	See *Airman's Information Manual*, Part 1, "Air Navigation Radio Aids," for normal usable altitudes and further information.
3	1	ATC does not provide aircraft separation or control traffic except in controlled airspace.
4	2	The turn needle is independent of the "ball." If the turn needle is properly calibrated, it shows the correct rate of turn regardless of the position of the ball. (See IFR Exam-O-Gram No. 18.)
5	1	Since many NavCom transceivers utilize part of the receiver circuitry when the transmitter is operating, unreliable CDI indication may be obtained while transmitting.
6	4	For information on compass errors, see page 49 of the *Instrument Flying Handbook* (AC 61-27A).
7	2	The elevator trim should be used to relieve elevator control pressures. A change of power or airspeed requires a change of elevator trim. (See *Instrument Flying Handbook*, page 66.)
8	3	A. FAR Part 91.5. B. There is no requirement to file either a VFR or IFR flight plan in this case, but it is considered a good practice. C. FAR Part 91.5. D. FAR Part 91.5. This is included in the phrase, "familiarize himself

Item	Answer	
		with all available information concerning that flight." At the time of this publication, there is a Notice of Proposed Rule Making, proposing the amending of 91.5 to make this clear.
9	2	When the altimeter is set to 29.92 (standard pressure), the pressure altitude can be read directly from the altimeter, assuming no altimeter error.
10	1	To determine magnetic bearing, use magnetic heading. (In this problem variation and wind are not needed.)

Compass heading	320°	
Dev.	5° W.	
Magnetic heading	315°	
Relative bearing	115°	
Magnetic heading	315°	
Magnetic bearing to station	430° −180°	−360° or 70° +180°
Magnetic bearing from station	250°	250°

11	4	An abrupt movement of the controls not only leads to over-controlling, but may put undue stress on the aircraft.
12	2	The ball indicates a skidding turn. The pilot is either holding right rudder, or the airplane is out of trim.
13	4	A. The greater the gross weight, the higher the stalling speed. B. Correct as stated. C. Since the airplane will stall at a higher airspeed, the approach speed should be increased. D. Correct as stated. E. The amount of load the stabilizer carries depends on the location of the center of gravity.
14	4	See AIM 1, "ATC Clearances/Separations—Clearance Items."
15	2	For further information on air flow, see *Aviation Weather* (AC 00-6).
16	2	A. Correct as stated (see *Aviation Weather*, page 117). B. Frost does not form from dew, but directly from water vapor. C. If the wings are cold, frost can occur as stated in A. D. Correct as stated.
17	1	For further information on stability of air masses, see *Aviation Weather*, page 35.
18	3	For further information on runways, see Part 1 of AIM and IFR Exam-O-Gram No. 26.
19	1	The load factor for a 60° bank is 2, which requires twice the lift required for a load factor of 1.
20	1	A. Maximum endurance is attained at an airspeed that requires minimum power. B. For propeller airplanes, minimum drag and minimum power do not occur at the same airspeed. C. Correct as stated. D. From the drag chart, notice that there are two speeds that have the same total drag.
21	4	Areas having IFR weather are enclosed by a solid line. South of SLN several stations are shown in Kansas inside an area enclosed by a scalloped line. This is an area of marginal VFR weather. (See IFR Exam-O-Gram No. 15.)
22	2	Area forecast (Figure 5), indicates a freezing level of 7,000 in Nebraska and Iowa, sloping to 10,000 in SW Kansas. Clouds in Colorado are above your proposed altitude. Upper wind prog (Figure 7), indicates temperatures of +6° C. in Colorado and Kansas, and +1 C. at Kansas City; all above freezing.
23	4	Denver has a broken ceiling at 17,000; Topeka has a ceiling of 400 feet; the temperature at Wichita is 40° F.

Item *Answer*

24 1 Power settings with various r.p.m. and manifold pressure combinations are listed in Figure 13 for 65% rated hp. The lowest r.p.m. results in the least fuel consumption as illustrated by Part throttle fuel consumption chart, Figure 10.

25 1 With a gross weight of 5,200 lbs., the Single engine climb rate chart (Figure 11), indicates an absolute ceiling of 6,200 ft. The airplane is capable of a 20 ft./min. climb at 6,000 ft.

26 1 Figure 12 indicates that at 9,000 feet, the true airspeed should be 200 m.p.h. or 174 knots.

27 3 Elevation ------ 5,330 ft.
Correction for non-standard (30.06) ------ −129 ft.
Pressure altitude 5,201 ft.
Density altitude from chart (PA 5,201 @ 58° F.) ---- 6,300 ft. (approx.)

28 3 The CAS is 150 knots. In this airspeed range, the IAS is 2 knots greater, or 152.

29 1 Avg. wind (true)
DEN to SLN=230° @ 18 knots
SLN to MKC=245° @ 19 knots
If one desires to change the true wind to magnetic, subtract average easterly variation.

Avg. wind (magnetic)
DEN to SLN=219° @ 18 knots
SLN to MKC=236° @ 19 knots
Avg. mag. course TXC to SLN=088°

From	*To*	*GS*	*Time*
Byers	TXC	187	:13.8
TXC	SLN	186	1:26.0
SLN	MKC	192	:44.8
MKC	SLN	163	:53

30 4 Subtracting 12 minutes from the total time of 2:41, gives 2:29. Using 143 lb./hr. fuel flow, the fuel burn to MKC should be 355+50 or 405 lbs.

Item *Answer*

It should take approximately 60 min. to go to the alternate, resulting in a fuel burn of 143 lbs. The reserve requirement is 45 minutes or a fuel burn of 107 lbs.

31 3 The moment for the fuel is 720×113 or 81,360; a total moment of 519,436. Dividing 5,200 into this, gives a c.g. of 99.9″ aft of datum.

32 2 TXC is not a VORTAC, therefore, has no DME signal.

33 4 See IFR Exam-O-Gram No. 23 for ADF procedures.

34 4 Since you are in radar contact, no position report is required; however, the center will want you to verify your altitude.

35 2 Goodland Radio has all standard FSS frequencies and an additional frequency of 122.3. If you cannot reestablish contact with Denver Center on 119.8, you should try to contact the nearest FSS which is Goodland Radio.

36 3 Explained above.

37 4 It is not necessary to make position reports when in radar environment unless requested. Both the enroute chart and area chart show a holding pattern with left turns which is nonstandard. See AIM 1, "ATC Clearances," and "Enroute–IFR" for more information.

38 1 When you are cleared for the approach, you are expected to make necessary turns to make the approach. However, you do not call the tower until so instructed by Approach Control.

39 3 Since the AL Chart is not the new format, for a straight-in approach add the ceiling of 400 feet to the field elevation. This is a DH of 758 ft.

40 1 An ILS RWY 35 circling approach has an MDA of 1700, while the VOR straight-in approach is 1740. If you

Item	*Answer*
	were cleared for a VOR approach and did not think you could safely make it, you could request the ILS approach. However, should Approach Control have a large amount of traffic, unless you had more than a loss of DME, they might delay your clearance and put you in a holding pattern until they could work you in for the ILS approach.

Appendix

This section contains supplementary data for use with the sample test.

FLIGHT TIME ANALYSIS

CHECK POINTS		ROUTE CRUISE ALT./FLT. LEVEL	Mag Avg Course	AIRSPEED-KTS.		WINDS ALOFT DIRECTION VELOCITY TEMPERATURE	DRIFT CORR ANGLE	GROUND SPEED	DISTANCE N.M.	TIME		FUEL CONSUMPTION LBS./GALS.		MISC.
FROM	TO			EAS OR MACH NO.	TAS					LEG	TOTAL	LEG	TOTAL	
Stapleton Airport	Byers	Radar Vector	---	---	---	-------	---	---	---	12.0	12	50*	50	*Includes taxi and warm up.
Byers	TXC	V4 9000	083		175	**								
TXC	SLN	"			"									
SLN	MKC	"	072°		"									
MKC	K.C. Muni	-----	---	---	---	-------	---	---	---	4.8				

ALTERNATE DATA

KC Muni	MKC	-----	---	---	---	-------	---	---	---	7.0	7.0
MKC	SLC				172	Mag. Wind 220°=11 kts					

FUEL SUMMARY

	TIME	LBS./GALS.
ENROUTE		
ALTERNATE		
RESERVE		
EXTRA		
TOTAL		

** Obtain wind aloft from 12 hr. upper wind prog., Figure 8. Use average of DEN and HLC winds for flight to Salina (SLN), use average of HLC and MKC winds for flight from Salina to Kansas City. Use fuel burn of 143 lb/hr unless fuel burn is shown on Flight Time Analysis.

FIGURE 1. Flight time analysis.

FAA AC 60-022

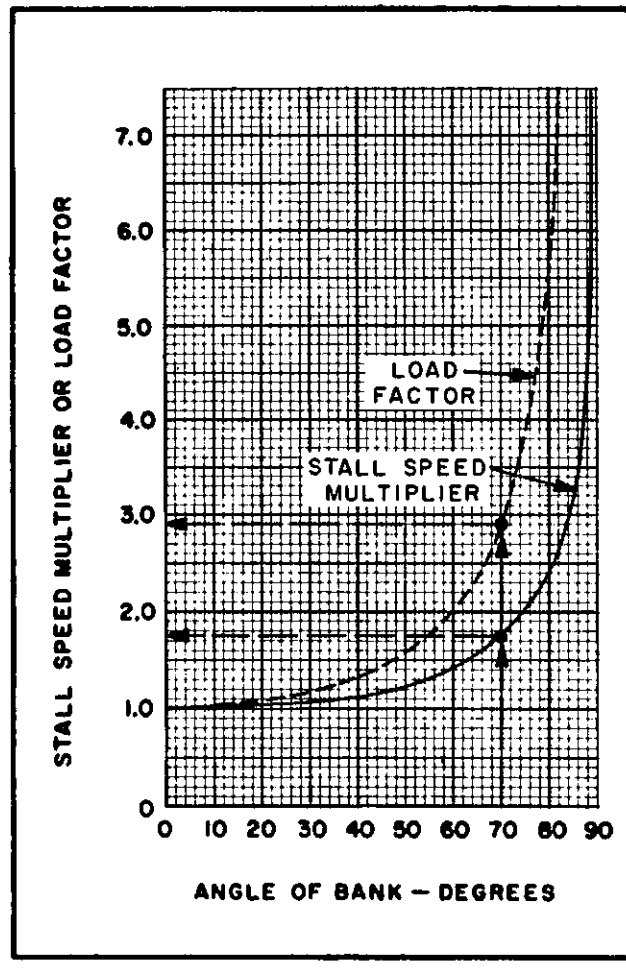
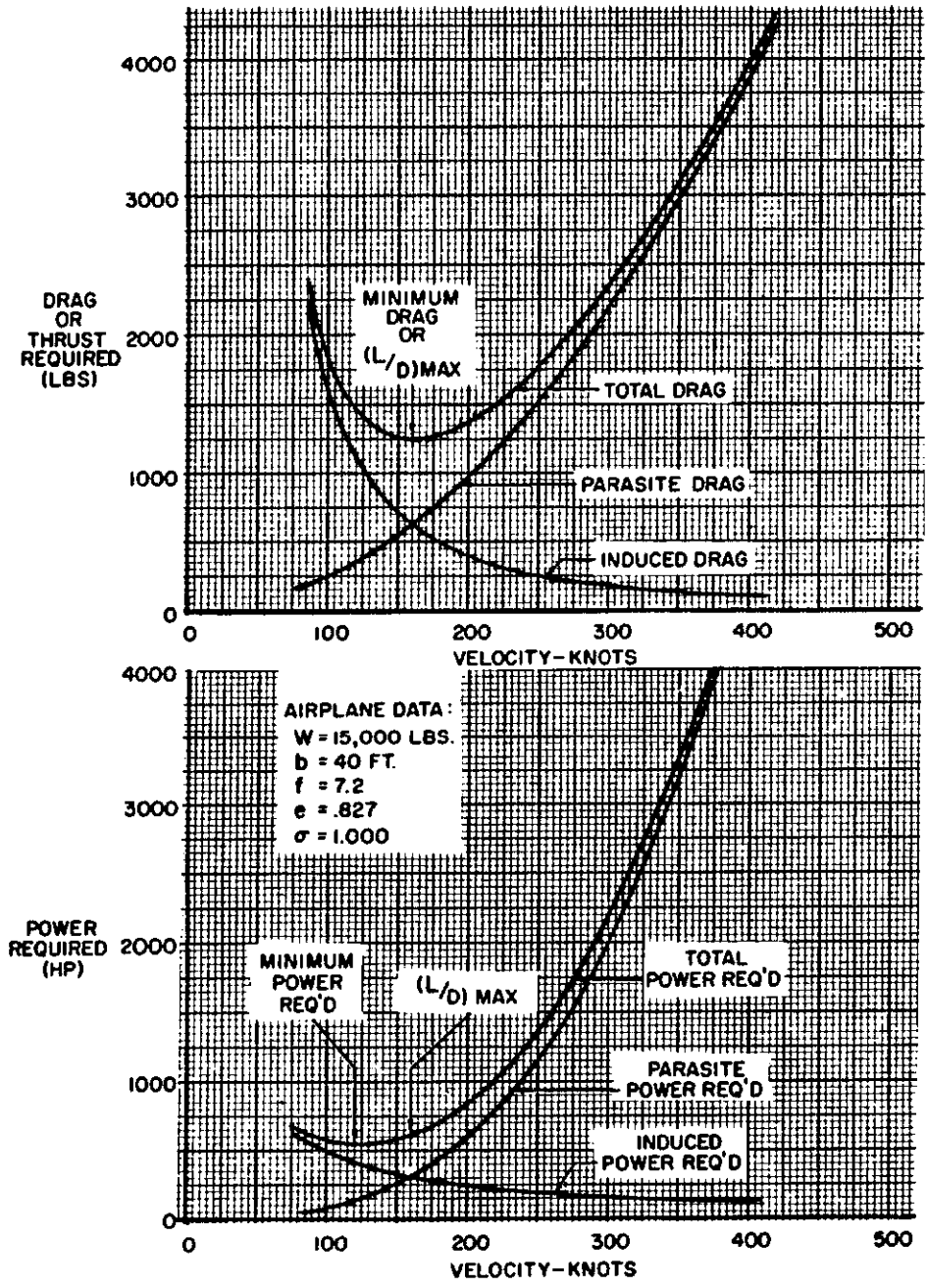


FIGURE 2. Stall speed multiplier or load factor.



Airplane Thrust and Power Required

FIGURE 3. Airplane thrust and power required.

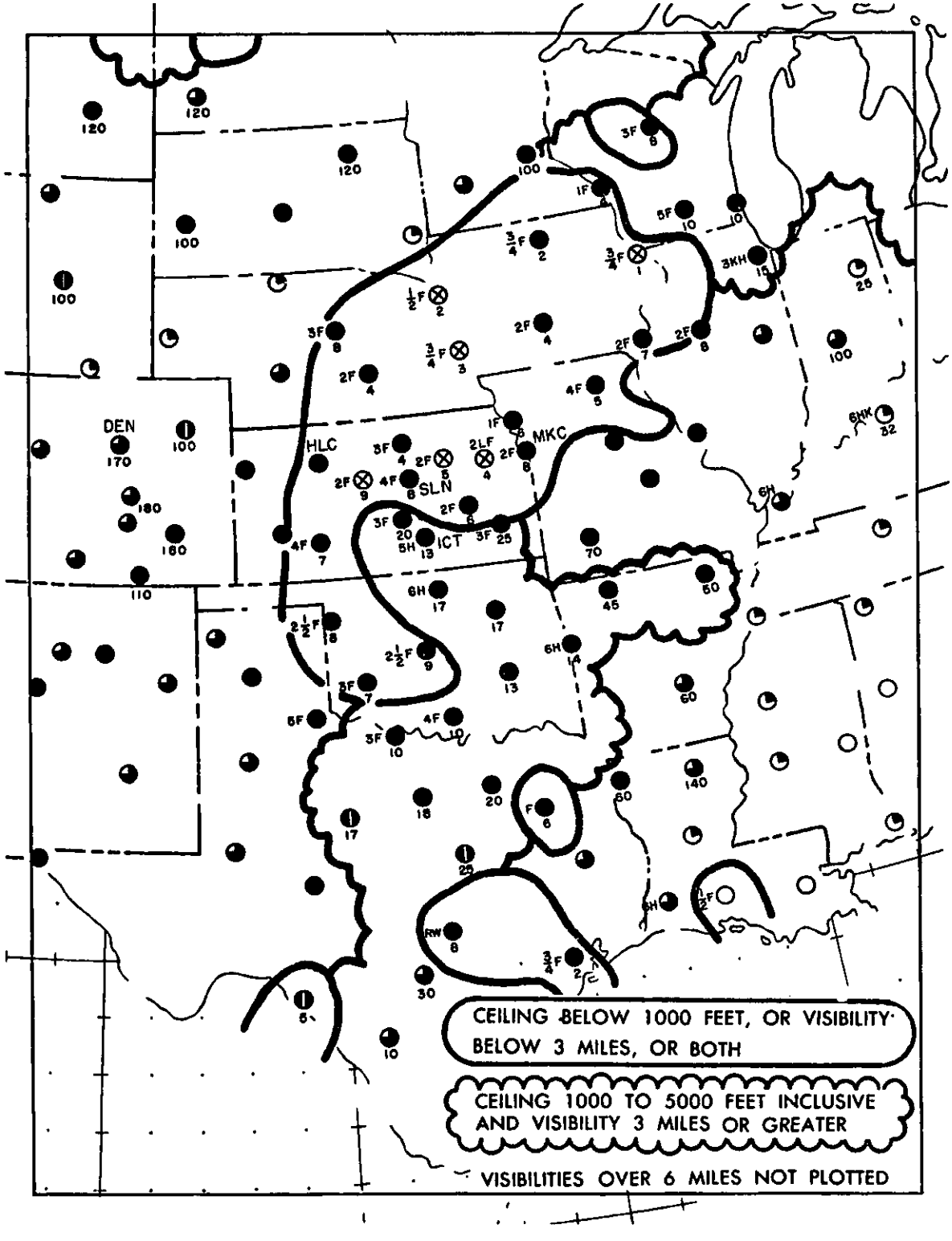


FIGURE 4. Weather depiction chart.

416-414 O - 71 - 3

FA MKC 171845Z
19Z WED-Ø7Z THU

NEB EXCP PNHDL IA KANS MO

HGTS ASL UNLESS NOTED.

SYNOPSIS. WDSPRD LOW ST AND FOG THU MOST OF FCST AREA WITH LTL IPVMT EXPCD THRU PD.

CLDS AND WX...

MOST OF IA NRN TWO THIRDS OF MO CNTRL AND ERN KANS PTNS OF SCNTRL AND ERN NEB C2-5⊕1-3F OCNL C2X1/2FL-- SERN HLF IA NWRN MO AND NERN KANS. SLO IPVMT EXTRM WRN EDGES BY ØØZ HWVR CONDS SPRDG SLOLY SWD RMNDR MO.

EXTRM S CNTRL AND SERN KANS SRN THIRD AND E CONTRL MO C15-35⊕V⊕3-5FK OR HK LWRG C8-12⊕2-5F WITH OCNL L-- BY Ø4Z.

WRN KANS C12Ø⊕3ØØ⊕7 WITH -X1-3GF SWRN HLF CHC C6-8⊕1F AND BCMG C4-6⊕3F BY Ø4Z SWRN PTNS.

N CNTRL NEB. 1ØØ⊕3ØØ-⊕ WITH CHC 12⊕25⊕C1ØØ⊕.

ICG. LGT TO OCNL MDT MXD ICGICIP. FRZLVL NEB AND IA SLPG TO 7Ø-1ØØ EXTRM SWRN KANS.

TURBC. LGT TO LCLLY MDT TURBC BLO 7Ø CNTRL NEB NWRN KANS.

OTLK Ø7Z-19Z THU. CONDS ERN NEB N CNTRL KANS LFTG 18-3Ø⊕V⊕5F BY 14Z AND 4Ø⊕8Ø⊕7 BY 19Z LTLCG ELSW.

FIGURE 5. Area forecast (MKC).

FA DEN 181845
19Z WED-Ø7Z THU

COLO WYO NEB PNHDL

HGTS ASL UNLESS NOTED

SNYS. HI PRES W OF CONTDVD. WK TROF OF LO PRES ERN PRNS OF AREA DRFTG EWD

CLDS AND WX. OVR AREA. 17Ø-2ØØ◐V◐3ØØ LCLY A FEW AREAS 1ØØ-12Ø◐V◐ OVR EXTRM NWRN WYO WITH ISOLD SNW SHWRS. OCNL MTN OBSCMT VCNTY SNW SHWRS

ICG. NONE OF CONSEQUENCE. FRZLVL 9Ø-1ØØ NRN WYO TO 11Ø-12Ø COLO

TURBC. LGT TO LCLY MDT W OF CONTDVD COLO. ELSW OVER AND NEAR MTNS MDT TURBC LCLY SVR WITH UDDF ALG ERN SLPS OF MTNS. MTN WAVE LKLY E OF CONTDVD WYO AND NRN COLO 22Ø-39Ø WITH LGT TO LCLY MDT CAT

OTLK Ø7Z-19Z THU. NO SGFNT CHGS

FIGURE 6. Area forecast (DEN).

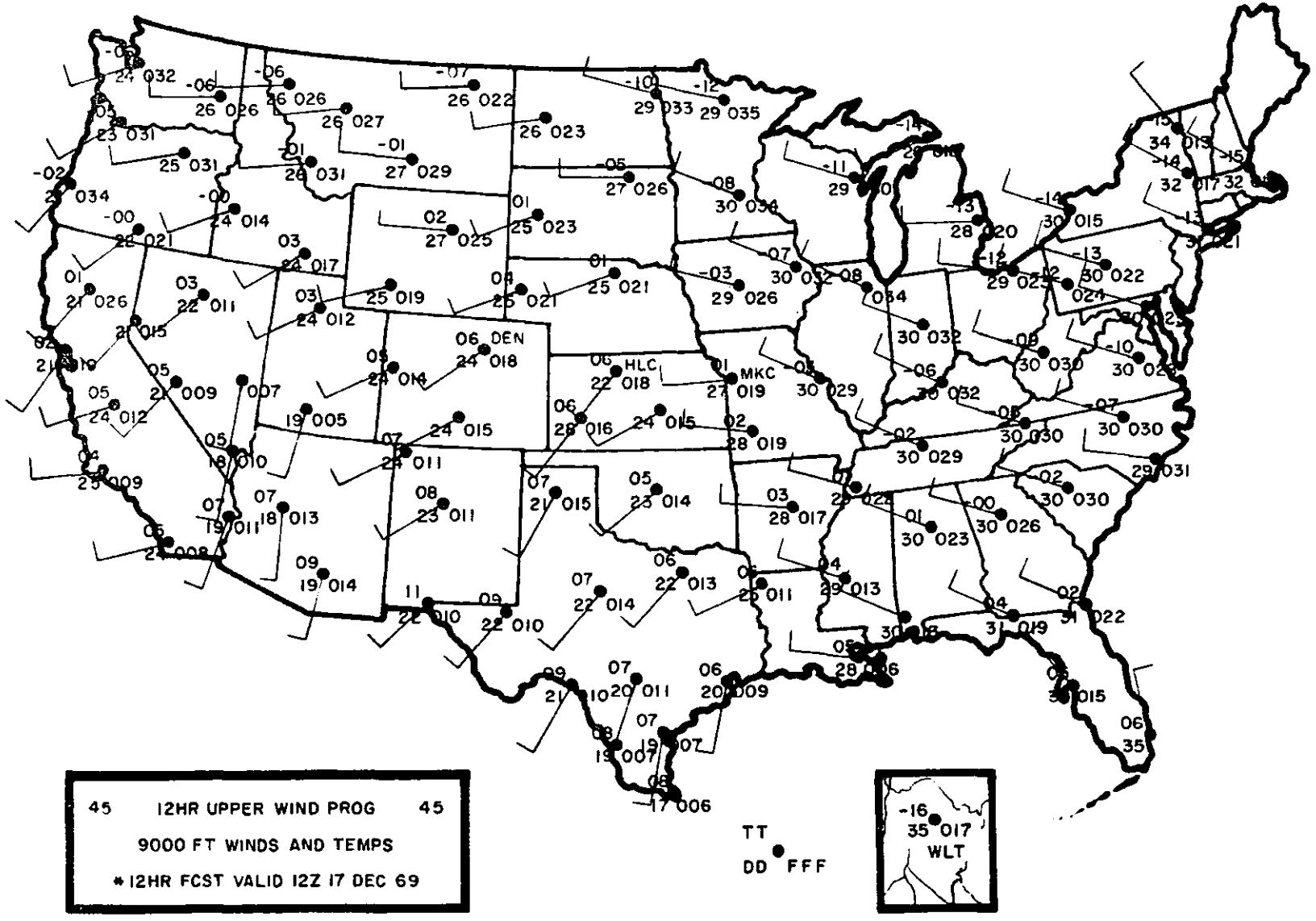


FIGURE 7. 12-hour upper wind prog.

```
Ø3Ø SA3Ø1719ØØ
DEN E17ØⓄ25ØⓄ6Ø 172/58/13/ØØØØ/ØØ6/ACSL ALQDS
  →DEN↘12/8 ASE OA 12/9 ASE XX
GLD 14ØⓄ24Ø⊕15+ 168/48/3Ø/3Ø1Ø/ØØØ
HLC 1Ø-⊕7 195/4Ø/32/22Ø6/ØØ4/FOG ALQDS
RSL W9X2F 2Ø9/38/33/1912G21/ØØ8/ PRESFR
SLN E8⊕4F 2Ø7/39/34/1814/Ø12→SLN↘12/6 FRI XX
MHK W5X2F 32/29/16Ø8/Ø18/⊕46 PRESFR
TOP S W4X2L-F 244/32/29/171Ø/Ø22
MKC S M8⊕2FK 25Ø/34/3Ø/14Ø7/Ø24→MKC↘12/4 XX
STJ S M6⊕1F 33/28/171Ø/Ø19/R35VV11/2+
COS E 18ØⓄ26Ø⊕1ØØ 173/59/-2/Ø2Ø9/ØØ8/ACSL ALQDS ⓄVⓄ
PUB 16ØⓄ25ØⓄ9Ø 162/61/14/3Ø18/ØØ3/ ACSL ALQDS
ICT M13⊕5H 223/4Ø/34/1511/Ø15→ICT↘11/9 UR
HUT S 7ⓄM2Ø⊕3F 41/35/16Ø5/Ø14
EMP B6⊕2F 243/34/29/171Ø/Ø2Ø
```

FIGURE 8. Aviation weather report.

Power Setting Table - Lycoming Model IO-540-C4B5, 250 HP Engine

Press. Alt. 1000 Feet	Std. Alt. Temp. °F	138 HP - 55% Rated Approx. Fuel 10.6 Gal./Hr. RPM AND MAN. PRESS. 2100	2200	2300	2400	163 HP - 65% Rated Approx. Fuel 11.9 Gal./Hr. RPM AND MAN. PRESS. 2100	2200	2300	2400	188 HP - 75% Rated Approx. Fuel 13.7 Gal./Hr. RPM AND MAN. PRESS. 2200	2300	2400
SL	59	21.9	21.0	20.2	19.6	24.6	23.5	22.7	22.0	26.2	25.2	24.4
1	55	21.7	20.8	20.0	19.4	24.4	23.3	22.5	21.8	25.9	25.0	24.1
2	52	21.4	20.6	19.8	19.2	24.1	23.0	22.2	21.5	25.6	24.7	23.9
3	48	21.2	20.3	19.6	19.0	23.8	22.8	22.0	21.3	25.3	24.5	23.6
4	45	20.9	20.1	19.4	18.8	23.6	22.5	21.8	21.1	25.0	24.2	23.4
5	41	20.7	19.9	19.2	18.6	23.3	22.3	21.5	20.9	24.8	24.0	23.1
6	38	20.5	19.6	19.0	18.4	23.1	22.0	21.3	20.7	24.6	23.8	22.9
7	34	20.2	19.4	18.8	18.2	22.8	21.8	21.1	20.4	---	23.6	22.7
8	31	20.0	19.2	18.5	18.0	22.6	21.5	20.8	20.2	---	---	22.5
9	27	19.8	18.9	18.3	17.8	22.4	21.3	20.6	20.0			
10	23	19.5	18.7	18.1	17.6	---	21.1	20.3	19.8			
11	19	19.3	18.5	17.9	17.4	---	---	20.1	19.6			
12	16	19.1	18.2	17.7	17.2	---	---	---	19.4			
13	12	18.9	18.0	17.5	17.0							
14	9	---	17.8	17.3	16.8							
15	5	---	---	17.1	16.6							

When using Hartzell Propeller HC-E2YK-2RB/8465-7R with IO-540-C4B5 engine. DO NOT EXCEED 27" MANIFOLD PRESSURE BELOW 2300 RPM or 25" BELOW 2000 RPM.

To maintain constant power, correct manifold pressure approximately 0.17" Hg. for each 10° F variation in induction air temperature from standard altitude temperature. Add manifold pressure for air temperatures above standard; subtract for temperatures below standard.

FIGURE 9. Power setting table.

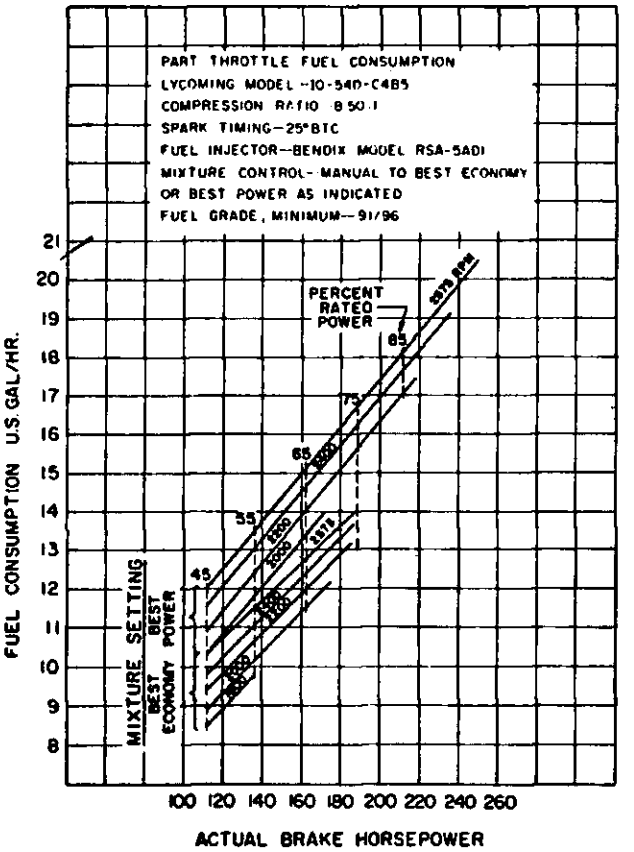


FIGURE 10. Part throttle fuel consumption chart.

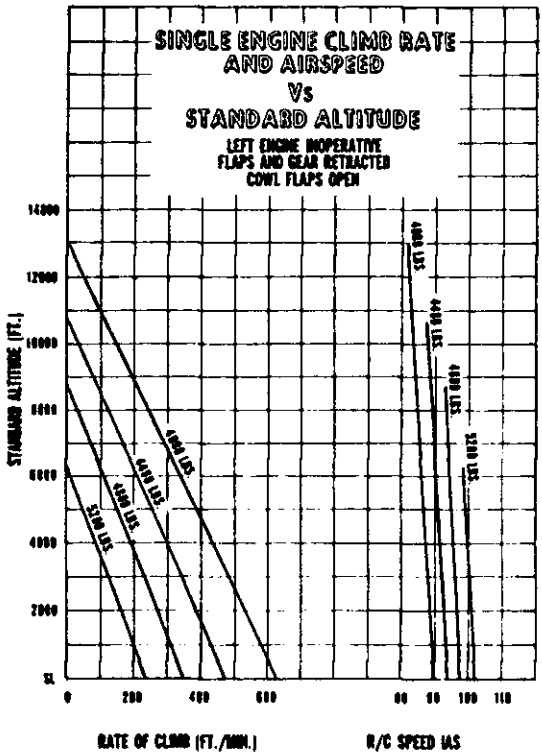


FIGURE 11. Single engine climb rate chart.

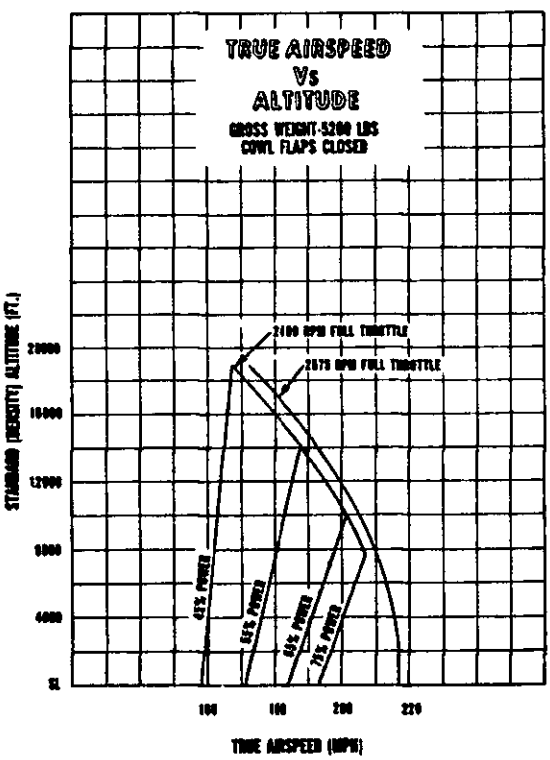
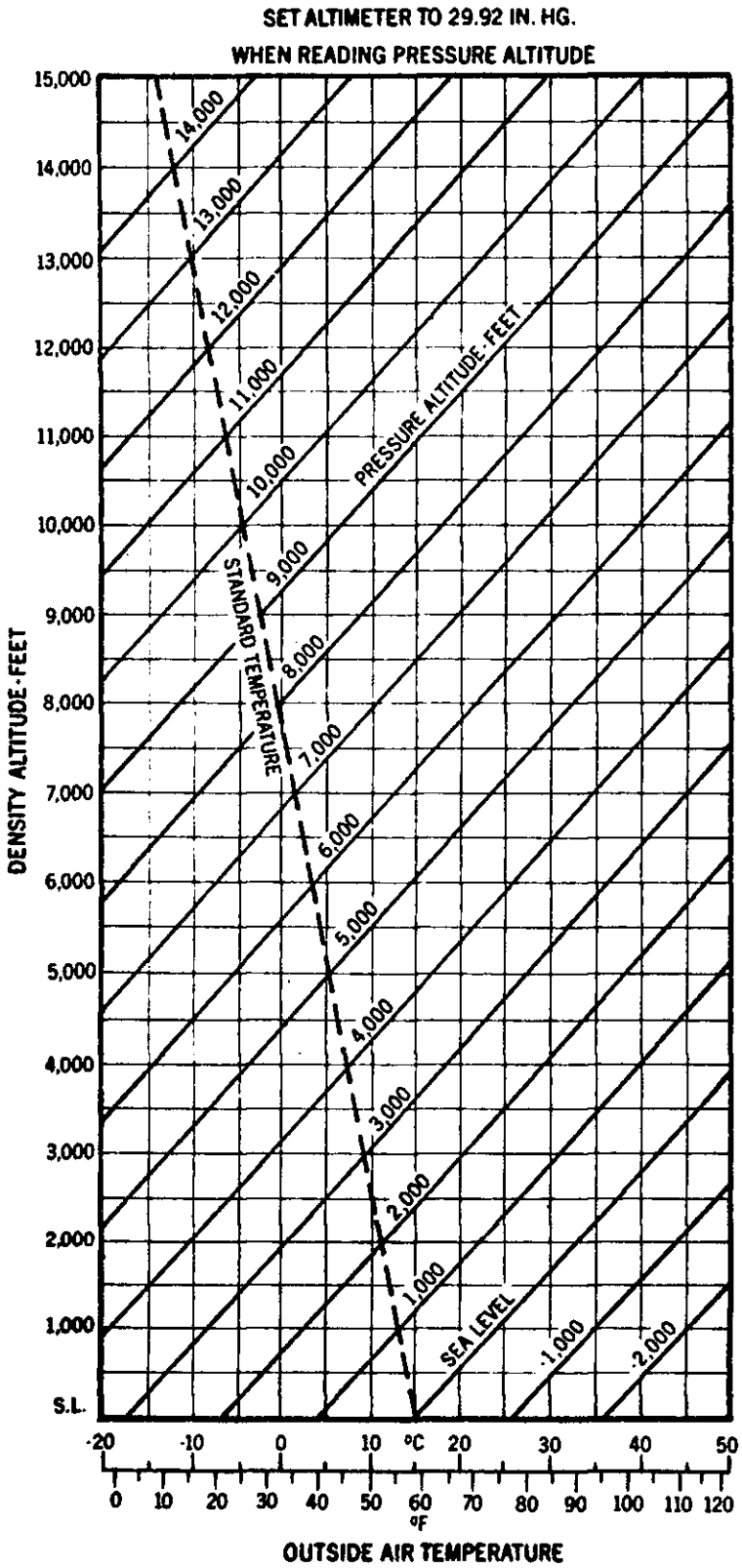


FIGURE 12. True airspeed chart.



ALTIMETER SETTING IN. HG.	ALTITUDE ADDITION FOR OBTAINING PRESSURE ALTITUDE
28.0	1,825
28.1	1,725
28.2	1,630
28.3	1,535
28.4	1,435
28.5	1,340
28.6	1,245
28.7	1,150
28.8	1,050
28.9	955
29.0	865
29.1	770
29.2	675
29.3	580
29.4	485
29.5	390
29.6	300
29.7	205
29.8	110
29.9	20
29.92	0
30.0	- 75
30.1	-165
30.2	-255
30.3	-350
30.4	-440
30.5	-530
30.6	-620
30.7	-710
30.8	-805
30.9	-895
31.0	-965

FIGURE 13. Pressure altitude density chart.

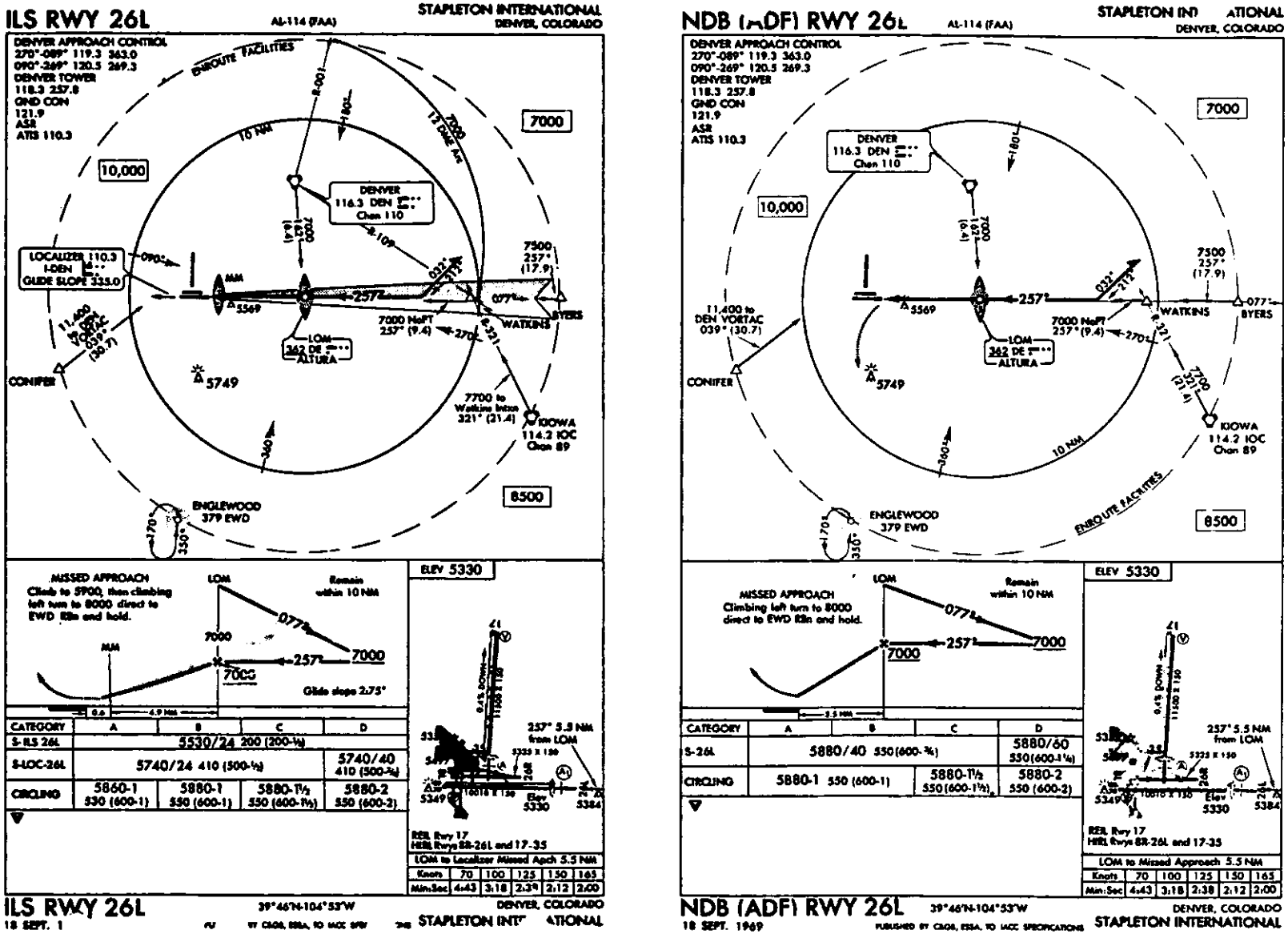


FIGURE 14. Instrument approach procedure charts—Denver, Colo.

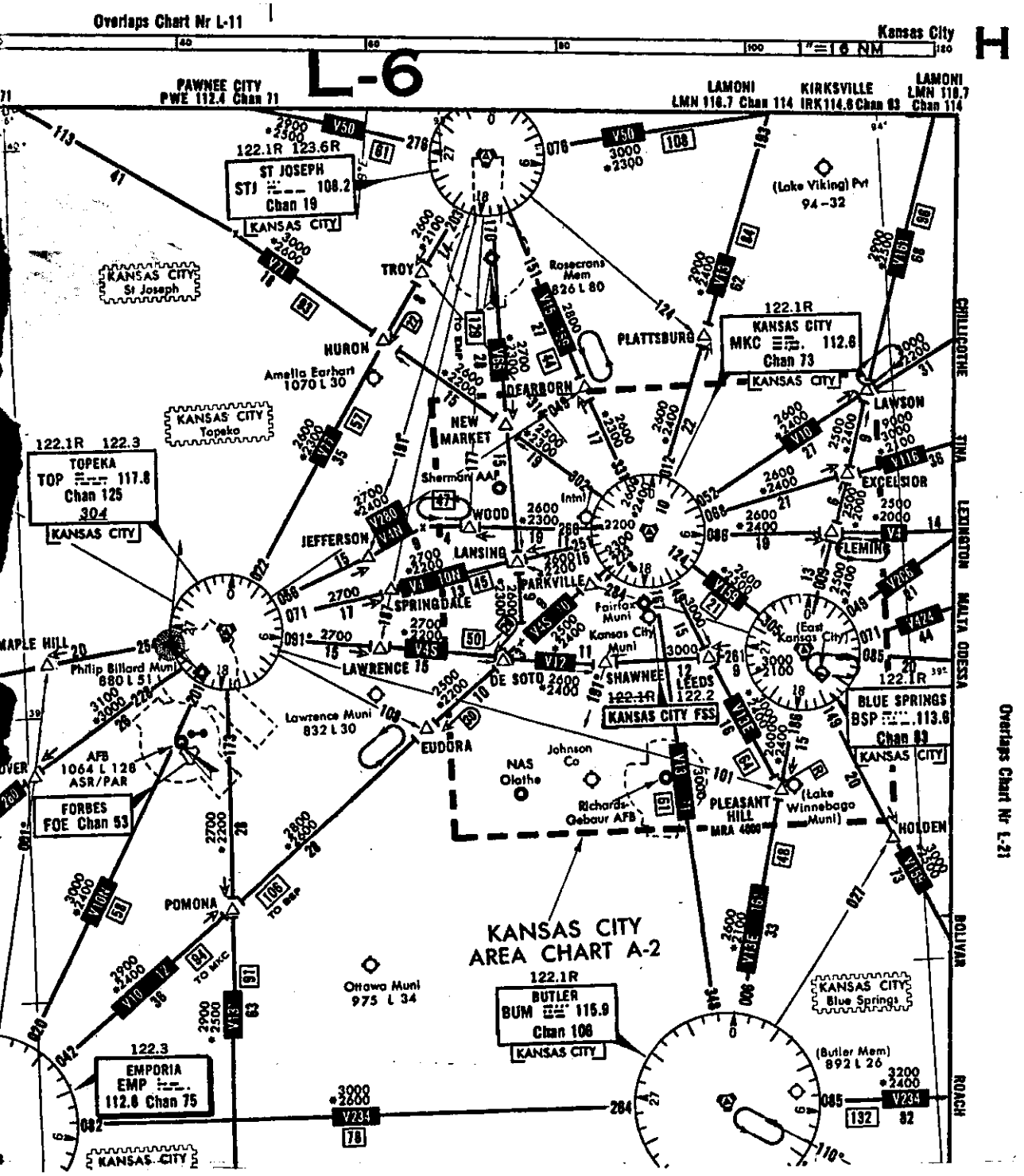
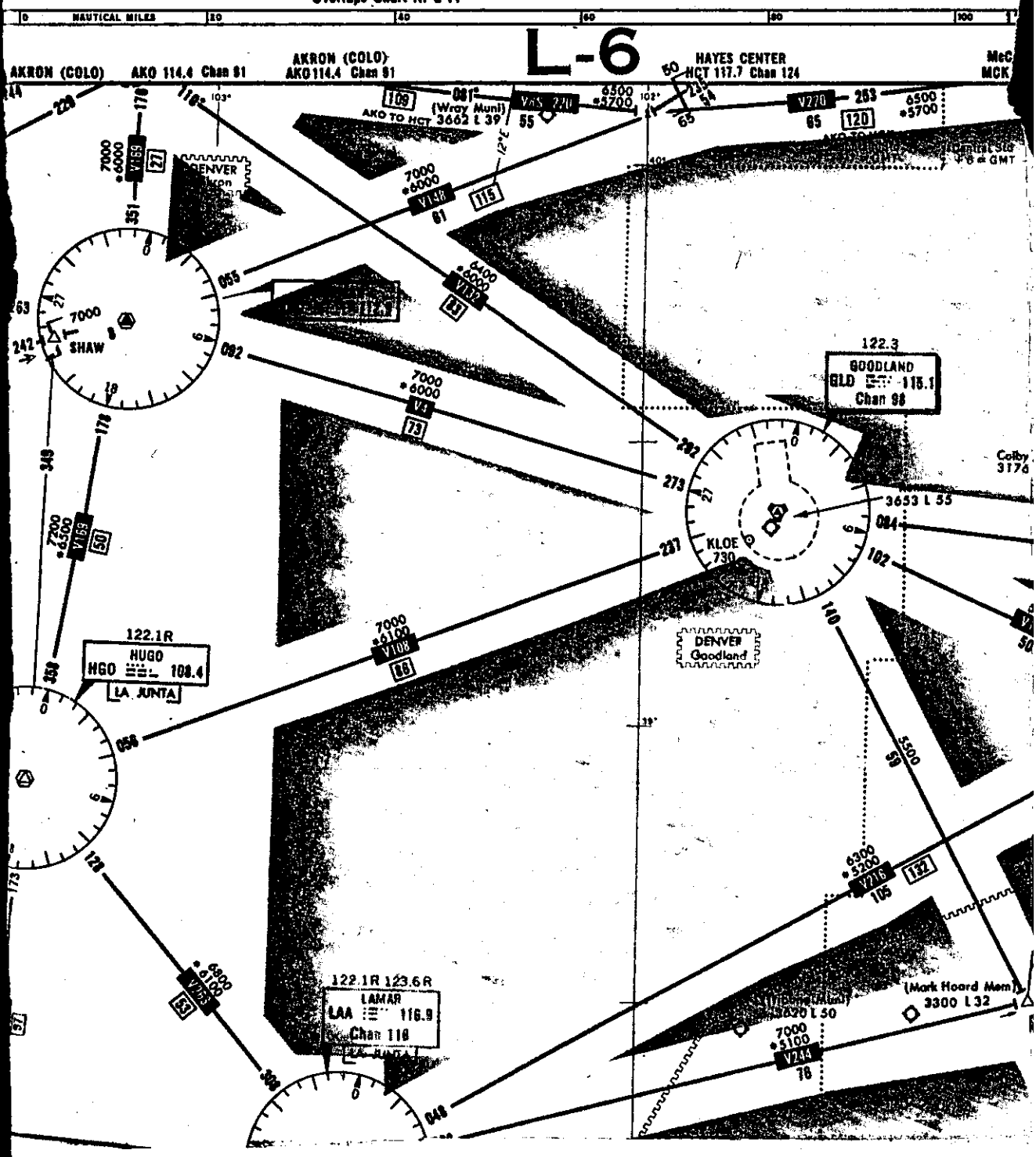


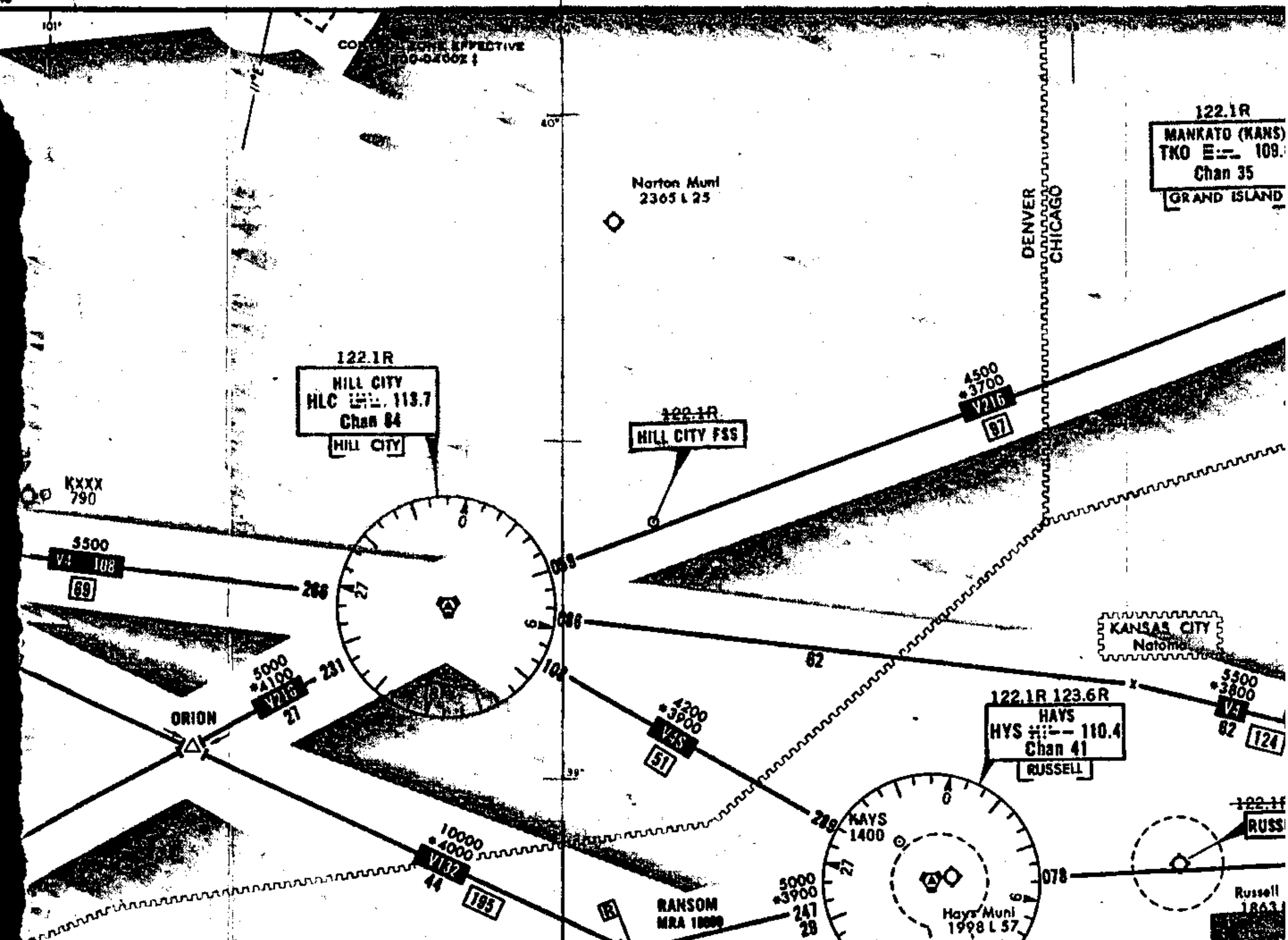
FIGURE 15. Segment of low altitude enroute chart L-6.

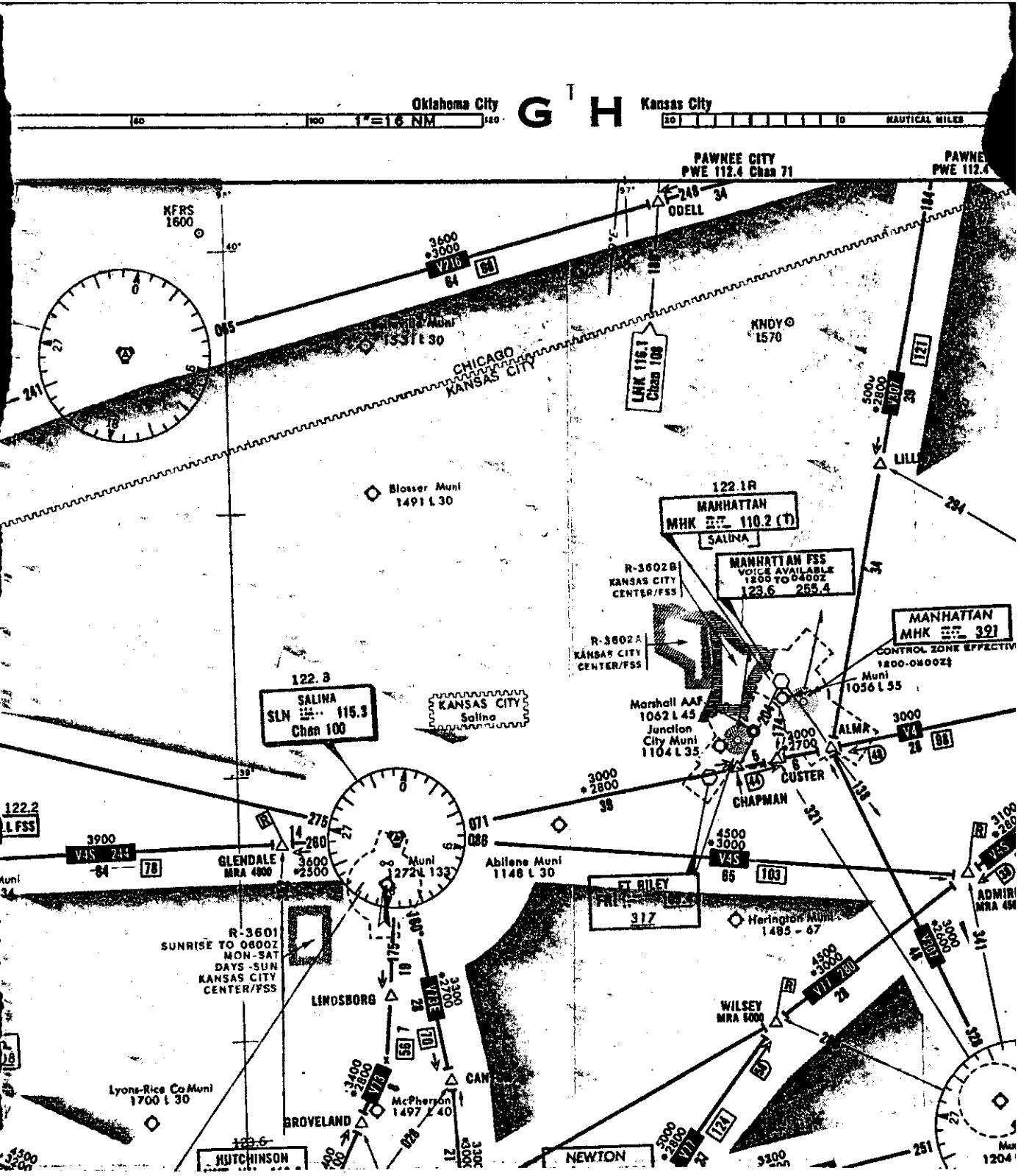

L-6
NAUTICAL MILES
AKRON (COLO) AKO 114.4 Chan 91
AKRON (COLO) AKO 114.4 Chan 91
HAYES CENTER HCT 117.7 Chan 124
AKO TO HCT 3662 L 39
(Wray Muni)
DENVER
SHAW
122.3
GOODLAND
GLD 115.1
Chan 98
KLOE
730
3653 L 55
Colby
3176
122.1R
HUGO
HGO 108.4
LA JUNTA
DENVER
Goodland
122.1R 123.6R
LAMAR
LAA 116.9
Chan 116
(Mark Hoard Mem)
3300 L 32
V69
V148
V132
V70
V270
V108
V216
V244

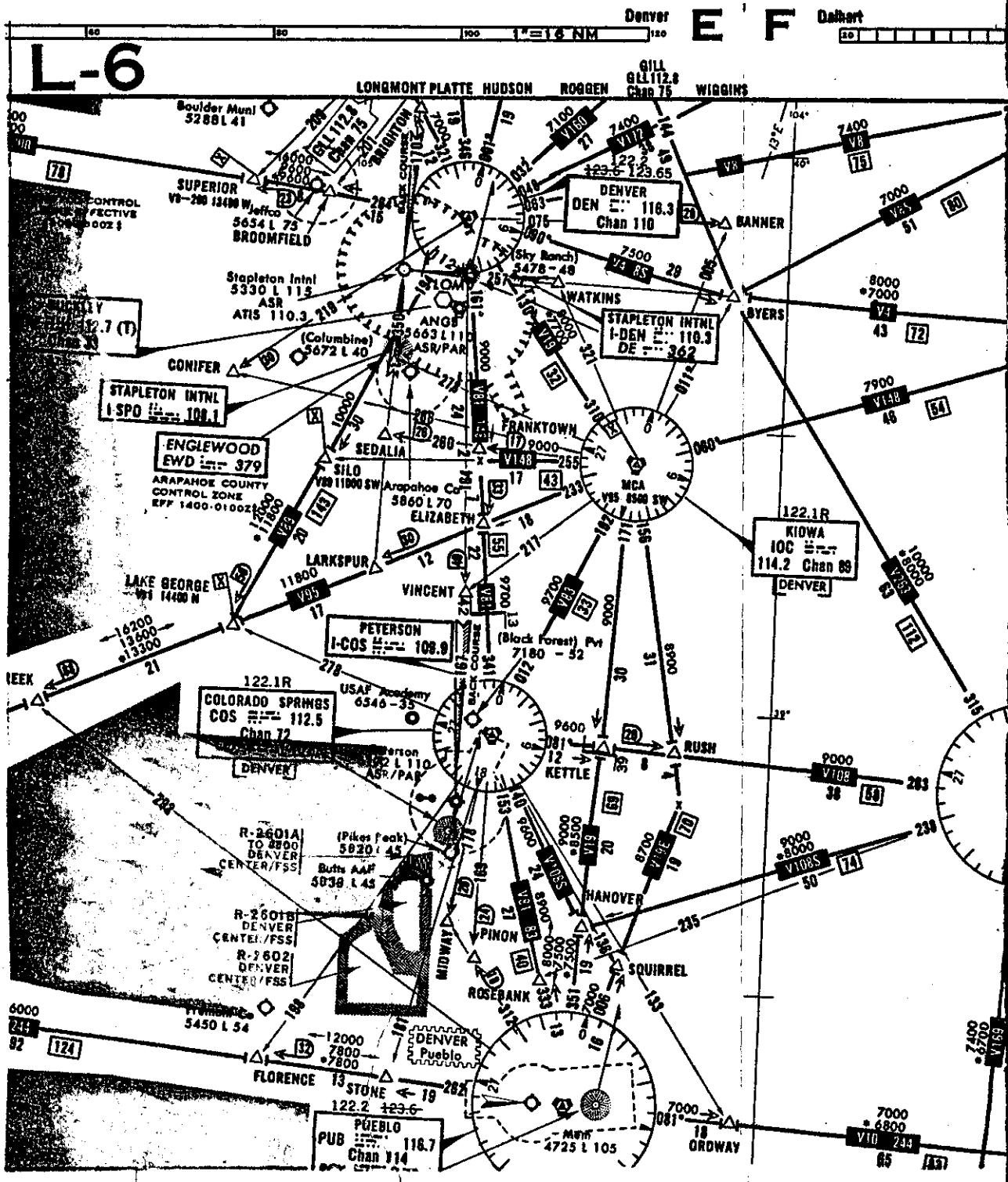
Dalhart **F** **G** Oklahoma City — Overlaps Chart Nr L-11

NAUTICAL MILES

L-6




Oklahoma City
G
H
Kansas City
1"=16 NM
NAUTICAL MILES
PAWNEE CITY
PWE 112.4 Chan 71
ODELL
KFRS
1600
KNDY
1570
CHICAGO
KANSAS CITY
LAK 116.1
Chan 108
Blosser Muni
1491 L 30
MANHATTAN
MHK 110.2 (T)
SALINA
MANHATTAN FSS
VOICE AVAILABLE
1200 TO 0400Z
123.6 255.4
R-3602B
KANSAS CITY
CENTER/FSS
R-3602A
KANSAS CITY
CENTER/FSS
MANHATTAN
MHK 391
CONTROL ZONE EFFECTIVE
1200-0400Z‡
Muni
1056 L 35
SALINA
SLN 116.3
Chan 100
KANSAS CITY
Salina
Marshall AAF
1062 L 45
Junction
City Muni
1104 L 35
ALMA
CUSTER
CHAPMAN
GLENDALE
MRA 4900
Muni
1272 L 133
Abilene Muni
1148 L 30
FT RILEY
317
Herington Muni
1485 - 67
R-3601
SUNRISE TO 0600Z
MON-SAT
DAYS -SUN
KANSAS CITY
CENTER/FSS
LINDSBORG
WILSEY
MRA 5000
Lyons-Rice Co Muni
1700 L 30
McPherson
1497 L 40
GROVELAND
HUTCHINSON
NEWTON


L-6
Denver
E
F
Dalhart
1"=16 NM
LONGMONT
PLATTE
HUDSON
ROGGEN
GILL
WIGGINS
Boulder Muni
5288 L 41
SUPERIOR
5654 L 75
BROOMFIELD
Stapleton Intnl
5330 L 115
ASR
ATIS 110.3
(Columbine)
5672 L 40
CONIFER
ANGS
5663 L 110
ASR/PAR
DENVER
DEN 116.3
Chan 110
(Sky Ranch)
5478 - 48
BANNER
WATKINS
BYERS
STAPLETON INTNL
I-DEN 110.3
STAPLETON INTNL
I-SPO 108.1
ENGLEWOOD
EWD 379
ARAPAHOE COUNTY
CONTROL ZONE
SEDALIA
FRANKTOWN
SILO
Arapahoe Co
5860 L 70
ELIZABETH
MCA
KIOWA
IOC 114.2 Chan 89
DENVER
LARKSPUR
LAKE GEORGE
14400 M
VINCENT
PETERSON
I-COS 108.9
(Black Forest) Pvt
7180 - 52
122.1R
COLORADO SPRINGS
COS 112.5
Chan 72
DENVER
USAF Academy
6546 - 35
KETTLE
RUSH
R-2601A
TO 9000
DENVER
CENTER/FSS
(Pikes Peak)
5920 L 45
Butts AAF
5038 L 45
R-2601B
DENVER
CENTER/FSS
R-2602
DENVER
CENTER/FSS
HANOVER
PINON
MIDWAY
ROSEBANK
SQUIRREL
5450 L 54
FLORENCE
STONE
DENVER
Pueblo
122.2 123.6
PUEBLO
PUB 116.7
Chan 114
Mem
4725 L 105
ORDWAY

UNITED STATES GOVERNMENT
FLIGHT INFORMATION PUBLICATION
AREA CHARTS—U. S.

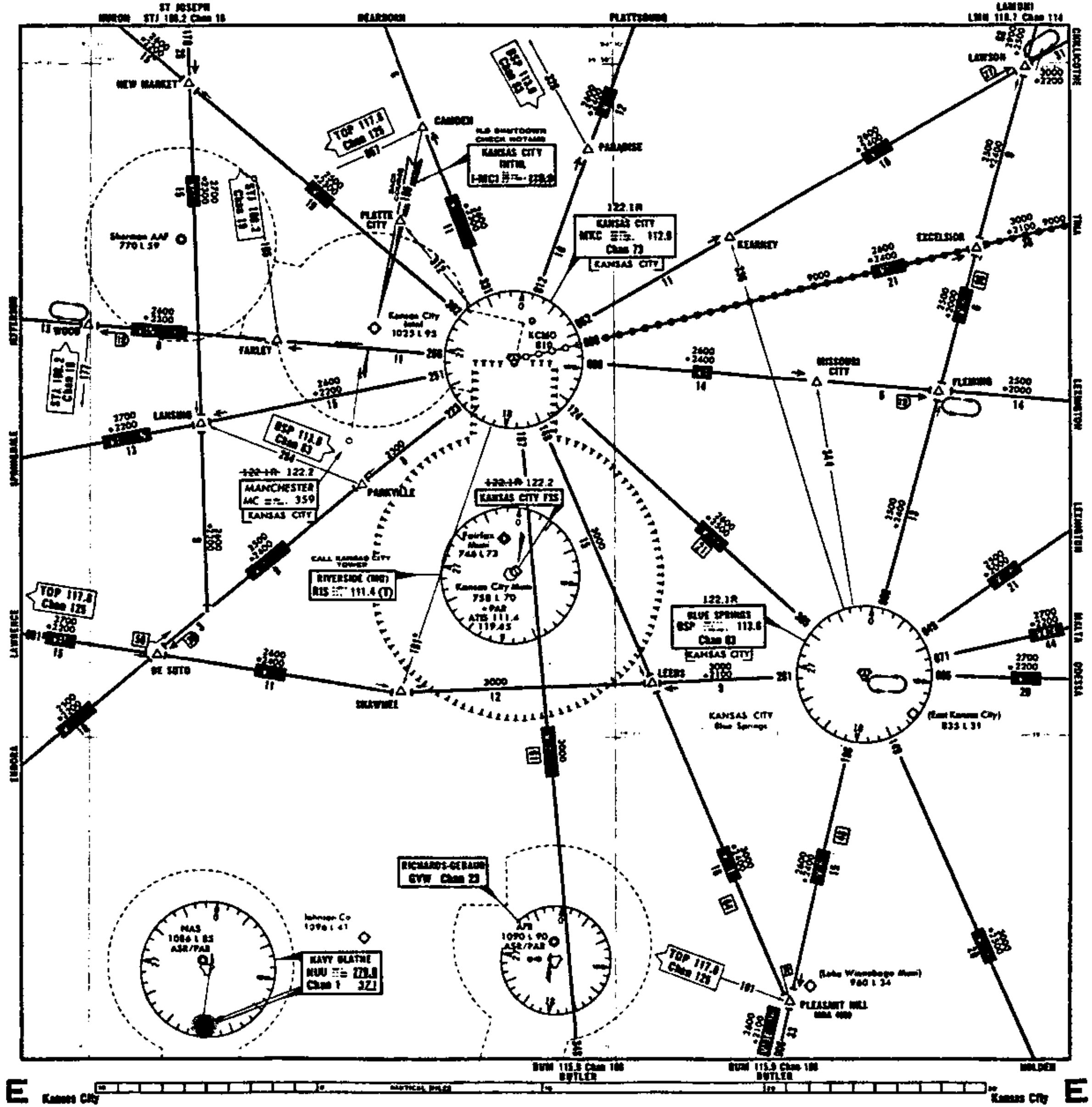
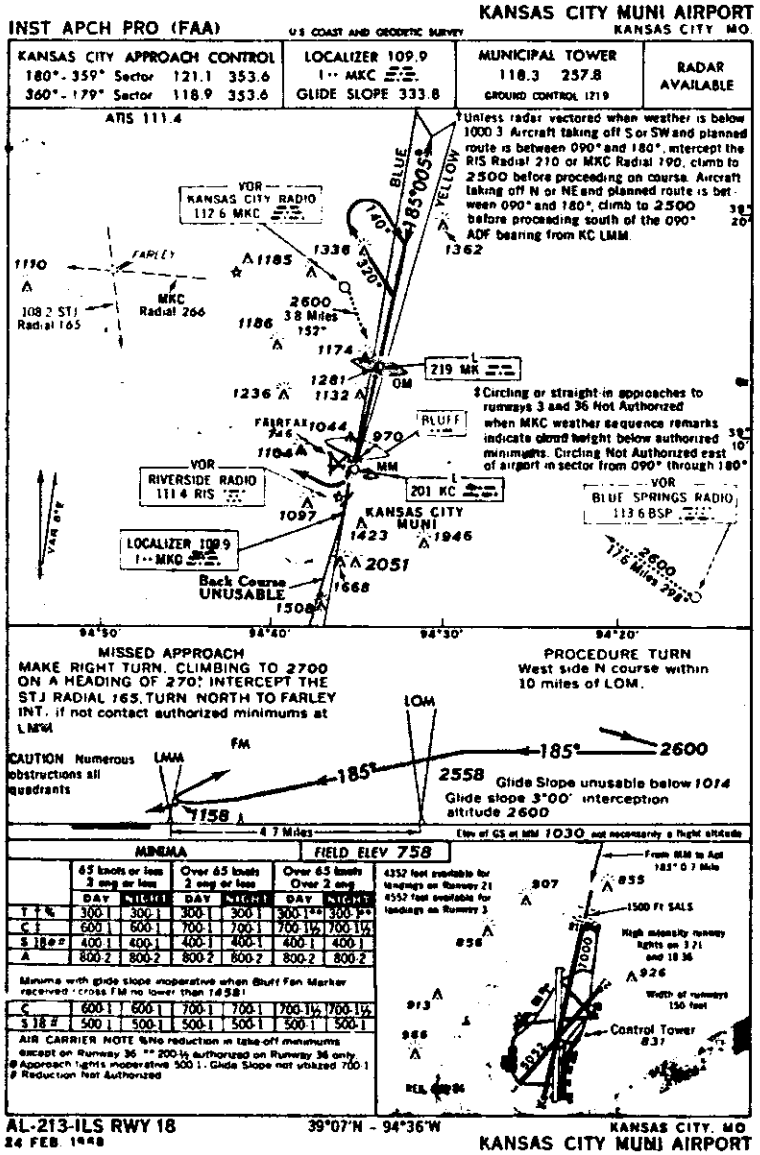


Figure 16. Kansas City area chart.



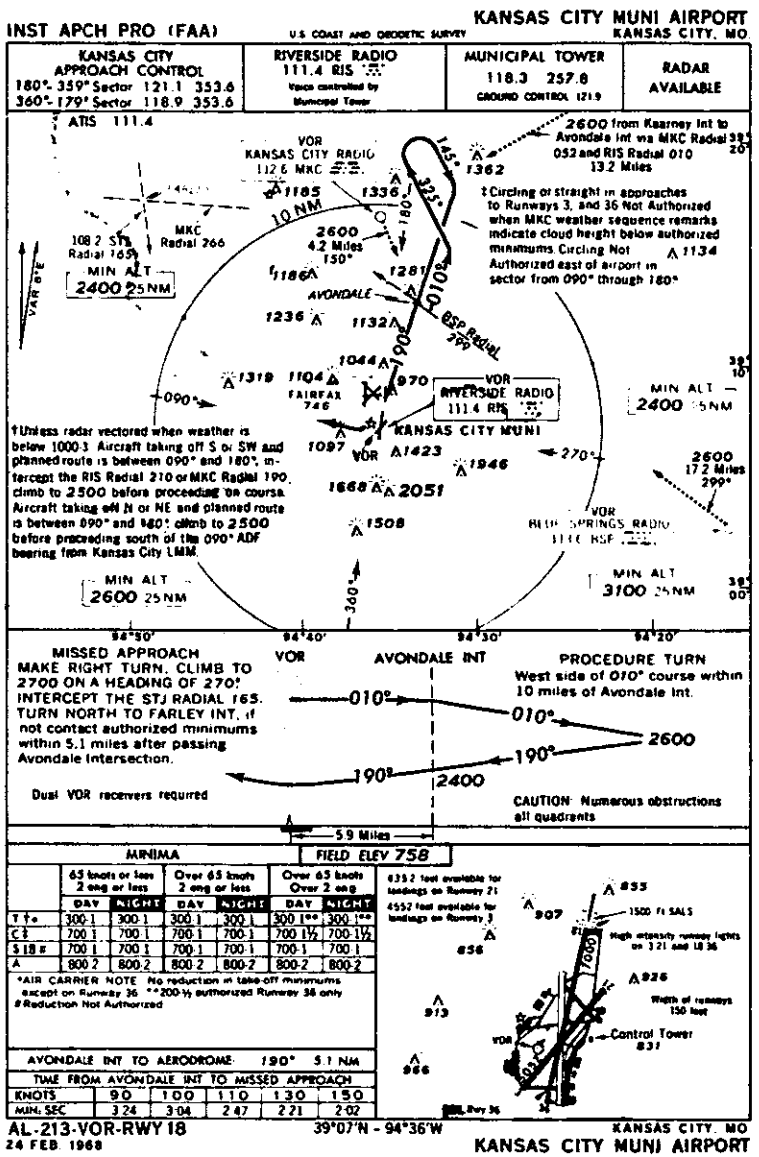


FIGURE 17. Instrument approach procedure charts—Kansas City, Mo.

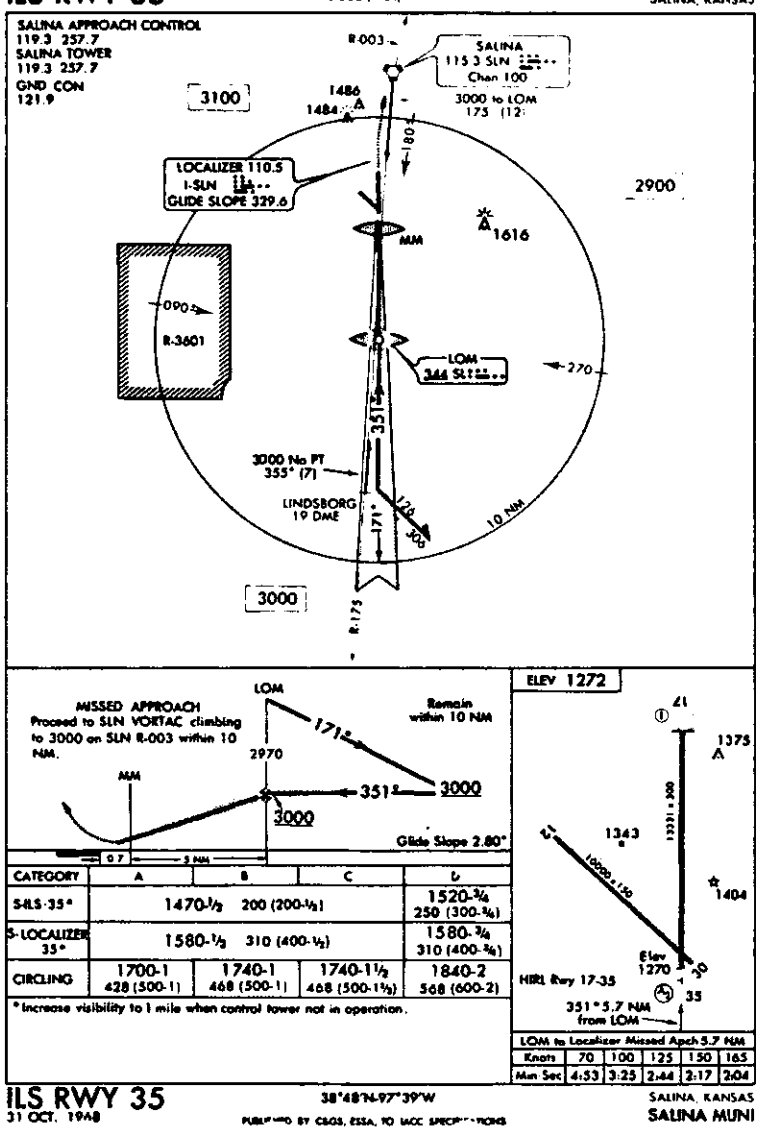


FIGURE 18. Instrument approach procedure charts—Salina, Kans.

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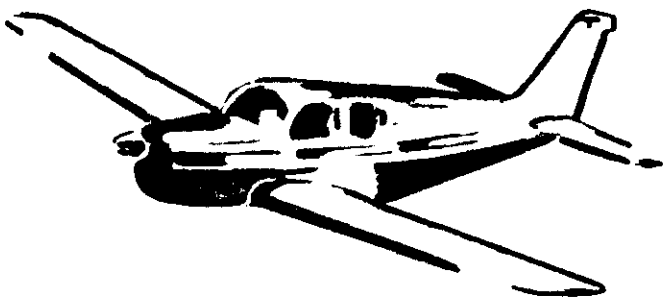
AC 143-2B

Return to
H. Norris TAD FM



GROUND INSTRUCTOR INSTRUMENT

Written Test Guide

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

GROUND INSTRUCTOR
INSTRUMENT
WRITTEN TEST GUIDE

AC 143-2B

Revised 1971

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

Ground Instructor—Instrument—Written Test Guide

Introduction

This written test guide has been prepared by the Flight Standards Service of the Federal Aviation Administration to assist applicants preparing for the Ground Instructor–Instrument–Written Test. It outlines the scope of aeronautical knowledge covered in the test for the Instrument Ground Instructor Rating and suggests the subject areas in which the applicant should be well informed.

This 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 to attain basic knowledge. Neither is there an alternative to persistent effort for developing competence. Continuous review is essential to remain current in the many areas where technological change is the rule rather than the exception.

An applicant for the Instrument Ground Instructor Rating should make a thorough review of the "Study Outline" given in this guide. If an area of weakness is found, he should study that area until he has confidence in his ability to teach the material to students. After the review, he should take the sample test *without aid*, and then compare his answers with those in the "Analysis of Answers to Sample Test Items" found at the end of the sample test. If nearly all of his answers are correct, he is probably prepared to take the Ground Instructor–Instrument–Written Test. The applicant should keep in mind, however, that the required test will cover considerably more areas of knowledge than found in the sample test.

Requirements for Certificates and Ratings

Eligibility requirements for ground instructor certificates are outlined in Volume IX, Part 143 of Federal Aviation Regulations. Ratings are as follows:

Ground Instructor Basic—Qualifies the holder to instruct in a basic pilot ground school.

Ground Instructor Advanced—Qualifies the holder to instruct in basic or advanced pilot ground school.

Ground Instructor Instrument—Qualifies the holder for ground instruction in an instrument flying school, and for the operation of instrument procedures training devices.

Applicants who do not hold a ground instructor certificate must take a written test on "Fundamentals of Instructing," as well as a written test for the rating desired.* Holders of a ground instructor certificate, with one or more ratings, are not required to retake the Fundamentals of Instructing test to obtain additional ratings. An applicant who holds a currently effective teacher certificate issued by a State, county, or city authorizing him to instruct in a junior or senior high school, or who is regularly employed as an instructor in an accredited college or university, shall be relieved from taking the written test on the "Fundamentals of Instructing."

The Written Test

The Ground Instructor Instrument Written Test emphasizes aeronautical knowledge areas in which the instrument ground instructor should be prepared to teach. Test items require a knowledge of air traffic, communications, and navigation procedures; operating principles of air navigation radio aids; and instrument flight techniques. The applicant

* For study guidance and reference materials for the test on "Fundamentals of Instructing," the applicant should consult the Ground Instructor Examination Guide, Basic–Advanced, AC 143–1B, available from the Superintendent of Documents, Government Printing Office for $1.00.

must apply his knowledge of regulations, preflight duties, inflight operation, weather, navigation aids and procedures. The official test booklets include appropriate planning materials similar to those which appear in the appendix of this guide.

The Ground Instructor–Instrument–Written Test consists of multiple-choice questions similar to those shown in the sample test in this guide. The applicant indicates his choice of answers 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 he begins the test. Incomplete or erroneous personal information on the answer sheet may delay the scoring process. Approximately 5 hours are allowed to complete the test.

The applicant is notified of his grade on Airman Written Test Report, AC Form 8060–37. The report also contains coded indications of the subject matter involved in items missed by the applicant on the test. A Written Test Subject Matter Outline is provided to relate the codes to specific areas of knowledge. The Study Outline contained in this guide is similar to the Subject Matter Outline the applicant receives with AC Form 8060–37. An applicant who has successfully passed the required test should present AC Form 8060–37 to the Flight Standards District Office for issuance of the Ground Instructor Certificate with the appropriate rating.

An applicant who receives a failing grade must present the AC Form 8060–37 when appearing for retesting. He may apply for retesting—(a) after 30 days after the date he failed the test; or (b) upon presenting a statement from an appropriately rated certificated ground instructor certifying that he has given the applicant at least 5 hours additional instruction in the areas failed and now considers that he can pass the test.

Taking the Test

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

Bear in mind the following points when taking the test:

1. Answer test items in accordance with the latest regulations and procedures.
2. Read every question thoroughly. Comments received from applicants indicate that unsatisfactory performance on the written test is frequently the result of failure to read carefully rather than lack of knowledge. Do not try to solve the problem before understanding the question.
3. Do not consider a complicated problem a "trick" question; each question has a specific objective. There is no deliberate attempt to trick applicants.
4. There is only one correct and complete answer for each item.
5. Do not waste too much time on problems that confuse you. Go on to the questions that you can answer readily, then return to the more difficult items.
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 to the correct answer because the correct answer is an average of the answers obtained by using several types of computers.

Reference Materials

Persons studying for the Ground Instructor–Instrument–Written Test will find the publications listed in this section most helpful. The list identifies material essential to preparing for the test but does not include all material available in the subject areas. Textbooks and reference materials are available from various commercial publishers. Many public and institutional libraries offer study materials in both teaching methods and aeronautical subject areas. It is the responsibility of each applicant to obtain study material appropriate to his need.

Airman's Information Manual (*AIM*)

This publication presents, in four parts, information necessary for the planning and conduct of flights in the National Airspace System. Besides providing frequently updated airport and NAVAID data, the AIM includes instructional and procedural informa-

tion, and is designed for use in the cockpit. Each part is available by annual subscription at the prices shown.

	Price	Additional for Foreign Mailing
Part 1, *Basic Flight Manual and ATC Procedures.* (Issued quarterly)	$ 4.00	$1.00
Part 2, *Airport Directory.* (Issued semiannually)	$ 4.00	$1.00
Part 3 and 3A, *Operational Data and Notices to Airmen.* (Operational data issued every 28 days; Notices to Airmen issued every 14 days)	$20.00	$5.00
Part 4, *Graphic Notices and Supplemental Data* (Issued semiannually)	$ 1.50	$0.50

Federal Aviation Regulations

The subscription prices listed include automatic revision service to all Parts contained in the Volume ordered. The FAR Parts contained in each Volume are listed in the "Advisory Circular Checklist and Status of Federal Aviation Regulations."

	Price	Additional for Foreign Mailing
Vol. I, Part 1, *Definitions and Abbreviations*	$ 1.50	$0.50
Vol. IX, Part 61, *Certification: Pilots and Flight Instructors*	$ 6.00	$1.50
Vol. VI, Part 91, *General Operating and Flight Rules*	$ 5.00	$1.25
Vol. XI, Part 95, *IFR Altitudes*	$ 2.75	$0.75
Part 97, *Standard Instrument Approach Procedures*		
Vol. VII, Part 135, *Air Taxi Operators and Commercial Operators of Small Aircraft*	$ 6.50	$1.75
Vol. IX, Part 141, *Pilot Schools*	$ 6.00	$1.50
Part 143, *Ground Instructors*		

Handbooks

Flight Instructor's Handbook, AC 61-16 ($1.25 — GPO — FAA 5.8/2:F 64/7. This handbook has been prepared for the information and guidance of pilots preparing for the flight instructor certificate and for use as a reference by certificated flight and ground instructors. This handbook will be most useful to those preparing for the Fundamentals of Instructing Section of the Ground Instructor Written Test.

Instrument Flying Handbook, AC 61-27 ($2.50—GPO—TD 4.408:In 7/3). This is a basic text for instrument pilots. It deals with training considerations, aerodynamic factors, physiological factors, flight instruments and their use, air navigation aids, communications, the air traffic system, and flight planning.

Aviation Weather, AC 00-6 ($4.00—GPO—FAA 5.8/2:W 37). An excellent reference treating phases of meteorology of interest to the instructor. Aviation weather reports and forecasts are also covered with respect to format and content.

Pilot's Weight and Balance Handbook, AC 91-23 (70¢—GPO—TD 4.408:P 64/3). Presented from the viewpoint of the pilot, this handbook pays particular attention to the aircraft loading problems of general aviation pilots when operating light aircraft, including twin-engine and air-taxi types. The text progresses from an explanation of basic fundamentals to the complex application of weight and balance principles in large aircraft operations.

Charts

Instrument Approach Procedure Charts. Individual charts give detailed information on procedures for specific airports.

Enroute Charts: Low-Altitude and High-Altitude. These charts provide the necessary aeronautical information for en route instrument navigation.

Low-Altitude Area Charts. These charts supplement the Enroute Charts by providing departure, arrival, and holding procedures at principal airports.

Advisory Circulars

The following Advisory Circulars pertain to areas of knowledge listed in the Study Outline and are free of charge: 00-17, 00-24, 20-32A, 60-4, 60-6, 90-1A, 90-12, 90-14A, 90-22B, 90-23A, 90-35, 90-36, 90-38A, 90-41, 90-46, 91-8A, 91-19, 91-30, 170-3B.

EXAM-O-GRAMS

VFR Exam-O-Grams and IFR Exam-O-Grams are nondirective in nature and are issued solely as an information service to individuals interested in airman written tests.

How To Obtain Study Materials

The study materials listed, except the charts, free Advisory Circulars, and Exam-O-Grams, may be obtained by remitting check or money order to:

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

To expedite your order when ordering publications from the Superintendent of Documents, be sure to include with the title of single publications the GPO catalog number given in the price line (e.g., TD 4.408:In 7/3 or FAA 5/8:W 37). Order subscription and single publications separately.

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:

Distribution Division (C–44)
National Ocean Survey
Washington, D.C. 20235

Orders for specific charts or publications should be accompanied by check or money order made payable to, "NOS, Dept 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 Technical Division
Operations Branch, AC–240
P.O. Box 25082
Oklahoma City, Okla. 73125

Advisory Circular titles and a summary of what each contains may be obtained by requesting an "Advisory Circular Checklist and Status of Federal Aviation Regulations," from:

Department of Transportation
Federal Aviation Administration
Distribution Unit, TAD–484.3
Washington, D.C. 20590

Study Outline

This study outline indicates the areas of aeronautical knowledge which 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:

AIM—Airman's Information Manual
EOG—IFR Exam-O-Gram
AC—Advisory Circular
AW—Aviation Weather (AC 00–6)
FAR—Federal Aviation Regulations
IFH—Instrument Flying Handbook

PILOT RESPONSIBILITIES (FAR)

A01. Authority and Limitations
- Pilot-in-Command (91.3)
- Emergency action (91.3)
  - deviation from rules
  - reports required

A02. Certificates and Ratings (61.3, 61.15, 61.16)
- Instrument rating requirements (61.35)
  - when required (61.3, 91.97)
  - written test unauthorized conduct (61.20)
  - retesting after failure (61.27)
- Medical certificates (61.43)
- Instrument flight time (AC 61–9)
  - pilot logbooks (61.39)
  - recent flight experience, (61.47, 91.21)
  - simulated (91.21)

Certificate reports
change name (61.13)
lost certificates (61.13)
change address (61.51)

A03. Preflight Action for Flight (91.5, AIM–1, EOG–31)
Weather check
Fuel required (91.23)
Alternate course of action
Delays

A04. Preflight Action for Aircraft
Documents (91.27)
Airworthiness Certificate (91.29)
Registration Certificate (91.27)
Operating Limitations (91.31)
Aircraft Inspections (91.165, 91.169)
Equipment and Systems
equipment required (91.33, 91.90, 91.97)
tests and inspections
VOR receiver (91.25)
altimeter system (91.170)
Portable electronic devices (91.19)

A05. Flight Plan (AIM–1)
When required (91.97, 91.115)
Information required (91.83)
Alternate airport (91.83)
when required (EOG–29)
minimums
Closing flight plan (91.83)

A06. Compliance With Clearance (91.75, EOG–6, AIM–1)
Communications reports (91.125)
With communications failure
route procedures (91.127)
malfunction reports (91.129)
Emergency deviation (91.75)
detour thunderstorm
change of altitude (icing or turbulence)
Mid-air collision avoidance (VFR EOG–22, 29, 48)

A07. Terminal Area Limitations (AIM–1)
Terminal control area (91.90)
Airport traffic area (91.85)
Airport with tower (91.80)
Airport without tower (91.89)
Takeoff and landing minimums (91.116, 91.105, 91.107)
IFR approaches (91.117)
descent below MDA or DH
unusable components and aids
Aircraft speed (91.70)

A08. Enroute Limitations (AIM–1)
Minimum altitudes (91.119, EOG–8,
MEA
MOCA
MCA
MRA
MAA
Cruising altitudes (91.121)
Courses to be flown (91.123)
Altimeter settings (91.81)
Special use airspace
restricted areas
positive control areas (91.97)
jet advisory areas (91.99)

BASIC KNOWLEDGE

B01. Physiological Factors (Ch. II–IFH, AIM–1)
Physiological altitude effects:
aerotitis; aerosinusitis; hypoxia (AC 91–8A)
Hypoxic effects
carbon monoxide (AC 20–32A); alcohol; hyperventilation; drugs
Sensations of instrument
flying (AC 60–4):
motion; postural sense; sight
Spatial disorientation

B02. Aerodynamic Factors (Ch. III–IFH Private Pilot's Handbook of Aeronautical Knowledge)
Forces
Power/airspeed/vertical speed
Turns
forces in a turn
constant rate turns
rate/speed/angle of bank
coordination

B03. Gyroscopic Instruments and Systems (Ch. IV–IFH)
Systems
vacuum
electric
Operating principles

Attitude Indicator (EOG-24)
preflight and flight limits
use
Turn Indicator
preflight and flight limits
use (EOG-18)
Directional Indicator
preflight and flight limits
use

B04. Magnetic Compass (Ch. IV-IFH)
types
principles of operation
use
errors and corrections

B05. Pitot-Static Instruments (Ch. IV-IFH)
Pitot static system
Altimeter (EOG-10)
principles of operation
use
altimeter settings (AIM-1)
pressure altitude
errors and corrections
altitude definitions
indicated
pressure
true
absolute
density
Vertical Speed Indicator
principles of operation
use
limits and adjustment
Airspeed Indicator
principles of operation
use
markings (VFR EOG-45)
airspeed definitions
indicated
calibrated
equivalent
true

B06. Attitude Instrument Flying (Ch. V-IFH)
Instruments
pitch
bank
power
Preflight instrument check
Basic maneuvers
straight and level
climbs and descents
turns (EOG-18)
unusual attitudes
flight patterns

B07. Unusual Flight Conditions (AC 90-12)
Wake turbulence (AC 90-23A, AIM-1)
cause
avoidance
Thunderstorm encounter (AC 00-24, page 110-AW)
Ice accumulation (pages 117, 124-AW)
structural
carburetor or induction system
frost
Clear air turbulence (AC 00-17)

B08. Flight Planning Computer Operations (Ch. XIII-IFH)
Slide rule face
groundspeed
time
distance
fuel
time
gallons or pounds
scale conversions (knots/m.p.h.)
airspeed conversions
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equivalent
true
altitude conversions pressure/density
Wind correction face
headings
variation
deviation
groundspeed

B09. Density Altitude Chart (VFR EOG-33)
Altimeter setting/pressure alt. tables
Pressure alt./density alt.

B10. Aircraft Performance (Aircraft Owner's Handbook) (VFR EOG-33, IFR EOG-32, AC 90-14A)
Performance Charts
cruise performance
altitude
gross weight
power settings (VFR EOG-38)

fuel flow
takeoff distance
climb performance
best angle
best rate
balked landing
single engine
landing distance
indicated/calibrated airspeed
Instrument markings
Placards

B11. Aircraft Operating Limitations (document in aircraft) (EOG–21, AC 60–6)
Weight and balance
c.g. or moment limits
passenger/baggage limits
fuel distribution
fuel burn
Instrument limit markings
Limiting placards
loading limits
gear and flap operation
maneuvering speed
Charts
turbulent air penetration
maximum safe crosswinds (VFR EOG–27)

B12. Properties of the atmosphere
Composition (Ch. 1–AW)
Temperature (Ch. 2–AW)
measurements
temperatures aloft
Atmospheric pressure (Ch. 3–AW)
measurements
sea level pressure
pressure systems
altimeters
Wind (Ch. 4–AW)
circulation
systems
local variations
Moisture (Ch. 5–AW)
changes of state
measurements
relative humidity
dew point
condensation, supersaturation, and sublimation products
cloud and fog
precipitation
dew and frost

B13. Stability
Atmosphere (Ch. 6–AW)
lapse rates
stability determinations
effects of stability and instability
Wind (Ch. 7–AW)
convection currents
obstructions to wind flow
shear
clear air turbulence
intensity

B14. Air Masses and Fronts (Ch. 9 & 10–AW)
Sources
air mass
frontogenesis
Classification
air mass
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Modification
Characteristics
Associated clouds (Ch. 8–AW)

B15. IFR Weather Hazards
Thunderstorms (Ch. 11–AW), AIM 1)
structure and formation
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hail
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types
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Fog and obstructions to vision
types
formation

B16. Weather Observations (Ch. 15–AW)
Aviation Weather Reports (SA) (EOG–5)
Pilot Weather Reports (UA)
Weather Radar Observations (SD)
Upper Air Observations
RAWIN
PIBAL

B17. Weather Charts (Ch. 16–AW)
Weather depiction (EOG–15)
Surface weather
Constant pressure
Radar summary (EOG–17)

Prognostic
surface (EOG–16)
constant pressure
significant weather
12-hour upper wind

B18. Aviation Weather Forecasts (Ch. 17-AW)
Terminal (EOG–5)
12-hour (FT1)
24-hour (FT2)
Area (FA) (EOG–5)
Winds aloft (FD) (EOG–5)
In-flight weather advisories (FL)
Severe weather
hurricane advisories (WH)
outlook (AC)
forecast (WU)
Prognoses
surface analysis (AS–2 and FS–1)
regional prognosis (FN–1)

B19. Interpretation of combined weather reports and forecasts

B20. Weather Services (Ch. 14 and 18–AW, AIM–1)
National Weather Service
telephone listings (AIM–2)
pilot/forecaster (Enroute Chart)
FSS
location (AIM–2)
telephone listing (AIM–2)
air/ground frequencies (AIM–3)
Scheduled broadcasts
local ATIS
NAV facilities
transcribed weather broadcasts
Unscheduled broadcasts
SIGMETS
AIRMETS

FACILITIES

C01. Airport Physical Facilities (AIM–3, 3A, Enroute and Approach Charts)
Service
fuel
storage
repair
oxygen
Runways
number and longest
surface and load bearing capacity
elevation
traffic pattern
obstructions
markings (AIM–1, EOG–26, 28)
Lighting (AIM–1)
rotating beacon
runway lighting aids
boundary
approach, REIL, and VASI
centerline
threshold
Unicom (AIM–3)
controlled airport
non-controlled airport

C02. Basic Principles of Navigation Facilities (Ch. VI–IFH)
Radio ranges
VOR, VORTAC
homing beacons
ILS
Aids
marker beacons
DF
radar beacon (AC 00–27)

C03. Use of Navigation Facilities (Ch. VII–IFH)
VOR (EOG–7, 14)
accuracy check (EOG–22, AC 91–18)
VOT (AIM–3)
VOR receiver checkpoints (AIM–4)
orientation
position
airway intersection
tracking
ADF
orientation
homing
basic procedures (EOG–23)
ILS (Ch. VI–IFH)
localizer
glide slope
marker beacons
lighting aids
DME (Ch. VI–IFH, AC 170–3B)
Transponder (EOG–25, AC 00–27)
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mode

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normal
low

C04. Control Tower Facility (Ch. VIII-IFH, AIM-1, 3, 3A, 4)

Ground Control
clearance delivery (AIM-1)
taxi control (AIM-1)
frequencies (AIM-3)
Departure Control
radar services (AIM-1)
frequencies (AIM-3)
Takeoff and landing control
separation (AIM-1)
frequencies (AIM-3)
Approach control
radar (AIM-1)
services
approaches
monitor
non radar (AIM-1)
frequencies (AIM-3)
VHF direction finding (AIM-1)
ATIS (AC 90-22A)
use
frequencies (AIM-3)
Use of runways (AIM-1)
Light signals (91.77, AIM-1)

C05. Flight Service Station facility

Weather Services (AIM-1)
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file and close
enroute reporting
communication frequencies (AIM-3, Enroute Chart)
Airport Advisory Service
airport information (AIM-1)
frequencies (AIM-3)
VHF direction finding (DF) (AIM-1)

C06. Air Route Traffic Control Center (ARTCC) (Ch. XI-IFH)

Traffic control
geographic area (enroute chart)
communication frequencies (Legend-Enroute Chart)
Advisories
Radar services
Distress assistance

C07. Use of Communication Facilities

Communication phraseology (Ch. IX-IFH, AIM-1)
procedures (EOG-11)
phonetic alphabet
procedural words and phrases (AC 90-39)
frequency discipline (AC 90-35)
Airborne equipment (Ch. VII, VIII-IFH)
systems
frequencies (AIM-3, AC 90-11A)
Clearances and control sequence (AIM-1, Ch. X, XI-IFH, EOG-4)
clearance shorthand (Ch. XIV-IFH)
clearance items (AIM-1)

C08. Status of Facilities and Airways

Airport/Facility Directory (AIM-3)
NOTAMS (AIM-3A)
Restrictions to Enroute Navigation Aids (AIM-4)
Special Notices (AIM-4)
Preferred Routes (AIM-3, AC 90-38)
SID's and STARS (AIM-3)
Substitute Route Structure (AIM-3)
Area Navigation Routes (AIM-3)
Charts
Enroute
Area

AIRSPACE AND AIRWAY ROUTE SYSTEM

D01. Controlled Airspace (AIM-1, Enroute and Area Charts)

Airport Traffic Area
Control Zone
Control Area
Continental Control Area
Positive Control Area

D02. Special Use Airspace (AIM III, Enroute and Area Charts)

Prohibited Area
Restricted Area and Climb Corridor
Warning Area
Intensive Student Jet Training Area
Alert Area

D03. National Security (AIM–1)
- ADIZ
- SCATANA

D04. Victor (VOR) Airways (Low Altitude Enroute and Area Charts)
- Limits
  - width
  - base
  - top
- Radials and bearings
- Route identification
  - airway
  - military route
  - substitute route
  - unusable route
- Altitude limits (EOG–8)
  - MOCA
  - MEA
  - MRA
  - MCA
  - MAA
- Compulsory and noncompulsory reporting points
  - facilities
    - VOR/VORTAC
    - NDB
  - intermediate fixes
    - VOR bearing intersections
    - DME/VOR radial
- Segment limits
  - mileage breakdown
  - minimum altitude change
  - VOR changeover points
  - altimeter setting boundary
  - time zone boundary

D05. Area Navigation (AC 90–45, EOG–31)
- Area Navigation Routes (RNAV)
- Waypoints
- Ground facilities
- Airborne equipment
  - types
  - presentation
    - course line
    - distance
    - vertical

D06. Direct Flights (AIM–1)

ATC Operations and Procedures

E01. Pre-Takeoff Procedures (Ch. XII–IFH)
- Flight Plan (AIM–1)
- ATIS (AIM–1)
- Route Clearance (AIM–1)
  - pre-taxi clearance delivery
  - other clearance delivery
- Taxi (AIM–1)

E02. Takeoff and Departure Procedures (AIM–1, Ch. XII–IFH)
- Takeoff
- Departure
  - non radar
  - radar vector
  - SID's (SID Booklet)
- Altitude control
  - climb
  - crossing

E03. Enroute Procedures (Ch. XII–IFH, AIM–1)
- Normal Navigation
  - reporting
  - handoffs
- Radar Environment
  - reporting
  - handoffs
- Altitude
  - climb or descent
  - VFR on top
  - cruise
  - maintain
- Delays
  - clearance limit
  - holding
    - procedures (AIM–1)
    - fixes (Enroute Chart)

E04. Arrival (Ch. XII–IFH, AIM–1)
- STARS (AC 90–41)
- Radar vectors
- Holding (AC 90–46)

E05. Approaches (AC 90–1A or Appendix IFH, Approach Charts)
- VOR
- VOR/DME
- NDB
- ILS
  - localizer
  - back course

Radar (AIM–1, EOG–27)
PAR
ASR
Contact and Visual
Missed Approaches

E06. V/STOL Operations (when available)

E07. Emergencies (AIM–1, EOG–2)
Lost
transponder code
triangle
emergency frequency
chaff (AC 90–36)
Forced landing or crash
beacon (AC 91–19)
air sea rescue (AIM–1)
Difficulty with communications
Malfunction of equipment
aircraft accessory
communication equipment
Part 430, Rules Pertaining to Aircraft Accidents, Incidents, Overdue Aircraft and Safety Investigations
immediate notification
manner of notification
reports

F01. Aeronautical Terms (FAR 1 and AIM–1, Glossary)

NOTE.—Applicants for original issuance of a Ground Instructor Certificate with an instrument rating should refer to the Ground Instructor Examination 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 pages 00 and 00.

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. An instrument rated pilot meets the recency of experience requirements for daylight instrument flight. Which statement is correct regarding additional recency of experience requirements for this pilot to carry passengers on an instrument flight at night?

1—Within the preceding 6 months, the pilot must have made at least 3 takeoffs and landings to a full stop between 1 hour after sunset and 1 hour before sunrise in an aircraft to be flown on the instrument flight.

2—Within the preceding 90 days, the pilot is required only to have made 5 takeoffs and landings to a full stop between 1 hour after sunset and 1 hour before sunrise in any aircraft.

3—Within the preceding 6 months, the pilot must have made at least 5 takeoffs and landings to a full stop between 1 hour after sunset and 1 hour before sunrise in an aircraft of the same category, class, and type as the aircraft to be flown.

4—Within the preceding 90 days the pilot is required only to have made 3 takeoffs and landings to a full stop between 1 hour after sunset and 1 hour before sunrise in any aircraft.

2. Normally, a VOR marked (T) on the enroute charts should not be used for navigation when flying at altitudes above 12,000 ft. An aircraft at this altitude may receive undependable navigation signals because

1—transmitter signal strength is under 25 watts.

2—course azimuth is not accurate above 12,000 feet.

3—atmosphere conditions may affect the signals.

4—signals from another VOR may interfere.

3. Students should be taught that a pilot departing an airport in uncontrolled airspace under instrument weather conditions

1—has no assurance of separation from other traffic.

2—must stay clear of clouds until he has received an IFR clearance.

3—must file a flight plan before takeoff.

4—will be controlled by Air Route Traffic Control.

4. Which is a true statement regarding the indications of the needle and ball of a properly calibrated 2-minute turn and slip indicator?

1—The turn needle gives a direct indication of the aircraft's angle of bank.

2—The position of the ball does not affect the accuracy of the turn needle.

3—A one-needle width deflection indicates a turn of 3° per second only if the ball is centered.

4—The rate of turn is too great for the angle of bank when the ball is on the low side of the turn.

5. Unreliable course guidance information may be indicated on a Nav/Com system during which of the following situations?

1—When using the Nav/Com transmitter.

2—During reception of voice transmissions.

3—When approaching a radio beacon on an LOC back course approach.

4—When making an ILS front course approach with the OBS set at some value other than the front course inbound bearing.

6. When using the magnetic compass to establish and maintain a heading, the pilot should remember that, due to the normal characteristics of a compass, it will usually indicate a turn toward

1—south when the airplane is accelerating on a heading of east.

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

3—east when accelerating on a heading of north.

4—west when entering a right turn from a heading of north.

7. Your students should know that the primary purpose of the elevator trim tab is to

1—keep the elevator streamlined.

2—relieve elevator control pressures.

3—reduce control pressures while changing the aircraft pitch attitude.

4—increase longitudinal stability.

8. An instrument student should know that on any simulated instrument flight outside the vicinity of an airport, the pilot-in-command must familiarize himself with all available information concerning that flight. Which of the following must the pilot accomplish?

A. Check available weather reports and forecasts.

B. File a flight plan.

C. Determine fuel requirements.

D. Determine runway lengths and takeoff and landing distances required at airports of intended use.

1—A, B, and C

2—A and C only

3—A, C, and D

4—B and D only

9. Pressure altitude is obtained by

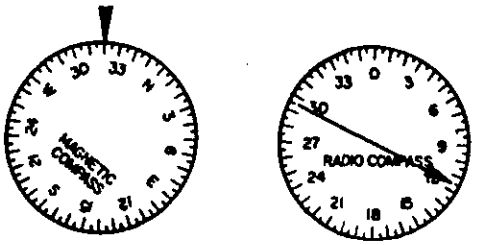
1—correcting terrain clearance altitude for temperature.

2—setting the altimeter to standard sea level pressure.

3—setting the altimeter to a station pressure in inches of mercury which has been corrected to sea level.

4—correcting the altimeter for temperature deviation from standard.

10. A pilot tunes his ADF receiver to a radio beacon. Refer to the following illustration:



VAR—10° E. TAS—170 knots
DEV—5° W. Wind—360°/30 (true)

The aircraft is located on a magnetic bearing from the station of

1—250°.
2—255°.
3—260°.
4—075°.

11. Abrupt control movement when changing aircraft attitude

1—helps to eliminate instrument lag.
2—results in erroneous indications on the attitude indicator.
3—results in less error in stabilizing the aircraft.
4—may result in overcontrolling and unnecessary stress on the aircraft.

12. If a student is making a timed turn to the right and the turn needle indicates the correct rate of turn, but the ball is to the left of center, the student should

1—apply left rudder pressure and maintain the same degree of bank.
2—decrease right rudder pressure if holding right rudder or apply left rudder and steepen the bank.
3—decrease right rudder pressure and shallow the bank.
4—use same rudder pressure and steepen the bank.

13. Choose all the statements which are true when the gross weight of the airplane is increased.

A. Stalling speed will decrease.
B. Takeoff distance will increase.
C. Recommended approach speed will remain the same.
D. Maximum rate of climb will decrease.
E. Horizontal stabilizer will carry a greater percent of the total weight.

1—A, B, and D
2—B and E
3—C, D, and E
4—B and D

14. If you are cleared to a fix short of your destination airport and not given an "expect further clearance time," normally you may expect to receive further clearance

1—at least 3 minutes before your ETA at the fix.
2—at least 10 minutes before your ETA at the fix.
3—when you notify ATC that you are at the clearance limit.
4—before reaching the fix.

15. In the Northern Hemisphere above the friction layer, the air flows

1—at right angles to the isobars from a high pressure area to a low pressure area.
2—counterclockwise around a low pressure area, clockwise around a high pressure area, and parallel to the isobars.
3—clockwise around a low pressure area, counterclockwise around a high pressure area, and parallel to the isobars.
4—from a high pressure area to a low pressure area at 45° to the isobars.

16. Choose the true statements regarding the formation of frost on an airplane's wings.

A. Frost can form in flight when an airplane descends from a zone of subzero temperatures to a zone of above freezing temperatures and high humidity.
B. Frost occurs when dew forms on the wings and the surrounding air is below freezing.
C. Frost cannot form on the wings of an airplane unless the temperature of the air surrounding the wings is at least 2° below freezing.

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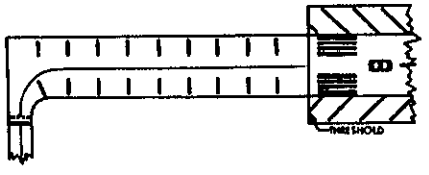
D. The surface of an airplane's wings must be below freezing before frost will form on the wings.

1—A and C
2—A and D
3—B and C
4—B and D

17. Which statement regarding the stability of the air is true?

1—If very stable moist air is forced to ascend a mountain slope, clouds will be layerlike with little vertical development.
2—If air is subsiding (sinking), the heat of compression causes the air to become unstable and usually sets off considerable vertical development of clouds.
3—When an area of poor visibility due to smoke and haze persists, it is usually due to the air being saturated and unstable.
4—When an unsaturated air mass is heated from below, the air tends to become more stable.

18.



In the figure above, the area to the left of the threshold is

1—an "over-run" with sufficient strength for all aircraft operations.
2—an abandoned runway area which may not be used for any aircraft operations.
3—a "deceptive area" with a marked centerline usable only for taxiing.
4—a stabilized blast-pad, no part of which may be used for taxiing, takeoff, or landing.

19. Students should understand that during a level turn, the stalling speed and load factor of an airplane increase as the bank increases. Which statement regarding load factor and stalling speed is true on an airplane with a V_{so} of 65 knots? (See Appendix, Figure 2.)

1—The lift required for a 60° bank is twice that required in straight and level flight.
2—The stalling speed when in a 60° bank is twice as much as when in straight-and-level flight.
3—After reaching a 60° bank the load factor and stalling speed increase at the same rate.
4—An airplane in normal category at full gross weight would not exceed the limit load (3.8) unless it reached a bank of 85°.

20. According to Figure 3, which statements concerning power and drag are true?

A. Maximum endurance is obtained at an airspeed of approximately 120 knots.
B. Minimum drag occurs at an airspeed of 160 knots, which is the best speed for maximum endurance.
C. L/D max occurs at the airspeed which also gives the least total drag.
D. Total drag always increases with an increase in airspeed.

1—A and C only
2—A, B, and C
3—B, C, and D
4—B and D only

Test items 21 through 40 are based on the planning and execution of an IFR training flight, covering some elements of preflight and inflight procedures.

Aircraft Data and Flight Conditions

This flight is assumed to be made in a light twin-engine aircraft typical of those used in general aviation. Aircraft data will be given as needed for particular test items. The flight is from Denver Stapleton International Airport to Kansas City Municipal Airport. The flight time analysis found in the Appendix (Figure 1), contains information to be used in the planning of this flight. It may be removed from the booklet and used for your calculations. The Appendix also includes data for use in solving various test items.

ROUTE OF FLIGHT: See partially completed flight plan below.

FEDERAL AVIATION AGENCY

FLIGHT PLAN

Form Approved.
Budget Bureau No. 04-R072.3

1. TYPE OF FLIGHT PLAN	2. AIRCRAFT IDENTIFICATION
[ ] FVFR [ ] VFR [XX] IFR [ ] DVFR	N 1234P

3. AIRCRAFT TYPE/SPECIAL EQUIPMENT 1/	4. TRUE AIRSPEED	5. POINT OF DEPARTURE	6. DEPARTURE TIME		7. INITIAL CRUISING ALTITUDE
			PROPOSED (Z)	ACTUAL (Z)	
ASTRO/A	170 KNOTS	DEN	1930		9,000

8. ROUTE OF FLIGHT

Radar Vector Byers V4 MKC

9. DESTINATION (Name of airport and city)	10. REMARKS
Kansas City Muni. Kansas City, Mo.	

11. ESTIMATED TIME EN ROUTE		12. FUEL ON BOARD		13. ALTERNATE AIRPORT(S)	14. PILOT'S NAME
HOURS	MINUTES	HOURS	MINUTES		
				SLN	

15. PILOT'S ADDRESS AND TELEPHONE NO. OR AIRCRAFT HOME BASE	16. NO. OF PERSONS ABOARD	17. COLOR OF AIRCRAFT	18. FLIGHT WATCH STATIONS

CLOSE FLIGHT PLAN UPON ARRIVAL

1/ SPECIAL EQUIPMENT SUFFIX
A — DME & 4096 Code transponder
B — DME & 64 Code transponder
D — DME
L — DME & transponder—no code
T — 64 Code transponder
U — 4096 Code transponder
X — Transponder—no code

FAA Form 7233—1 (4-65) FORMERLY FAA 398

0052-027-8000

21. According to the weather depiction chart (Figure 4),

1—the lowest ceiling along the proposed route of flight is at Kansas City (MKC).

2—VFR conditions exist for more than half of the route.

3—stations between SLN and MKC have scattered clouds.

4—VFR conditions exist in Kansas south of Salina (SLN).

22. After checking the area forecasts (Figures 5 and 6) and the 12-hour upper wind prog (Figure 7), you determine that during the proposed flight you

1—will encounter moderate icing in eastern Kansas.

2—are not likely to encounter icing conditions.

3—are likely to encounter moderate CAT in Colorado.

4—are likely to encounter moderate turbulence in northwest Kansas.

23. Which statement is a correct interpretation of the SA report (Figure 8)?

1—Denver (DEN) has scattered clouds at 1,700 feet.

2—Topeka (TOP) does not have a ceiling, but the visibility is 2 miles with very light rain.

3—Wichita (ICT) has a temperature of 34° F.

4—Kansas City (MKC) has a wind from 140° at 7 knots.

24. From the Power setting table and Fuel consumption chart (Figures 9 and 10), determine the power setting that will give the best fuel economy at 65%. (Pressure altitude of 9,000 feet—air induction temperature 0° C.)

1—2100 r.p.m. 22.4" manifold pressure.

2—2200 r.p.m. 21.13" manifold pressure.

3—2300 r.p.m. 20.6" manifold pressure.

4—Any of the above will give 65% power and have the same fuel burn.

25. If the left engine fails after you start the climb, what rate of climb should be obtainable according to Figure 11?

1—20′ per minute
2—0′ per minute
3—50′ per minute
4—200′ per minute

(Use gross weight of 5,200 lbs.–standard altitude of 6,000 feet–IAS of 97 m.p.h. or 84 knots.)

26. At a standard altitude of 9,000 feet, 65% power should produce a true airspeed of (Figure 12)

1—174 knots.
2—178 knots.
3—185 knots.
4—200 knots.

27. Determine the density altitude for Stapleton International Airport from the Pressure altitude density chart (Figure 13).

(Obtain temperature and altimeter setting from the SA 1900Z report, Figure 3—elevation of Stapleton is 5,330 feet.)

1—5,125 feet.
2—6,625 feet.
3—6,300 feet.
4—5,525 feet.

28. If you decide to use a true airspeed of 175 knots at a pressure altitude of 9,000 feet and a temperature of 6° C., you would need an indicated airspeed of (see airspeed correction table below)

1—165 knots.
2—148 knots.
3—152 knots.
4—160 knots.

Airspeed Correction Table
Flaps–0

IAS (knots)	CAS (knots
140	138
150	148
160	158

29. The computed flight time from takeoff to Kansas City Municipal Airport is

1—2:41.
2—2:46.
3—2:36.
4—2:51.

30. The fuel required for this IFR flight is approximately

1—520 lbs.
2—643 lbs.
3—553 lbs.
4—655 lbs.

31. Determine the c.g. in inches aft of datum with a loading as shown below.

	Weight (lbs.)	*Arm (in.)*	*Moment (lb.-in.)*
Empty weight (includes 4 gal. unusable fuel)	3,147		283,746
Oil	45	55.0	2,475
Pilot & co-pilot seat	340	89.0	30,260
Middle seats	410	126.0	51,660
Rear seats	345	157.0	54,165
Fuel (4 tanks)	720	113.0	
Baggage (front)	113	10.0	1,130
Baggage (rear)	80	183.0	14,640
	5,200 lbs.		

1—91.5
2—90.2
3—99.9
4—96.9

32. Assume that after takeoff at Stapleton, you lost your VOR navigation receivers and you elect to return to Stapleton. You are cleared for an NDB (ADF) approach to runway 26L (Figure 14). You turn outbound from the LOM on a heading of 077° and the ADF needle indicates 180° on roll out, but deflects to the left (clockwise) while you maintain a magnetic heading of 077, a correct procedure is to

1—turn right 20° and fly a magnetic heading of 097° until the ADF needle deflects 20° to the left. At that time you are back on course and should allow for a wind from your right.

2—turn left 20° and fly a magnetic heading of 057° until the ADF needle shows a deflection of 20° to the right. Then, turn right to 072° and if the wind correction you made was satisfactory, the ADF needle will remain on 180°.

3—turn right 20° and hold that heading until the ADF needle indicates 200°,

then turn to a heading of 082° to allow a 5° correction for the wind.

4—turn left 20 degrees to 057° and fly until the ADF needle indicates 200°, then turn right to a heading of 072° to allow a 5° correction for wind drift.

33. What is a correct sequence for tuning the DME on this flight from DEN to GLD? (See enroute chart, Figure 15.)

1—Set DME on 110.3 (Stapleton) until reaching Byers; tune to TXC (112.9) until about 36.5 miles from GLD; then tune to GLD.

2—Before takeoff, tune to DEN (116.3); when at TXC tune to GLD.

3—Tune the DME to the same facility as you tune your No. 1 navigation receiver, and as soon as you change your navigation receiver to another facility, change the DME to that facility.

4—Tune your DME to the navigation facility you are approaching unless it is over 100 miles between facilities.

* * * * * * * * *

After takeoff, Stapleton tower instructs you to contact Departure Control on 124.8. You contact Departure Control and they confirm radar contact and vector you to intercept V4. You are also instructed to report reaching 9,000. You report reaching 9,000. Upon intercepting V4, Departure Control instructs you to contact Denver Center on 119.8.

* * * * * * * * *

34. The recommended phraseology for making contact with Denver Center is

1—Denver Center—this is ASTRO 1234P 40 miles west of Thurman—9,000—Thurman at 2000Z—MKC—over.

2—Denver Center—ASTRO 1234P—Thurman 2000Z—9,000—MKC—over.

3—Denver Center—ASTRO 34P—MKC—over.

4—Denver Center—ASTRO 1234P—9,000—over.

35. Assume that about 10 minutes after passing Thurman (TXC), you are told to contact Denver Center on 142.5. As you attempt to change your communication receiver to this frequency, you realize it only goes to 129.9. You are unable to reestablish contact with Denver Center on 119.8. In this situation, you should attempt to contact

1—Denver Center on any other frequency listed on the enroute chart for Denver Center.

2—Goodland Radio on any standard FSS frequency or 122.3.

3—any ATC facility on 121.5.

4—Departure Control on 126.9.

36. The communication box at Goodland (Figure 15), indicates that

1—all standard frequencies except 122.3 are available.

2—only 122.3 is available.

3—all standard frequencies and also 122.3 are available.

4—all standard frequencies are available, but 122.3 is the best frequency to use.

37. At Topeka, you receive the following amended clearance: ASTRO 1234P CLEARED TO WOOD INTERSECTION V4N—DESCEND TO AND MAINTAIN 7000—EXPECT FURTHER CLEARANCE AT 2210Z. Upon arrival at Wood Intersection (still in radar environment), you should (area chart, Figure 16)

1—call Kansas City Center and tell them you have arrived at Wood Intersection.

2—go into a standard holding pattern with a direct entry to the pattern.

3—hold at Wood Intersection until 2210, and then, if you have not received further clearance, continue to MKC.

4—make a direct entry into a nonstandard holding pattern.

38. Before reaching Wood Intersection, you are instructed to contact Kansas City Approach Control. After contact, you are given a radar vector for an ILS approach to runway 18. While on a heading of 150°, you are cleared for an ILS approach. In this situation, you should

1—turn onto the localizer upon interception and make the approach as shown on the approach plate.

2—continue on a heading of 150° through the localizer as Approach Control may want to bring you back from the other side for spacing.

3—call Approach Control when you intercept the localizer for permission to track inbound.

4—turn onto the localizer upon interception and immediately call Kansas City Tower.

39. Which statement is correct regarding minimums for this approach (Figure 17)?

1—Since this is a straight-in approach, the MDA is 400 ft.

2—The MDA is 1,160 ft.

3—The DH is 1,158 ft.

4—Since this plate does not have the new format, a ceiling of 400 ft. and a visibility of 1 mile are required.

40. If you had to go to your alternate (Salina) and your DME was inoperative, which statement is true regarding your approach (Figure 18)?

1—Although the wind is out of the south, you would have a lower MDA by circling to land from an ILS approach to runway 35 than by making a VOR runway 17 straight-in approach.

2—Should you be cleared for a VOR approach to runway 17, you would have to make this approach to land at Salina.

3—With a visibility of ¾ mile, you could make either a VOR approach to runway 17 or an ILS approach to runway 35, even though the control tower was not in operation.

4—If you were cleared for an approach while holding at the Salina VORTAC, you could make a straight-in approach.

Analysis of Answers to Sample Test Items

Item	*Answer*	
1	2	To be current, a pilot must have made 5 takeoffs and 5 landings to a full stop in the category, class, and type aircraft he is to fly. He can meet the requirements of FAR 61.47 for carrying passengers at night by making the 5 takeoffs and landings in any aircraft.
2	4	See *Airman's Information Manual*, Part 1, "Air Navigation Radio Aids," for normal usable altitudes and further information.
3	1	ATC does not provide aircraft separation or control traffic except in controlled airspace.
4	2	The turn needle is independent of the "ball." If the turn needle is properly calibrated, it shows the correct rate of turn regardless of the position of the ball. (See IFR Exam-O-Gram No. 18.)
5	1	Since many NavCom transceivers utilize part of the receiver circuitry when the transmitter is operating, unreliable CDI indication may be obtained while transmitting.
6	4	For information on compass errors, see page 49 of the *Instrument Flying Handbook* (AC 61-27A).
7	2	The elevator trim should be used to relieve elevator control pressures. A change of power or airspeed requires a change of elevator trim. (See *Instrument Flying Handbook*, page 66.)
8	3	A. FAR Part 91.5. B. There is no requirement to file either a VFR or IFR flight plan in this case, but it is considered a good practice. C. FAR Part 91.5. D. FAR Part 91.5. This is included in the phrase, "familiarize himself

Item	Answer	
		with all available information concerning that flight." At the time of this publication, there is a Notice of Proposed Rule Making, proposing the amending of 91.5 to make this clear.
9	2	When the altimeter is set to 29.92 (standard pressure), the pressure altitude can be read directly from the altimeter, assuming no altimeter error.
10	1	To determine magnetic bearing, use magnetic heading. (In this problem variation and wind are not needed.)

Compass heading	320°	
Dev.	5° W.	
Magnetic heading	315°	
Relative bearing	115°	
Magnetic heading	315°	
Magnetic bearing to station	430° − 360° or −180°	70° +180°
Magnetic bearing from station	250°	250°

11	4	An abrupt movement of the controls not only leads to over-controlling, but may put undue stress on the aircraft.
12	2	The ball indicates a skidding turn. The pilot is either holding right rudder, or the airplane is out of trim.
13	4	A. The greater the gross weight, the higher the stalling speed. B. Correct as stated. C. Since the airplane will stall at a higher airspeed, the approach speed should be increased. D. Correct as stated. E. The amount of load the stabilizer carries depends on the location of the center of gravity.
14	4	See AIM 1, "ATC Clearances/Separations—Clearance Items."
15	2	For further information on air flow, see *Aviation Weather* (AC 00–6).
16	2	A. Correct as stated (see *Aviation Weather*, page 117). B. Frost does not form from dew, but directly from water vapor. C. If the wings are cold, frost can occur as stated in A. D. Correct as stated.
17	1	For further information on stability of air masses, see *Aviation Weather*, page 35.
18	3	For further information on runways, see Part 1 of AIM and IFR Exam-O-Gram No. 26.
19	1	The load factor for a 60° bank is 2, which requires twice the lift required for a load factor of 1.
20	1	A. Maximum endurance is attained at an airspeed that requires minimum power. B. For propeller airplanes, minimum drag and minimum power do not occur at the same airspeed. C. Correct as stated. D. From the drag chart, notice that there are two speeds that have the same total drag.
21	4	Areas having IFR weather are enclosed by a solid line. South of SLN several stations are shown in Kansas inside an area enclosed by a scalloped line. This is an area of marginal VFR weather. (See IFR Exam-O-Gram No. 15.)
22	2	Area forecast (Figure 5), indicates a freezing level of 7,000 in Nebraska and Iowa, sloping to 10,000 in SW Kansas. Clouds in Colorado are above your proposed altitude. Upper wind prog (Figure 7), indicates temperatures of +6° C. in Colorado and Kansas, and +1 C. at Kansas City; all above freezing.
23	4	Denver has a broken ceiling at 17,000; Topeka has a ceiling of 400 feet; the temperature at Wichita is 40° F.

Item Answer

24 1 Power settings with various r.p.m. and manifold pressure combinations are listed in Figure 13 for 65% rated hp. The lowest r.p.m. results in the least fuel consumption as illustrated by Part throttle fuel consumption chart, Figure 10.

25 1 With a gross weight of 5,200 lbs., the Single engine climb rate chart (Figure 11), indicates an absolute ceiling of 6,200 ft. The airplane is capable of a 20 ft./min. climb at 6,000 ft.

26 1 Figure 12 indicates that at 9,000 feet, the true airspeed should be 200 m.p.h. or 174 knots.

27 3 Elevation ------ 5,330 ft.
Correction for non-standard (30.06) ------ −129 ft.
Pressure altitude 5,201 ft.
Density altitude from chart (PA 5,201 @ 58° F.) ---- 6,300 ft. (approx.)

28 3 The CAS is 150 knots. In this airspeed range, the IAS is 2 knots greater, or 152.

29 1 Avg. wind (true)
DEN to SLN=230° @ 18 knots
SLN to MKC=245° @ 19 knots
If one desires to change the true wind to magnetic, subtract average easterly variation.

Avg. wind (magnetic)
DEN to SLN=219° @ 18 knots
SLN to MKC=236° @ 19 knots
Avg. mag. course TXC to SLN=088°

From	*To*	*GS*	*Time*
Byers	TXC	187	:13.8
TXC	SLN	186	1:26.0
SLN	MKC	192	:44.8
MKC	SLN	163	:53

30 4 Subtracting 12 minutes from the total time of 2:41, gives 2:29. Using 143 lb./hr. fuel flow, the fuel burn to MKC should be 355+50 or 405 lbs.

Item Answer

It should take approximately 60 min. to go to the alternate, resulting in a fuel burn of 143 lbs. The reserve requirement is 45 minutes or a fuel burn of 107 lbs.

31 3 The moment for the fuel is 720×113 or 81,360; a total moment of 519,436. Dividing 5,200 into this, gives a c.g. of 99.9″ aft of datum.

32 2 TXC is not a VORTAC, therefore, has no DME signal.

33 4 See IFR Exam-O-Gram No. 23 for ADF procedures.

34 4 Since you are in radar contact, no position report is required; however, the center will want you to verify your altitude.

35 2 Goodland Radio has all standard FSS frequencies and an additional frequency of 122.3. If you cannot reestablish contact with Denver Center on 119.8, you should try to contact the nearest FSS which is Goodland Radio.

36 3 Explained above.

37 4 It is not necessary to make position reports when in radar environment unless requested. Both the enroute chart and area chart show a holding pattern with left turns which is non-standard. See AIM 1, "ATC Clearances," and "Enroute–IFR" for more information.

38 1 When you are cleared for the approach, you are expected to make necessary turns to make the approach. However, you do not call the tower until so instructed by Approach Control.

39 3 Since the AL Chart is not the new format, for a straight-in approach add the ceiling of 400 feet to the field elevation. This is a DH of 758 ft.

40 1 An ILS RWY 35 circling approach has an MDA of 1700, while the VOR straight-in approach is 1740. If you

Item	*Answer*
	were cleared for a VOR approach and did not think you could safely make it, you could request the ILS approach. However, should Approach Control have a large amount of traffic, unless you had more than a loss of DME, they might delay your clearance and put you in a holding pattern until they could work you in for the ILS approach.

Appendix

This section contains supplementary data for use with the sample test.

FLIGHT TIME ANALYSIS

CHECK POINTS		ROUTE CRUISE ALT./FLT. LEVEL	Mag Avg Course	AIRSPEED-KTS.		WINDS ALOFT DIRECTION VELOCITY TEMPERATURE	DRIFT CORR ANGLE	GROUND SPEED	DISTANCE N.M.	TIME		FUEL CONSUMPTION LBS./GALS.		MISC.
FROM	TO			EAS OR MACH NO	TAS					LEG	TOTAL	LEG	TOTAL	
Stapleton Airport	Byers	Radar Vector	---	---	---	--------	---	---	---	12.0	12	50*	50	*Includes taxi and warm up.
Byers	TXC	V4 9000	083		175	**								
TXC	SLN	"			"									
SLN	MKC	"	072°		"									
MKC	K.C. Muni	-----	---	---	---	--------	---	---	---	4.8				

ALTERNATE DATA

KC Muni	MKC	-----	---	---	---	--------	---	---	---	7.0	7.0
MKC	SLC				172	Mag. Wind 220°=11 kts					

FUEL SUMMARY

	TIME	LBS./GALS.
ENROUTE		
ALTERNATE		
RESERVE		
EXTRA		
TOTAL		

** Obtain wind aloft from 12 hr. upper wind prog., Figure 8. Use average of DEN and HLC winds for flight to Salina (SLN), use average of HLC and MKC winds for flight from Salina to Kansas City. Use fuel burn of 143 lb/hr unless fuel burn is shown on Flight Time Analysis.

FIGURE 1. Flight time analysis.

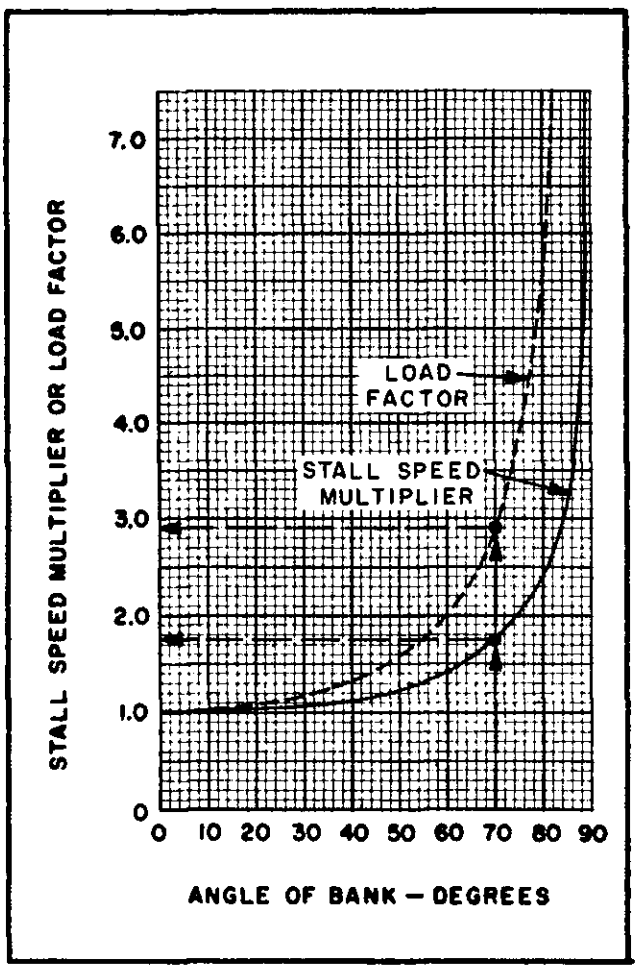
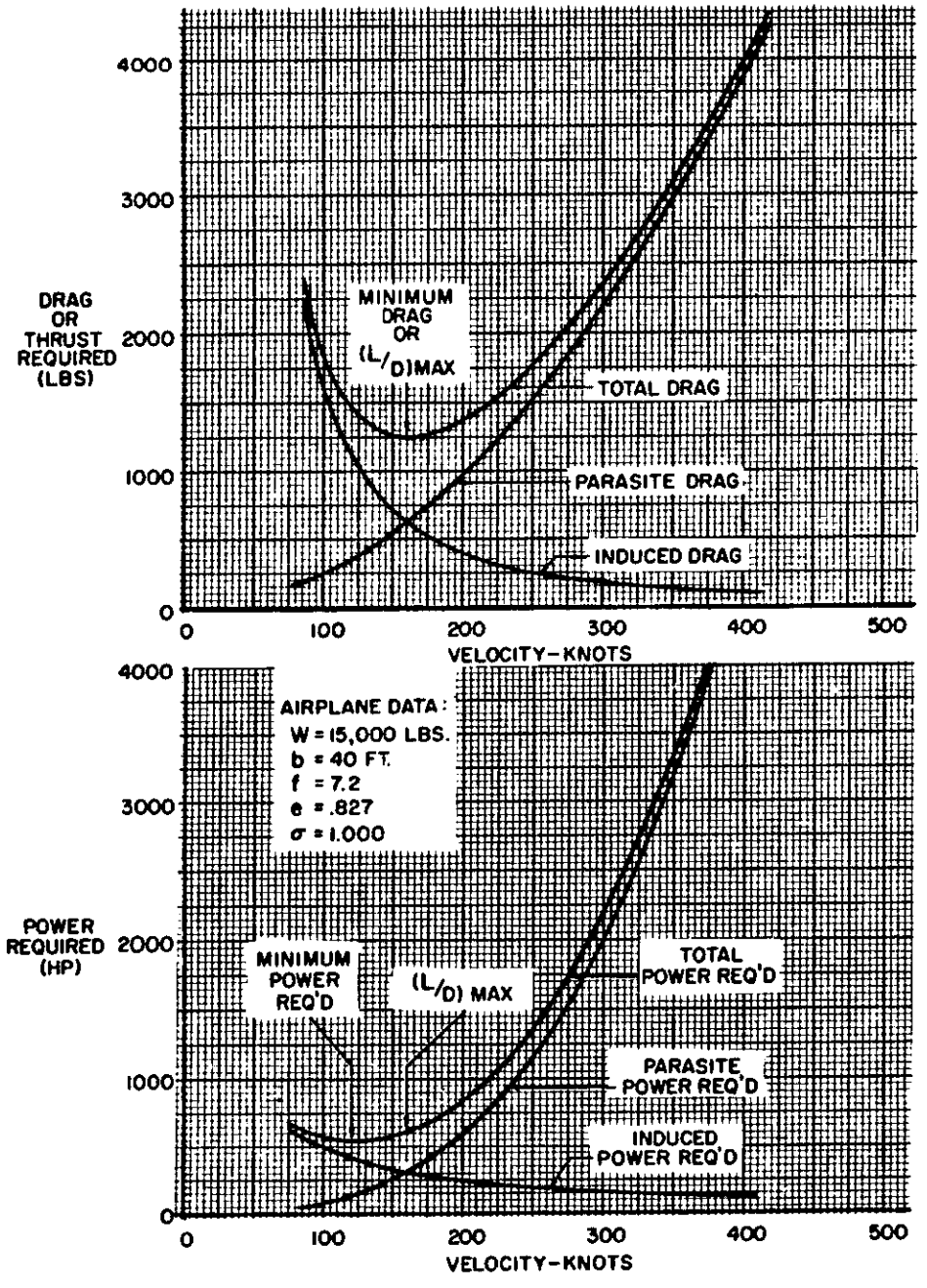


FIGURE 2. Stall speed multiplier or load factor.



Airplane Thrust and Power Required

FIGURE 3. Airplane thrust and power required.

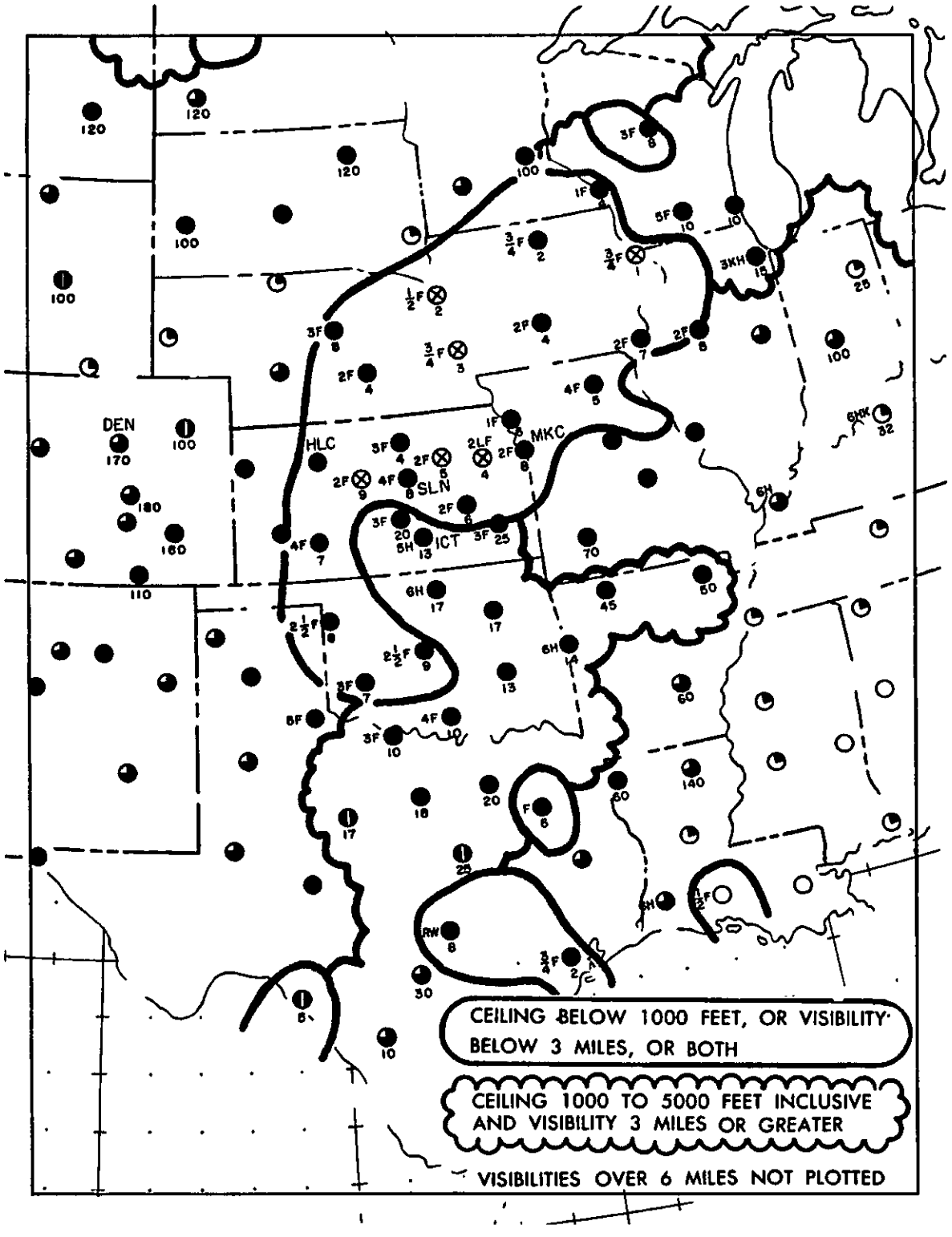


FIGURE 4. Weather depiction chart.

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FA MKC 171845Z
19Z WED-Ø7Z THU

NEB EXCP PNHDL IA KANS MO

HGTS ASL UNLESS NOTED.

SYNOPSIS. WDSPRD LOW ST AND FOG THU MOST OF FCST AREA WITH LTL IPVMT EXPCD THRU PD.

CLDS AND WX...

MOST OF IA NRN TWO THIRDS OF MO CNTRL AND ERN KANS PTNS OF SCNTRL AND ERN NEB C2-5⊕1-3F OCNL C2X1/2FL-- SERN HLF IA NWRN MO AND NERN KANS. SLO IPVMT EXTRM WRN EDGES BY ØØZ HWVR CONDS SPRDG SLOLY SWD RMNDR MO.

EXTRM S CNTRL AND SERN KANS SRN THIRD AND E CONTRL MO C15-35⊕V⊕3-5FK OR HK LWRG C8-12⊕2-5F WITH OCNL L-- BY Ø4Z.

WRN KANS C12ØØ3ØØ⊕7 WITH -X1-3GF SWRN HLF CHC C6-8⊕1F AND BCMG C4-6⊕3F BY Ø4Z SWRN PTNS.

N CNTRL NEB. 1ØØ⊕3ØØ-⊕ WITH CHC 12⊕25⊕C1ØØ⊕.

ICG. LGT TO OCNL MDT MXD ICGICIP. FRZLVL NEB AND IA SLPG TO 7Ø-1ØØ EXTRM SWRN KANS.

TURBC. LGT TO LCLLY MDT TURBC BLO 7Ø CNTRL NEB NWRN KANS.

OTLK Ø7Z-19Z THU. CONDS ERN NEB N CNTRL KANS LFTG 18-3Ø⊕V⊕5F BY 14Z AND 4Ø⊕8Ø⊕7 BY 19Z LTLCG ELSW.

FIGURE 5. Area forecast (MKC).

FA DEN 181845
19Z WED-Ø7Z THU

COLO WYO NEB PNHDL

HGTS ASL UNLESS NOTED

SNYS. HI PRES W OF CONTDVD. WK TROF OF LO PRES ERN PRNS OF AREA DRFTG EWD

CLDS AND WX. OVR AREA. 17Ø-2ØØDVD3ØØ LCLY A FEW AREAS 1ØØ-12ØDVD OVR EXTRM NWRN WYO WITH ISOLD SNW SHWRS. OCNL MTN OBSCMT VCNTY SNW SHWRS

ICG. NONE OF CONSEQUENCE. FRZLVL 9Ø-1ØØ NRN WYO TO 11Ø-12Ø COLO

TURBC. LGT TO LCLY MDT W OF CONTDVD COLO. ELSW OVER AND NEAR MTNS MDT TURBC LCLY SVR WITH UDDF ALG ERN SLPS OF MTNS. MTN WAVE LKLY E OF CONTDVD WYO AND NRN COLO 22Ø-39Ø WITH LGT TO LCLY MDT CAT

OTLK Ø7Z-19Z THU. NO SGFNT CHGS

FIGURE 6. Area forecast (DEN).

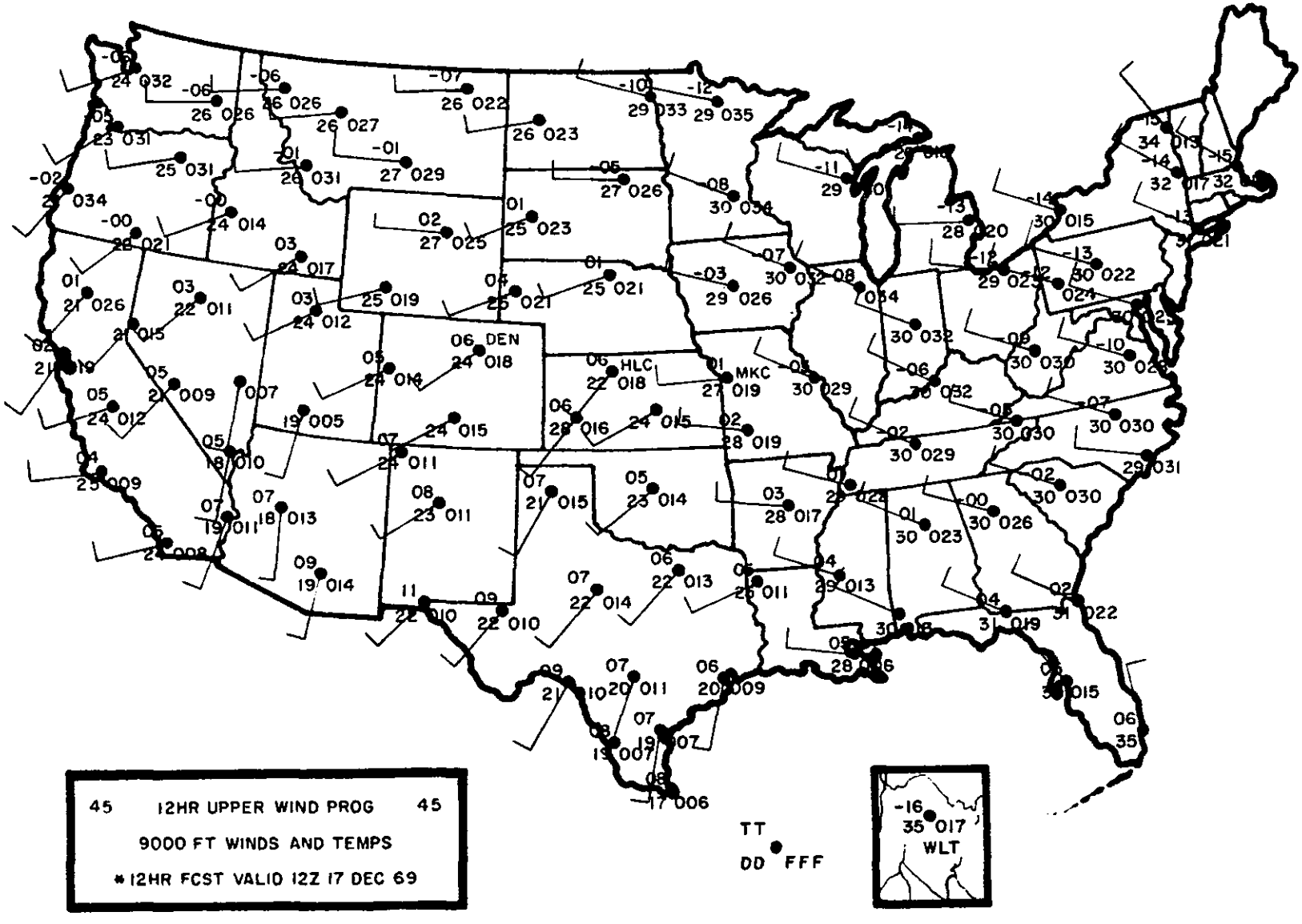


FIGURE 7. 12-hour upper wind prog.

```
Ø3Ø SA3Ø1719ØØ
DEN E17ØⓄ25ØⓄ6Ø 172/58/13/ØØØØ/ØØ6/ACSL ALQDS
  →DEN↘12/8 ASE OA 12/9 ASE XX
GLD 14ØⓄ24Ø⊕15+ 168/48/3Ø/3Ø1Ø/ØØØ
HLC 1Ø-⊕7 195/4Ø/32/22Ø6/ØØ4/FOG ALQDS
RSL W9X2F 2Ø9/38/33/1912G21/ØØ8/ PRESFR
SLN E8⊕4F 2Ø7/39/34/1814/Ø12→SLN↘12/6 FRI XX
MHK W5X2F 32/29/16Ø8/Ø18/⊕46 PRESFR
TOP S W4X2L-F 244/32/29/171Ø/Ø22
MKC S M8⊕2FK 25Ø/34/3Ø/14Ø7/Ø24→MKC↘12/4 XX
STJ S M6⊕1F 33/28/171Ø/Ø19/R35VV11/2+
COS E 18ØⓄ26Ø⊕1ØØ 173/59/-2/Ø2Ø9/ØØ8/ACSL ALQDS ⓄVⓄ
PUB 16ØⓄ25ØⓄ9Ø 162/61/14/3Ø18/ØØ3/ ACSL ALQDS
ICT M13⊕5H 223/4Ø/34/1511/Ø15→ICT↘11/9 UR
HUT S 7ⓄM2Ø⊕3F 41/35/16Ø5/Ø14
EMP B6⊕2F 243/34/29/171Ø/Ø2Ø
```

FIGURE 8. Aviation weather report.

Power Setting Table-Lycoming Model IO-540-C4B5, 250 HP Engine

Press. Alt. 1000 Feet	Std. Alt. Temp. °F	138 HP - 55% Rated Approx. Fuel 10.6 Gal./Hr. RPM AND MAN. PRESS. 2100	2200	2300	2400	163 HP - 65% Rated Approx. Fuel 11.9 Gal./Hr. RPM AND MAN. PRESS. 2100	2200	2300	2400	188 HP - 75% Rated Approx. Fuel 13.7 Gal./Hr. RPM AND MAN. PRESS. 2200	2300	2400
SL	59	21.9	21.0	20.2	19.6	24.6	23.5	22.7	22.0	26.2	25.2	24.4
1	55	21.7	20.8	20.0	19.4	24.4	23.3	22.5	21.8	25.9	25.0	24.1
2	52	21.4	20.6	19.8	19.2	24.1	23.0	22.2	21.5	25.6	24.7	23.9
3	48	21.2	20.3	19.6	19.0	23.8	22.8	22.0	21.3	25.3	24.5	23.6
4	45	20.9	20.1	19.4	18.8	23.6	22.5	21.8	21.1	25.0	24.2	23.4
5	41	20.7	19.9	19.2	18.6	23.3	22.3	21.5	20.9	24.8	24.0	23.1
6	38	20.5	19.6	19.0	18.4	23.1	22.0	21.3	20.7	24.6	23.8	22.9
7	34	20.2	19.4	18.8	18.2	22.8	21.8	21.1	20.4	---	23.6	22.7
8	31	20.0	19.2	18.5	18.0	22.6	21.5	20.8	20.2	---	---	22.5
9	27	19.8	18.9	18.3	17.8	22.4	21.3	20.6	20.0			
10	23	19.5	18.7	18.1	17.6	---	21.1	20.3	19.8			
11	19	19.3	18.5	17.9	17.4	---	---	20.1	19.6			
12	16	19.1	18.2	17.7	17.2	---	---	---	19.4			
13	12	18.9	18.0	17.5	17.0							
14	9	---	17.8	17.3	16.8	When using Hartzell Propeller HC-E2YK-2RB/8465-7R with IO-540-C4B5 engine, DO NOT EXCEED 27" MANIFOLD PRESSURE BELOW 2300 RPM or 25" BELOW 2000 RPM.						
15	5	---	---	17.1	16.6							

To maintain constant power, correct manifold pressure approximately 0.17" Hg. for each 10° F variation in induction air temperature from standard altitude temperature. Add manifold pressure for air temperatures above standard; subtract for temperatures below standard.

FIGURE 9. Power setting table.

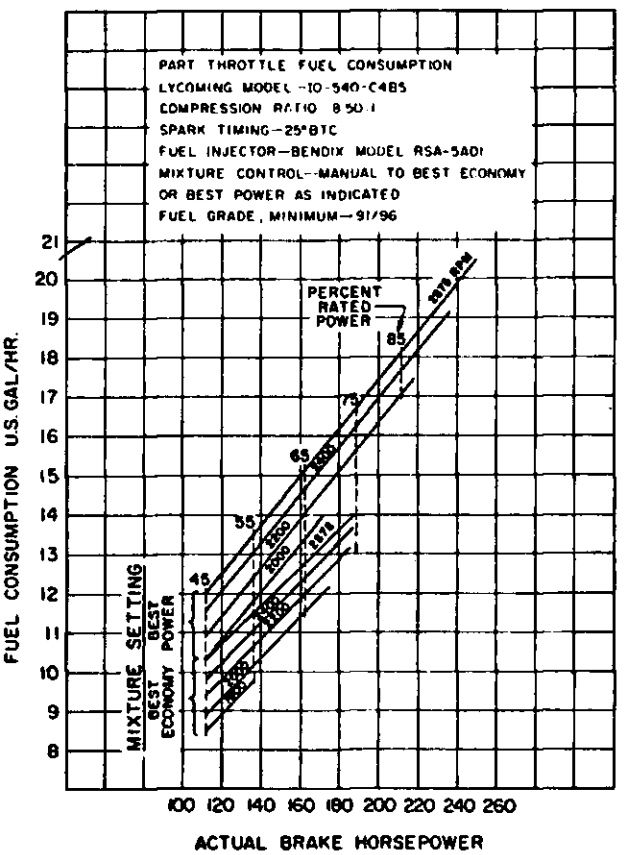


FIGURE 10. Part throttle fuel consumption chart.

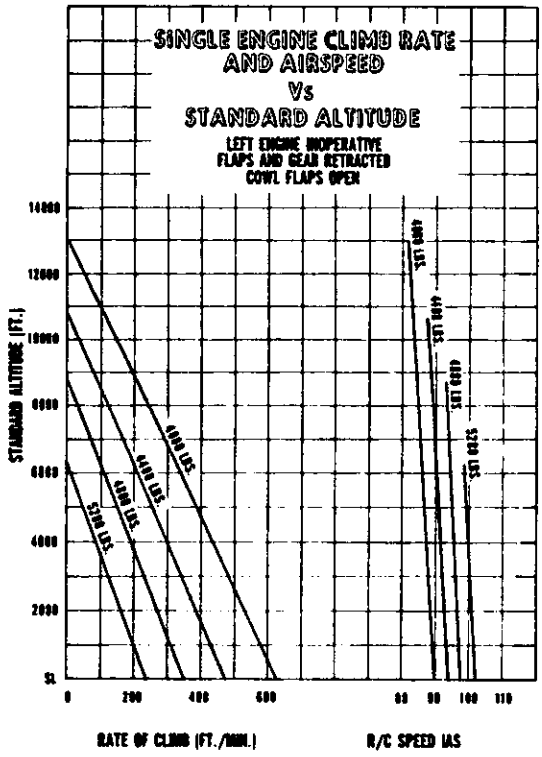


FIGURE 11. Single engine climb rate chart.

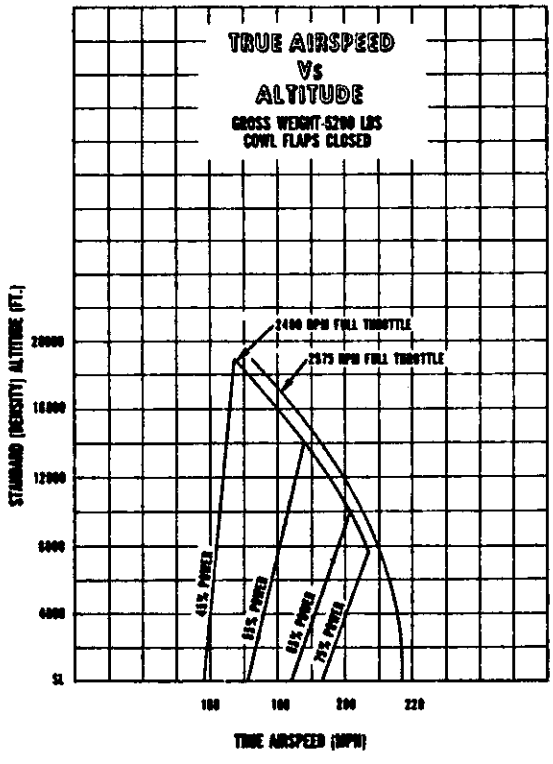
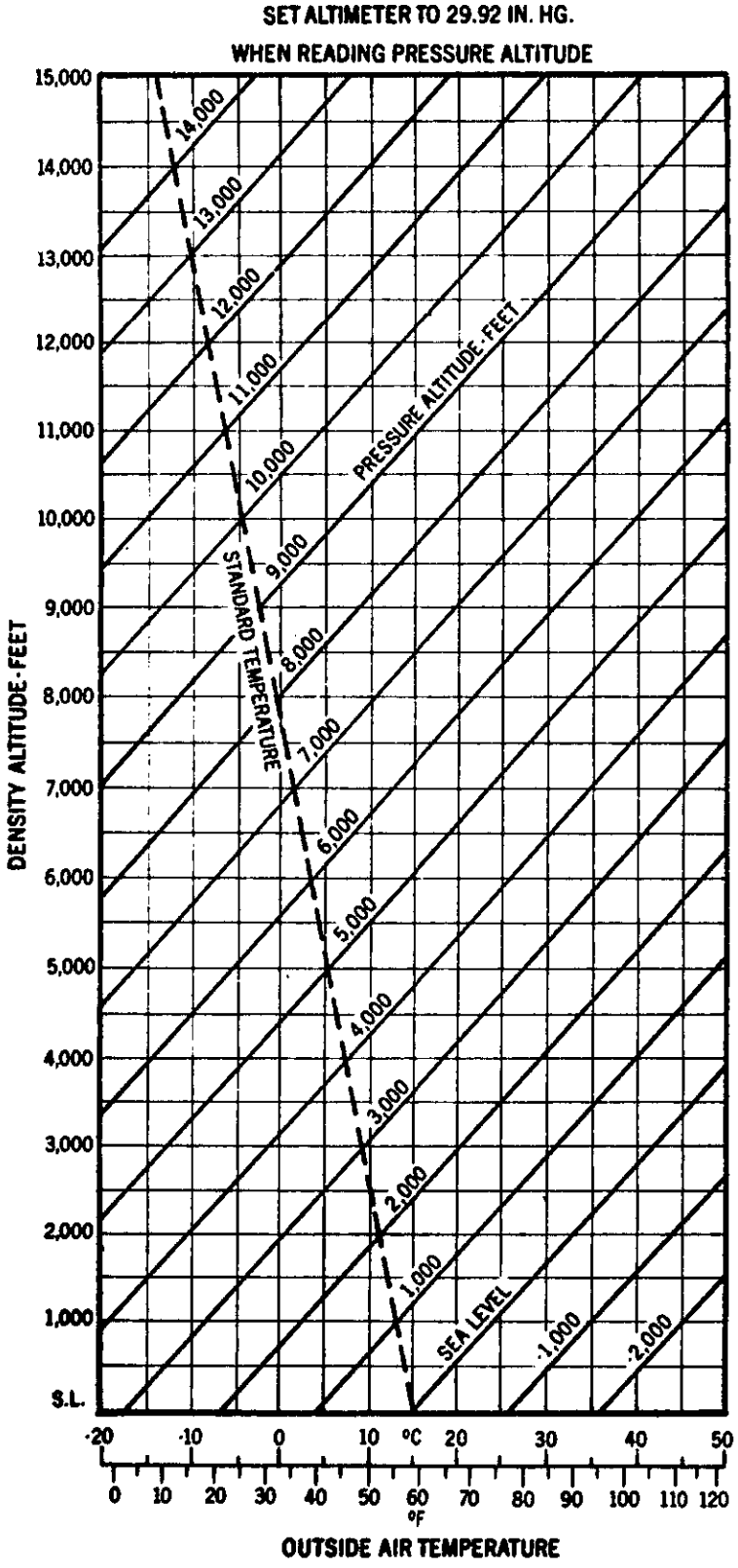
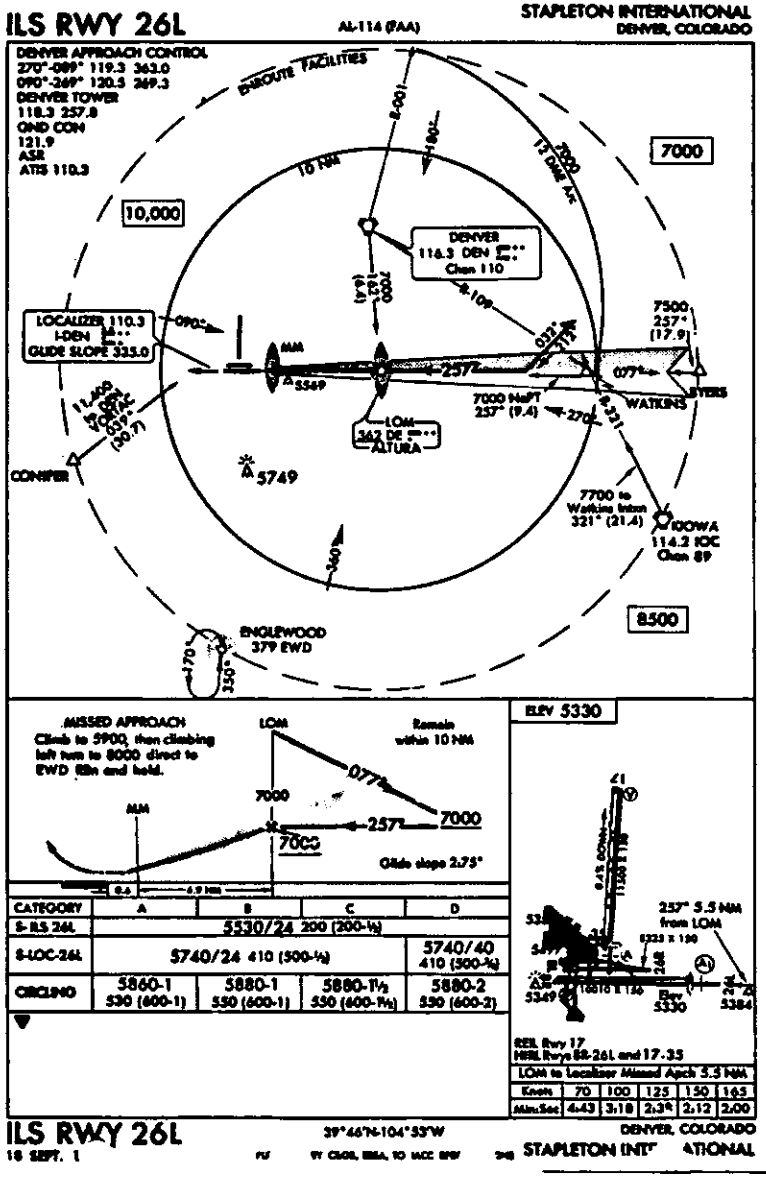


FIGURE 12. True airspeed chart.



ALTIMETER SETTING IN. HG.	ALTITUDE ADDITION FOR OBTAINING PRESSURE ALTITUDE
28.0	1,825
28.1	1,725
28.2	1,630
28.3	1,535
28.4	1,435
28.5	1,340
28.6	1,245
28.7	1,150
28.8	1,050
28.9	955
29.0	865
29.1	770
29.2	675
29.3	580
29.4	485
29.5	390
29.6	300
29.7	205
29.8	110
29.9	20
29.92	0
30.0	- 75
30.1	-165
30.2	-255
30.3	-350
30.4	-440
30.5	-530
30.6	-620
30.7	-710
30.8	-805
30.9	-895
31.0	-965

FIGURE 13. Pressure altitude density chart.



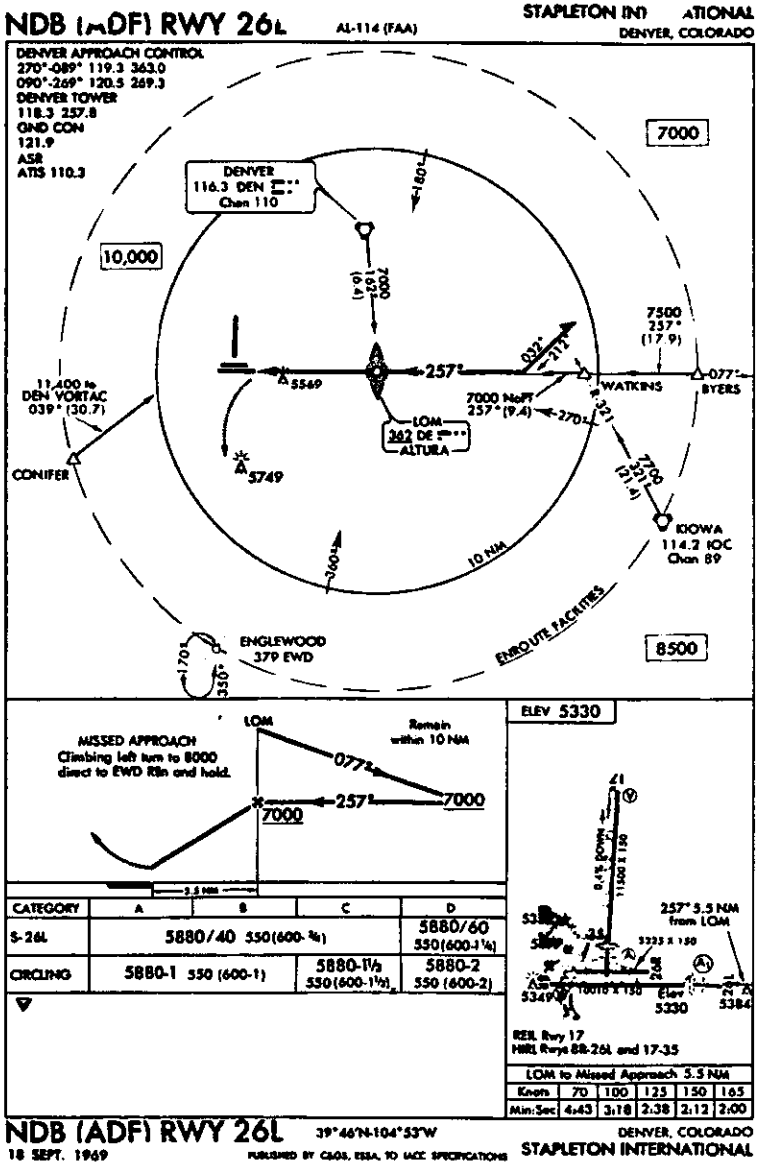


FIGURE 14. Instrument approach procedure charts—Denver, Colo.

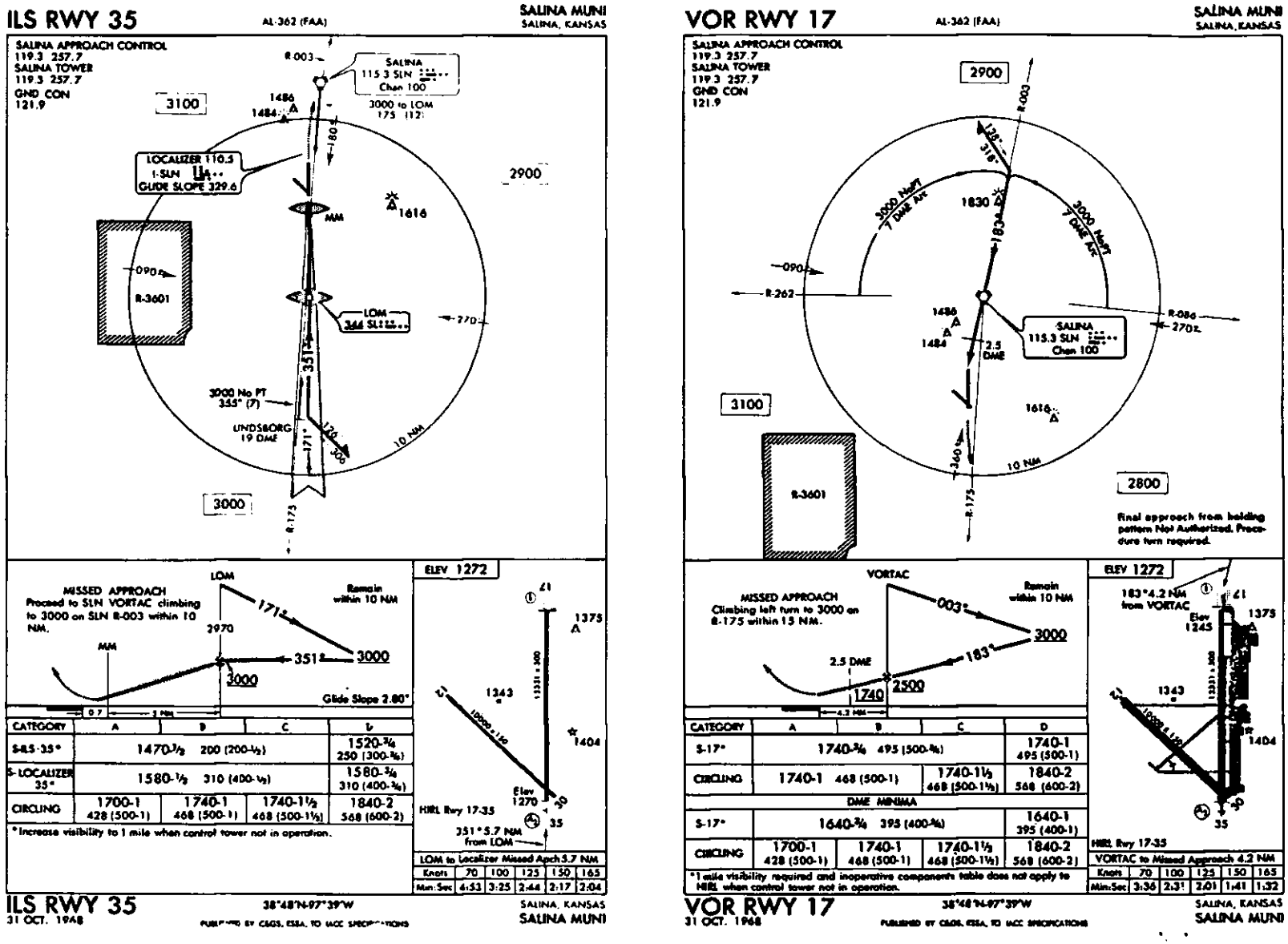


FIGURE 18. Instrument approach procedure charts—Salina, Kans.

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