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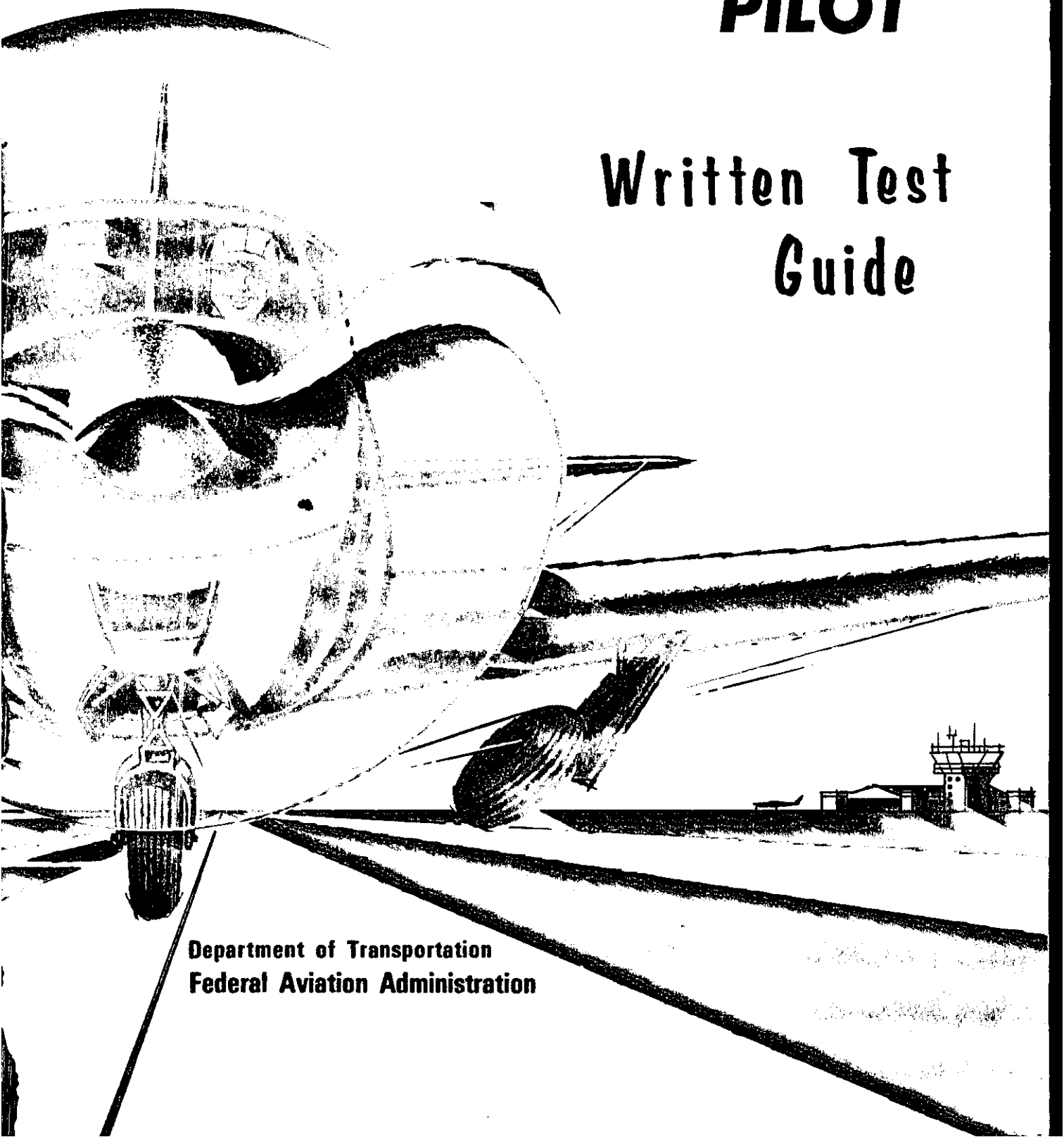
AC 61-28A

REFERENCE

COMMERCIAL PILOT

Written Test Guide



Department of Transportation
Federal Aviation Administration

COMMERCIAL PILOT WRITTEN TEST GUIDE

Revised 1970

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
FLIGHT STANDARDS SERVICE

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PREFACE

The Operations Branch of Flight Standards Technical Division has issued this Commercial Pilot Written Test Guide, AC 61–28A, to assist applicants who are preparing for the Commercial Pilot Written Test. The guide was prepared by the same Federal Aviation Administration Specialists who developed the Commercial Pilot Written Tests currently in use. Its purpose is to guide prospective applicants toward a clear understanding of the requirements, the reference material, the form of the written test, and the examining procedures.

This guide supersedes the Commercial Pilot Examination Guide, AC 61–28, dated 1966.

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COMMERCIAL PILOT WRITTEN TEST GUIDE

INTRODUCTION

This guide is not offered as a quick and easy way to obtain the necessary knowledge for passing the written test; there is NO quick and easy way to obtain the background of experience, knowledge, and skill that the present-day professional pilot must acquire. Rather, the intent of this guide is to define the scope and narrow the field of study, insofar as possible, to the knowledge requisite to the Commercial Pilot Certificate.

BASIS FOR THE WRITTEN TEST

No longer is the commercial pilot concerned primarily with "hopping passengers around the cow pasture" on sunny Sunday afternoons. He now conducts extended personal or business flights, or engages in the various phases of air commerce. His area of operation is virtually boundless. Consequently, he often encounters situations involving rapidly changing weather conditions and unfamiliar terrain which demand knowledge of the elements as well as precise navigation. The airports and airspace he now uses have become congested with all types of flight operations, making stringent control imperative for the smooth, efficient flow of air traffic.

Technological advances and refinements have made the modern airplane versatile, reliable, and efficient. Many of today's smaller general aviation airplanes—the modern light single-engine or twin-engine airplanes—have a performance capability which, a short time ago, was found only in the larger and more powerful air carrier and military aircraft.

With its increased performance, improved instrumentation, and the addition of reliable radio navigation equipment such as VOR and ADF, it is natural that the airplane's primary commercial use is for safe, speedy, and efficient transportation. For these reasons the Commercial Pilot Written Test is slanted to the transportation function. The basis of the test is an operationally realistic cross-country flight.

The test items in the written test are those which relate to a successfully planned and executed flight. The pilot employs all pertinent flight information, and applies his knowledge of air traffic rules, weather, navigation, radio, operation of aircraft and engines, etc., in planning a safe, efficient flight. Recognizing this functional approach, the test is designed to integrate technical information of several subjects into the test items of a single section.

TYPE OF TEST ITEMS

The written test contains 60 test items of the "objective, multiple-choice" type, and each can be answered by the selection of a single response from among the four presented. This type of test has several advantages, two of which are (1) rapid scoring, making it possible for the applicant to receive his grade as soon as possible, and (2) objective scoring, eliminating any element of individual judgment by the examiner in determining the grade.

TAKING THE WRITTEN TEST

The equipment needed for taking the test includes a straight-edge, a protractor or plotter, and a computer (preferably one with a wind vector face). It is also desirable to have a pair of dividers for accurate measurement of distances.

Always bear in mind the following facts when you are taking the test.

1. There are *no* "trick items." Each statement means exactly what it says. Do not look for hidden meanings nor read into the test item something that is not intended. Unless specifically stated otherwise, test items do not concern exceptions to the rule; they are based on the general rule.
2. Always read the complete test item, including the optional responses, *before* you make your choice. In many cases, the responses listed below the test item are your only clue to the point of knowledge being tested. Be sure that you understand what they mean. Then, from the list of alternative responses, decide which one you think is correct. Be sure that the one you select is the best among those listed.

3. Only *one* of the responses given is completely correct. The others may be the result of incorrect computation, misconceptions of rules and principles, or erroneous or incomplete analysis of the problem. Be sure that you understand and consider all factors.
4. Each test item is independent of other test items; that is, the correct response to one item is not based on the correct response to a previous item, although occasionally the same factors may be used.
5. If you find that you have considerable difficulty with a particular test item, do not spend too much time on it. Go on to the next item. When you reach the end of the test, go back to any items which you have passed over previously. This will enable you to use the available time to maximum advantage in demonstrating your knowledge and understanding of the subject.
6. In working problems which require computations or the use of the computer, your result may not agree exactly with any of the responses listed. This could be due to slight differences in individual computers and small errors that you might make in measuring distances, true courses, etc. However, sufficient spread is provided between correct and incorrect responses so that you will be able to make a positive selection, provided you have used correct technique and reasonable care in your computations. Therefore, choose the response that is *nearest* to your result. (NOTE: When the test questions are prepared, correct responses are "double-checked" by several types of computers commonly used throughout the country.)
7. When reporting for the written test, you should be prepared to present to the person administering the test proof of your eligibility to take it, as well as documentary evidence of your identity. Normally, *you will not be permitted to begin the test unless there is sufficient time to complete it.* Four hours is the normal time allowed for completing the Commercial Pilot (Airplane) Written Test.

ELIGIBILITY FOR TAKING THE TEST

Although certain requirements for the issuance of the Commercial Pilot Certificate are prescribed in FAR Part 61, there are, at the time of this writing, no prerequisites for taking the written test initially. Requirements for *retaking* the test after failing are prescribed in Section 61.27, FAR Part 61.

STUDY OUTLINE
FOR
THE COMMERCIAL PILOT WRITTEN TEST

This study outline is the framework of basic aeronautical knowledge that the prospective commercial pilot must know and be able to apply to pertinent situations. Every test item in the FAA test can be directly related to one or more of the topics contained in this outline. Frequently, topics may overlap when the situation demands the application of several knowledge areas to arrive at the complete solution of a problem. This subject matter is predicated on operationally realistic airman activity and encompasses the requirements specified in Federal Aviation Regulations. Many topics in this outline are references to pertinent sources of information. All references to Exam-O-Grams apply to the VFR series.

A. FEDERAL AVIATION REGULATIONS

Have a knowledge of:

1. Commercial pilot privileges and limitations (FAR Part 61).
2. Recency of experience requirements (FAR Part 61).
3. Commercial pilot certificates (FAR Part 61).
4. Pilot medical certificates (FAR Part 61).
5. Pilot responsibilities and preflight actions (FAR Part 91; Exam-O-Gram 4).
6. Aircraft maintenance and inspection requirements (FAR Part 91; Exam-O-Gram 26).
7. Aircraft certificates and documents (FAR Part 91; Exam-O-Gram 26).
8. General operating rules (FAR Part 91; Exam-O-Grams 4, 6).
9. General flight rules (FAR Part 91; Exam-O-Grams, 2, 4).
10. Visual flight rules (FAR Part 91).
11. Operating rules at airports (FAR Part 91; AIM*).
12. Airport traffic signals, airport lighting and runway markings (FAR Part 91; AIM*).
13. Accident reporting rules (NTSB Part 430; AIM*).
14. Midair Collision Avoidance, Right-of-way rules (FAR 91, Exam-O-Grams 22, 29, 48).

*AIM *(Airman's Information Manual)*

B. FLIGHT INFORMATION PUBLICATIONS AND CHARTS

Have a knowledge of:

1. *Airman's Information Manual* (AIM).
2. Aeronautical chart symbols (aeronautical chart; Exam-O-Grams 23, 50, 51).
3. Special Use Airspace (restricted and prohibited areas, etc.) (Exam-O-Gram 51; AIM).
4. Use of airport advisory service (AIM; Exam-O-Grams, 22, 50).
5. Radio facility data and symbols (AIM; Exam-O-Grams, 22, 50).
6. Controlled airspace boundaries (aeronautical chart; FAR Part 1, 71; Exam-O-Gram 26).
7. Significance of runway designations (AIM).
8. Airport night lighting (AIM).

Be able to:

1. Obtain radio facility information (AIM; Exam-O-Grams 22, 50).
2. Obtain airport facility information (Airport Directories, AIM; aeronautical chart).
3. Select appropriate aeronautical charts (aeronautical chart; Exam-O-Grams 4, 51).
4. Determine terrain and obstruction clearance (aeronautical chart; Exam-O-Gram 23).
5. Relate FAR flight rules to airport symbols or data.
6. Relate FAR flight rules to chart elevations.
7. Relate FAR flight rules to controlled airspace symbols.

8. Relate FAR flight rules to restricted or prohibited areas.

C. WEATHER FUNDAMENTALS, FORECASTS, AND REPORTS

(NOTE: Most useful reference is "Aviation Weather," AC 00–6.)

Have a knowledge of:

1. Measurement of atmospheric pressure.
2. Cause of atmospheric circulation.
3. Effect of mountains and other obstructions on wind.
4. Relative humidity (Exam-O-Gram 17).
5. Methods by which air reaches the saturation point.
6. Effect of temperature on air density.
7. Effect of temperature on flight.
8. Cloud types and associated weather.
9. Fog, frost, clouds, and precipitation.
10. Thunderstorms and turbulence.
11. Freezing levels and icing conditions (Exam-O-Gram 21).
12. Characteristics of a cold front.
13. Characteristics of a warm front.
14. Characteristics of an occluded front.
15. Symbols used in teletype reports and forecasts (Exam-O-Grams 26, 46).
16. Radio weather broadcasts (Exam-O-Grams 5, 17, 26).
17. Significance of temperature/dewpoint reports (Exam-O-Gram 21).
18. Significance of cloud and ceiling reports (Exam-O-Grams 17, 20, 21, 44).
19. Significance of surface wind reports (Exam-O-Grams 17, 21, 26).
20. Significance of atmospheric pressure reports (Exam-O-Gram 21).

Be able to:

1. Recognize basic weather conditions and trends on surface weather maps.
2. Interpret and relate Area Forecasts to the route of flight.
3. Interpret and relate Terminal Forecasts to the route of flight.
4. Interpret and relate In-flight Advisories to the route of flight.
5. Interpret and relate Aviation Weather Reports to the route of flight.
6. Interpret and relate Pilot Reports (PIREPS) to the route of flight.
7. Interpret and relate Winds Aloft Forecasts to the route of flight.
8. Relate surface wind reports to available runways (Exam-O-Grams 21, 26).
9. Use the Weather Depiction Charts, Prognostic Charts, and Sullins briefing on "In-Flight Visibility and the VFR Pilot."
10. Relate weather conditions or information to FAR flight rules.
11. Obtain weather briefings and weather information for preflight planning and while flying en route (Exam-O-Grams 5, 34).

D. PILOTAGE, DEAD RECKONING, AND RADIO NAVIGATION

Have a knowledge of:

1. Methods used in pilotage.
2. Chart projections used for air navigation.
3. Time zones and 24-hour clock system.
4. Effects of wind on navigation (Exam-O-Gram 27).
5. Significance of magnetic variation and compass deviation.
6. Significance of true airspeed, indicated airspeed, and groundspeed (Exam-O-Grams 26, 27, 45).
7. Significance of track, course, heading, bearing, and radial (Exam-O-Grams 15, 16, 27).
8. Principles of LF ranges, omni ranges, and radio beacons.
9. Operation of aural range receivers, omni receivers, and ADF receivers.
10. Use of navigation computers—slide rule side and wind vector side.
11. Flight plans (Exam-O-Grams 4, 6).

Be able to:

1. Measure distances on the chart.
2. Measure courses on the chart.
3. Select appropriate landmarks and checkpoints on the chart.
4. Select cruising altitudes based on weather conditions (Exam-O-Gram 2).
5. Select cruising altitudes based on the direction of flight (Exam-O-Grams 2, 17, 22).
6. Determine winds by interpolation of Winds Aloft Forecasts.

7. Determine headings using Winds Aloft by wind triangle or computer.
8. Determine compass heading, using compass correction card.
9. Determine groundspeed, using Winds Aloft by wind triangle or computer.
10. Determine groundspeed and ETA's by in-flight check.
11. Determine time, distance, or speed, using Winds Aloft by wind triangle or computer.
12. Determine fuel consumption or rate of consumption from performance charts and computer.
13. Determine true airspeed from altitude, temperature, and IAS, using computer.
14. Determine rate of climb or descent, using computer.
15. Determine true altitude, pressure altitude, density altitude, using computer.
16. Solve "off course" problems.
17. Relate LF aural signals to position.
18. Relate omni indications to position (Exam-O-Grams 15, 16).
19. Relate ADF indications to position (Exam-O-Gram 39).
20. Determine time/distance to station, using VOR or ADF.

E. RADIO COMMUNICATIONS

Have a knowledge of:

1. Radio procedures and phraseology (Exam-O-Gram 50).
2. Standard transmitting and receiving frequencies (Exam-O-Gram 50).
3. Characteristics of standard broadcast (AM), low frequency (LF), and very high frequency (VHF) stations.
4. Availability of in-flight assistance (Exam-O-Grams 19, 26).
5. Security control of air traffic—ADIZ (AIM).
6. Direction finding procedures (AIM, Exam-O-Gram 19).

Be able to:

1. Interpret and apply wind information as received in radio transmissions (Exam-O-Gram 26).
2. Determine when communications are required (Exam-O-Gram 50).
3. Make position reports.
4. Interpret airport traffic instructions and plan approaches and departures (FAR Part 91).
5. Interpret enroute traffic instructions (AIM).
6. Obtain emergency assistance (Exam-O-Gram 19; AIM).

F. FLIGHT INSTRUMENTS AND RELATED FACTORS

Have a knowledge of:

1. Characteristics of the magnetic compass.
2. Airspeed limitation instrument markings (Exam-O-Grams 26, 45).
3. Significance of altimeter settings.
4. Significance of pressure and density altitude.
5. Effect of temperature on altimeters.
6. Relationship of turn indicators to speed and bank.

Be able to:

1. Apply altimeter settings and compensate for errors.
2. Interpret altitude indications.
3. Interpret pitch attitude instruments.
4. Interpret bank attitude instruments.
5. Interpret power setting instruments.
6. Use airspeed correction table (Exam-O-Grams 26, 45).
7. Determine pressure altitude by altimeter or pressure reports.
8. Determine density altitude by computer.

G. AIRPLANE AND ENGINE OPERATION

Have a knowledge of:

1. Theory of airfoils.
2. Forces acting on the airplane.
3. Functions of the flight controls and related axes.
4. Use of control surface trim tabs.
5. Effect of wind on airplane speeds (Exam-O-Gram 27).
6. Effect of crosswinds on ground control (Exam-O-Gram 27).
7. Effect of altitude on airplane speeds (Exam-O-Gram 26).
8. Effect of attitude on stalling speeds (Exam-O-Gram 28).
9. Effect of frost or ice on airfoils (Exam-O-Gram 28).

10. Theory of reciprocating engines.
11. Theory of carburetion.
12. Theory of propellers.
13. Basic airplane fuel systems.
14. Basic airplane lubricating systems.
15. Engine instruments and controls.
16. Procedures for adjusting RPM and manifold pressure.
17. Effect of altitude on engine performance.
18. Effect of improper use of the mixture control (Exam-O-Gram 38).
19. Effect and cause of detonation (Exam-O-Gram 38).
20. Effect of the use of improper fuel grade.
21. Effect of and conditions conducive to carburetor icing.
22. Methods of detecting and eliminating carburetor icing.
23. Methods of preventing and eliminating fuel contamination.
24. In-flight emergency procedures.
25. Significance of best climb speeds (Exam-O-Gram 17).
26. Maneuvering speed and its use.
27. Methods of coping with wake turbulence such as wingtip vortices (AIM).
28. Procedures for landing in turbulent air (AIM).
29. Preflight and postflight safety practices.
30. Oxygen equipment and its uses (Exam-O-Gram 49).

H. AIRPLANE PERFORMANCE CHARACTERISTICS

Have a knowledge of:

1. Static and dynamic stability.
2. Airplane Flight Manuals.
3. Relationship between airspeed, bank, and rate of turn.
4. Significance of load factors (Exam-O-Gram 28).
5. Effect of humidity on airplane and engine performance (Exam-O-Gram 17).

Be able to:

1. Compute gross weight and allowable load.
2. Compute c.g. location through the use of landing graphs.
3. Use maximum safe crosswind chart.
4. Use Denalt Computer for takeoff and climb data.
5. Use takeoff performance charts—tabular and graphic (Exam-O-Gram 33).
6. Use climb performance charts—tabular and graphic (Exam-O-Gram 33).
7. Use cruise performance charts—tabular and graphic (Exam-O-Gram 33).
8. Use fuel consumption charts—tabular and graphic (Exam-O-Gram 33).
9. Use stalling speed charts (Exam-O-Gram 33).
10. Use landing distance charts—tables and graphs (Exam-O-Gram 33).

SAMPLE WRITTEN TEST

The following test items are included for one purpose—to familiarize you with the *type* of items you may expect to find on the FAA tests. You should keep in mind that these sample items do not include all the topics on which you may be tested in the FAA test. FAA written tests are, at best, a sampling of your aeronautical knowledge. It is for this reason that you should concentrate on the section entitled STUDY OUTLINE FOR THE COMMERCIAL PILOT WRITTEN TEST. A knowledge of all the topics mentioned in this outline—*not* just mastery of the sample test items—should be used as the criterion for determining that you are properly prepared to take the FAA written test and meet the knowledge requirements for the Commercial Pilot Certificate.

The correct responses to the sample test items, with explanations, are given at the end of the test. The appendix of this booklet contains the supplementary materials which will be required from time to time during the sample test. These materials include weather information, aircraft description and performance data, and the flight planning data (excerpted information from the AIM). Cincinnati Sectional Aeronautical Chart is also provided for your use.

This test is based on a flight from Columbus, Ohio, to Parkersburg, West Virginia, and then to Charleston, West Virginia.

Although the test sets up a hypothetical situation, the weather data is authentic. The airplane you are assumed to be flying is a Condor 410, which is a late-model, four-place single-engine airplane. It is equipped with retractable landing gear and a constant-speed propeller. Airplane data is given in the supplementary information provided in the appendix.

NOTES The reader should bear in mind that these sample test items are based on Federal Aviation Regulations in effect on January 1, 1970.

Assume that you have a Commercial Pilot Certificate and are employed by a manufacturing company. This company uses several business aircraft. You are to fly three sales representatives on a VFR cross-country flight from Port Columbus International Airport to Wood County Airport (Parkersburg) and then to Kanawha Airport at Charleston. Landings will be made at Parkersburg and Charleston.

The proposed route of this cross-country flight is as follows:

LEG I

Depart Port Columbus International Airport, Columbus, Ohio (40°00′N; 82°53′W) direct to Wood County Airport, Parkersburg, West Virginia. (39°21′N; 81°26′W).

LEG II

Depart Wood County Airport on a true course of 180°until intercepting V115 then via V115 to Charleston VORTAC; then direct to Kanawha Airport, Charleston, West Virginia (38°22′N; 81°36′W).

* * * * * *

Draw the courses for the proposed flight on the Sectional Chart.

* * * * * *

1. Assume that you have a Commercial Pilot Certificate and that a second-class medical certificate was issued to you on June 1, 1970. With regard to carrying passengers for hire, your medical certificate is valid until the end of—

1—May 1972.
2—June 1972.
3—May 1971.
4—June 1971.

2. According to FAR Part 91, an airplane shall not be operated unless it has had an annual inspection within the preceding 12 calendar months. When an airplane has received this inspection, it is indicated by—

1—the issuance of a new Airworthiness Certificate.
2—the issuance of a new Aircraft Registration Certificate.
3—an entry in the maintenance records.
4—completion of an alteration and repair form.

3. For VFR flight in a Control Area at more than 1,200 feet above the surface but less than 10,000 feet m.s.l., the proximity to cloud requirements and minimum flight visibility is—

1—1,000 feet over or 500 feet under and at least 1 mile visibility.
2—1,000 feet under or 500 feet over and at least 1 mile visibility.
3—1,000 feet under or 500 feet over and at least 3 miles visibility.
4—1,000 feet over or 500 feet under and at least 3 miles visibility.

4. Much of the success of a cross-country flight is directly dependent on careful flight planning. Preflight action should include a careful study of available current weather reports and forecasts, taking into consideration fuel requirements and an alternate course of action if the flight cannot be completed as planned. Such preflight action is—

1—good operating practice and is required by FAR.
2—required by FAR only if passengers are carried for hire.
3—required by FAR only if the flight is to traverse controlled airspace.
4—good operating practice but is not required by FAR.

* * * * * *

You arrive at Port Columbus International Airport at 0830 EST to start your preflight planning.

* * * * * *

5. Assume that the forecasts shown in Figure 10 of this guide are available to you. In comparing the Terminal Forecasts for Columbus and Charleston you determine that—

1—the sky and visibility conditions are forecast to improve sooner at Columbus than at Charleston.
2—it will probably be necessary to delay your departure from Columbus until after 1000 EST.
3—a cold front is forecast to pass Columbus at 1230Z.
4—Columbus is forecast to be clear within 5 miles visibility and haze after 0730 EST.

6. Based on the 1245Z Cleveland and Washington Area Forecasts (Figures 6 and 7 of this guide), you can expect—

1—a weak cold front extending southwestward across southern Pennsylvania, central West Virginia, and eastern Kentucky at 1300Z.
2—the freezing level to be above 8,000 feet in southern Ohio.
3—light to moderate turbulence below 8,000 feet over western West Virginia after 1800Z.
4—clear to partly cloudy sky conditions with 7 miles visibility east of the front in southern Ohio and western part of West Virginia until 1500Z.

7. By referring to the 1600Z Aviation Weather Reports in Figure 12 of this guide, you determine that—

1—Roanoke, Virginia is reporting thin broken clouds at 3,500 feet.
2—the altimeter setting at Columbus is 30.26" Hg.
3—the temperature/dewpoint spread is greater at Columbus than it is at Charleston.
4—Parkersburg is reporting a ceiling of 3,000 feet.

8. Assume that Columbus is reporting broken clouds at 3,200 feet at the time of your departure. If you were flying directly over Columbus International Airport (see Sectional Chart) at 3,500 feet m.s.l. this would mean that you would be—

1—approximately 300 feet below the base of the clouds.
2—approximately 500 feet below the base of the clouds.
3—approximately 500 feet above the base of the clouds.
4—on top of the clouds.

9. Refer to the Weather Depiction Chart as shown in Figure 3. The smooth solid lines (not scalloped) enclose areas containing—

1—equal barometric pressure.
2—heavy precipitation.
3—marginal, but better than VFR minimums.
4—weather that would be below VFR minimums in controlled airspace.

10. Using the Winds Aloft Forecasts for Charleston, (Figure 8), you determine that the wind at 7,500 feet is from a—

1—true direction of 026° at 22 knots.
2—magnetic direction of 260° at 27 m.p.h.
3—true direction of 220° at 10 knots.
4—true direction of 260° at 27 knots.

11. You decide to cruise with a power setting of 2,200 r.p.m. and 21" Hg., producing 55% b. hp. (brake horsepower) on the first leg of your flight. Using the Cruise Performance Chart for 5,000 feet (Figure 49) you determine your true airspeed and rate of fuel consumption will be approximately—

1—172 m.p.h. and 11.7 g.ph.
2—165 m.p.h. and 10.4 g.ph.
3—163 m.p.h. and 6.3 g.ph.
4—158 m.ph. and 10.0 g.ph.

12. Assume that your true airspeed will be 173 m.p.h. and the wind is forecast to be from 240° at 16 knots at your selected cruising altitude. What will be your magnetic heading and groundspeed from Columbus to Wood County Airport at Parkersburg? (Use Sectional Chart.)

1—118° MH and 180 m.p.h. groundspeed.
2—123° MH and 158 m.p.h. groundspeed.
3—128° MH and 182 m.p.h. groundspeed.
4—113° MH and 186 m.p.h. groundspeed.

13. In order to make good a true airspeed of 176 m.p.h. at 6,000 feet, where the outside air temperature is reported as −08° C., your indicated airspeed should be approximately—

1—164 m.p.h.
2—159 m.p.h.
3—178 m.p.h.
4—152 m.p.h.

NOTES Assume the indicated altitude to be the same as pressure altitude.

14. Which of the following statements concerning Port Columbus International Airport is correct? See Figures 70 through and Figure 78.

1—There are only two hard-surfaced runways at this airport—the longest of which is 10,700 feet.
2—The highest grade of aviation gasoline available for aircraft is 115/145.
3—A Visual Approach Slope Indicator (VASI) is installed for runway 28L.
4—The tower transmits and receives on the frequencies 120.5 and 122.4.

15. *Assume* each of the four persons aboard the airplane weighs 180 lbs. and that the airplane will have a full fuel load. From the information in the airplane owners manual in Figure 42, you determine that to remain within the maximum allowable gross weight the baggage should not exceed—

1—17 lbs.
2—36 lbs.
3—120 lbs.
4—136 lbs.

NOTE: Based on 6 lbs. per gallon of fuel and 7.5 lbs. per gallon of oil.

* * * * * *

After filing a flight plan, you conduct a thorough preflight inspection of the airplane and prepare for takeoff.

* * * * * *

16. While allowing the engine to warm up prior to your "before takeoff check," you remember that detonation may result in severe damage to the engine and occurs when the fuel mixture explodes instead of burning evenly and progressively. *One* factor that is likely to cause detonation is—

1—high density altitudes.
2—excessively rich fuel-air mixtures.
3—the abrupt opening of the throttle.
4—the use of higher-than-recommended fuel octanes.

17. The stalling speed of your airplane is 65 m.p.h. indicated airspeed in a wings-level attitude. After takeoff you are climbing directly into a 30 m.p.h. headwind at an indicated airspeed of 95 m.p.h. If a turn is made so that the wind is from directly behind the airplane, the—

1—airplane would stall.
2—groundspeed would increase by 60 m.p.h.
3—indicated airspeed would read 125 m.p.h.
4—true airspeed would increase to 125 m.p.h.

18. In using the magnetic compass to establish and maintain your heading, you should know that the normal characteristics of a compass in the Northern Hemisphere will usually cause it to indicate a turn toward the—

1—west as you enter a medium banked left turn from a south heading.
2—east as you enter a medium banked left turn from a north heading.
3—south when you accelerate on an east heading.
4—north when you decelerate on a west heading.

19. In reviewing the NOTAMS (Figure 86) for the airports you will be using on this flight you determine that—

1—runway 10R–28L at Port Columbus International is closed to aircraft of over 12,500 lbs.

2—runway 5R–23L at Parkersburg, Wood County Airport is closed (0700–1730) until further notice.

3—there may be intermittent kite flying up to 10,000 feet and above, approximately 10 miles west of Port Columbus International during daylight hours.

4—the threshold on runway 35 is displaced 500 feet at the Kanawha Airport in Charleston.

20. After departing Port Columbus, you are flying on course toward Parkersburg. You tune in Appleton VORTAC, located to the left of your course, and at 1217 CST you cross the 223° radial of Appleton VORTAC. Five minutes later you cross the 180° radial of Appleton. If you maintain the same groundspeed, the approximate ETA over Parkersburg, Wood County Airport should be—

1—1237 CST.
2—1242 CST.
3—1247 CST.
4—1252 CST.

21. While flying on a magnetic heading of 128° enroute to Parkersburg, you note that a relative bearing of 305° to the Zanesville nondirectional radio beacon (to the left of course) is indicated on the fixed scale ADF dial. On what magnetic bearing *from* the radio beacon is your aircraft located?

1—253°.
2—73°.
3—233°.
4—243°.

22. On course to Parkersburg, you tune in Zanesville VORTAC to check your position in relation to the 180° radial. Zanesville VORTAC is located north of your course. With the omnibearing selector set to 180° and the TO-FROM indicator showing "FROM," you note the CDI (Left-Right) needle shows a full-scale deflection to the right. This means that you—

1—have already crossed the 180° radial of Zanesville.
2—have not crossed the 180° radial of Zanesville.
3—probably have a malfunction in your omni equipment since Zanesville is to the left of your course.
4—are not using a proper method for determining your position in relation to Zanesville.

23. You departed Columbus with an altimeter setting of 30.26" Hg. If you failed to readjust to the altimeter setting of 30.23" Hg. given to you by Wood County Tower, your altimeter will read, upon landing at Parkersburg, approximately—

1—828 feet.
2—888 feet.
3—798 feet.
4—918 feet, only if the temperature lapse rate is standard.

24. As you approach Parkersburg, assume that you receive the following message from Wood County Tower:

". . . . WIND TWO ZERO ZERO AT ONE FIVE, ALTIMETER THREE ZERO, TWO FIVE, ENTER LEFT TRAFFIC FOR RUNWAY TWO ONE . . . ."

Based on the message above, you would plan to land on runway 21 with an approximate—

1—true direction of 210° and your heading on base leg should be approximately 300°.
2—magnetic direction of 021° and your heading on base leg should be approximately 115°.
3—magnetic direction of 021° and your heading on base leg should be approximately 125°.
4—magnetic direction of 210° and your heading on base leg should be approximately 295°.

25. As you maneuver the airplane in the traffic pattern, you are aware that a stall this close to the ground is dangerous. You should realize that an airplane can be stalled—

1—only when the nose is high and the airspeed is low.
2—only when the nose is too high in relation to the horizon.
3—only when the airspeed decreases to the established stalling speed.
4—at any airspeed and any flight attitude.

26. Most performance charts are based on pressure altitude. The pilot can determine pressue altitude by adjusting the altimeter to the—

1—current altimeter setting provided by the weather station and the indicated altitude will be the pressure altitude.
2—standard sea level pressure of 29.92" Hg. and the indicated altitude will be the pressure altitude.
3—station pressure reduced to sea level and the indicated altitude will be the pressure altitude.
4—field elevation and add the number of feet indicated by the smallest hand.

27. By referring to the Sectional Chart as you approach Wood County Airport, you note an obstruction (approximately 1½ miles to the right of course and 13 miles northwest of the airport). This obstruction is—

1—a television tower, extending to a height of 321 feet above the ground, that is under construction.
2—1,146 feet above the ground.
3—more than 1,000 feet above the ground.
4—1,146 feet MSL at the top.

28. *Assume* that the runways at an airport where you plan to land have special markings as shown in Figure 22. Which of the following is a true statement in regard to operating from this airport?

1—Runways 3 and 9 are closed for landings.
2—Runway 3 has a jet overrun at the upwind end of the runway.
3—Takeoffs are not permitted using the full length of runway 9 because of the displaced threshold.
4—Touchdowns may be made at the beginning of the hard surface on runway 27.

29. After reviewing the AIM excerpts in Figures 70 through 79, and 86, determine which of the following statements are true, with respect to landing at Parkersburg, Wood County Airport:

A. The highest grade of aviation gasoline available at this airport is 115/145.
B. The tower is in operation between the hours 0700–2300 local time.
C. You can transmit to the tower on the frequency 123.7 and receive the tower on 122.5.
D. There are three hard surfaced runways at this airport but only two of them are usable since runway 16–34 is closed.
E. Major airframe and major powerplant repairs may be obtained.

The correct statements are—

1—A, C.
2—B, D, E.
3—B, C.
4—C, D, E.

* * * * * *

You land at Parkersburg and check the weather before departing for Charleston.

* * * * * *

30. The Condor 410 has an unsupercharged engine rated at 260 hp. at sea level with 2,625 r.p.m. and 29″ Hg. With the constant-speed propeller set to full low pitch, the mixture full forward, and using full throttle for takeoff at an airport where the elevation is 5,000′ above sea level, you should expect, because of the elevation, to have—

1—less than 29″ Hg. manifold pressure.
2—less than 2,625 r.p.m.
3—an excessively lean fuel/air mixture.
4—more than 2,625 r.p.m.

31. Assume that you plan to take off from an airport where the pressure altitude is currently 5,000 feet, the wind is calm, and the airplane is loaded to maximum allowable gross weight. Using the Takeoff Data Chart in Figure 43, determine the *increase* in takeoff distance to clear a 50-foot obstacle when the temperature is 96° F, over a similar condition with the temperature 41° F.

1—205 feet.
2—368 feet.
3—405 feet.
4—791 feet.

32. *Assume* that you are flying an airplane equipped with a float-type carburetor. While in level cruising flight, you notice that although the position of the throttle and propeller controls are unchanged, you are gradually losing manifold pressure and airspeed. Suspecting carburetor ice, you apply carburetor heat. If carburetor ice does exist, you will note—

1—an immediate increase in manifold pressure as carburetor heat is applied.
2—a progressive increase in r.p.m. as the carburetor heat melts the ice.
3—a further loss of manifold pressure followed by a gradual increase while carburetor heat is being applied.
4—a decrease in r.p.m. until the application of carburetor heat is discontinued.

33. Reports of weather conditions at flight altitude, particularly between stations, seen by the pilot instead of the ground observer, are available in weather stations and frequently broadcast by radio. This type of information is termed—

1—In-flight Weather Advisories.
2—AMOS reports.
3—SIGMETS.
4—PIREPS.

34. A high, lens-shaped cloud termed "Standing Lenticular" and reported in aviation weather sequence reports by a contraction ACSL, is usually associated with a "mountain wave" type weather phenomenon.

Associated with a cloud of this type, you should expect to find in-flight conditions such as—

1—fog and poor visibility.
2—heavy precipitation.
3—calm wind conditions.
4—severe turbulence.

35. While on the ground at Parkersburg, you request that your fuel tanks be refilled. With regard to various grades of aviation gasoline, which of the following statements is TRUE?

1—Use of a lower than specified grade results in reduced power output and is usually more harmful to the engine than higher grade.
2—Use of a lower than specified grade may result in reduced power output but is usually less harmful to the engine than higher grade.
3—Use of a higher than specified grade usually improves engine performance and is not harmful to the engine.
4—Use of a higher than specified grade improves engine performance but is usually harmful to the engine.

36. Using appropriate information from the Airplane Flight Manual, Figure 42, and the Weight and Balance Charts, Figures 46 and 47, determine whether the airplane, if loaded as follows, meets weight and balance requirements.

4 occupants	170 lbs. each
Full fuel tanks	6 lbs. per gal.
Full oil tank	7.5 lbs. per gal.
Oil moment	−.4
Empty airplane moment	+63.7
Baggage	70 lbs.

On the basis of this information, the total moment is—

1—135.5, but the airplane would not be within c.g. limits.
2—125.1, and the airplane would be within c.g. limits.
3—131.3, and the airplane would be within c.g. limits.
4—125.1, but the airplane would not be within c.g. limits.

* * * * * *

After taking care of some business at Parkersburg, you check the weather and file a flight plan for the flight to Charleston.

* * * * * *

37. To taxi to runway 21 at Wood County Airport, from where you are parked, it is necessary to cross runway 28. In response to your request for taxi instructions, ground control replies,

". . . . CLEARED TO RUNWAY TWO ONE. . . ."

This phraseology means that you are—

1—authorized to taxi to runway 21 but clearance must be obtained to cross runway 28.
2—cleared to runway 21 and need no further clearance to cross runway 28.
3—authorized to use runway 21 for takeoff but must contact the control tower for clearance to cross runway 28.
4—cleared to taxi to and take off from runway 21 unless further instructed to hold.

38. Refer to the Climb Data Chart, Figure 44, to determine the best indicated airspeed for climb at 5,000 feet (assume standard temperature) for the Condor 410 at a gross weight of 2,800 pounds. By interpolation, you determine the best climb airspeed and resulting rate of climb to be—

1—102 m.p.h. and 1,405 feet per minute.
2—99 m.p.h. and 1,095 feet per minute.
3—101 m.p.h. and 980 feet per minute.
4—97 m.p.h. and 1,210 feet per minute.

39. You are on course to Charleston on V115 at 4,500 feet MSL. As you approach V174 which crosses your course, you observe a large twin engine airplane flying westbound on this airway at your same altitude and converging from your left. The airplane to your left is—

1—at a proper altitude but does not have the right-of-way.
2—not at a proper altitude but does have the right-of-way.
3—at a proper altitude and has the right-of-way.
4—not at a proper altitude and does not have the right-of-way.

* * * * * *

As you prepare to land at Kanawha Airport at Charleston, you observe several jet airliners landing and departing from this airport.

* * * * * *

40. The intensity of the vortices associated with the wake turbulence of large aircraft is greatest when such airplanes are operating at—

1—high airspeeds and low gross weights.
2—high airspeeds and high gross weights.
3—low airspeeds and high gross weights.
4—low airspeeds and low gross weights.

EXPLANATIONS OF THE SAMPLE TEST ITEMS

NOTE: We wish to emphasize that a creditable performance on this sample test should not be interpreted to mean that you have achieved the knowledge requirements for the issuance of a Commercial Pilot Certificate. This test is merely to acquaint you with the *types* of test items in the official written test and to assist you in *preparing* for that test.

1—(4) FAR 61.43 prescribes that for operations requiring a Commercial Pilot Certificate, a Second Class Medical Certificate expires at the end of the *last day* of the 12th month *after* the month in which it was issued. The 12th month after June 1970 is June 1971. The last day of June 1971 is the 30th of June. Therefore, the medical certificate expires at the end of June 30, 1971, as correctly indicated only in response number 4.

2—(3) Response number 1 is incorrect because Airworthiness Certificates are normally issued when the aircraft is certificated as being airworthy at the time of original manufacture, and after substantial alteration or repair has been made and the airworthiness renewed. It is *not* issued after each annual inspection. Number 2 is wrong in that Registration Certificates are reissued *only* when ownership of the aircraft has been transferred. Number 3 is correct since FAR Part 91 requires that entries be made in the maintenance records each time maintenance work, including inspections, is performed. Number 4 is incorrect since the alteration and repair form describe only the alteration and repair that was performed on the aircraft or component, and does not refer to an inspection of the whole airplane.

3—(4) The Basic VFR weather minimums are outlined in FAR 91.105. Response 1 is incorrect because it lists 1 mile visibility. Response 2 is incorrect as the distance from clouds is reversed and the 1 mile visibility is not correct. Response 3 also has the distance from clouds reversed. Therefore, Response 4 is the correct answer in accordance with the regulations.

4—(1) Response number 1 is correct because this action *is* good operating practice and FAR Part 91 *does require* that each pilot in command, before beginning a flight away from the vicinity of the airport, shall familiarize himself with available weather reports and forecasts, fuel requirements, alternative actions if the planned flight cannot be completed, and any known traffic delays of which he has been advised by ATC. Hence, response numbers 2, 3, and 4 are incorrect since this requirement of FAR is *not limited* to flights carrying passengers for hire, *nor* to those flights traversing controlled airspace.

5—(2) Response 1 is incorrect since at 1400Z Charleston is forecast to have partial obscuration sky conditions with 3 miles visibility and smoke improving to 25,000 thin broken clouds at 1600Z. Columbus is forecast to have only ½ mile visibility with fog until 1500Z. Response 2 is the correct answer because of the fog condition, forecast to last until 1500Z (1000 EST). There is no mention of a cold front or wind shift at 1230Z, thus response 3 is incorrect. Response 4 is also incorrect because of fog forecast at 1230Z (0730 EST).

6—(3) Response 1 is incorrect, as the weak cold front extends southwestward across southeastern Michigan and Central Missouri and is not expected to move to the Ohio/West Virginia border until 0100Z Tuesday. Response 2 is incorrect since the freezing level is forecast at or near the surface. Response 3 is the correct answer as mentioned in the Washington forecast. Response 4 is incorrect because of the visibility restrictions (fog, haze, and smoke).

7—(2) The thin broken clouds are at 25,000 feet and the visibility is 35 miles at Roanoke. Therefore, response 1 is incorrect. Response

2 is the correct answer since the first figure of the altimeter setting is always omitted from the report. Response 3 is incorrect because Charleston has a temperature/dewpoint spread of 16 degrees and the spread at Columbus is only 4 degrees. Response 4 is incorrect because there is no ceiling reported at Parkersburg—only thin scattered clouds at 30,000 feet.

8—(2) The correct answer is response 2. Cloud heights are reported above the ground at the reporting station. In this case, the broken clouds are reported at 3,200 feet and this figure, added to the Columbus Airport elevation of 816 feet, places the base of the clouds at 4,016 feet MSL. Therefore, your flight at 3,500 feet MSL places you 516 feet below the base of the clouds. Obviously, responses 3 and 4 are incorrect since you are not above the base of the clouds, and response 1 is not correct since you are more than 30 feet below the clouds.

9—(4) The correct answer to this sample test item can be found in the legend at the bottom of the Weather Depiction Chart. Response 4 is correct since the smooth solid lines (not scalloped) enclose areas where the ceiling is below 1,000 feet or visibility is below 3 miles or both. FAR 91.105 deals with basic VFR weather minimums in controlled airspace. Responses 1 and 2 are incorrect since these markings are not related to barometric pressure or areas of precipitation. Response 3 is obviously not in accord with regulations.

10—(4) Remember, the Winds Aloft Forecasts give the direction from which the wind is blowing as measured from TRUE north, and the speed is given in KNOTS. Since, in Figure 8, the wind is not given for 7,500 feet, we must interpolate using the winds data given on either side of this altitude. It is noted that the wind is from 260° at 22 knots at 6,000 feet, and from 260° at 33 knots at 9,000 feet. Therefore, for each 1,000 feet between these altitudes the wind direction remains the same. The wind speed increases 11 knots between the 6,000 and 9,000 foot levels. Since 7,500 feet falls halfway between these levels we add 5 knots (half of 11) to 22 knots, which equals 27 knots, as correctly given in response number 4. Response 2 is wrong because of the incorrect magnetic value; and because the speed is in m.p.h. Responses 1 and 3 list both incorrect wind directions and wind speeds.

11—(2) The Cruise Performance Chart for 5,000 feet shows the power setting of 2200 r.p.m. at 21″ Hg. and 55% b.hp. results in a TAS of 165 m.p.h. while using 10.4 g.p.h. of gasoline—as indicated in the correct answer, response 2. Response 1 is incorrect because it concerns using 23″ Hg. and 62% b.hp. Response 3 lists the figures for 2100 r.p.m., 53% b.hp. and the 6.3 gallons from the *endurance* column. Response 4 is wrong because it lists data from the 2,500 foot chart.

12—(3) At the meridian nearest the midpoint of your flight (see Sectional Chart), measure the true course (120°) between the two points. After converting the windspeed from 16 knots to 18.4 m.p.h. (since your airspeed is in m.p.h.), apply the wind direction and windspeed to the true course and true airspeed (by graphically plotting a wind triangle problem or by use of the wind face of a computer). After doing so, you determine that the true heading is 125° and the groundspeed is 182 m.p.h. On the Sectional Chart you find a magnetic variation of 3° in the area of your flight. Adding this variation of 3° (since it is westerly) to the true heading, gives you a magnetic heading of 128°.

Given		*Find*	
TC	120°	TH	125°
TAS	173 m.p.h.	Mag. Var.	3° W
Windspeed	18.4 m.p.h. (16 knots)	MH	128°
Wind Direction	240° True	GS	182 m.p.h.

Although slight variances may exist in different computers, if you use correct procedures, your results should more nearly agree with response number 3 than with the incorrect responses 1, 2, and 4.

13—(1) The explanation presented herein is pertinent to the type of computers having a typical True Airspeed Computations scale and may differ slightly from methods used in various other computers. However, the fundamental solutions are similar. On the Airspeed Computations scale set the outside air temperature, −08°, opposite the cruising

altitude of 6,000 feet. Directly below 176 m.p.h. TAS on the True Airspeed Scale, read the indicated airspeed of 164 m.p.h. on the Indicated Airspeed scale. The incorrect figures in responses 2, 3, and 4 may result if you do not make certain that the problem is set up on the Airspeed Computations scale of this computer; or if +08° is used instead of −08°; or if you read the indicated airspeed on the True Airspeed scale instead of on the Indicated Airspeed scale.

14—(2) According to the AIM excerpts, there are five hard-surfaced runways at Port Columbus, thus making response 1 wrong. Response 2 is the correct answer since the code F–22 represents 115/145 grade aviation gasoline. The higher codes represent jet fuels. Response 3 is incorrect as there is no VASI installed at this airport. The tower transmits and receives only on the frequency 120.5. The tower can only receive on 122.4, which means that response 4 is incorrect.

15—(2) The correct method of computation for this problem is as follows:

1,840.0 lbs. empty weight (including 1.5 gal. of unusable fuel).
+ 22.5 lbs. of oil (3 gal. at 7.5 lbs. per gal.).
+720.0 lbs. for occupants (4 persons at 180 lbs. each).
+381.0 lbs. of fuel (63.5 gal. usable fuel at 6 lbs. per gal.).

2,963.5 lbs. loaded weight
3,000.0 lbs. (maximum gross weight)
−2,963.5 lbs. (loaded weight)

36.5 lbs. baggage

16—(3) Detonation is always closely associated with abnormally high cylinder temperatures and pressures. Response number 1 is incorrect because high density altitudes will cause the fuel/air mixture to become richer with a cooler engine temperature. Number 2 is incorrect since a rich mixture burns faster than a lean mixture, and therefore produces less heat and pressure. Number 3 is correct because abrupt opening of the throttle from a slow speed will result in sharp increases of pressure within the cylinder, causing an almost instantaneous burning of the mixture which is characteristic of detonation. Number 4 is incorrect because the octane rating reflects the ability of the fuel to withstand compression without detonation. Therefore, the higher the octane rating, the less likelihood of detonation.

17—(2) Remember, airspeed is the speed at which an aircraft is traveling *through* the air mass. Since the direction it travels through the air has no effect on its speed through the air, the true airspeed and indicated airspeed will not be affected by a change in direction of travel. Thus, responses 3 and 4 are incorrect. Response number 1 is also incorrect because if the stalling speed is 65 m.p.h. and the airplane, as implied above, is still traveling 95 m.p.h. *through* the air, the airplane will not stall. Number 2 is correct because when headed into the wind, the airplane's speed over the ground is retarded to 65 m.p.h., but when headed downwind, the wind increases the groundspeed to 125 m.p.h., a gain of 60 m.p.h.

18—(2) The lines of force in the earth's magnetic field are parallel to the earth's surface at the equator but point increasingly downward when moving closer to the magnetic poles. In addition to aligning itself with the magnetic field and magnetic poles, the compass card has a tendency to dip downward because of the downward pull of the magnetic field. In straight-and-level flight the compass card is balanced to compensate for this tendency to dip downward. While in a banked attitude, however, the vertical component of the earth's magnetic field causes the north-seeking end of the compass card to dip to the low side of the bank and thus to rotate. In a bank from a north heading, this rotation, from the pilot's viewpoint, is opposite to the direction of the bank, and from a south heading is in the same direction as the bank. In a left bank from a south heading, the card will rotate toward east, hence response number 1 is incorrect. A left bank from a north heading will rotate the card toward east as correctly stated in response number 2. During acceleration and deceleration on east and west headings, the card tilts fore and aft, and again is caused to rotate. The direction of this rotation during acceleration or deceleration on east

and west headings can be easily remembered by associating the letters of the word ANDS; i.e., Acceleration (to the) North; Deceleration (to the) South. Therefore, responses 3 and 4 are incorrect.

19—(3) The NOTAM for Columbus, Ohio, in Figure 86, lists the following information: "Columbus, Port Columbus International Airport: Intermittent kite flying up to 10,000 feet and above, approximately 10 miles west of airport during daylight hours. Voice on localizer frequency 109.5 unavailable until further notice." Response 3, the correct answer, was excerpted from the above NOTAM. Responses 1, 2, and 4 are fictitious statements.

20—(3) In solving this problem on a computer, you find that 14 statute miles were covered in 5 minutes, which resulted in a groundspeed of 168 m.p.h. The distance from the 180° radial of Appleton VORTAC to Parkersburg, Wood County Airport is 70 statute miles, which will require 25 minutes at 168 m.p.h. groundspeed. Therefore, response 3 is correct, since by adding the time of crossing the 180° radial of Appleton (1222 CST) to the 25 minutes, you find the ETA at Wood County Airport to be 1247 CST. Response 2 is incorrect, since the 25 minutes was added to the time over the 223° radial instead of the 180° radial. This is a common error in solving this type of problem.

21—(1) To obtain the magnetic bearing to the station (radio beacon) from the airplane, add the magnetic heading (128°) to the ADF relative bearing (305°). The sum is 433°, which is greater than 360°; therefore, you must subtract 360° with a result of 073°. The 073° represents the magnetic bearing from the airplane to the station. To obtain the magnetic bearing from the station to the airplane, calculate the reciprocal by adding 180° to 073°. This results in a total of 253° as indicated in correct response 1.

Solution:

128° magnetic heading
+305° ADF relative bearing

433°
−360°

073° magnetic bearing aircraft to station
073°
+180° reciprocal

253° magnetic bearing station to aircraft.

NOTE: If the bearing from the aircraft to the station is more than 180° it is necessary to subtract 180° in order to calculate the reciprocal bearing. When the bearing from aircraft to station is less than 180° add 180° for the reciprocal.

22—(1) A reliable way for position checking in relation to an off-course omni station radial is to place the omnibearing selector on the radial you wish to locate. The TO-FROM indicator will then indicate "FROM." In this problem, the airplane is somewhere south of Zanesville VORTAC, and by placing 180° on the omnibearing selector, the TO-FROM indicator reads "FROM." The CDI (Left-Right) needle is deflected to the side the station is on (to the left) until reaching the 180° radial. Upon arrival at the 180° radial, the CDI needle centers, and after passing this radial, the CDI needle deflects to the opposite side from which the station is located (to the right). Another way to visualize your position in relation to the 180° radial is to imagine that you have turned the airplane to a heading parallel to the 180° radial. If you have not reached the 180° radial the CDI needle will be deflected to the left. When arriving at the 180° radial, the CDI needle centers and after passing the 180° radial the needle deflects to the right. Therefore, response 1 is the correct answer since the CDI needle indicates a full scale deflection to the right denoting that the 180° radial has been crossed.

23—(2) Each 0.1″ Hg. of pressure indicated in the Kollsman window represents approximately 100 ft. on the altimeter dial. The altimeter setting of 30.26 is .03 higher than the proper setting of 30.23, which represents 30 feet on the altimeter dial. In this case, the 30-foot error must be added to the Wood County Airport elevation of 858′ (858+30=888′). The erroneous reading of 888′ will appear

upon landing as stated in correct response 2. Hence, responses 1, 3, and 4 are incorrect.

24—(4) The runway number 21 corresponds to the magnetic direction (210°) of a takeoff or landing on that runway. In runway designations, the last digit is always omitted. Response numbers 2 and 3 are incorrect because a runway with a direction of 021° would be designated as runway 02 instead of 21 and also the base leg headings are for right-hand patterns. Response 1 is incorrect because it mentions true direction for the runway and no allowance is made for drift corrections on base leg. Therefore, response 4 is the correct answer, since the magnetic direction of the runway is 210° and a left-hand base leg, 90° degrees to the runway and corrected for a left crosswind, requires a magnetic heading slightly less than 300° (295°).

25—(4) A stall is always the result of exceeding the critical angle of attack. This can occur not only at low airspeeds or nose high attitudes, but also when excessive or sudden back pressure is applied in a pull-up from a high-speed steep dive, steep turn, or any other attitude. High speed stalls of this type are sometimes well above the established stalling speed. Therefore, the conditions prescribed in response numbers 1, 2, and 3 are *not* the *only* conditions in which a stall can occur. Response number 4 is the only correct answer.

26—(2) Response 1 is incorrect since this procedure will give you the altitude above mean sea level (MSL), and is used in establishing cruising altitudes below 18,000 feet. Number 2 is correct in that pressure altitude is actually the height above a standard pressure level of 29.92″ Hg. Number 3 is incorrect since this procedure in fact is what you are accomplishing in response 1. Number 4 is in error because the smallest hand on the altimeter indicates the 10,000-foot increments only.

27—(4) To answer this test item you should refer to the Sectional Chart legend. It is true that the chart lists in parenthesis (321) which is the height of the structure above the ground as mentioned in response 1. However, the letters UC (under construction) do not appear on the chart, thus making response 1 incorrect. Response 4 is the correct answer, since the numbers 1146 without parenthesis indicate elevation above sea level of the top of the structure. Responses 2 and 3 are incorrect, since the numbers in parenthesis indicate the height of tower—321 feet above the ground.

28—(4) This guide contains an excerpt from AIM (Figure 69) which deals with Airport, Air Navigation Lighting and Marking Aids. Response 1 is incorrect because the "X" symbol does not appear on runways 3 or 9. Response 2 is incorrect because there are no overrun markings on runway 3. The displaced threshold on runway 9 designates the beginning of that portion of the runway usable for *landing*, thus making response 3 incorrect, since the full length of runway 9 is available for takeoff. Response 4 is correct since the markings on this runway are all-weather runway markings and both takeoffs and landings are permissible at the beginning of the hard surface of runway 27.

29—(2) Response 2 includes only the three correct statements (B, D, E). B—The Airport/Facility Directory excerpt in Figure 79, lists for Parkersburg in remarks, "Operations 0700–2300 local time." D—Figure 79 shows 3 hard-surfaced runways at Parkersburg, and the NOTAM in Figure 86 indicates that runway 16–34 is closed until further notice for repairs. E—The meaning of the symbol "S–5" in the airport data is explained in Figure 71. The incorrect statements A and C appear in responses 1, 3, and 4. Statement A is incorrect since Code F–18 in the Airport Directory represents 100/130 grade aviation gasoline and F–30 is jet fuel (Figure 71). Statement C is false since it is possible to transmit and receive the tower on the simplex frequency 123.7, but the frequency 122.5R listed in the Airport Directory means the tower receives *only* on this frequency.

30—(1) Although the engine controls are in normal position for takeoff, you should not expect the engine to develop normal power at the 5,000-foot airport, because of the lesser air density at the high elevation. As correctly stated in response number 1, you would obtain less than the normal 29″ Hg. Since the

airplane is equipped with a constant-speed propeller, the r.p.m. should not be affected unless there is a drastic reduction in manifold pressure. Thus, responses 2 and 4 are incorrect. Because of the less dense air at this elevation, the fuel/air mixture will be richer than normal, rather than too lean, making response number 3 incorrect.

31—(2) With a gross weight of 3,000 lbs., the distance required to clear a 50-foot obstacle on takeoff at 5,000 feet with zero wind and 41° F., according to the chart in Figure 27, is 1,675 feet. This distance will increase 10% for each 25° F. that the temperature is above the standard 5,000-foot temperature (41° F.). Since the temperature is 96°, we have an increase of 55° (96−41=55). This means that we will have an increase of 22% in takeoff distance. Twenty-two percent of 1,675 feet is 368 feet. Therefore, only response number 2 is correct.

32—(3) When ice exists in the carburetor venturi, it chokes off some of the air that enters the carburetor, resulting in a loss of manifold pressure. When heat is applied, an additional loss of manifold pressure results since heated air is less dense and some of the ram-effect is lost. As the ice is melted by the carburetor heat, air is again allowed to enter normally and the manifold pressure increases. Thus response number 1 is incorrect and number 3 is correct. Numbers 2 and 4 are incorrect because with a constant-speed propeller, the r.p.m. will remain the same.

33—(4) Response number 1 is incorrect because In-flight Weather Advisories are actually *forecasts*, from a ground observer, of weather that is potentially hazardous to aircraft in flight. Number 2 is incorrect because AMOS reports are weather reports from an Automatic Meteorological Observation Station. Number 3 is incorrect since SIGMETS are a form of In-flight Weather Advisories. Number 4 is correct because PIREPS are Pilot Reports of weather he has seen or experienced in flight.

34—(4) A standing lenticular cloud is formed by strong winds striking a mountain peak and rising. On the leeward side, the air flow breaks down into strong downdrafts and severe turbulence. This turbulence is found below the lenticular cloud, as correctly indicated in response number 4 and incorrectly stated in number 3. Due to the strong winds associated with a mountain wave, it is unlikely that fog would form in these areas, making response number 1 incorrect. Number 2 is also incorrect because, with the severe downdrafts on the leeward side, the air is heated as it descends, decreasing the likelihood of condensation or precipitation.

35—(1) Fuel grade ratings indicate the antiknock value or the ability of the fuel to withstand compression and resist detonation. The likelihood of engine damage due to detonation is less with the use of the higher grade fuel. Conversely, as correctly stated in response number 1, if the grade of the fuel used is lower than specified for the engine, detonation may result and cause damage to the engine. Although the lower grade reduces power output, it is always more harmful than the higher grade fuel. Therefore, number 2 is incorrect. Numbers 3 and 4 are not true because use of fuel with a higher than specified grade does *not* usually improve performance and may cause engine damage by burning the valves.

36—(2) On the loading graph in Figure 46, follow the appropriate diagonal line to the point where it intersects the horizontal line representing the weight of each loaded item. From this point drop straight down the graph to determine the moment of each item. Add the weight of each item to the empty weight (unusable fuel is included in the airplane's empty weight) to determine the total weight, and add all the moments to find the loaded airplane moment.

	Weight	*Moment*
2 front seat occupants @ 170 lbs. each	340 lbs.	+12.2
2 rear seat occupants @ 170 lbs. each	340 lbs.	+24.0
63.5 gal. usable fuel @ 6 lbs. per gal.	381 lbs.	+18.2
3 gal. (12 qt.) oil @ 7.5 lbs. per gal.	22.5 lbs.	−00.4
Baggage	70 lbs.	+07.4
Empty airplane weight	1,840 lbs.	+63.7
Total	2,993.5	+125.1

Thus, the total moment is 125.1 as stated in response number 2. Now enter the Center of Gravity Moment Envelope, Figure 47, at the total moment for the loaded aircraft until intersecting the horizontal line representing the weight of the loaded airplane. Since this point of intersection lies within the boxed area on the graph, the airplane as loaded is within the c.g. limits, as correctly stated in response 2. Hence, numbers 1, 3, and 4 are incorrect.

37—(2) Response 2 is the correct answer and response 1 is incorrect, since authorization to taxi "to" a runway is authorization to cross runways that intersect the taxi route, unless instructions to the contrary are received. Authorization to taxi "to" a runway does not constitute a clearance to taxi "on" that runway—thus responses 3 and 4 are incorrect.

38—(2) The Climb Data Chart (Figure 44) lists data for aircraft with gross weights of 2,600 and 3,000 lbs. The gross weight of 2,800 lbs. falls midway between 2,600 and 3,000 lbs. Therefore, for a gross weight of 2,800 lbs., it is necessary to interpolate. Under the 5,000-foot column of the Climb Data Chart, at a gross weight of 2,600 lbs., we find the best climb airspeed to be 97 m.p.h. with a rate of climb of 1,210 f.p.m. At a gross weight of 3,000 lbs., the chart shows the best climb airspeed to be 101 m.p.h. with a rate of climb of 980 f.p.m. Therefore, midway between these figures, for a gross weight of 2,800 lbs., the best climb airspeed is 99 m.p.h. and the rate of climb is 1,095 f.p.m.—as listed in correct response 2. All other answers are incorrect.

39—(1) The proper VFR altitudes are even thousands plus 500 feet, at 3,000 feet or more above the surface and below 18,000 feet, between 180° and 359° magnetic. In this problem, the magnetic courses of the two aircraft are 199° and 269°—both of which fall within the 180° to 359° direction of flight. Therefore, both aircraft are at a proper altitude as stated in responses 1 and 3. The regulation concerning "converging" aircraft states in part: "When aircraft of the same category are converging at approximately the same altitude (except head-on or nearly so), the aircraft to the other's right has the right-of-way." Since you are on the other aircraft's right, you have the right-of-way and both aircraft are of the same category—both are airplanes. Response 1 is the only completely correct answer.

40—(3) Wake turbulence vortex intensity is explained in the following AIM excerpt. "When an airfoil passes through a mass of air and creates lift, energy proportional to the weight being lifted is transmitted to the mass of air. Generally, the greater the lift, the greater the energy transmitted to the air mass in the form of turbulence. The turbulence is directly related to the weight, wing span and speed of the aircraft. Its intensity is directly proportional to the weight and inversely proportional to the wing span and speed of the aircraft. The heavier and slower the aircraft, the greater the intensity of the air circulation in the vortex cores. Thus, it can be seen that modern large transport aircraft will create vortices having maximum rotational velocities during takeoff and landing at or near maximum gross weights." Therefore, response 3 is correct, while responses 1, 2, and 4 are incorrect.

RECOMMENDED STUDY MATERIALS

NOTE: References listed were available at the time this publication went to press.

1. *Airman's Information Manual* (AIM) ($29.50). An FAA publication developed as a pilot's operational manual presenting information necessary for the planning and conduct of a flight in the National Airspace system. (Excerpts of this manual are presented in the Appendix of this study guide.)

AIM is divided into four basic parts, each of which may be purchased separately.

Part 1, Basic Flight Manual and ATC Procedures ($4.00).

Part 2, Airport Directory ($4.00).

Part 3, Operational Data and Notices to Airmen; Part 3-A, Notices to Airmen ($20.00).

Part 4, Graphic Notices and Supplemental Data ($1.50).

2. *Flight Training Handbook* ($1.25). This is a basic reference manual containing information of great importance to the commercial pilot. The subjects covered include theory of flight, principles of safe flying, inspection and care of aircraft, and performance and analysis of flight maneuvers.

3. *Aviation Weather* ($4.00). A detailed study of weather phenomena from the viewpoint of the pilot.

4. *Private Pilot's Handbook of Aeronautical Knowledge* ($2.75). This text of basic aeronautical knowledge was designed to meet the needs of the private pilot. However, the commercial pilot who is thoroughly familiar with the material discussed in this book has gone a long way toward mastering the subject areas required for commercial operation.

5. *Federal Aviation Regulations.* The applicant is responsible for knowing applicable portions of Parts 61 and 91, which in turn will require a knowledge of some portions of Parts 1 and 71.

The regulations are published by FAA in Volumes containing related FAR Parts. As amendments are issued, they will be furnished as page revisions to the pertinent Parts by numbered transmittal sheets.

The applicable volume structure is:

Volume	*FAR Part*	*Price*
I	1	$1.50 (Foreign mailing—50 cents additional.)
VI	91, 93, 99, 101, 103, 105.	$5.50 (Foreign mailing—$1.25 additional.)
IX	61, 63, 65, 67, 141, 143, 147.	$6.00 (Foreign mailing—$1.50 additional)
XI	71, 73, 75, 77, 95, 97, 157, 169, 171.	$2.75 (Foreign mailing—75 cents additional.)

6. *National Transportation Safety Board Investigation Regulations, Part 430* ($0.10). Prescribes the procedures and requirements pertaining to aircraft accidents and certain other incidents involving aircraft.

7. *VFR EXAM-O-GRAMS.* Analyses and explanations of selected topics of aeronautical knowledge presented in the form of questions and answers. These are issued by the FAA Operations Branch, Flight Standards Technical Division on an irregular basis and are distributed free of charge, single copy per request. An example of the Exam-O-Grams is presented on pages 22 and 23.

HOW TO OBTAIN STUDY MATERIALS

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. They are available *free of charge* (single copy only per request) by ordering from:

Department of Transportation
FAA Aeronautical Center
Flight Standards Technical Division
Operations Branch, AC–240
P.O. Box 25082
Oklahoma City, Oklahoma 73125

(Indicate in your request if you wish to be placed on the mailing list for future issues.)
All other* study materials listed may be obtained by remitting check or money order to the nearest U. S. Government Printing Office Bookstore.

HOW TO GET GPO PUBLICATIONS PROMPTLY

(1) Use an order form, not a letter, unless absolutely necessary. Order forms, *which may be duplicated by the user*, are included in the catalog "FAA Publications," sent free upon request from:

Distribution Unit, TAD 484.3
Department of Transportation
Washington, D. C. 20590

(2) Send separate orders for a subscription and a non-subscription item.
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(4) Send a check, not cash. Send the exact amount.
(5) Enclose a self-addressed mailing label if you have no order blank.
(6) Use special delivery when needed.
(7) Use GPO bookstores—they give priority mail order service.

The retail GPO bookstores now in being are located at the following addresses:

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GPO Bookstore
Federal Building
Room 135
601 East 12th Street
Kansas City, Mo. 64106

GPO Bookstore
Federal Building
Room 1023
450 Golden Gate Avenue
San Francisco, Calif. 94102

GPO Bookstore
Federal Building
300 N. Los Angeles Street
Los Angeles, California
90012

GPO Bookstore
Room G25
John F. Kennedy Federal Building
Sudbury St.
Boston, Massachusetts 02203

There are many excellent commercially prepared textbooks, audio-visual training aids, and programmed instruction courses, which may be helpful in preparation for the written test.

* *Private Pilot's Handbook of Aeronautical Knowledge* is also available at many airports.

Department of Transportation

FEDERAL AVIATION ADMINISTRATION

VFR PILOT EXAM-O-GRAM NO. 45

AIRSPEEDS AND AIRSPEED INDICATOR MARKINGS (Series 2)

Most FAA written tests contain several test items involving airspeed. Analyses show that many applicants are not knowledgeable concerning airspeeds. The use of performance charts, computation of navigation problems, and filing of flight plans involves the use of True Airspeed. However, in various configurations and flight conditions, airplanes are also operated with reference to Calibrated Airspeed.

WHAT ARE THE DIFFERENT AIRSPEEDS? The four principle airspeeds are defined below.

Indicated Airspeed (IAS) is the uncorrected speed read from the airspeed dial. It is the measurement of the difference between impact pressure and atmospheric pressure in the pitot-static system.

Calibrated Airspeed (CAS) is indicated airspeed corrected for instrument error and installation error in the pitot-static system. As the aircraft flight attitude or configuration is changed, the airflow in the vicinity of the static inlets may introduce impact pressure into the static source, which results in erroneous airspeed indications. The pitot section is subject to error at high angles of attack, since the impact pressure entering the system is reduced, when the pitot tube is not parallel to the relative wind. Note in the chart to the right the difference between indicated and calibrated airspeed in the lower speed ranges. Performance data in aircraft flight manuals is normally based on calibrated airspeed.

AIRSPEED CORRECTION TABLE

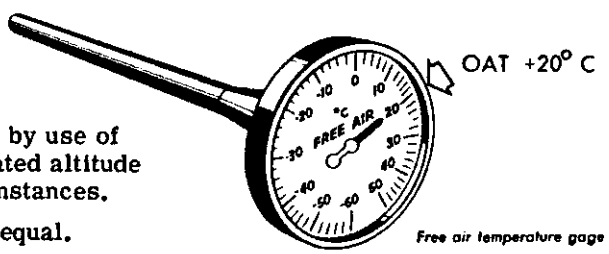
FLAPS	IAS	40	50	60	70	80	90	100	110	120	130	140
FLAPS UP	CAS	55	60	66	72	80	89	98	108	117	127	136
FLAPS DOWN	CAS	52	58	65	73	82	91	101	•	•	•	•

Equivalent Airspeed (EAS) is calibrated airspeed corrected for compressibility factor. This value is very significant to pilots of high speed aircraft, but relatively unimportant to pilots operating at speeds below 250 knots at altitudes below 10,000 feet.

True Airspeed (TAS) is calibrated airspeed (or equivalent airspeed if applicable) corrected for air density error. TAS is the actual speed of the aircraft through the air mass. Air density error is caused by nonstandard pressure and temperature for which the instrument does not automatically compensate. The standard airspeed indicator is calibrated to read correctly only at standard sea level conditions--that is, when the pressure is 29.92 inches Hg and the temperature is 15°C.

○○○○○

HOW IS TRUE AIRSPEED DETERMINED? To find TAS, it is necessary to--(a) work a computer solution, or - (b) have in the aircraft an airspeed indicator, similar to the one illustrated to the left, which incorporates that portion of a computer which is necessary for determining TAS in the cruising speed range. This represents the current trend in the design of flight instruments that reduce pilot workload. In either case, the prerequisites for determining TAS are pressure altitude*, CAS, and outside air temperature. Example: For a pressure altitude of 6,500 feet, a CAS** of 175 mph, and an outside air temperature (OAT) of +20°C., you would use the instrument to the left as follows: With the adjusting knob, set the pressure altitude (6,500 feet) opposite the OAT (+20°C.). The needle then shows a TAS of 202 mph while on the inner portion of the dial the needle is registering an IAS of 175 mph or 152 knots.



Free air temperature gage

*The most accurate method of solving for TAS is by use of pressure altitude. However, you can use indicated altitude without introducing too great an error in most instances.

**For this example the IAS and CAS are assumed equal.

NOTE: Free Air Temperature gages are subject to heat of compression (friction) errors. The higher the TAS the more the increase in indication above the actual temperature of the air.

DO SOME INSTRUMENTS AUTOMATICALLY REGISTER TRUE AIRSPEED? Yes, more advanced true airspeed indicators contain components which correct for pressure altitude, OAT, and compressability to automatically provide TAS without computations on the part of the pilot.

WHAT ADDITIONAL AIRSPEED INDICATOR MARKINGS ARE REQUIRED IN MULTI-ENGINE AIRPLANES? FAR Part 23, which deals with Airworthiness Standards for airplanes of 12,500 lbs. or less, was amended November 11, 1965, to require the following airspeed markings in multi-engine airplanes: (a) a blue radial line to show the best rate of climb speed (V_y) with one-engine-inoperative. (b) a red radial line to show V_{mc} -the minimum control speed with one-engine-inoperative. Note in the illustration to the left, that these markings for key speeds in multi-engine airplanes are in addition to those normally required for other airplanes.

WHICH MULTI-ENGINE AIRPLANES ARE REQUIRED TO HAVE THESE MARKINGS? Only those airplanes which were type certificated under Part 23 on or after November 11, 1965, are required to have these markings. However, airplanes type certificated before that date may also be so marked at the option of the owner.

Exam-O-Grams are non-directive in nature and are issued solely as an information service to individuals interested in Airman Written Examinations.

VFR – No. 45

FAA Aeronautical Center
Flight Standards Technical Division
Operations Branch
P. O. Box 25082
Oklahoma City, Oklahoma 73125
1/69

Exam-O-Grams available free of charge - single copy only per request.

NOTE: THE COLORED MARKINGS ON AIRSPEED INDICATORS ARE BASED ON CAS, NOT IAS.

APPENDIX

LIST OF ILLUSTRATIONS

Aircraft Description and Performance Data—Con'd.

Figure

46 Condor—loading graph.
47 Condor—center of gravity moment envelope.
48 Condor—cruise performance (2,500').
49 Condor—cruise performance (5,000').
50 Condor—cruise performance (7,500').
51 Condor—cruise performance (10,000').
52 Bobwhite—airplane flight handbook.
53 Bobwhite—center of gravity envelope.
54 Bobwhite—loading graph.
55 Bobwhite—normal takeoff chart.
56 Bobwhite—performance data.
57 Bobwhite—fuel consumption chart.
58 Bobwhite—cruising operation.
59 Bobwhite—cruising power settings.
60 Bobwhite—normal landing chart.

Airman's Information Manual (Excerpts)

61 AIM—Air navigation radio aids.
62 AIM—Air navigation radio aids—cont'd.
63 AIM—Air navigation radio aids—cont'd.
64 AIM—Air navigation radio aids—cont'd.
65 AIM—Weather—(broadcasts).
66 AIM—Weather—(in-flight advisories).
67 AIM—Weather (turbulence report criteria).
68 AIM—Weather (PIREPS).
69 AIM—Airport, air navigation lighting and marking aids.
70 AIM—Airport/facility directory.
71 AIM—Airport/facility directory—cont'd.
72 AIM—Airport/facility directory—cont'd.
73 AIM—Airport/facility directory—cont'd.
74 AIM—Airport directory.
75 AIM—Airport directory—cont'd.
76 AIM—Airport directory—cont'd.
77 AIM—Airport/facility directory.
78 AIM—Airport/facility directory—cont'd.
79 AIM—Airport/facility directory—cont'd.
80 AIM—Heavy wagon oil burner routes.
81 AIM—Index of heavy wagon oil burner routes.
82 AIM—Heavy wagon route.
83 AIM—Oil burner route.
84 AIM—Restrictions to enroute navigation aids.
85 AIM—VOR receiver check points.
86—AIM—NOTAMS.
87 AIM—Telephone numbers.

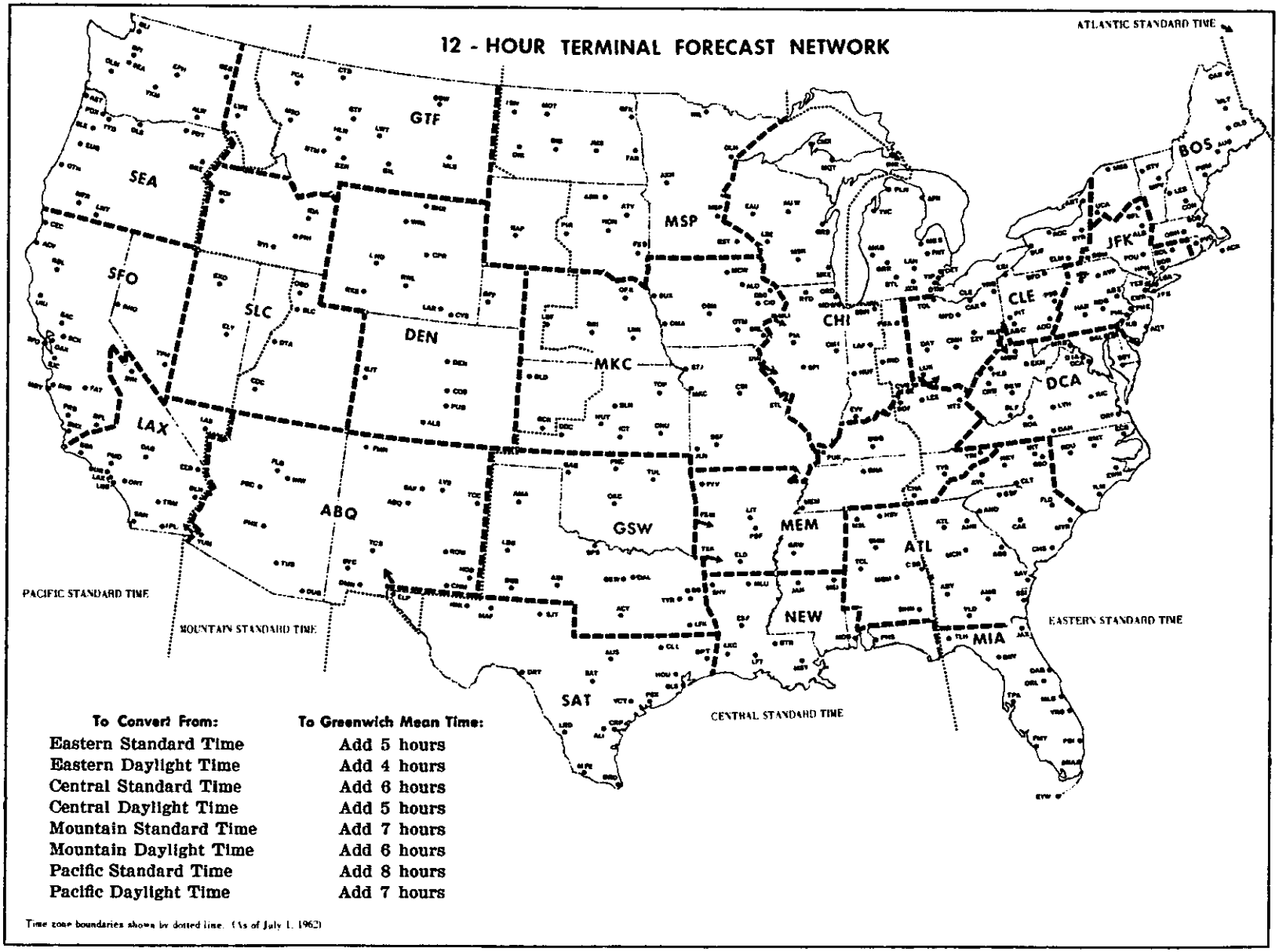


Figure 1. Map showing time zones and station locations.

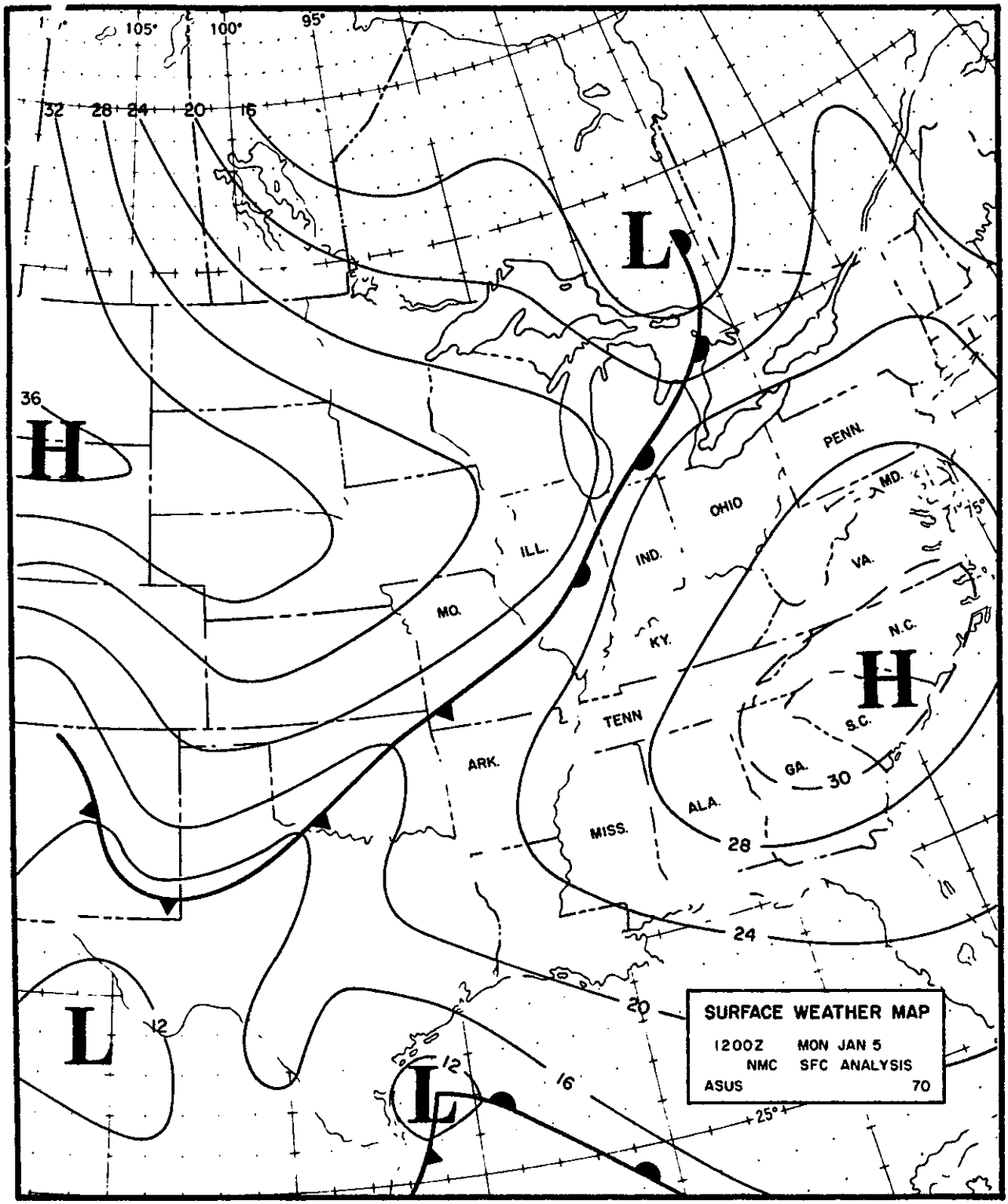


Figure 2. Surface weather map excerpt.

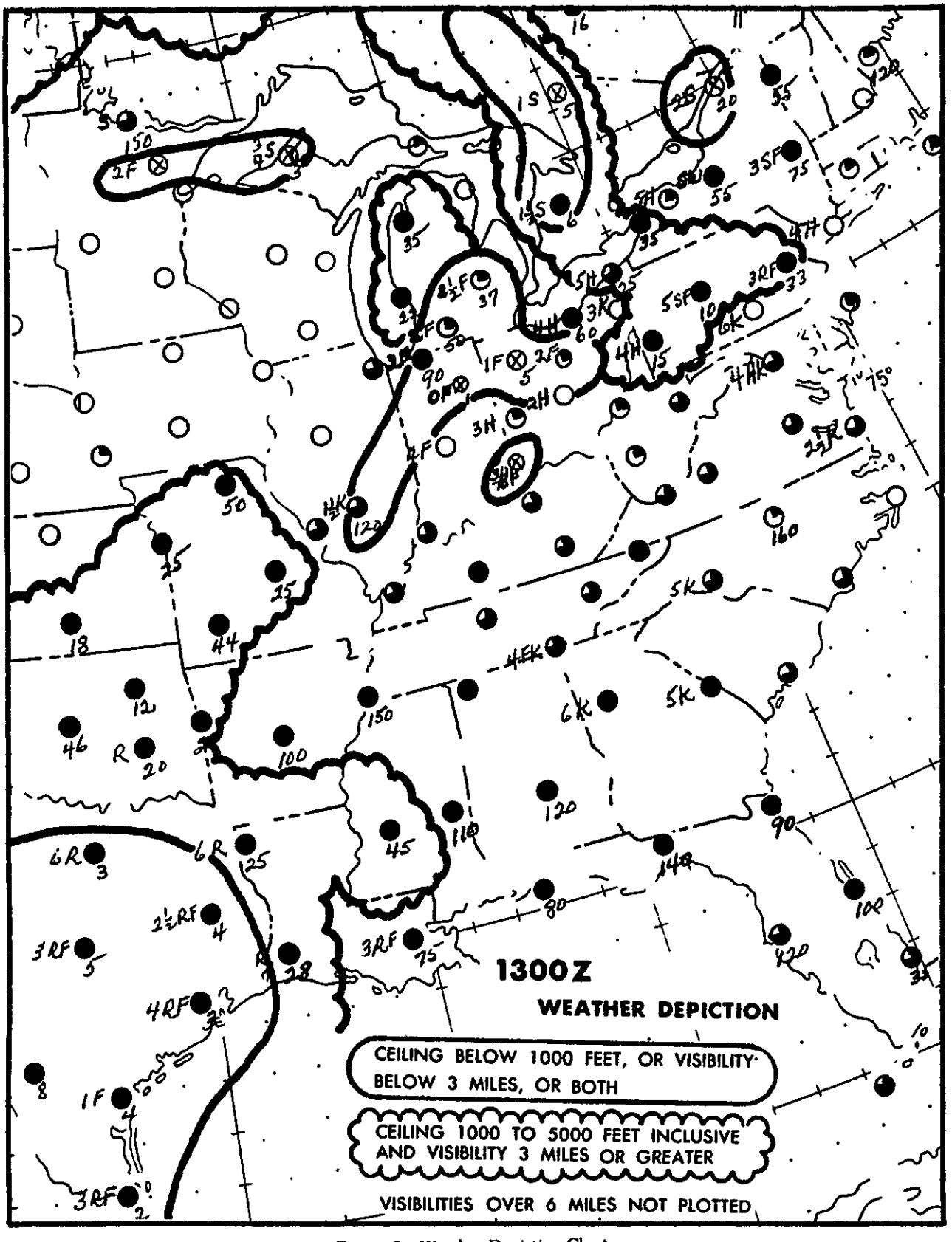


Figure 3. Weather Depiction Chart.

STATION DESIGNATORS AND LOCATIONS
(These coordinates represent the airport location)

BLF	Bluefield, West Virginia	37°18'N; 81°13'W
TRI	Bristol-Johnson City-Kingsport (Tri-City Airport)	36°28'N; 82°24'W
CRW	Charleston, West Virginia	38°22'N; 81°36'W
DAY	Dayton, Ohio	39°54'N; 84°13'W
LUK	Cincinnati, Ohio (Lunken Airport)	39°06'N; 84°25'W
CLE	Cleveland, Ohio	112 stat. mi. NE of CMH
CMH	Columbus, Ohio	40°00'N; 82°53'W
CVG	Covington, Kentucky (Greater Cincinnati)	39°03'N; 84°40'W
EKN	Elkins, West Virginia	38°53'N; 79°52'W
GSO	Greensboro-High Point, North Carolina	36°06'N; 79°57'W
HKY	*Hickory, North Carolina*	76 stat. mi. SE of TRI
IND	Indianapolis, Indiana	98 stat. mi. NW of CVG
TYS	Knoxville, Tennessee	79 stat. mi. S of LOZ
LEX	Lexington, Kentucky	38°02'N; 84°36'W
LOZ	London, Kentucky	37°05'N; 84°05'W
SDF	Louisville, Kentucky (Standiford Field)	84 stat. mi. SW of CVG
LYH	Lynchburg, Virginia	37°19'N; 79°13'W
MGW	Morgantown, West Virginia	39°38'N; 79°55'W
PKB	Parkersburg, West Virginia	39°21'N; 81°26'W
PIT	Pittsburgh, Pennsylvania	145 stat. mi. NE of CMH
ROA	Roanoke, Virginia	37°19'N; 79°59'W
HLG	Wheeling, West Virginia	40°10'N; 80°39'W
ZZV	Zanesville, Ohio	39°57'N; 81°54'W

Figure 4. Station designators and locations.

AREA FORECASTS

FA MEM 051245
13Z MON-01Z TUE

ARK KY TENN N HLF MISS

HGTS ASL UNLESS NOTED

SYNOPSIS. CDFNT CNTRL IND TO CNTRL OKLA WILL MOVE SEWD TO A LN FM NRN KY TO SW ARK BY 01Z. LOW PRES SYS IN WRN GLF MEX MOVG TO S LA BY 01Z.

CLDS AND WX. ARK C80-120⊕6+ TOPS 160 EXCPT C30-40⊕6+ NW PTN. CHC OF FEW R- W HLF STATE. CONDS OF C20-40⊕ OCNL R- SPRDG OVR ENTIRE STATE BY 18Z WITH ADNL LWRG TO C6-12⊕1-3R-F S PTN. CONDS NW OF CDFNT GENLY C8-15⊕ WITH OCNL SW-.

NW MISS W TENN C100⊕6+ BCMG C50⊕ OCNL R- BTWN 16Z-18Z AND C18-25⊕2-5R-F BTWN 21Z-23Z.

CNTRL AND E TENN NE MISS C250ⒹV⊕ VSBYS LCLY 3-5GF. BCMG C100-120ⒹV⊕ TOPS 160 BTWN 15Z-18Z. LWRG TO C40-60⊕ OCNL R- NE MISS CNTRL TENN BY 01Z.

KY C250ⒹV-Ⓓ6+. C100ⒹV⊕ MOVG INTO S PTN BY 16Z AND SPRDG ACRS STATE BY 20Z. LWRG TO C30-50⊕ W KY AFT 22Z.

ICG. OCNL MDT RIME ICG IP IC ACRS ARK THIS MRN INTO N MISS W TENN DRG AFTN. FRZG LVL SFC KY CNTRL AND E TENN SLPG TO 80 SW ARK. FRZG LVL LWRG TO SFC RDPLY AFT FROPA. SE OF FNT FRZG LVL SLOLY LFTG DRG PD.

TURBC. OCNL MDT TURBC DVLPG LWR 6 THSD FT NW ARK BY LATE MRN NR AND NW OF CDFNT. CHC OF MDT CAT 230-380 ACRS AREA.

OTLK. 01Z-19Z TUE. LOW PRES SYS S LA MOVG NEWD TO S.C. BY END OF PD. CDFNT CONTG TO MOVE VERY SLOLY SEWD TO EXTRM E PTN OF AREA BY MID MRN TUE. C15-30⊕2-4R-F AND OCNLY C6-10⊕1RF DVLPG ACRS ALL OF AREA SE OF CDFNT BY 06Z. BND OF C8-15⊕ OCNL 1-3SW- ABT 75 TO 100 MI NW OF CDFNT IPVG TO C20-40ⒹV⊕ OCNL SW MORE THAN 100 MI NW OF FNT.

Figure 5. Memphis – Area Forecasts.

AREA FORECASTS

FA DCA 051245
13Z MON-01Z TUE

WVA MD DEL DC VA E NC CSTL WATERS

HGTS ASL UNLESS NOTED

SYNOPSIS. HI PRES CNTRD NRN SC WITH RDG EXTDG NEWD ACRS ERN NY WL MOV ENEWD ABT 30 KT. WK CDFNT EXTDG SWWD ACRS SERN MICH AND CNTRL MO WL MOV TO OHIO WVA BDR BY 01Z.

CLDS AND WX. OVR WVA. O LCLY IN VLY AREAS -X3/4-4HK CHC C1X1/16FK IPVG BY 16Z 120⊖250-⊖ AND BY 20Z 40⊖C100⊖V⊖.

OVR MD DEL DC VA E NC AND ADJT CSTL WATERS. O TO 250-⊖ LCLY 4GFHK TIL 15Z. BY 19Z 120⊖250-⊖V⊖.

ICG. FRZLVL AT OR NR SFC XCP SERN NC CSTL WATERS AT 20-30. LGT ICGIC OVR WVA.

TURBC. LGT TO MDT CAT LKLY 230 TO 380 OVR DIST. LGT TO MDT TURBC DVLPG BLO 80 OVR WRN WVA AFT 18Z.

OTLK 01Z-19Z TUE. WK CDFNT NE TO SW OHIO WVA BDR WITH OCNL C30⊕ CHC 5SW-- WL MOV SEWD AND BCM DFUS OVR THE MTNS OF WVA BY 12Z. LOW PRES SRN LA CST WL MOV ENEWD ABT 25 KT TO SWRN GA BY 19Z AND LWR CONDS GRDLY OVR SRN WVA SRN VA E NC AND ADJT CSTL WATERS BY 19Z TO GENLY C8-15⊕1/2-3R-F XCP S- OVR THE MTNUS AREAS OBSCG THE RDGS. TURBC AND ICG CONDS BCMG MDT. OVR NRN WVA NRN VA MD DEL DC AND ADJT CSTL WATERS COND GRDLY LWRG BY 19Z TO C30⊖V⊕80⊕ CHC 5SW--.

Figure 6. Washington – Area Forecasts.

AREA FORECASTS

FA CLE 051245
13Z MON-01Z TUE

OHIC WRN PA WRN NY U.S. PTNS LKS ERIE AND ONTARIO

HGTS ASL UNLESS NOTED

SYNS. WK DFUS NE-SW CDFNT W OF DIST ENTRG NW CORNER OF OHIO BY 16Z MOVG EWD ABT 20 KTS TO A LN FM WRN LK ONT SWWD THRU EXTRM NWRN PA TO SWRN OHIO BY 01Z

CLDS AND WX. U.S. PTNS LK ONT AND ERN LK ERIE WRN NY NRN AND ERN PTNS PA C15-30⊕V⊙7 OCNL C8-15X1-3SW-. TOPS MOSTLY 60-80. OVR RMNDR WRN PA C20-40⊙V⊙7. OVR WRN LK ERI AND OHIO CLR TO 250-⊙3-7 KH LCLY CONDS -X1/2-2GFH DSIPTG BY ARND 15Z. WITH APCHG CDFNT BCMG 80-100⊙V⊙ C250⊙7+ LWRG ALG AND W OF FNT TO C25-40⊙80-100⊙V⊙7. TOPS ACAS LYRS NEAR 150.

ICG. LGT TO LCLY MDT RIME ICGIC. FRZLVL SFC

TURBC. LCLY MDT TURBC BLO 80 DVLPG THRU FNTL ZONE AND ALSO OVR ALGHNY MTN SECS. LCLY MOGR CAT 180-360 MOST LKLY FM ERN LK ERIE AND NWRN PA NWD.

OTLK 01Z-13Z TUE. U.S. PTNS LKS ERIE AND ONTARIO NERN OHIO WRN PA AND WRN NY MOSTLY C15-35⊕V⊙7 OCNLY C8-15X1-3SW-. OVR RMNDR OHIO AGL 25-40⊙C80-100⊙V⊙7 LWR CLDS DSIPTG ERY IN PRD.

Figure 7. Cleveland – Area Forecasts.

WINDS ALOFT FORECASTS

FD WBC 050545
BASED ON 050000Z DATA
VALID 051800Z FOR USE 1500-2100Z. TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
CRW	2416	2622-08	2633-12	2645-16	2674-24	7603-33	763844	765552	765157
LOU	2605	2616-07	2627-11	2638-15	2568-24	2597-33	753144	755052	754356
IND	2908	2717-10	2629-14	2541-18	2669-27	2597-35	752646	754053	752255
TRI		2417-05	2526-08	2636-12	2665-21	2695-30	753242	755049	756258

Figure 8. Winds Aloft Forecasts.

IN-FLIGHT WEATHER ADVISORIES

FL MEM 051915
051915-060000

SIGMET ALFA 2. W HLF ARK MDT TO OCNL SVR ICGIC LKLY BLO 100. ALSO CIGS BLO 1 THSD FT AND VSBYS BLO 2 MI. CONDS GRDLY DVLPG EWD RMDR ARK AND CONTG PAST 00Z

Figure 9. In-Flight Weather Advisories.

TERMINAL FORECASTS

11Z-23Z MON

GSO 250-◐. 20Z C120◐..
ROA O. 19Z 250-◐..
DAN O. 22Z 120◐C250-◐..
EKN DLAD TIL 12Z..
BKW O. 18Z 120◐250-◐..
CRW -X3/4K CHC C1X1/16FH. 14Z -X3K. 16Z 250-◐. 22Z 40◐C100◐..
HTS O7 CHC 4HK. 14Z 250-◐. 20Z 40◐C100◐ 2110..
LUK O5H. 1230Z -X1 1/2F VRBL C2X1/8F. 16Z 250-◐4H..
CVG O7 OCNL -X2F TIL 15Z..
TYS C250⊕. 17Z C120◐250⊕..
TRI C250◐4GF. 17Z C120◐250⊕..
LOZ C250⊕4GF. 17Z C120◐300⊕..
LEX 250-◐. 20Z C120◐300⊕..
DAY O5H. 1230Z -X2F OCNL -X1/2F TIL 15Z. 17Z C250◐5H. 22Z O 3410..
CMH O5H. 1230Z -X2F OCNL -X1/2F TIL 15Z. 17Z C250◐5FH..
ZZV O3F. 12Z -X2F OCNL -X1F TIL 15Z. 17Z C250◐5H..

Figure 10. Terminal Forecasts.

KEY TO AVIATION WEATHER REPORTS.....

LOCATION IDENTIFIER AND TYPE OF REPORT*	SKY AND CEILING	VISIBILITY WEATHER AND OBSTRUCTION TO VISION	SEA-LEVEL PRESSURE	TEMPERATURE AND DEW POINT	WIND	ALTIMETER SETTING	RUNWAY VISUAL RANGE	CODED PIREPS
MKC	15⊘M25⊕	1R-K	132	/58/56	/18⊘7	/993/	R⊘4LVR2⊘V4⊘	/⊕55

SKY AND CEILING
Sky cover symbols are in ascending order. Figures preceding symbols are heights in hundreds of feet above station

Sky cover symbols are:

- ○ Clear: Less than 0.1 sky cover
- ◑ Scattered: 0.1 to less than 0.6 sky cover.
- ● Broken: 0.6 to 0.9 sky cover
- ⊕ Overcast: More than 0.9 sky cover.
- — Thin (When prefixed to the above symbols.)
- –X Partial obscuration: 0.1 to less than 1.0 sky hidden by precipitation or obstruction to vision (bases at surface.)
- X Obscuration: 1.0 sky hidden by precipitation or obstruction to vision (bases at surface.)

Letter preceding height of layer identifies ceiling layer and indicates how ceiling height was obtained. Thus:

A	Aircraft	R	Radar.
B	Balloon (Pilot or ceiling).	W	Indefinite
E	Estimated	"V"	Immediately following numerical value indicates a varying ceiling
M	Measured		

VISIBILITY
Reported in Statute Miles and Fraction.. (V-Variable)

WEATHER AND OBSTRUCTION TO VISION SYMBOLS

A	Hail	IC	Ice Crystals	RW	Rain Showers
BD	Blowing Dust	IF	Ice Fog	S	Snow
BN	Blowing Sand	IP	Ice Pellets	SG	Snow Grains
BS	Blowing Snow	IRW	Ice Pellet Showers	SP	Snow Pellets
D	Dust	K	Smoke	SW	Snow Showers
F	Fog	L	Drizzle	T	Thunderstorm
GF	Ground Fog	R	Rain	T+	Severe Thunderstorm
H	Haze			ZL	Freezing Drizzle
				ZR	Freezing Rain

Precipitation intensities are indicated thus:
– Very Light; - Light; (no sign) Moderate; + Heavy

WIND
Direction in tens of degrees from true north, speed in knots. 0000 indicates calm. G indicates gusty. Peak speed follows G or Q when gusts or squalls are reported. The contraction WSHFT followed by local time group in remarks indicates windshift and its time of occurrence. (Knots X 1.15 = statute mi/hr.)

EXAMPLES 3627 360 Degrees, 27 Knots;
3627G40 360 Degrees, 27 Knots Peak speed in gusts 40 knots.

ALTIMETER SETTING
The first figure of the actual altimeter setting is always omitted from the report.

RUNWAY VISUAL RANGE (RVR)
RVR is reported from some stations. Extreme values for 10 minutes prior to observation are given in hundreds of feet. Runway identification precedes RVR report.

CODED PIREPS
Pilot reports of clouds not visible from ground are coded with MSL height data preceding and/or following sky cover symbol to indicate cloud bases and/or tops, respectively.

DECODED REPORT
Kansas City: Record observation, 1500 feet scattered clouds, measured ceiling 2500 feet overcast, visibility 1 mile, light rain, smoke, sea level pressure 1013.2 millibars, temperature 58°F, dewpoint 56°F, wind 180°, 7 knots, altimeter setting 29.93 inches, Runway 04 left, visual range 2000 ft. variable to 4000. Pilot reports top of overcast 5500 feet. (MSL).

***TYPE OF REPORT**
The omission of type-of-report data identifies a scheduled record observation for the hour specified in the sequence heading; the time of an out-of-sequence, special observation is given as "S" followed by a time group (24-hour clock GMT) e.g., "PIT S 0715-XM..." A special indicates a significant change in one or more elements. Local reports are identified by "LCL" and a time group. Locals are transmitted on local teletypewriter circuits only.

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KEY TO AVIATION WEATHER FORECASTS.....

GPO : 1969 O—361-874

TERMINAL FORECASTS contain information for specific airports on ceiling, cloud heights, cloud amounts, visibility, weather condition and surface wind. They are written in a form similar to the AVIATION WEATHER REPORT.

CEILING: Identified by the letter "C"
CLOUD HEIGHTS: In hundreds of feet above the station (ground)
CLOUD LAYERS: Stated in ascending order of height
VISIBILITY: In statute miles, but omitted if over 8 miles
SURFACE WIND: In tens of degrees and knots; omitted when less than 10.

EXAMPLE OF TERMINAL FORECASTS

C15⊕	Ceiling 1500', broken clouds	O11/2GF	Clear, visibility one and one-half miles, ground fog.
20⊘C70⊕6K 3230G	Scattered clouds at 2000', ceiling 7000' overcast, visibility 6 miles, smoke, surface wind 320 degrees 30 knots, gusty.	C5X1/4S+	Sky obscured, vertical visibility 500 ft. visibility one-fourth mile, heavy snow.

AREA FORECASTS are 12-hour forecasts plus 12-hour OUTLOOKS (18 hour outlook in FA valid at 1300Z) of cloud, weather and frontal conditions for an area the size of several states. Heights of cloud tops, icing, and turbulence are ABOVE SEA LEVEL (ASL); ceiling heights, ABOVE GROUND LEVEL (AGL); bases of cloud layers are ASL unless indicated. Area Forecasts are amended by SIGMET's or AIRMET's.

SIGMET or AIRMET warn airmen in flight of potentially hazardous weather such as squall lines, thunderstorms, fog, icing, and turbulence. SIGMET concerns severe and extreme conditions of importance to all aircraft. AIRMET concerns less severe conditions which may be hazardous to some aircraft or to relatively inexperienced pilots. Both are broadcast by FAA on NAVAID voice channels.

WINDS AND TEMPERATURES ALOFT (FD) FORECASTS are computer prepared forecasts of wind direction (nearest 10° true N) and speed (knots) for selected flight levels. Temperatures aloft (°C) are included for all levels (±7500 ft. above station elevation) except the 3000-foot level.

EXAMPLES OF WINDS AND TEMPERATURES ALOFT (FD) FORECASTS:

FD WBC 121745
BASED ON 121200Z DATA
VALID 130000Z FOR USE 1800-0300Z. TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
BOS	3137	3425-07	3420-11	3421-16	3516-27	3512-38	311649	292451	283451
JFK	3026	3327-08	3324-12	3322-16	3120-27	2923-38	284248	285150	285749

At 6000 feet ASL over JFK wind from 330° at 27 knots and temperature minus 8° C.

PILOTS report in-flight weather to nearest FSS

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For Sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402. Price 5 cents; $2.25 per 100

Figure 11. Key to Aviation Weather Reports.

AVIATION WEATHER REPORTS

```
022 SA22051600          (1100 EST)
CLE OVCH 256/20/12/2010/0024 AC N QOMAX/3 CAR →CLE↘ 11/49
    ACO AI
AGC O8 31/20/2208/FEW CI →AGC↘1/1 COV AH
PIT O7 262/26/15/2209/0024/HAZY→PIT↘12/6 AG

023 SA23051600
MGW 300-OVC015+ 285/30/17/2110/031
MRB 300OVC015 281/32/19/2105/032→MRB↘12/20 HGR UR 12/32 CBE UR
ROA 250-OVC035 296/38/17/2610/036 →ROA↘1/1 BCB UR
LYH 300-OVC020 301/37/19/2311/038/CONTRAILS
DAN 120OVC250-OVC08 312/36/22/2306/042
BKT 250-OVC012 40/20/2410/041
AVL 140OVC250-OVC010 311/30/19/2603/038
CLT 120OVCE250BKN5HK 320/36/20/1703/044/ BINOVC→CLT↘1/1 UR
HKY E120OVC250OVC030 315/36/27/0000/042
GSO 180OVCE250BKN7 317/34/25/2005/043

025 SA25051600
IND 80OVCE250OVC05H 245/12/11/3104/020→IND↘12/18 XX 1/1 CLU 10
DAY E200VC2200VC04H 249/27/19/2114/022→DAY↘12/39 XX 12/48 UR
    12/54 MWO AH
CMH M320VC250OVC06KH 265/25/21/1807/026 QURAX/4 28L-10R CV88
SDF 40OVCE280BKN10 261/40/25/2209/028/ BINOVC QOMAX/4→LOU↘12/52
    CTC AH 1/9 FTK ES
LEX 65OVCE300BKN10 271/39/26/2113/030→LEX↘12/5 XX
LUK 500VC900VCE3000VC05HK 260/25/23/0000/027 QOMAX/3 TRUCK
CVG M60OVC300OVC010 260/33/23/2310/025 QURAX/2-1 27R-9L ACFT
CRW -X300-OVC02K 281/36/20/1805/032/K1→CRW↘11/7XX 11/16AO
PKB 300OVC07 2714/32/22/1910/029/KLYR W-N QOMAX/5 PUP
EKN 300-OVC015+ 288/32/18/1903/028/QURAX/3 BE99→EKN↘1/3 UR
LOZ E300BKN12 292/36/23/1806/035
TYS 140OVCE300BKN15 305/32/22/0503/040
```

Figure 12. Aviation Weather Reports.

AVIATION WEATHER REPORTS

```
022 SA22051700          (1200 EST)
CLE 250-04H 248/22/14/2007/021 FEW SC AND AC QOMAX/3 CAR
    BKL QOMAX/3
AGC 010 33/20/2410 →AGC↘ 1/1 COV AH
PIT 07 255/28/16/2110/022/FEW THN CI →PIT↘12/6 AG

023 SA23051700
MGW 280-015+ 275/32/18/2312/028
MRB 300015 263/37/18/2108/028→MRB↘12/20 HGR UR 12/32 ←O↗3 74
ROA 250-035 286/40/15/2513/034 →ROA↘1/1 BCB UR
LYH 280-020 287/47/17/2810/034
DAN 140250-010 298/41/21/2208/038
BKT 250-012 44/18/2510/037
AVL 140250-010 302/35/16/2703/036
CLT 250-010 309/42/18/1306/041→CLT↘1/1 UR
HKY E120250030 302/40/18/1806/038/BINOVC W
GSO E180250007 304/41/23/2010/040

025 SA25051700
IND 800E250004GF 240/20/19/2604/019→IND↘ 12/18 XX 1/1 CLU 10
DAY S 700E220005H 237/29/21/2213/018→DAY↘12/39← // 12/48 UR
    12/54 MWO AH
CMH M320600006KH 253/27/20/1910/023/BINOVC QURAX/4 28L-10R CV88
SDF E400250010 251/42/24/2113/025 QOMAX/4→LOU↘12/52 CTC AH
    1/9 FTK ES
LEX E270010 261/41/27/2214/027/FEW SC→LEX↘12/5 XX
LUK 500300-08 249/36/25/2305/024 QOMAX/3 TRUCK
CVG 600E300010 247/36/24/2315/022 QURAX/2-1 27R-9L ACFT
CRW 1200E2800 3K 271/40/21/2005/029→CRW↘11/7XX 11/16AO
PKB 30007 261/36/22/1910/025 QOMAX/5 PUP
EKN 300300-015+ 269/32/21/2313/024/QURAX/3 BE99→EKN↘1/3 UR
LOZ 1200E270012 284/39/23/2210/033
TYS E140300015 298/34/21/0203/038
```

Figure 13. Aviation Weather Reports – cont'd.

AVIATION WEATHER REPORTS

```
022 SA22051800              (1300 EST)
CLE 30OL4H 237/23/13/2111/018 QOMAX/3 CAR BKL QOMAX/3 ACFT
    →CLE↘ 11/49 ACO AP 1/8 UR 1/10 AP
AGC 40O12 35/21/2412 →AGC↘1/1 COV AH
PIT E100O10 240/30/18/1910/018/ SC W →PIT↘12/6 AG

023 SA23051800
MGW 250O15+ 262/35/19/2312/ 025
MRB 30O280O15+ 252/39/19/2109/025→MRB↘12/20 HGR UR 12/32
    CBE UR
ROA E250O35 274/42/15/2510/030 →ROA↘1/1 BCB UR
LYH E250O35 278/45/15/2610/032
DAN 140OE250O10 288/43/18/2210/035
BKT 250→O12 46/18/2410/035
AVL 140OE250O15 291/37/16/2014/033
CLT 150OE250O12 300/44/18/1505/039/ BINOVC→CLT↘1/1 UR
HKY E120O250O30 293/41/18/2008/036/ SC SW
GSO 180OE250O10 299/42/20/2110/038

025 SA25051800
IND 120E250O4GF 238/25/23/2806/018→IND↘ 12/18 XX 1/1 CLU IO
DAY 80OE220O6H 235/30/23/2212/017→DAY↘12/39 XX 12/48 UR
    12/54 MWO AH
CMH E50O70O6H 245/30/22/1909/021/BINOVC
SDF E50O250O10 245/45/24/2012/023 QOMAX/4→LOU↘12/52 CTC AH
    1/9 FTK ES
LEX 100OE250O10 255/42/26/2315/025→LEX↘12/5 XX
LUK 60OE270O10 242/38/25/2510/022 QOMAX/3 TRUCK
CVG 60OE300O10 242/38/25/2414/020
CRW 120OE280O5K 261/42/21/2108/025→CRW↘11/7 XX 11/16 AO
PKB 80O120OE300O1C 251/38/23/1910/023/BINOVC QOMAX/5 PUP
EKN 30O300→O15+ 265/34/18/2310/022
LOZ 120OE270O12 274/40/23/2209/030/BINOVC
TYS E120O300O12 282/36/22/3603/034
```

Figure 14. Aviation Weather Reports – cont'd.

AVIATION WEATHER REPORTS

```
022 SA22051900          (1400 EST)
CLE M8⊕4H 234/23/14/2308/017 QOMAX/3 CAR BKL QOMAX/3 ACFT
    →CLE↘11/49 ACO AP 1/8 UR
AGC E40⊕12 38/22/2312/BINOVC →AGC↘1/1 COV AH
PIT 55⊙E100⊙12 225/33/19/2209/014/ SB44E52/ SWU E→PIT↘12/6AG

023 SA23051900
MGW 250⊙15+ 243/37/20/2312/021
MRB 25⊙280→⊙15 242/40/20/2110/022→MRB↘12/20 HGR UR 12/32 CBE
    UR
ROA E250⊕35 263/44/14/2508/027 →ROA C1/1↙C1/5
LYH E250⊕35 269/44/14/2310/029
DAN 140⊙E250⊕12 278/45/15/2211/033
BKT 250→⊙12 48/17/2311/032
AVL 150⊙E250⊕15+ 282/38/16/1406/030
CLT 150⊙E250⊕12 290/45/18/1706/036/ BINOVC→CLT↘1/1 UR
HKY 40⊙E120⊙250⊕30 287/42/17/2212/034
GSO 160⊙E250⊕12 290/43/19/2108/036

025 SA25051900
IND M12⊙250⊕4GF 236/27/25/3008/018→IND↘12/18 XX 1/1 CLU 10
DAY E220⊕7 231/31/24/2311/016→DAY↘12/39 XX 12/48 UR 12/54
    MWO AH
CMH E70⊙250⊙7 237/32/24/1908/019
LEX E100⊙250⊕12 248/44/25/2415/023→LEX↘12/5 XX
LUX 70⊙E250⊕15 236/42/25/2712/020
CVG 60⊙E270⊙10 237/39/25/2513/019
CRW 120⊙E250⊕10 250/43/21/2310/024→CRW↘11/7 XX 11/16 AO
PKB E80⊙120⊕12 240/41/25/2009/020/BINOVC QOMAX/5 PUP
EKN 30⊙E300⊙15+ 258/36/15/2209/020
LOZ 120⊙E270⊙12 264/41/22/2308/027
TYS E120⊙300⊕12 270/38/22/3404/030
```

Figure 15. Aviation Weather Reports – cont'd.

AVIATION WEATHER REPORT

```
022 SA22052000        (1500 EST)
CLE S M12⊕21/2S-- 237/23/16/2704/018 SB30 QOMAX/3 CAR →CLE↘
    11/49 ACO AP 1/8 UR
AGC E70⊕12 38/22/2412 BINOVC →AGC↘1/1 COV AH
PIT M95⊕15 228/34/19/2311/015 BINOVC →PIT↘ 12/6AG

023 SA23052000
MGW E50⊖250⊕15+ 247/35/21/2210G18/021/ BINOVC
MRB 25⊖250-⊖15 242/40/21/2210/022→MRB↘12/20 HGR UR 12/32
    CBE UR
ROA 250-⊖35 260/44/14/2510/026
LYW 250-⊖35 266/44/11/2509/028
DAN 140⊖E250⊕12 278/44/15/2208/033
BKT 250-⊖12 47/12/2611/032
AVL 130⊖E250⊕15+ 274/42/16/1707/028
CLT 150⊖E250⊕12 283/46/15/2209/034→CLT↘1/1 UR
HKY 60⊖E120⊖250⊕30 200/41/18/1814/032
GSO E150⊖250⊕12 288/43/20/1908/035

SA25052000
IND M11⊖250⊕4GF 237/26/24/3108/018→IND↘12/18 XX 1/1 CLU 10
DAY 250-⊖10 232/32/26/2408/017→DAY↘12/39 XX 12/48 UR 12/54
    MWO AH
CMH E120⊖250⊖8 237/36/26/2312/019
SDF 50⊖E250⊖10 234/46/25/2310/020 QOMAX/4→LOU↘12/52 CTC AH
    1/9 FK EE 1/10 FTK AQ 1/11 MYS AP
LEX E100⊖250⊕12 246/43/24/2211/022/FEW SC→LEX↘12/5 XX
LUK 70⊖E250⊖15 236/43/25/2411G18/020 QOMAX/3 TRK
CVG 60⊖250-⊖10 237/40/24/2612/019 QURAX/2-1 27R-9L ACFT
CRW 120⊖E250⊕15 248/44/21/2207/024→CRW↘11/7 XX 11/16 AO
PKB E45⊕12 240/41/26/2412/019 QOMAX/5 PUP
EKN E300⊖15+ 258/36/16/2410/020
LOZ 120⊖270-⊖15 259/43/22/2010/026
TYS E100⊕8 266/40/23/0104/029
```

Figure 16. Aviation Weather Reports – cont'd.

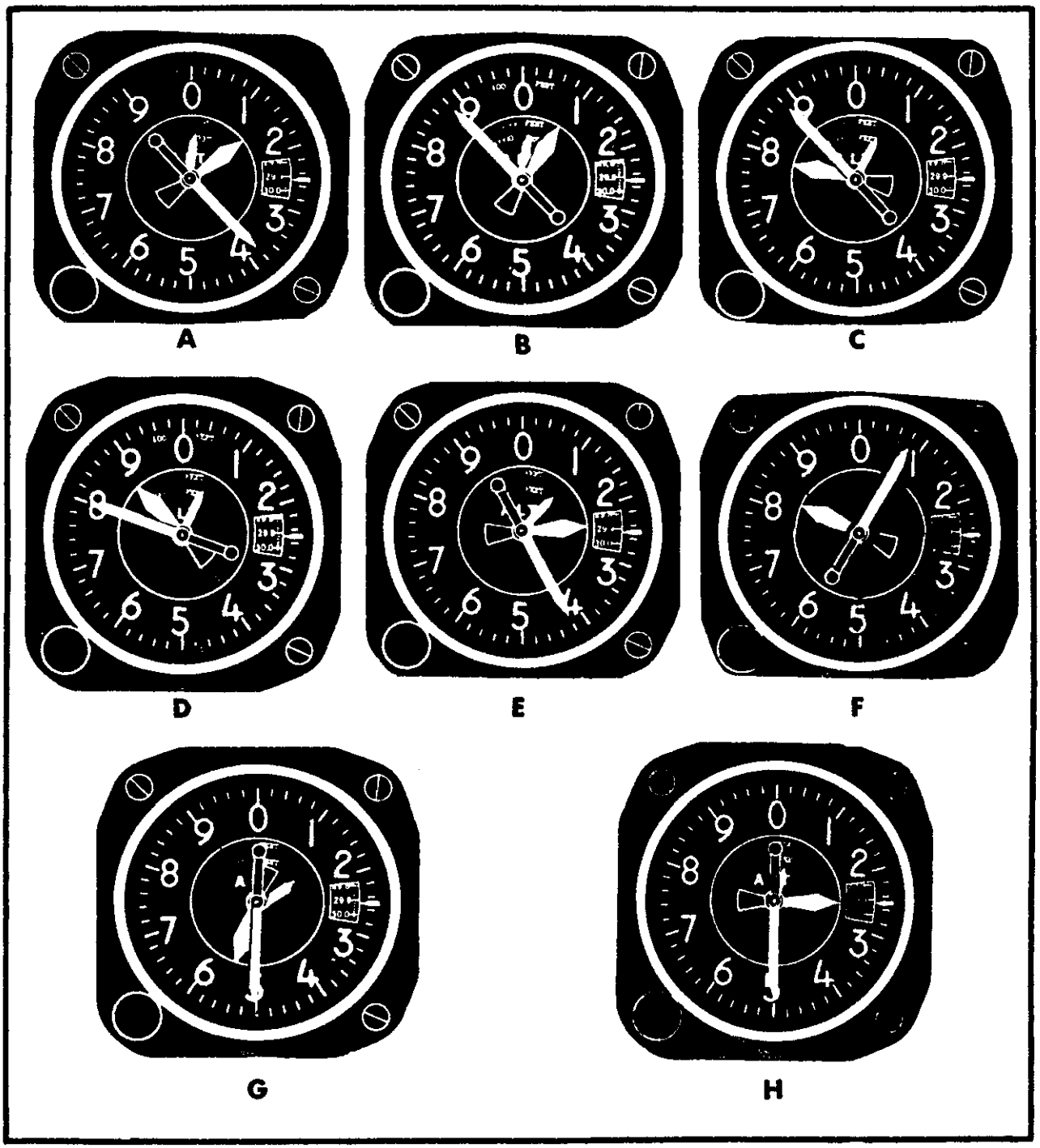


Figure 17. Altimeter illustrations.

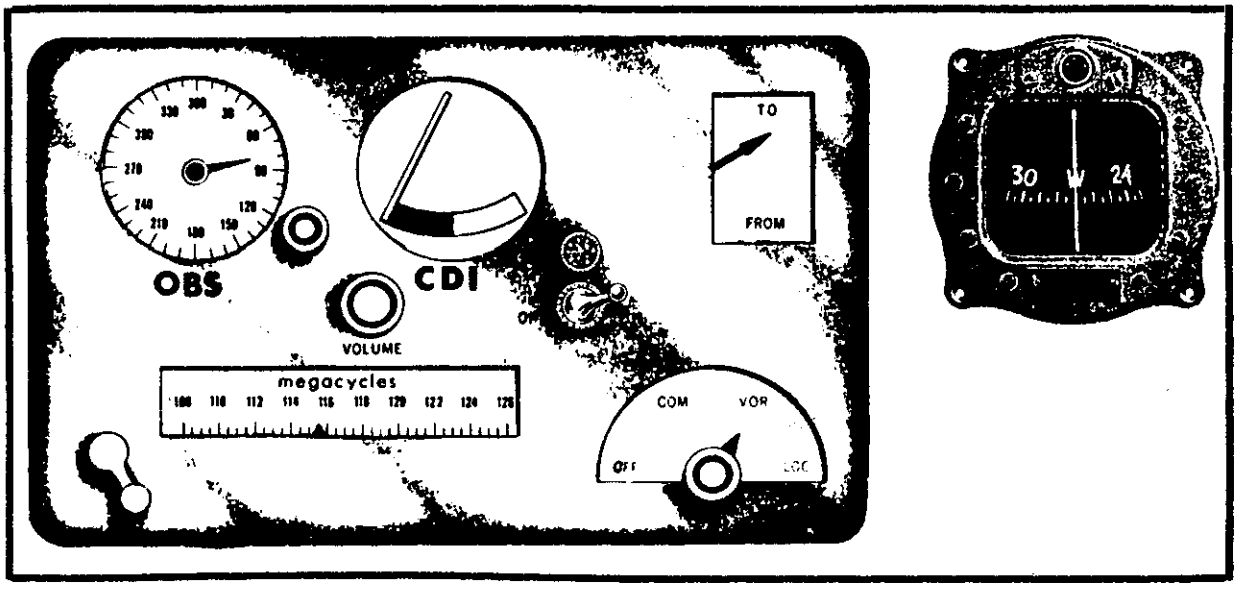


Figure 18. Omni receiver indications.

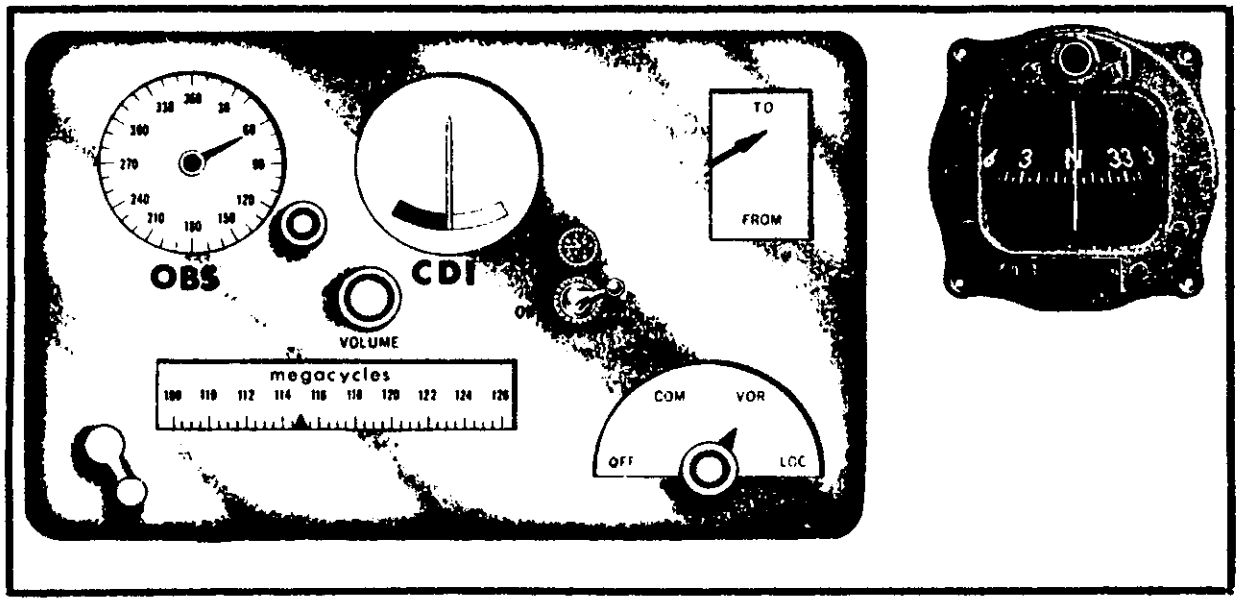


Figure 19. Omni receiver indications.

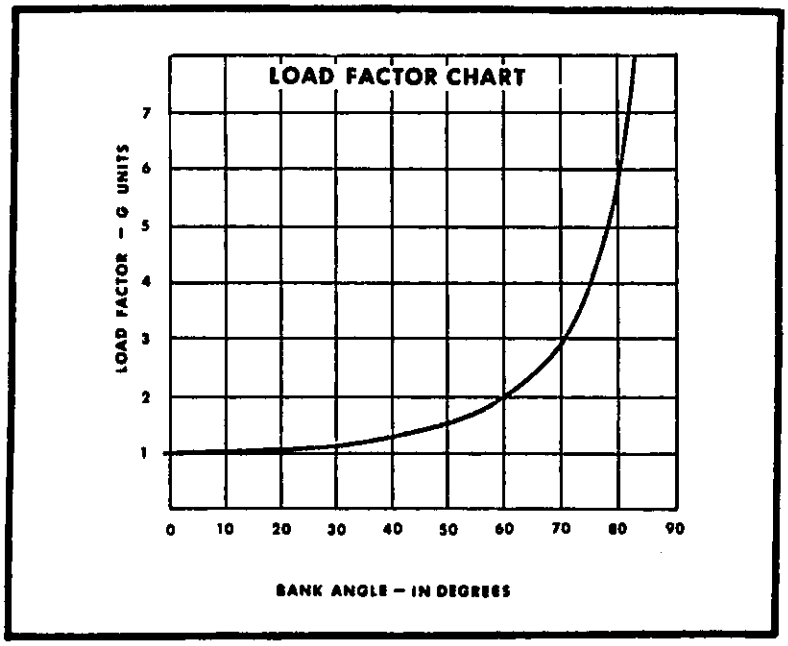


Figure 20. Load Factor Chart.

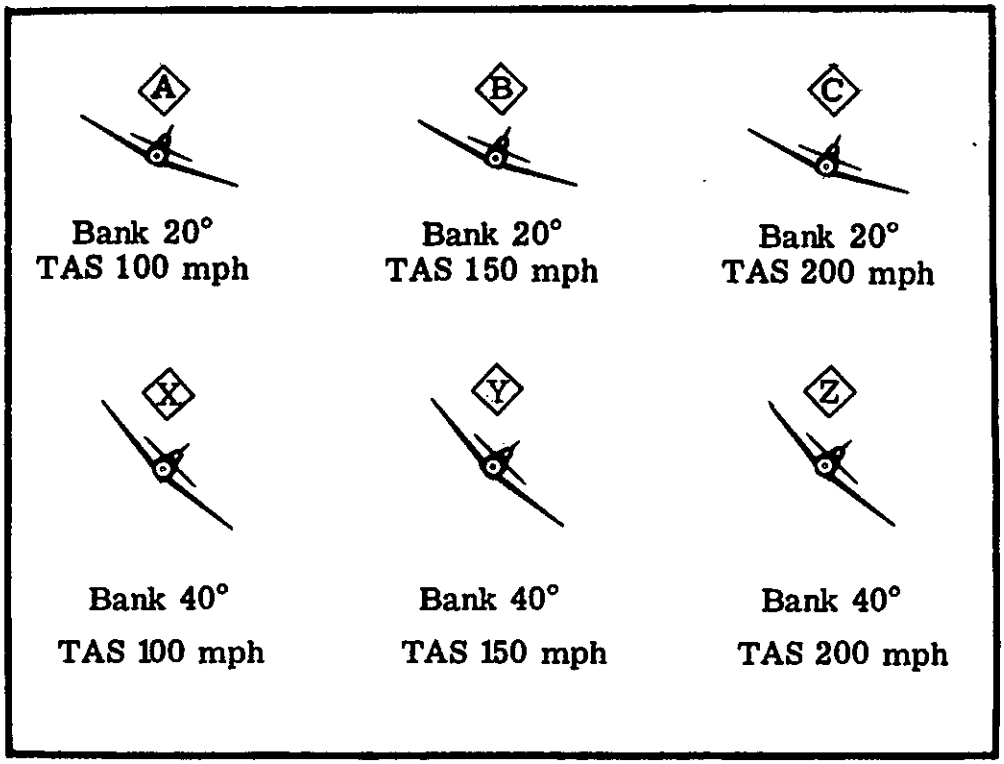


Figure 21. Angle of Bank vs Airspeed.

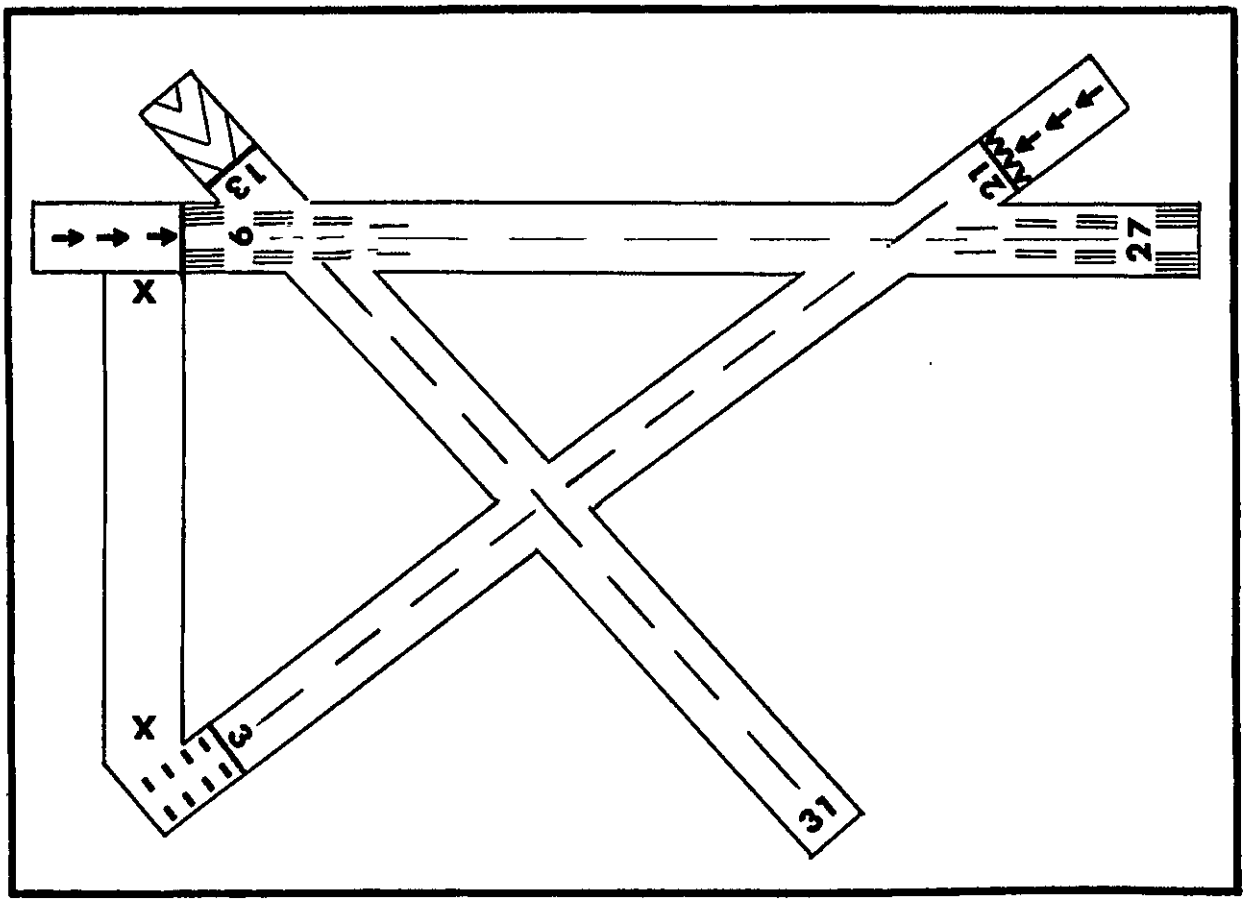


Figure 22. Runway Markings.

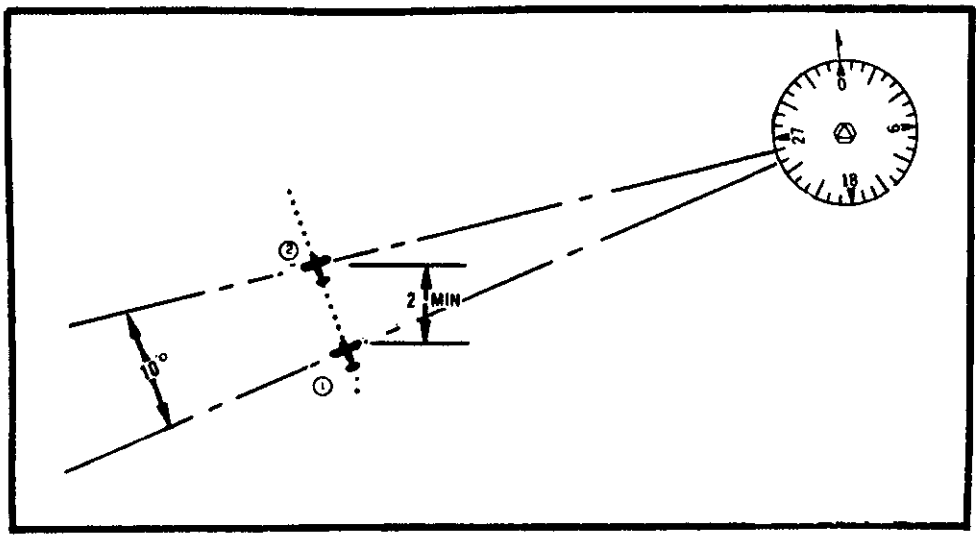


Figure 23. VOR time/distance check.

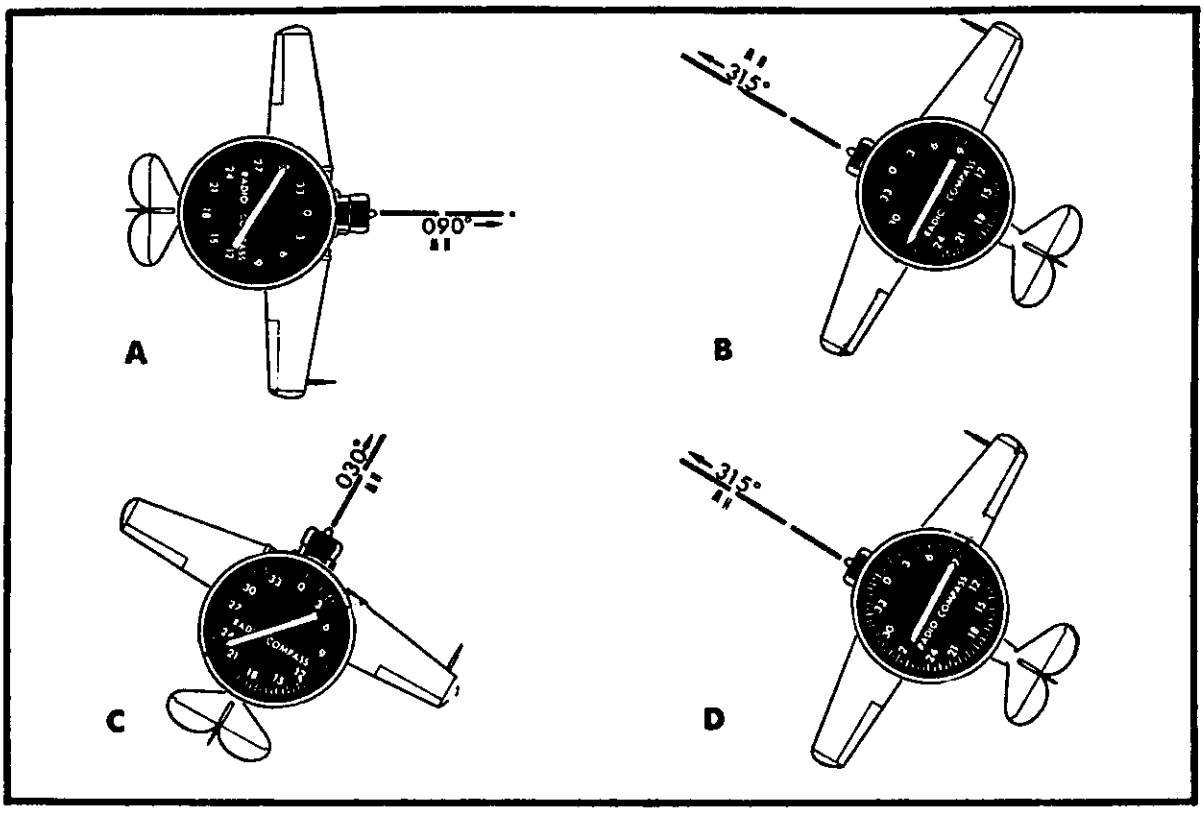


Figure 24. ADF orientation.

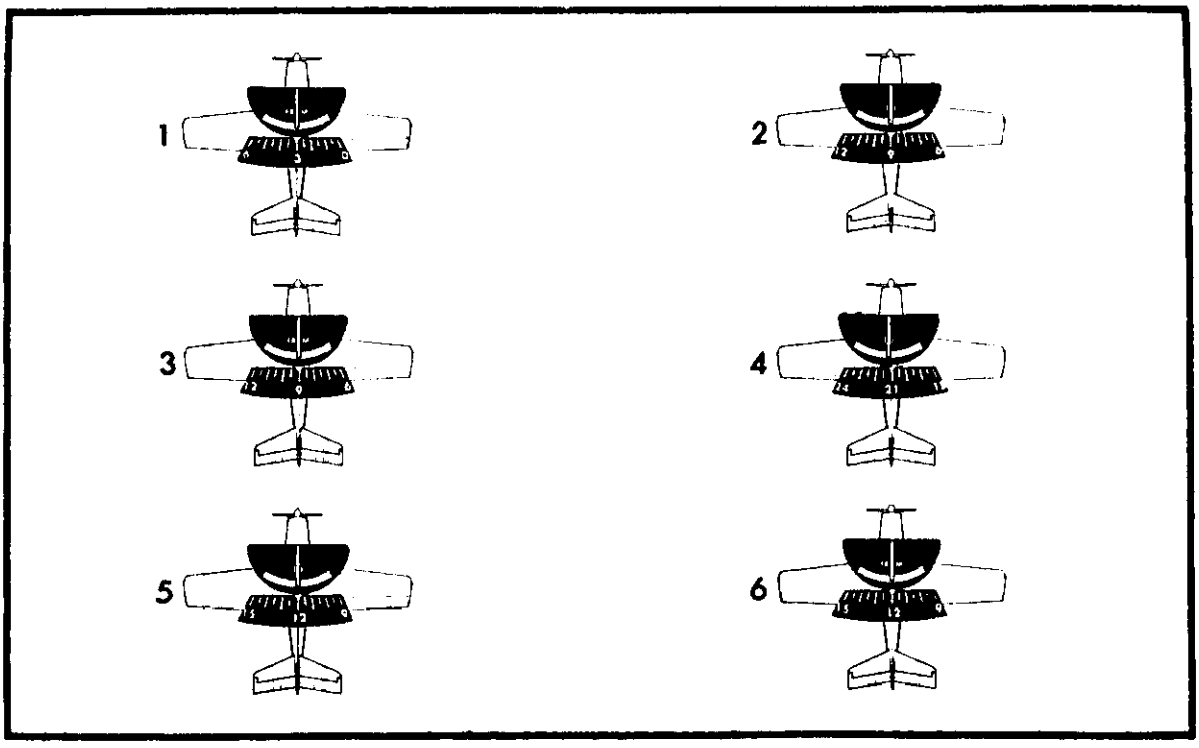


Figure 25. VOR orientation.

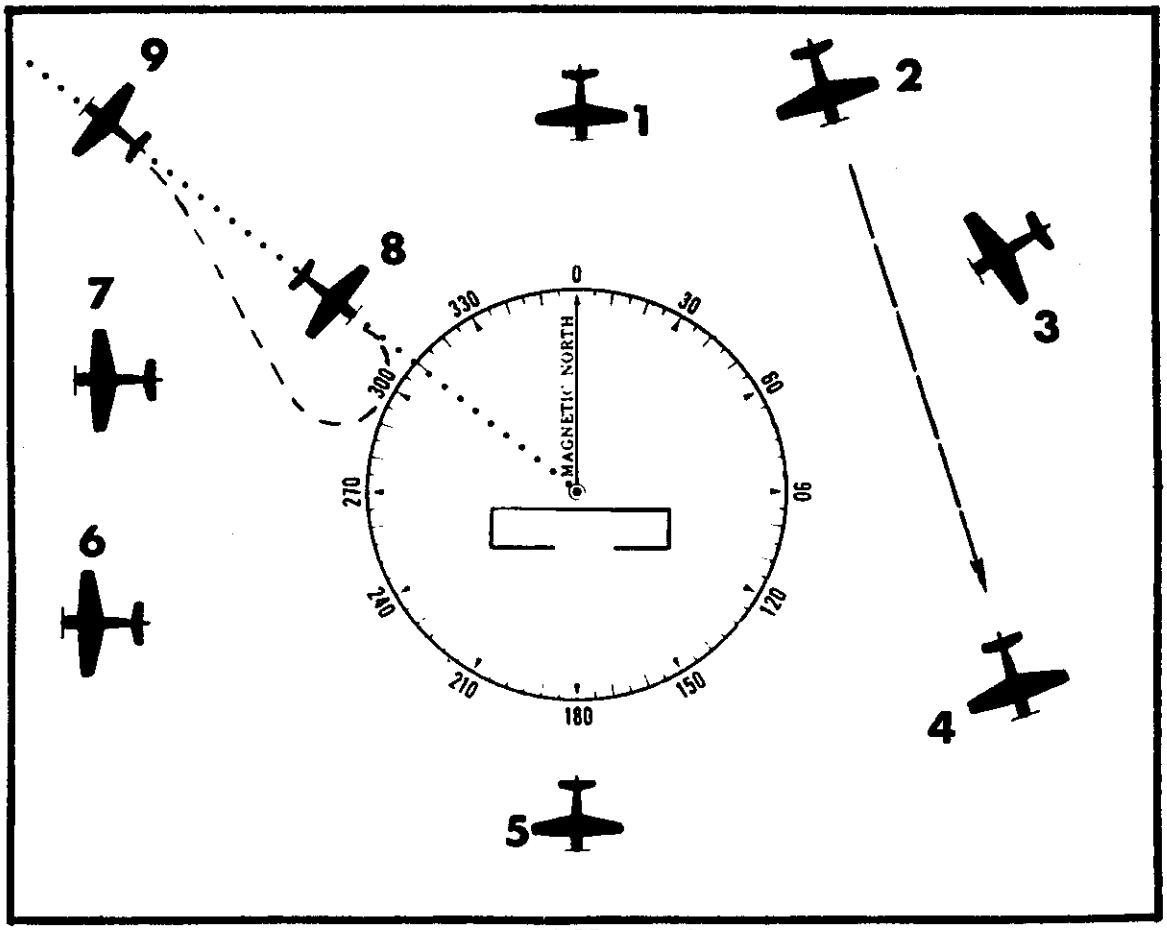


Figure 26. VOR orientation.

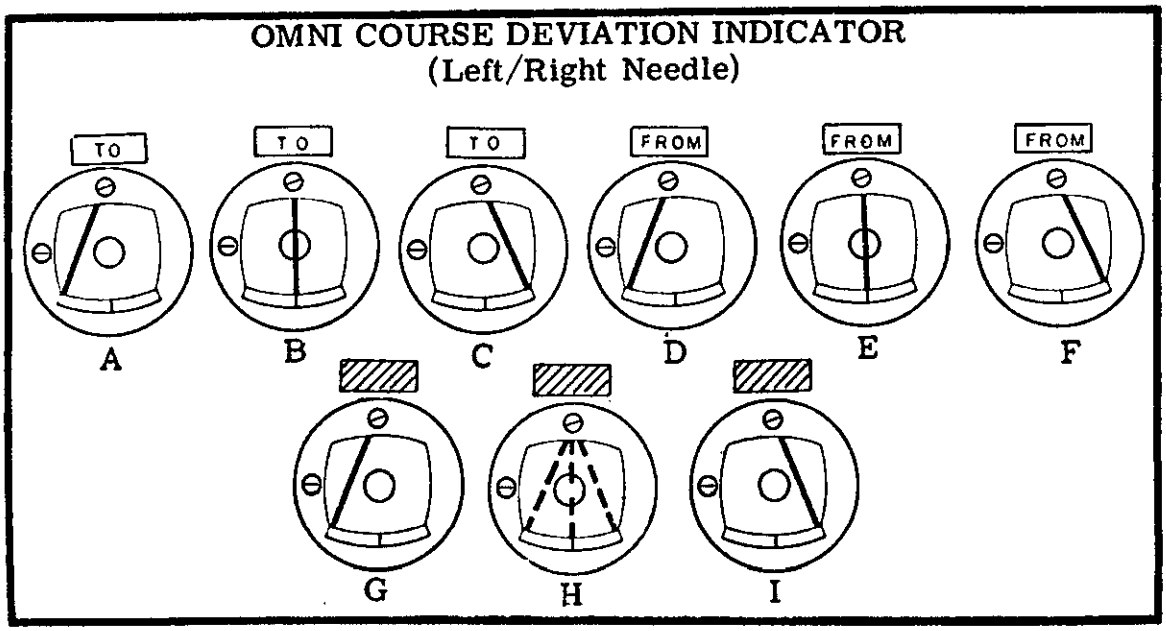


Figure 27. Omnibearing indications.

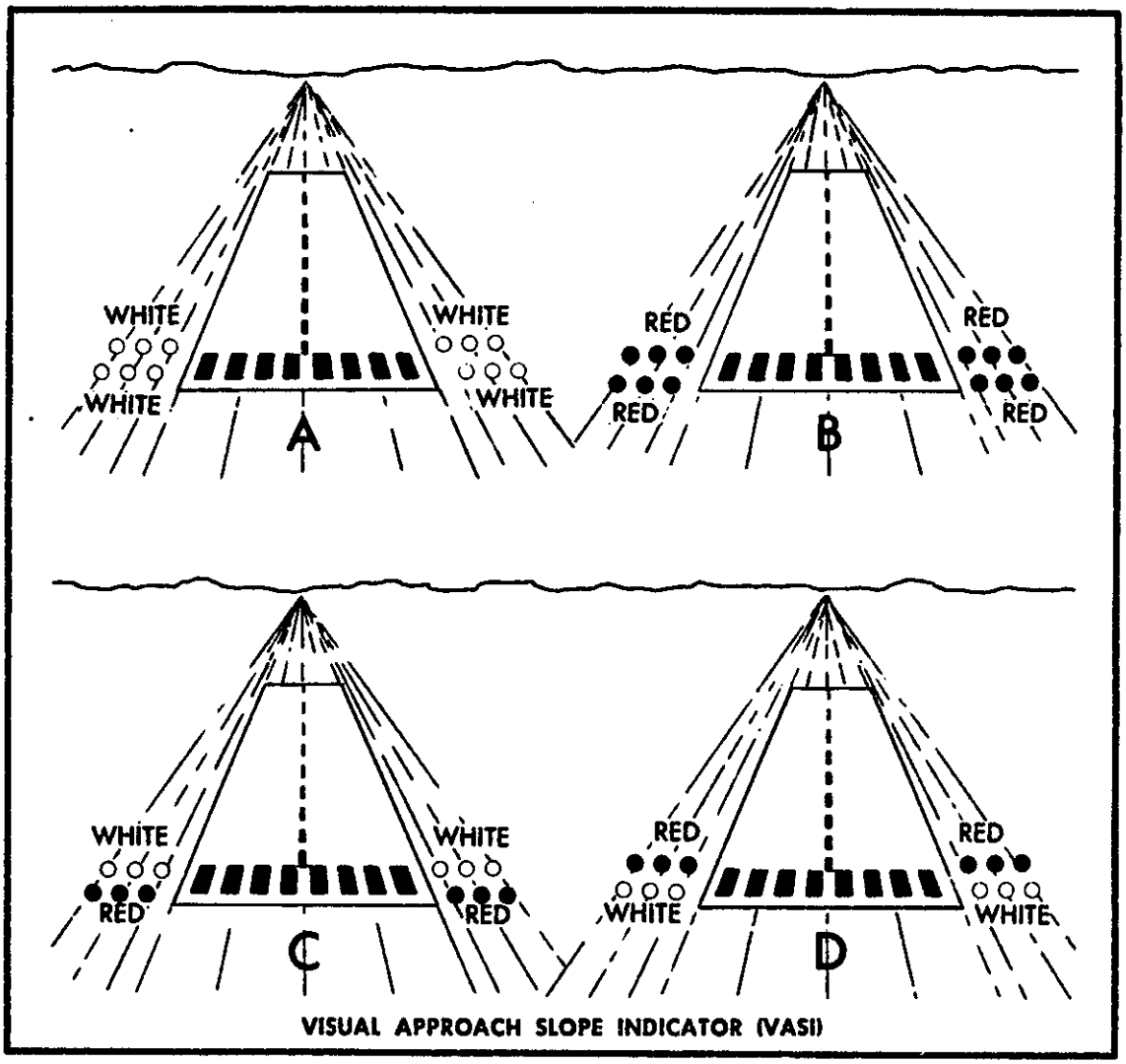


Figure 28. VASI.

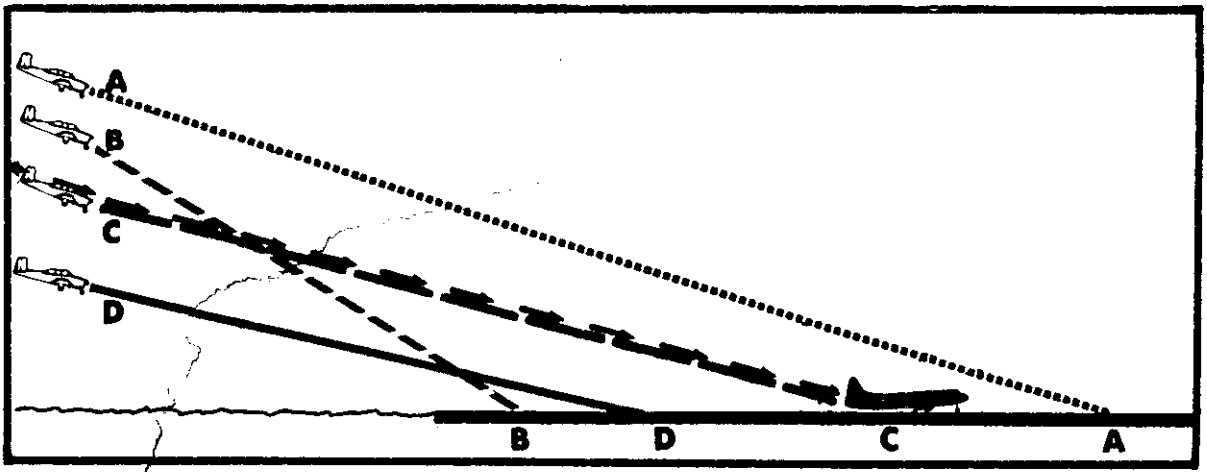


Figure 29. Wake turbulence on final approach.

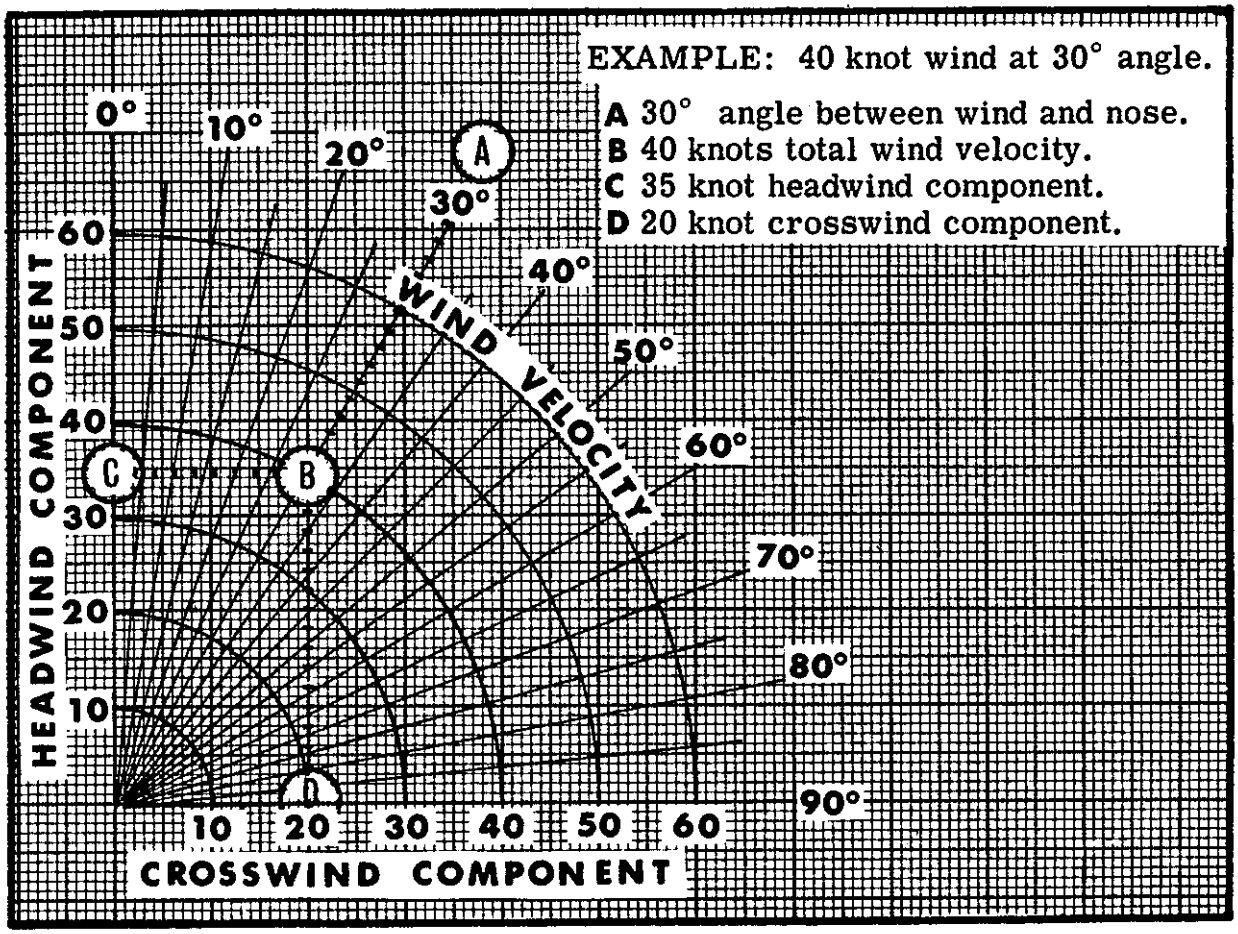


Figure 30. Wind Component Chart.

STALL SPEED, POWER OFF

Gross Weight 2900 lbs.	ANGLE OF BANK			
CONFIGURATION	0°	20°	40°	60°
GEAR & FLAPS UP	65	67	75	92
GEAR DOWN FLAPS 20°	60	62	68	84
GEAR DOWN FLAPS 40°	59	61	67	83

SPEEDS ARE MPH, CAS

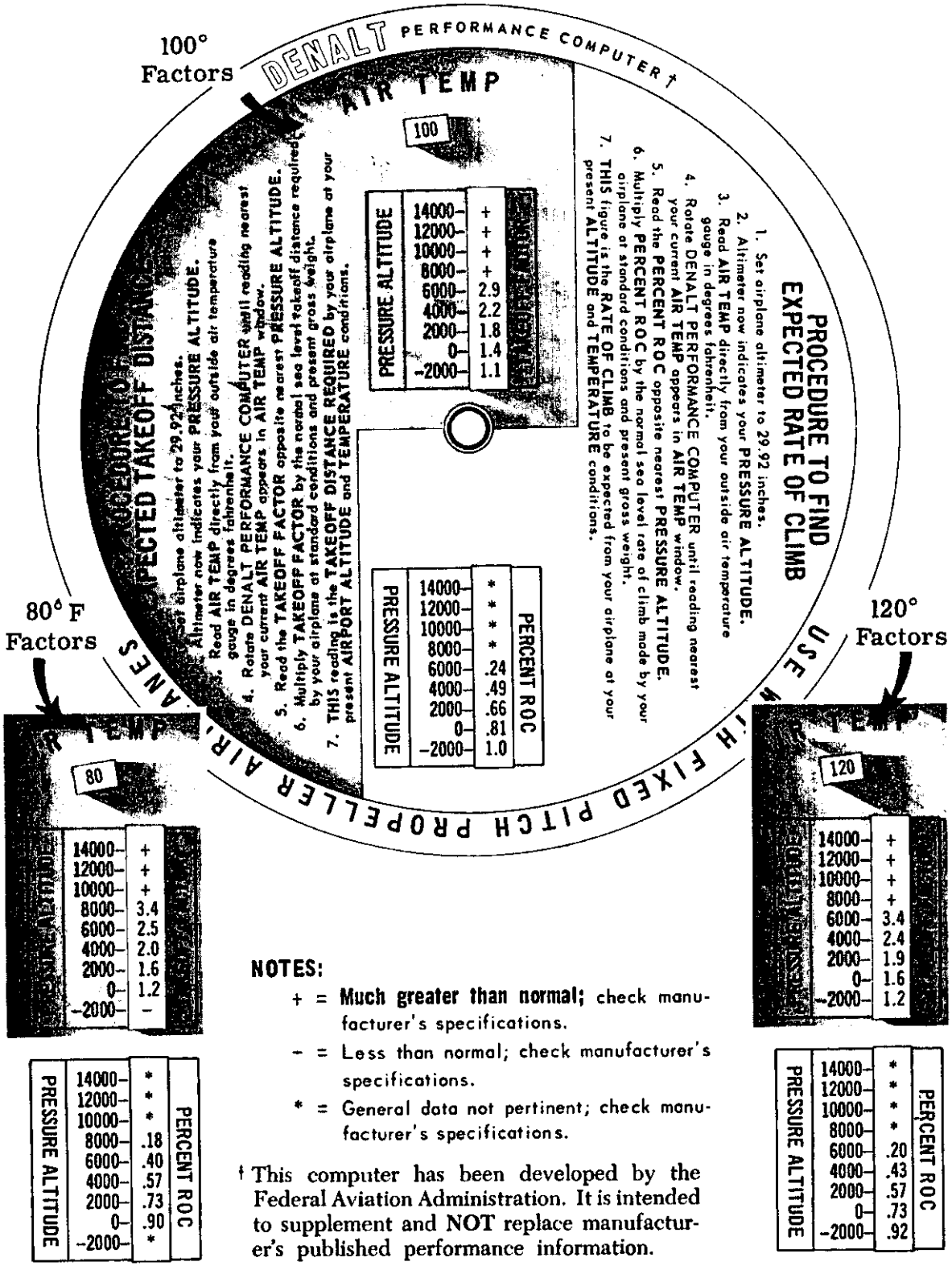
Figure 31. Stall Speed Chart.

AIRSPEED CORRECTION TABLE

FLAPS 0°								
IAS - MPH	60	80	100	120	140	160	180	200
CAS - MPH	69	82	100	119	139	160	181	202
***FLAPS 20°**								
IAS - MPH	40	50	60	70	80	90	100	110
CAS - MPH	57	62	68	75	84	93	102	112
***FLAPS 40°**								
IAS - MPH	40	50	60	70	80	90	100	110
CAS - MPH	57	62	68	75	83	92	102	111

*Maximum flap speed 120 MPH - CAS

Figure 32. Airspeed Correction Table.



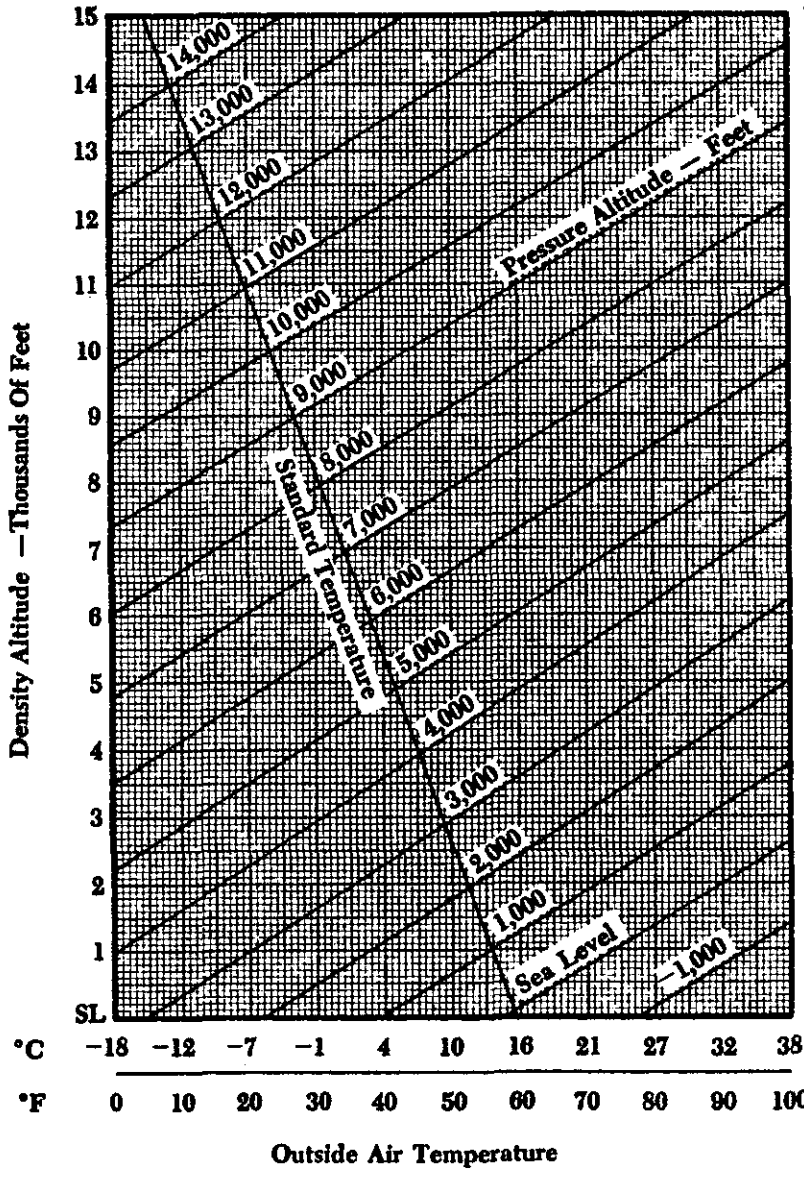
NOTES:

- \+ = **Much greater than normal;** check manufacturer's specifications.
- \- = Less than normal; check manufacturer's specifications.
- * = General data not pertinent; check manufacturer's specifications.

† This computer has been developed by the Federal Aviation Administration. It is intended to supplement and NOT replace manufacturer's published performance information.

Figure 33. Denalt Computer.

PRESSURE ALTITUDE AND DENSITY CHART



Altimeter Setting in Hg.	Altitude Correction 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	-225
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 34. Pressure Altitude and Density Chart.

PELICAN AIRCRAFT CORP.

AIRPLANE OWNERS HANDBOOK
(Excerpts)

AIRPLANE DESIGNATION:- Pelican 250.
ENGINE OPERATING LIMITATIONS:- 250 HP at 2575 RPM.
FUEL SYSTEM:- Float-type Carburetor.
Recommended Fuel 91/96 Minimum Grade.
Fuel Capacity Standard Tanks 60 gallons.
Usable Fuel All Flight Conditions 56 gallons.
OIL CAPACITY:- 12 quarts.
PROPELLER:- Constant - speed Hydraulically Controlled.
LANDING GEAR:- Retractable Tricycle Landing Gear.
Electrically Operated.
Emergency Operation - Manual Lever to Extend Gear Only.
WING FLAPS:- Electrically Operated.
EMPTY WEIGHT:- 1, 660 lbs.
MAXIMUM GROSS WEIGHT:- 2, 900 lbs.
RADIO EQUIPMENT:-

1 VHF Communications Transceiver	118. 0 to 135. 95 MHz
1 VHF Localizer/VOR Receiver	108. 0 to 117. 9 MHz
1 ADF Receiver (fixed azimuth)	200 kHz to 1750 kHz

AIRSPEED LIMITATIONS:-

Never exceed speed	227 mph CAS
Maximum structural cruising speed	180 mph CAS
Maximum maneuvering speed	144 mph CAS
Maximum gear operating speed	150 mph CAS
Maximum gear extended speed	150 mph CAS
Maximum flaps extended speed	125 mph CAS

MAXIMUM ALLOWABLE WEIGHT IN BAGGAGE COMPARTMENT - 120 LBS.

Figure 35. Pelican – Airplane Owner's Handbook.

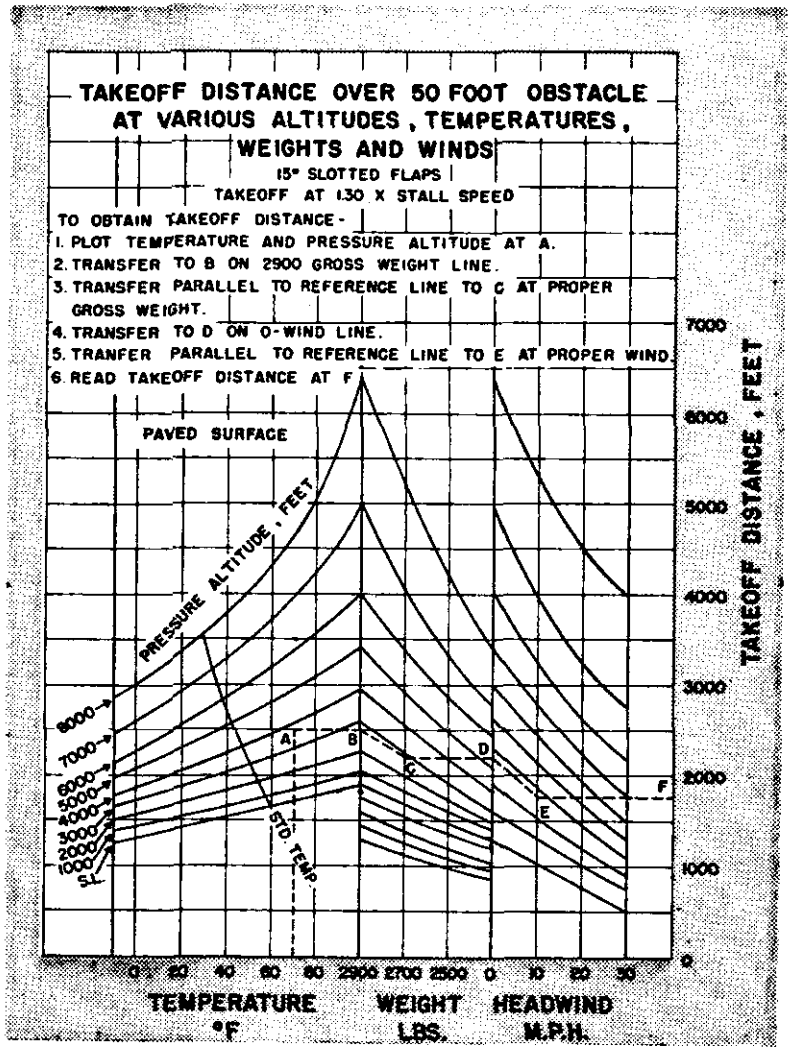


Figure 36. Pelican – Take-Off Distance Chart.

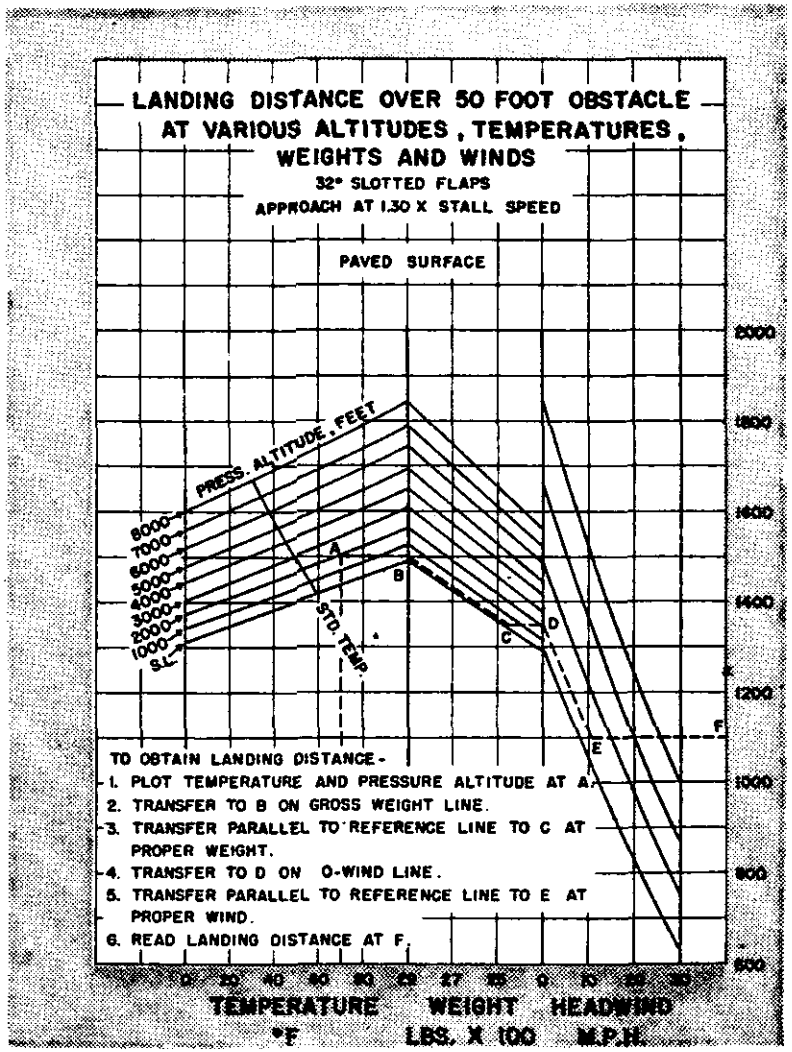


Figure 37. Pelican – Landing Distance Chart.

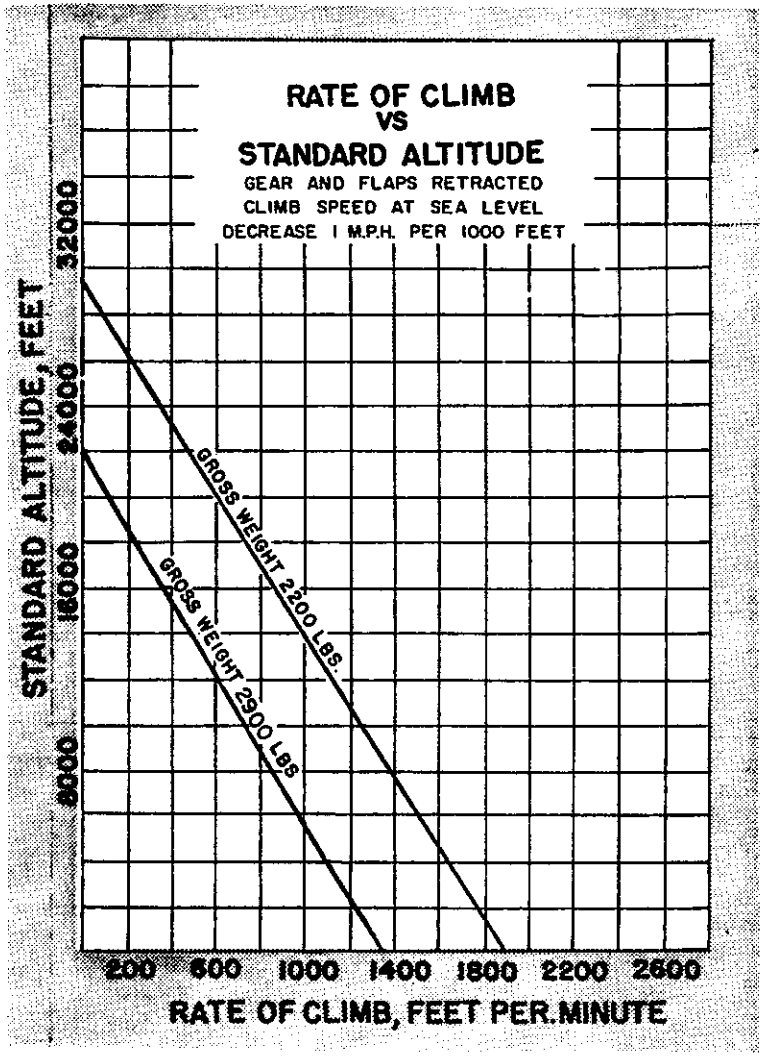


Figure 38. Pelican – Rate of Climb Chart.

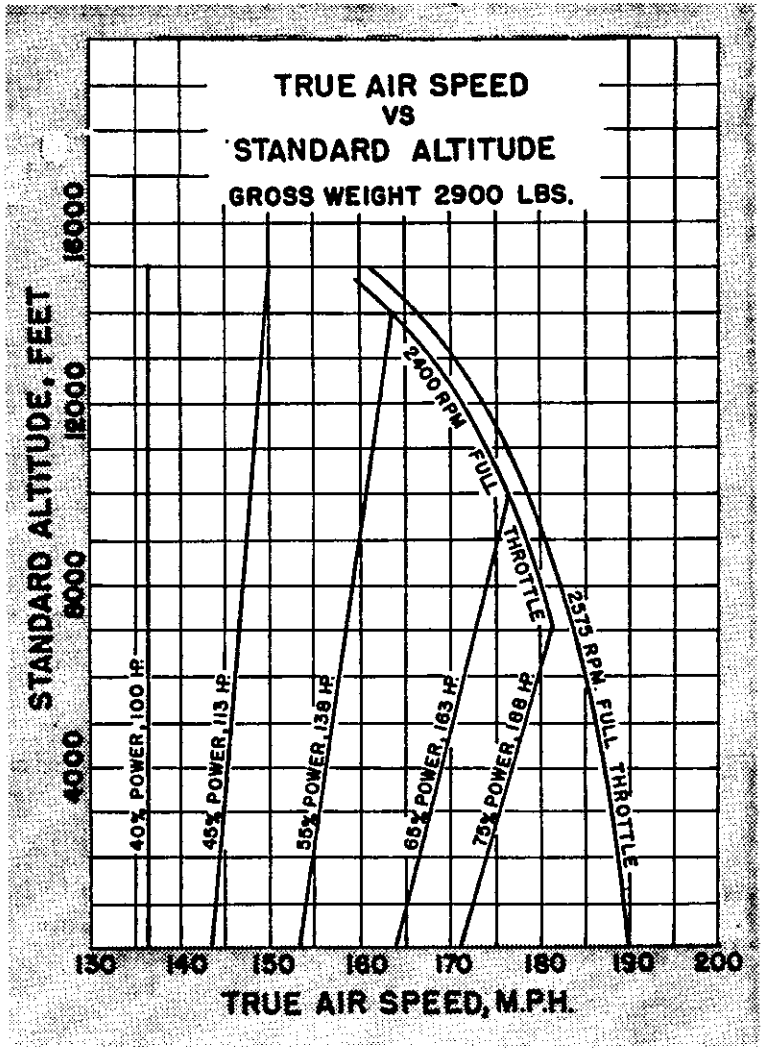


Figure 39. Pelican – TAS vs. Standard Altitude Chart.

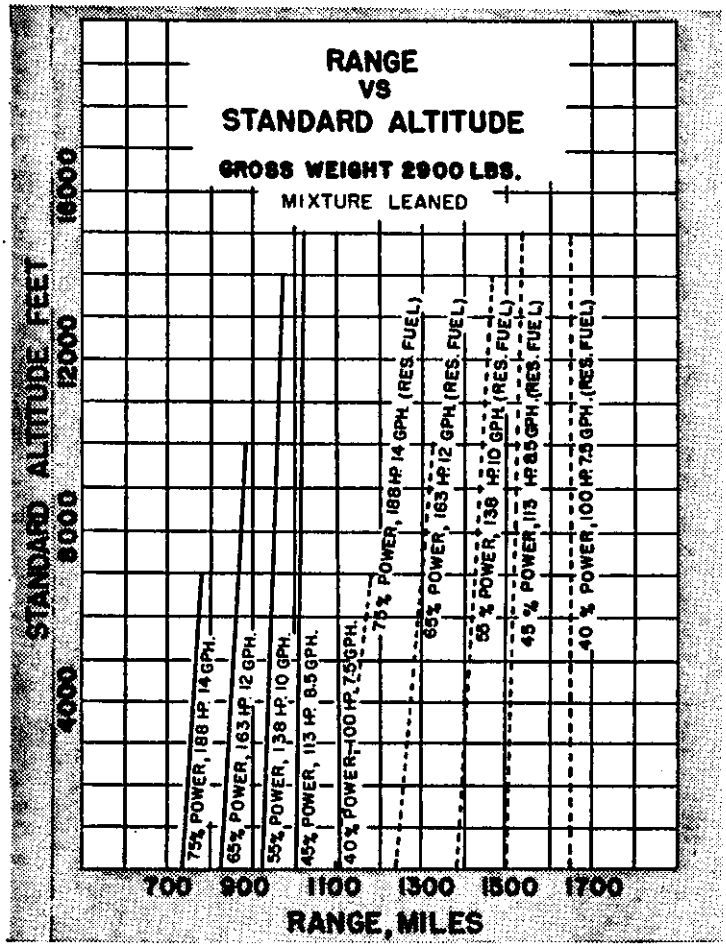


Figure 40. Pelican – Range vs. Standard Altitude Chart.

Power Setting Table – Model O-54 -A, 250 HP Engine

Press. Alt. 1000 Feet	Std. Alt. Temp. °F	138 HP – 55% Rated Approx. Fuel 10.3 Gal./Hr. RPM AND MAN. PRESS.				163 HP – 65% Rated Approx. Fuel 12.3 Gal./Hr. RPM AND MAN. PRESS.				188 HP – 75% Rated Approx. Fuel 14.0 Gal./Hr. RPM AND MAN. PRESS.		
		2100	2200	2300	2400	2100	2200	2300	2400	2200	2300	2400
SL	59	21.6	20.8	20.2	19.6	24.2	23.3	22.6	22.0	25.8	25.1	24.3
1	55	21.4	20.6	20.0	19.3	23.9	23.0	22.4	21.8	25.5	24.8	24.1
2	52	21.1	20.4	19.7	19.1	23.7	22.8	22.2	21.5	25.3	24.6	23.8
3	48	20.9	20.1	19.5	18.9	23.4	22.5	21.9	21.3	25.0	24.3	23.6
4	45	20.6	19.9	19.3	18.7	23.1	22.3	21.7	21.0	24.8	24.1	23.3
5	41	20.4	19.7	19.1	18.5	22.9	22.0	21.4	20.8	—	23.8	23.0
6	38	20.1	19.5	18.9	18.3	22.6	21.8	21.2	20.6	—	—	22.8
7	34	19.9	19.2	18.6	18.0	22.3	21.5	21.0	20.4	—	—	—
8	31	19.6	19.0	18.4	17.8	—	21.3	20.7	20.1			
9	27	19.4	18.8	18.2	17.6	—	—	20.5	19.9			
10	23	19.1	18.6	18.0	17.4	—	—	—	19.6			
11	19	18.9	18.3	17.8	17.2	—	—	—	—			
12	16	18.6	18.1	17.5	17.0	—	—	—	—			
13	12	—	17.9	17.3	16.8							
14	9	—	—	17.1	16.5							
15	5	—	—	—	16.3							

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

Figure 41. Pelican – Power Setting Table.

CONDOR AIRCRAFT CORP.

AIRPLANE OWNERS MANUAL
(Excerpts)

AIRCRAFT DESIGNATION:- Condor 410.
ENGINE OPERATION LIMITATIONS:- 260 HP at 2625 RPM.
FUEL SYSTEM:- Fuel injection System (Fuel discharged into combustion chamber)
Recommended Fuel 100/130 Minimum Grade.
Fuel Capacity Standard Tanks 65 gallons.
Usable Fuel All Flight Conditions 63.5 gallons.
OIL CAPACITY:- Total 12 quarts.
PROPELLER:- Constant-speed Hydraulically Controlled.
LANDING GEAR:- Retractable Tricycle Landing Gear.
Hydraulic Actuators Powered By Engine Driven Hydraulic Pump.
Emergency Operation:- Manual Hydraulic Pump.
WING FLAPS:- Hydraulically Operated; Powered By Engine Driven Hydraulic Pump.
EMPTY WEIGHT:- 1840 lbs. (moment 63.7)
MAXIMUM GROSS WEIGHT:- 3000 lbs.
LOAD FACTOR:-
Flaps Up + 3.8, -1.52
Flaps Dn. +3.5

RADIO EQUIPMENT:-

1 VHF Communications Transceiver	118.0 to 135.95 MHz
1 VHF Localizer/VOR Receiver	108.0 to 117.9 MHz
1 ADF Receiver (fixed azimuth)	200 kHz to 1750 kHz

AIRSPEED LIMITATIONS:-

Never exceed speed	225 mph CAS
Maximum structural cruising speed	190 mph CAS
Maximum maneuvering speed	132 mph CAS
Maximum gear operating speed	160 mph CAS
Maximum gear extended speed	160 mph CAS
Maximum flap extended speed	
Flaps 10°	160 mph CAS
Flaps 10° - 40°	110 mph CAS

MAXIMUM ALLOWABLE WEIGHT IN BAGGAGE COMPARTMENT - 120 LBS.

Figure 42. Condor – Airplane Owner's Manual.

TAKE-OFF DATA

TAKE-OFF DISTANCE WITH 20° FLAPS FROM HARD-SURFACED RUNWAY

GROSS WEIGHT LBS.	IAS AT 50 FT. MPH	HEAD WIND MPH	AT SEA LEVEL & 59°F		AT 2500 FEET & 50°F		AT 5000 FT. & 41°F		AT 7500 FT. & 32 F	
			GROUND RUN	TO CLEAR 50' OBSTACLE	GROUND RUN	TO CLEAR 50' OBSTACLE	GROUND RUN	TO CLEAR 50' OBSTACLE	GROUND RUN	TO CLEAR 50' OBSTACLE
2200	55	0	345	680	405	770	480	885	580	1040
		15	205	460	245	525	295	615	365	725
		30	100	275	120	320	155	380	195	460
2600	60	0	500	915	585	1045	705	1230	855	1470
		15	310	635	370	735	455	870	560	1055
		30	165	395	200	465	255	565	325	695
3000	64	0	695	1210	820	1405	990	1675	1205	2045
		15	450	855	535	1005	660	1215	815	1505
		30	250	555	310	665	390	820	500	1030

NOTE: INCREASE DISTANCES 10% FOR EACH 25°F ABOVE STANDARD TEMPERATURE FOR PARTICULAR ALTITUDE.

Figure 43. Condor – Take-Off Data.

CLIMB DATA

GROSS WEIGHT LBS.	AT SEA LEVEL & 59°F			AT 5000 FT. & 41°F			AT 10000 FT. & 23°F			AT 15000 FT. & 5°F			AT 20000 FT. & -12°F		
	BEST CLIMB IAS MPH	RATE OF CLIMB FT/MIN	GAL. OF FUEL USED	BEST CLIMB IAS MPH	RATE OF CLIMB FT/MIN	FROM S.L. FUEL USED	BEST CLIMB IAS MPH	RATE OF CLIMB FT/MIN	FROM S.L. FUEL USED	BEST CLIMB IAS MPH	RATE OF CLIMB FT/MIN	FROM S.L. FUEL USED	BEST CLIMB IAS MPH	RATE OF CLIMB FT/MIN	FROM S.L. FUEL USED
2200	96	1800	2.0	92	1530	2.9	88	1150	3.9	83	780	5.1	78	410	6.8
2600	100	1540	2.0	97	1210	3.1	93	890	4.4	88	580	6.1	84	250	8.6
3000	105	1270	2.0	101	980	3.4	97	690	5.0	94	400	7.3	90	120	11.5

NOTE: FULL THROTTLE, 2625 RPM, MIXTURE AT RECOMMENDED LEANING SCHEDULE. FLAPS AND GEAR UP. FUEL USED INCLUDES WARM-UP AND TAKE-OFF ALLOWANCE.

Figure 44. Condor – Climb Data.

LANDING DISTANCE TABLE

GROSS WEIGHT LBS.	APPROACH IAS MPH	AT SEA LEVEL & 59°F		AT 2500 FT & 50°F		AT 5000 FT & 41°F		AT 7500 FT & 32°F	
		GROUND ROLL	TO CLEAR 50' OBSTACLE	GROUND ROLL	TO CLEAR 50' OBSTACLE	GROUND ROLL	TO CLEAR 50' OBSTACLE	GROUND ROLL	TO CLEAR 50' OBSTACLE
2200	61	355	945	385	980	415	1020	445	1060
2600	66	420	1030	455	1070	490	1110	530	1155
3000	71	485	1110	525	1150	565	1200	610	1255

NOTE: REDUCE LANDING DISTANCES 10% FOR EACH 6 MPH HEADWIND. FLAPS 40° AND POWER OFF.

Figure 45. Condor – Landing Distance.

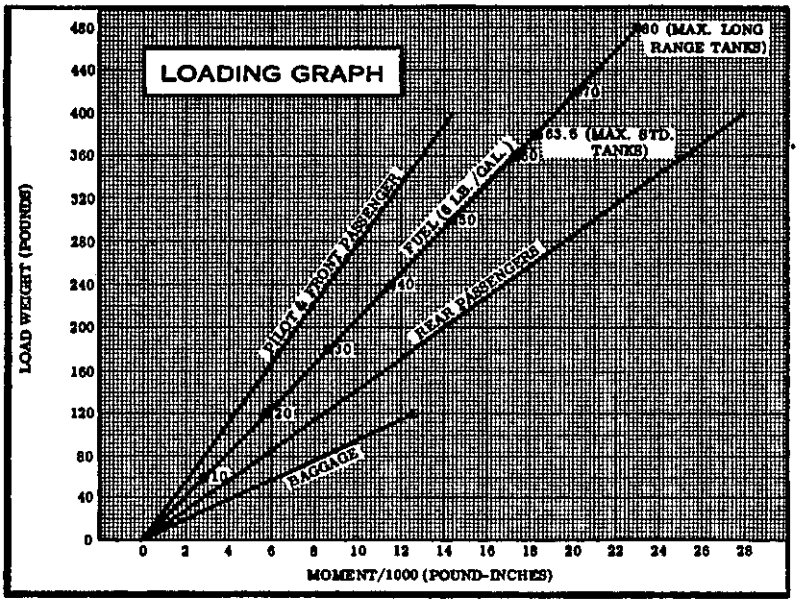


Figure 46. Condor – Loading Graph.

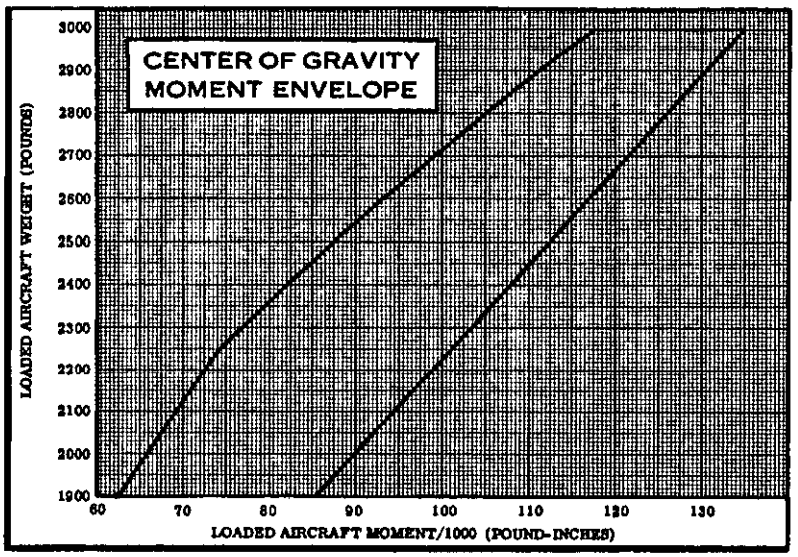


Figure 47. Condor – Center of Gravity Movement Envelope.

2500 CRUISE PERFORMANCE

NORMAL LEAN MIXTURE

Standard Atmosphere • Zero Wind • Gross Weight - 3000 Pounds

2500 FEET

RPM	MP	% BHP	TAS MPH	Gal/ Hour	63.5 Gal. (No Reserve) Endr. Hours	63.5 Gal. (No Reserve) Range Miles	80 Gal. (No Reserve) Endr. Hours	80 Gal. (No Reserve) Range Miles
2450	24	76	180	14.3	4.4	800	5.6	1010
	23	71	177	13.4	4.7	835	6.0	1050
	22	67	173	12.7	5.0	865	6.3	1090
	21	63	169	11.9	5.3	900	6.7	1135
2300	24	68	174	12.8	4.9	860	6.2	1085
	23	64	170	12.1	5.2	890	6.6	1120
	22	61	166	11.4	5.6	925	7.0	1165
	21	57	163	10.8	5.9	960	7.4	1210
2200	23	60	166	11.3	5.6	930	7.1	1175
	22	56	162	10.7	6.0	965	7.5	1215
	21	53	158	10.0	6.3	1005	8.0	1265
	20	49	154	9.4	6.7	1035	8.5	1305
2100	22	52	157	9.9	6.4	1010	8.1	1275
	21	48	153	9.3	6.8	1045	8.6	1320
	20	45	148	8.7	7.3	1080	9.2	1360
	19	42	144	8.3	7.7	1105	9.7	1390
	18	39	139	7.8	8.1	1130	10.2	1420
	17	35	133	7.3	8.7	1150	10.9	1445
	16	32	126	6.9	9.2	1160	11.6	1460

Figure 48. Condor – Cruise Performance – (2,500′).

CRUISE PERFORMANCE 5000

NORMAL LEAN MIXTURE

Standard Atmosphere • Zero Wind • Gross Weight - 3000 Pounds

5000 FEET

RPM	MP	% BHP	TAS MPH	Gal/ Hour	63.5 Gal. (No Reserve) Endr. Hours	63.5 Gal. (No Reserve) Range Miles	80 Gal. (No Reserve) Endr. Hours	80 Gal. (No Reserve) Range Miles
2450	24	79	187	14.8	4.3	800	5.4	1010
	23	74	183	14.0	4.5	830	5.7	1050
	22	70	179	13.1	4.8	870	6.1	1095
	21	65	175	12.3	5.2	905	6.5	1140
2300	24	71	180	13.3	4.8	860	6.0	1080
	23	67	177	12.6	5.0	890	6.4	1125
	22	63	173	11.8	5.4	925	6.8	1170
	21	59	169	11.1	5.7	965	7.2	1215
2200	23	62	172	11.7	5.4	935	6.8	1175
	22	58	168	11.0	5.8	970	7.2	1220
	21	55	165	10.4	6.1	1005	7.7	1265
	20	51	160	9.8	6.5	1040	8.2	1310
2100	22	53	163	10.1	6.3	1020	7.9	1290
	21	50	159	9.6	6.6	1055	8.4	1330
	20	46	154	9.0	7.1	1090	8.9	1370
	19	43	150	8.5	7.5	1115	9.4	1405
	18	40	145	8.1	7.9	1140	9.9	1435
	17	37	139	7.6	8.4	1160	10.6	1465
	16	34	132	7.1	8.9	1175	11.2	1480
	15	31	125	6.7	9.4	1180	11.9	1485

Figure 49. Condor – Cruise Performance – (5,000′).

7500 CRUISE PERFORMANCE

NORMAL LEAN MIXTURE

Standard Atmosphere • Zero Wind • Gross Weight-3000 Pounds

7500 FEET

RPM	MP	% BHP	TAS MPH	Gal/ Hour	63.5 Gal. (No Reserve) Endr. Hours	63.5 Gal. (No Reserve) Range Miles	80 Gal. (No Reserve) Endr. Hours	80 Gal. (No Reserve) Range Miles
2450	22	72	186	13.6	4.7	870	5.9	1095
	21	67	182	12.7	5.0	910	6.3	1145
	20	64	178	12.0	5.3	945	6.7	1190
	19	59	173	11.1	5.7	990	7.2	1245
2300	22	65	179	12.2	5.2	930	6.6	1175
	21	61	175	11.5	5.5	970	7.0	1220
	20	57	171	10.8	5.9	1005	7.4	1270
	19	53	167	10.1	6.3	1040	7.9	1320
2200	22	61	175	11.4	5.6	970	7.0	1225
	21	57	171	10.7	5.9	1010	7.5	1275
	20	53	166	10.1	6.3	1045	7.9	1315
	19	50	162	9.5	6.7	1080	8.4	1360
2100	21	52	165	9.8	6.4	1060	8.1	1335
	20	48	160	9.3	6.8	1095	8.6	1380
	19	45	155	8.7	7.3	1125	9.2	1420
	18	42	150	8.3	7.7	1150	9.7	1450
	17	39	145	7.8	8.1	1175	10.2	1485
	16	35	138	7.4	8.6	1190	10.9	1500
	15	32	131	6.9	9.1	1200	11.5	1510

Figure 50. Condor – Cruise Performance – (7,500′)

CRUISE PERFORMANCE 10,000

NORMAL LEAN MIXTURE

Standard Atmosphere • Zero Wind • Gross Weight-3000 Pounds

10,000 FEET

RPM	MP	% BHP	TAS MPH	Gal/ Hour	63.5 Gal. (No Reserve) Endr. Hours	63.5 Gal. (No Reserve) Range Miles	80 Gal. (No Reserve) Endr. Hours	80 Gal. (No Reserve) Range Miles
2450	20	65	184	12.3	5.2	950	6.5	1200
	19	61	179	11.5	5.5	995	7.0	1250
	18	57	174	10.7	5.9	1035	7.5	1305
	17	52	169	10.0	6.4	1075	8.0	1355
2300	20	59	177	11.1	5.7	1010	7.2	1275
	19	55	173	10.4	6.1	1050	7.7	1325
	18	51	168	9.8	6.5	1090	8.2	1370
	17	48	162	9.1	6.9	1125	8.7	1420
2200	20	55	173	10.4	6.1	1050	7.7	1325
	19	52	168	9.9	6.4	1085	8.1	1365
	18	48	163	9.2	6.9	1120	8.7	1410
	17	44	158	8.7	7.3	1155	9.2	1450
2100	20	50	166	9.5	6.7	1105	8.4	1390
	19	47	161	9.0	7.0	1135	8.9	1430
	18	44	156	8.5	7.4	1160	9.4	1465
	17	40	150	8.0	7.9	1185	9.9	1495
	16	37	144	7.6	8.4	1205	10.5	1520
	15	34	137	7.1	8.9	1215	11.2	1530
	14	30	126	6.6	9.6	1200	12.0	1510

Figure 51. Condor – Cruise Performance – (10,000′).

BOBWHITE AIRCRAFT CORPORATION

AIRPLANE FLIGHT HANDBOOK
(Excerpts)

AIRCRAFT DESIGNATION:- Bobwhite 45H.
ENGINE OPERATION LIMITATIONS:- 240 HP at 2600 RPM.
FUEL SYSTEM:- Pressure Type Carburetor (Fuel discharged into induction system)
Recommended Fuel 91/96 Minimum Grade.
Fuel Capacity Standard Tanks 60 gallons.
Usable Fuel All Flight Conditions 55 gallons.
OIL CAPACITY:- Total 12 quarts.
PROPELLER:- Constant-speed Hydraulically Controlled.
LANDING GEAR:- Retractable Tricycle Landing Gear.
Electrically Operated.
Emergency Operation - Manual Handcrank to Lower Gear ONLY.
WING FLAPS:- Electrically Operated.
EMPTY WEIGHT:- 1,839 lbs. (moment 65.9)
MAXIMUM GROSS WEIGHT:- 2,900 lbs.
LOAD FACTOR:-
Flaps Up +4.4, -1.7
Flaps Dn + 1.5

RADIO EQUIPMENT:-

1 VHF Communications Transceiver	118.0 to 135.95 MHz
1 VHF Localizer/VOR Receiver	108.0 to 117.9 MHz
1 ADF Receiver (fixed azimuth)	200 kHz to 1750 kHz

AIRSPEED LIMITATIONS:-

Never exceed speed	210 mph CAS
Maximum structural cruising speed	175 mph CAS
Maximum maneuvering speed	142 mph CAS
Maximum gear extended speed	140 mph CAS
Maximum flaps extended speed	120 mph CAS

MAXIMUM ALLOWABLE WEIGHT IN BAGGAGE COMPARTMENT - 120 LBS.

Figure 52. Bobwhite – Airplane Flight Handbook.

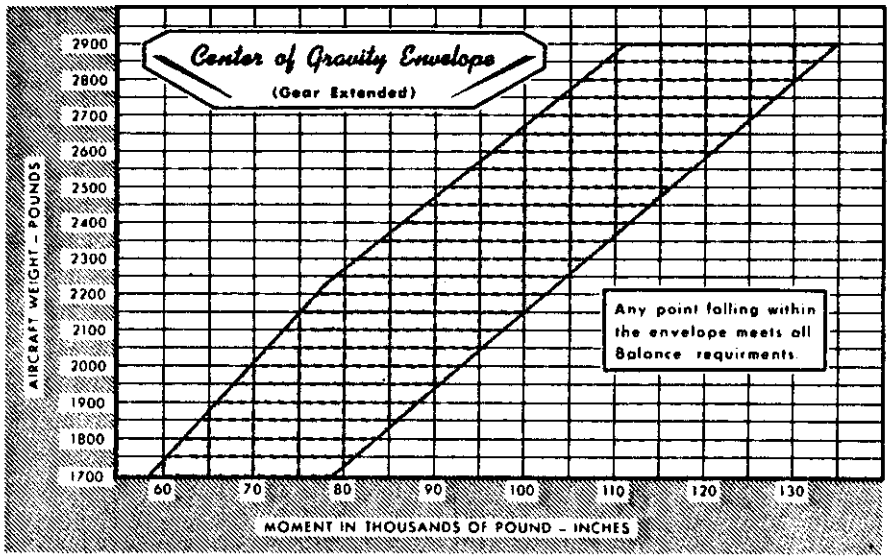


Figure 53. Bobwhite – Center of Gravity Envelope.

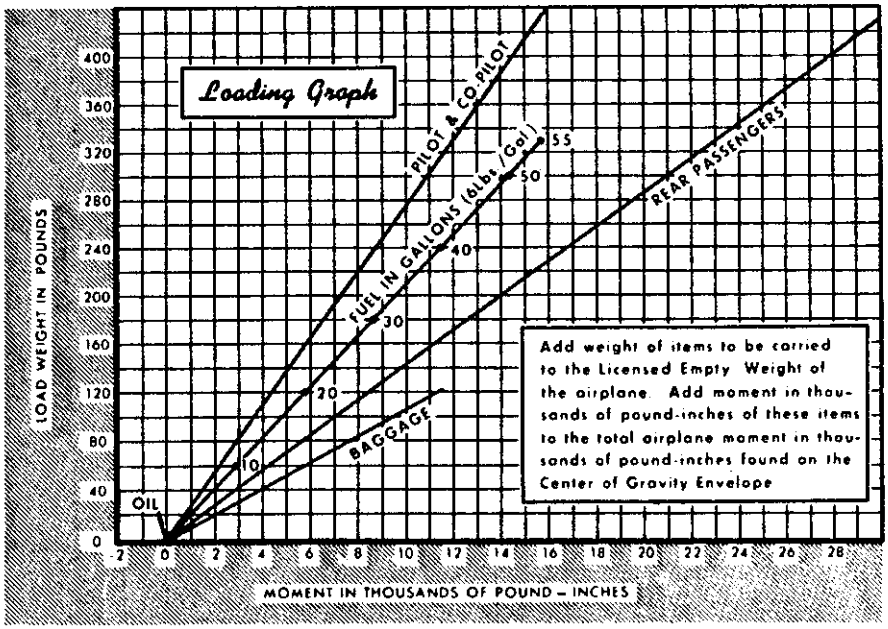


Figure 54. Bobwhite – Loading Graph.

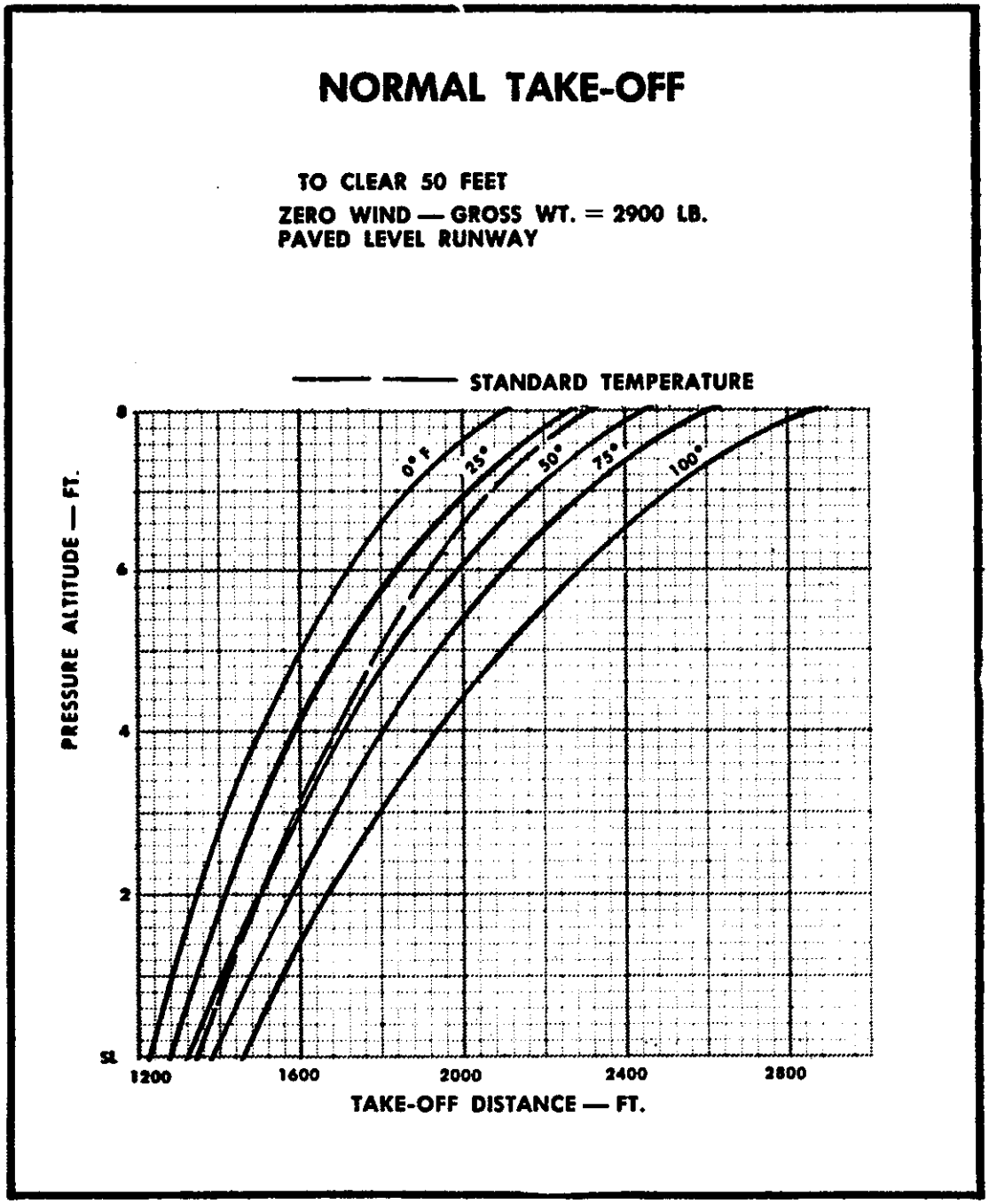


Figure 55. Bobwhite – Normal Take-Off Chart.

INSTRUCTIONS
FOR USE OF CRUISE PERFORMANCE DATA

NOTE: NO ALLOWANCES WERE MADE IN THE GRAPHS FOR RESERVES, NOR FOR VARIABLE FACTORS SUCH AS WINDS AND FUEL CONSUMED IN THE WARM-UP AND TAXIING; YOU MUST MAKE ALLOWANCES FOR THESE CONDITIONS AS THEY ACTUALLY EXIST, FROM ONE FLIGHT TO ANOTHER.

HORSEPOWER

TO DETERMINE THE HORSEPOWER BEING DEVELOPED, APPLY THE RPM AND MANIFOLD PRESSURE SETTINGS TO BE USED TO THE CRUISING HORSEPOWER CHART. NOTE THAT THE MANIFOLD PRESSURE REQUIRED TO OBTAIN A GIVEN HORSEPOWER WILL VARY WITH THE OUTSIDE AIR TEMPERATURE.

FUEL CONSUMPTION

TO DETERMINE THE RATE OF FUEL CONSUMPTION, APPLY THE HORSEPOWER BEING USED AND THE CRUISING ALTITUDE TO THE FUEL CONSUMPTION VS. HORSEPOWER CHART.

CRUISING AIRSPEED

TO DETERMINE THE CRUISING AIRSPEED THAT RESULTS FROM THE HORSEPOWER BEING USED, APPLY THE HORSEPOWER AND THE CRUISING ALTITUDE TO THE CRUISING OPERATION CHART.

DENSITY ALTITUDE

EXCEPT WHEN CONTRARY TO THE PROBLEM POSED IN SPECIFIC TEST ITEMS, CONSIDER INDICATED ALTITUDE, PRESSURE ALTITUDE, AND DENSITY ALTITUDE AS BEING IDENTICAL IN DETERMINING CRUISE CONTROL DATA FOR THE AIRPLANE.

Figure 56. Bobwhite – Performance Data.

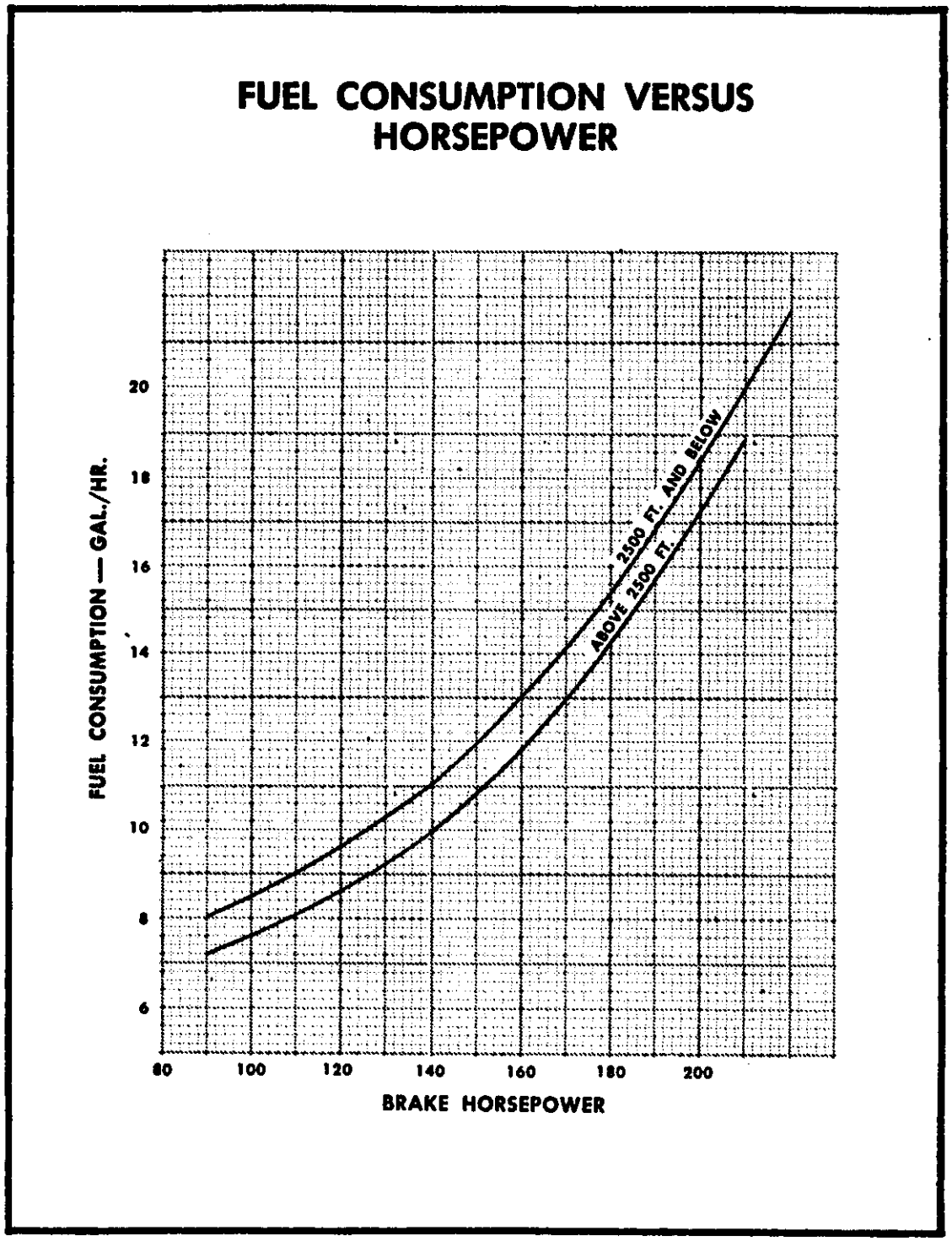


Figure 57. Bobwhite – Fuel Consumption Chart.

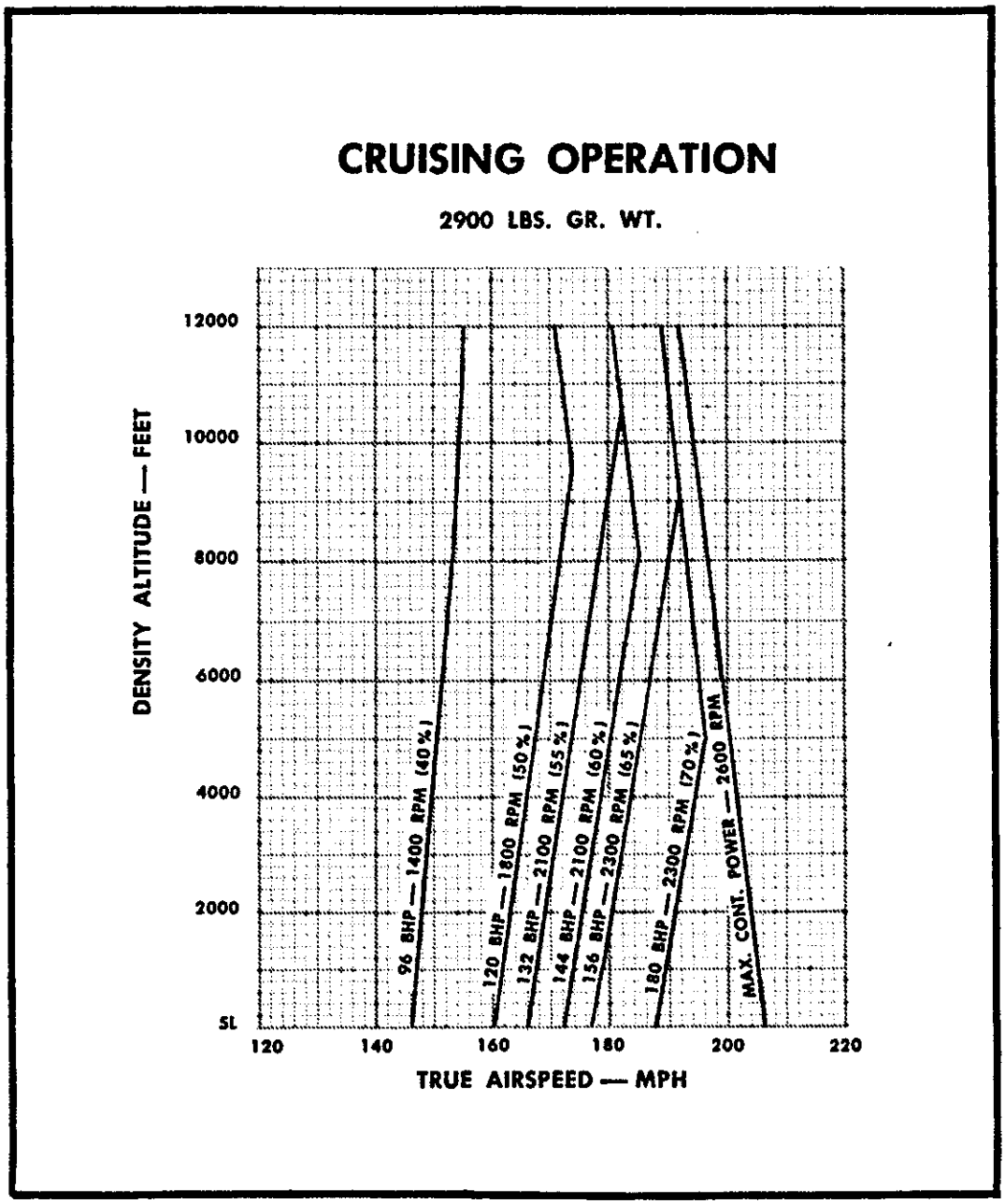


Figure 58. Bobwhite – Cruising Operation.

CRUISING POWER SETTINGS

SEA LEVEL			PRESSURE ALTITUDE		2000 FEET			
MP AT 2300 RPM	MP AT 2100 RPM	MP AT 1900 RPM	OAT °F.	BHP	OAT °F	MP AT 2300 RPM	MP AT 2100 RPM	MP AT 1900 RPM
21.4	23.6	26.5		156		21.3	23.6	26.3
20.2	22.3	24.8	0	144	0	20.0	22.0	24.5
19.1	21.0	23.3		132		18.7	20.6	22.8
17.9	19.6	21.8		120		17.6	19.3	21.5
21.7	24.0	26.9		156		21.6	24.0	26.7
20.5	22.7	25.2	20	144	20	20.3	22.4	24.9
19.5	21.4	23.7		132		19.1	21.0	23.2
18.2	19.9	22.2		120		17.9	19.6	21.9
22.0	24.4	27.3		156		21.9	24.3	27.1
20.8	23.0	25.6	40	144	40	20.6	22.7	25.3
19.8	21.7	24.1		132		19.4	21.3	23.6
18.5	20.2	22.5		120		18.2	19.9	22.2
22.3	24.7	27.7		156		22.0	24.5	27.3
21.1	23.3	26.0	60	144	50	20.7	22.9	25.5
20.0	22.0	24.5		132		19.5	21.4	23.8
18.7	20.5	22.8		120		18.3	20.0	22.4
22.5	24.9	27.9		156		22.2	24.6	27.5
21.2	23.5	26.1	70	144	60	20.9	23.0	25.7
20.1	22.1	24.6		132		19.6	21.6	24.0
18.8	20.6	22.9		120		18.4	20.2	22.5
22.6	25.1	28.1		156		22.3	24.8	
21.3	23.6	26.3	80	144	70	21.0	23.2	25.8
20.2	22.2	24.8		132		19.7	21.7	24.1
18.9	20.7	23.0		120		18.5	20.3	22.6
22.8	25.2	28.3		156		22.5	25.0	
21.4	23.7	26.5	90	144	80	21.1	23.3	26.0
20.3	22.3	24.9		132		19.8	21.8	24.3
18.9	20.8	23.0		120		18.6	20.4	22.7
22.9	25.4	28.5		156		22.6	25.2	
21.5	23.8	26.6	100	144	90	21.2	23.4	26.2
20.3	22.3	25.1		132		19.9	21.9	24.4
19.0	20.9	23.1		120		18.6	20.5	22.7

4000 FEET					6000 FEET			
21.0	23.3			156		20.9	23.0	
19.8	21.8	24.3	0	144	0	19.6	21.6	
18.4	20.3	22.5		132		18.3	20.2	22.4
17.4	19.1	21.2		120		17.2	18.9	21.0
21.3	23.7			156		21.2	23.4	
20.1	22.2	24.7	20	144	20	19.9	22.0	
18.8	20.5	22.9		132		18.7	20.6	22.8
17.7	19.4	21.6		120		17.5	19.2	21.4
21.6	24.0			156		21.4	23.5	
20.4	22.5	25.2	40	144	30	20.1	22.1	
19.1	21.0	23.3		132		18.8	20.7	23.0
18.0	19.7	21.9		120		17.7	19.4	21.6
21.7	24.1			156		21.5	23.7	
20.5	22.6	25.3	50	144	40	20.2	22.3	
19.1	21.1	23.5		132		19.0	20.9	23.2
18.1	19.9	22.1		120		17.8	19.5	21.7
21.9	24.3			156		21.6		
20.7	22.8	25.5	60	144	50	20.3	22.5	
19.3	21.3	23.7		132		19.1	21.0	23.4
18.2	20.0	22.2		120		17.9	19.6	21.9
22.0	24.5			156		21.8		
20.8	23.0		70	144	60	20.5	22.6	
19.4	21.4	23.8		132		19.2	21.2	23.6
18.3	20.1	22.3		120		18.0	19.8	22.0
22.2	24.7			156		21.9		
20.9	23.1		80	144	70	20.6	22.8	
19.5	21.5	24.0		132		19.3	21.3	23.7
18.4	20.2	22.4		120		18.1	19.9	22.1
22.3	24.9			156		22.1		
21.0	23.2		90	144	80	20.7	22.9	
19.6	21.6	24.1		132		19.4	21.4	23.9
18.4	20.3	22.4		120		18.2	20.0	22.2

8000 FEET			PRESSURE ALTITUDE		10000 FEET			
MP AT 2300 RPM	MP AT 2100 RPM	MP AT 1900 RPM	OAT °F	BHP	OAT °F	MP AT 2300 RPM	MP AT 2100 RPM	MP AT 1900 RPM
20.7				156		20.5		
19.4	21.5		0	144	−10	19.1		
18.1	19.9			132		17.7	19.5	
16.9	18.7	20.7		120		16.6	18.2	20.2
21.0				156				
19.7	21.9		20	144	0	19.3		
18.5	20.3			132		17.9	19.7	
17.2	19.0	21.1		120		16.8	18.4	20.4
21.2				156				
19.9	22.0		30	144	10	19.6		
18.6	20.4			132		18.1	19.9	
17.4	19.2	21.3		120		16.9	18.6	20.6
21.3				156				
20.0			40	144	20	19.6		
18.8	20.6			132		18.3	20.1	
17.5	19.3	21.4		120		17.1	18.7	
21.4				156				
20.1			50	144	30	19.8		
18.9	20.7			132		18.4	20.2	
17.6	19.4	21.6		120		17.3	18.9	
21.6				156				
20.3			60	144	40	19.9		
19.0	20.9			132		18.6	20.4	
17.7	19.6	21.7		120		17.4	19.0	
21.7				156				
20.4			70	144	50	20.0		
19.1	21.0			132		18.7	20.5	
17.8	19.7	21.8		120		17.5	19.1	
21.9				156				
20.5			80	144	60	20.2		
19.2	21.1			132		18.8		
17.9	19.8	21.9		120		17.6	19.3	

12000 FEET				
			156	
18.9		−10	144	
17.6			132	
16.4	18.0		120	
			156	
19.1		0	144	
17.8			132	
16.6	18.2		120	
			156	
		10	144	
18.0			132	
16.7	18.4		120	
			156	
		20	144	
18.2			132	
16.9	18.5		120	
			156	
		30	144	
18.3			132	
17.1	18.7		120	
			156	
		40	144	
18.5			132	
17.2	18.8		120	
			156	
		50	144	
18.6			132	
17.3	18.9		120	
			156	
		60	144	
18.7			132	
17.4	19.1		120	

75 PERCENT POWER — 180 BHP — 2300 RPM

OAT	SEA LEVEL AT 2300 RPM	2000 FEET AT 2300 RPM	4000 FEET AT 2300 RPM
0	23.7	23.6	23.4
20	24.0	23.9	23.8
40	24.4	24.3	24.2
60	24.8	24.7	24.6
80	25.2	25.2	25.0
100	25.7	25.7	25.4

Figure 59. Bobwhite – Cruising Power Settings.

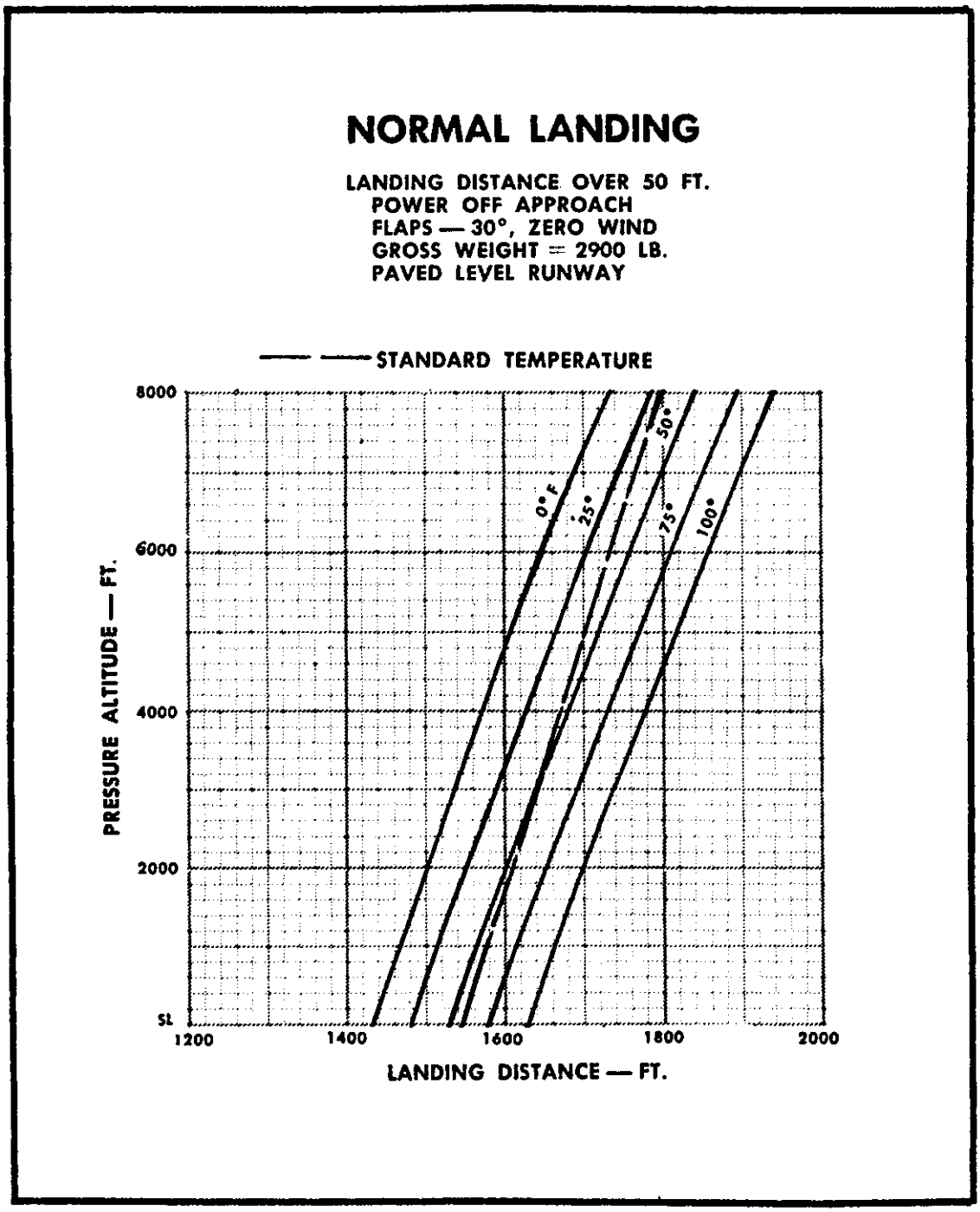


Figure 60. Bobwhite – Normal Landing Chart.

Airman's Information Manual EXCERPTS

AIR NAVIGATION RADIO AIDS

GENERAL

Various types of air navigation aids are in use today, each serving a special purpose in our system of air navigation.

These aids have varied owners and operators namely: the Federal Aviation Administration, the military services, private organizations; and individual states and foreign governments.

The Federal Aviation Administration has the statutory authority to establish, operate, and maintain air navigation facilities and to prescribe standards for the operation of any of these aids which are used by both civil and military aircraft for instrument flight in federally controlled airspace. These aids are tabulated in the Airport/Facility Directory by State in Part 3 of this Manual.

A brief description of these aids follows. Also, a composite table of normal usable altitudes and distances appears in Class of VOR/VORTAC/TACAN.

LOW/MEDIUM FREQUENCY (L/MF) RADIO RANGE

1. These ranges are classified by their type of antenna. Two types of low-frequency ranges are in use: Loop range (L) and Adcock range (A).

2. It is a popular misconception that loop ranges should not be used for homing. The dual-frequency or "simultaneous" type loop range transmits a nondirectional signal that can be used quite satisfactorily for this purpose.

3. Low-frequency radio range courses are subject to disturbances that result in multiple courses, signal fades and surges over rough country. Pilots flying over unfamiliar routes are cautioned to be on the alert to detect these vagaries, particularly over mountainous terrain.

NON-DIRECTIONAL RADIO BEACON (NDB)

1. A low or medium-frequency radio beacon transmits nondirectional signals whereby the pilot of an aircraft equipped with a loop antenna can determine his bearing and "home" on the station. These facilities normally operate in the frequency band of 200 to 415 kHz and transmit a continuous carrier with 1,020-cycle modulation keyed to provide identification except during voice transmission.

2. When a radio beacon is used in conjunction with the Instrument Landing System markers, it is called a Compass Locator.

3. All radio beacons except the compass locators transmit a continuous three-letter identification in code except during voice transmissions. Compass locators transmit a continuous two-letter identification in code. The first and second letters of the three-letter location identifier are assigned to the front course outer marker compass locator (LOM), and the second and third letters are assigned to the front course middle marker compass locator (LMM).

Example:

ATLANTA, ATL, LOM-AT, LMM-TL.

4. Voice transmissions are made on radio beacons unless the letter "W" (without voice) is included in the class designator (HW).

5. Radio beacons are subject to disturbances that result in ADF needle deviations, signal fades and interference from distant station during night operations. Pilots are cautioned to be on the alert for these vagaries.

VHF OMNIDIRECTIONAL RANGE (VOR)

1. Omniranges operate within the 108-118 MHz freqency band and have a power output of approximately 200 watts. The equipment is VHF, thus, it is subject to line-of-sight restriction, and its range varies proportionally to the altitude of the receiving equipment. There is some "spill over," however, and reception at an altitude of 1000 feet is about 40 to 45 miles. This distance increases with altitude.

2. There is voice transmission on the VOR frequency and all information broadcast over L/MF ranges is also available over the VOR's.

3. The effectiveness of the VOR depends upon proper use and adjustment of both ground and airborne equipment.

a. **Accuracy:** The accuracy of course alignment of the VOR is excellent, being generally plus or minus 1°.

b. **Roughness:** On some VORs, minor course roughness may be observed, evidenced by course needle or brief flag alarm activity (some receivers are more subject to these irregularities than others). At a few stations, usually in mountainous terrain, the pilot may occasionally observe a brief course needle oscillation, similar to the indication of "approaching station." Pilots flying over unfamiliar routes are cautioned to be on the alert for these vagaries, and in particular, to use the "to-from" indicator to determine positive station passage.

(1) Certain propeller RPM settings can cause the VOR Course Deviation Indicator to fluctuate as much as ±6°. Slight changes to the RPM setting will normally smooth out this roughness. Helicopter rotor speeds may also cause VOR course disturbances. Pilots are urged to check for this propeller modulation phenomenon prior to reporting a VOR station or aircraft equipment for unsatisfactory operation.

4. The only positive method of identifying a VOR is by its Morse Code identification or by the recorded

Figure 61. AIM — Air Navigation Radio Aids.

automatic voice identification which is always indicated by use of the word "VOR" following the range's name. Reliance on determining the identification of an omnirange should never be placed on listening to voice transmissions by the Flight Service Station (FSS) (or approach control facility) involved. Many FSS remotely operate several omniranges which have different names from each other and in some cases none have the name of the "parent" FSS. (During periods of maintenance the coded identification is removed. See MAINTENANCE OF FAA NAVAIDS.)

5. Voice identification has been added to numerous VHF omniranges. The transmission consists of a voice announcement, "AIRVILLE VOR" (VORTAC) alternating with the usual Morse Code identification. If no air/ground communications facility is associated with the omnirange, "AIRVILLE UNATTENDED VOR" (VORTAC) will be heard.

VOR RECEIVER CHECK

1. Periodic VOR receiver calibration is most important. If a receiver's Automatic Gain Control or modulation circuit deteriorates, it is possible for it to display acceptable accuracy and sensitivity close in to the VOR or VOT and display out-of-tolerance readings when located at greater distances where weaker signal areas exist. The likelihood of this deterioration varies between receivers, and is generally considered a function of time. The best assurance of having an accurate receiver is periodic calibration. Yearly intervals are recommended at which time an authorized repair facility should recalibrate the receiver to the manufacturer's specifications.

2. Part 91.25 of the Federal Aviation Regulations provides for certain VOR equipment accuracy checks prior to flight under instrument flight rules. To comply with this requirement and to ensure satisfactory operation of the airborne system, the FAA has provided pilots with the following means of checking VOR receiver accuracy: (1) VOR test facility (VOT), (2) certified airborne check points, and (3) certified check points on the airport surface.

a. The VOR test facility (VOT) transmits a test signal for VOR receivers which provides users of VOR a convenient and accurate means to determine the operational status of their receivers. The facility is designed to provide a means of checking the accuracy of a VOR receiver while the aircraft is on the ground. The radiated test signal is used by tuning the receiver to the published frequency of the test facility. With the Flight Path Deviation Indicator (FPDI) centered the omnibearing selector should read 0° with the to-from indication being "from" or the omnibearing selector should read 180° with the to-from indication reading "to." Should the VOR receiver be of the automatic indicating type, the indication should be 180°. Two means of identification are used with the VOR radiated test signal. In some cases a continuous series of dots is used while in others a continuous 1020 cycletone will identify the test signal. Information concerning an individual test signal can be obtained from the local Flight Service Station.

b. Airborne and ground check points consist of certified radials that should be received at specific points on the airport surface, or over specific landmarks while airborne in the immediate vicinity of the airport.

c. Should an error in excess of ±4° be indicated through use of the ground check, or ±6° using the airborne check, IFR flight shall not be attempted without first correcting the source of the error. CAUTION: no correction other than the "correction card" figures supplied by the manufacturer should be applied in making these VOR receiver checks.

d. The list of airborne check points and ground check points is published in Part 3. VOT's are included with the airport information in Part 3.

e. If dual system VOR (units independent of each other except for the antenna) is installed in the aircraft, the person checking the equipment may check one system against the other. He shall tune both systems to the same VOR ground facility and note the indicated bearings to that station. The maximum permissiable variations between the two indicated bearings is 4°.

TACTICAL AIR NAVIGATION (TACAN)

1. For reasons peculiar to military or naval operations (unusual siting conditions, the pitching and rolling of a naval vessel, etc.) the civil VOR-DME system of air navigation was considered unsuitable for military or naval use. A new navigational system, Tactical Air Navigation (TACAN), was therefore developed by the military and naval forces to more readily lend itself to military and naval requirements. As a result, the FAA has been in the process of integrating TACAN facilities with the civil VOR-DME program. Although the theoretical, or technical principles of operation of TACAN equipment are quite different from those of VOR-DME facilities, the end result, as far as the navigating pilot is concerned, is the same. These integrated facilities are called VORTAC's.

2. TACAN ground equipment consists of either a fixed or mobile transmitting unit. The airborne unit in conjunction with the ground unit reduces the transmitted signal to a visual presentation of both azimuth and distance information. TACAN is a pulse system and operates in the UHF band of frequencies. Its use requires TACAN airborne equipment and does not operate through conventional VOR equipment.

VHF OMNIDIRECTIONAL RANGE/TACTICAL AIR NAVIGATION (VORTAC)

1. VORTAC is a facility consisting of two components, VOR and TACAN, which provides three individual services: VOR azimuth, TACAN azimuth and TACAN distance (DME) at one site. Although consisting of more than one component, incorporating more than one operating frequency, and using more than one antenna system, a VORTAC is considered to be a unified navigational aid. Both components of a VORTAC are envisioned as operating simultaneously and providing the three services at all times.

2. Transmitted signals of VOR and TACAN are each identified by three-letter code transmission and are interlocked so that pilots using VOR azimuth with TACAN distance can be assured that both signals being received are definitely from the same ground station. A supplementary automatic voice identification is being added to the VOR. The frequency channels of the VOR and the TACAN at each VORTAC facility are "paired" in accordance with a national plan to simplify airborne operation.

Figure 62. AIM – Air Navigation Radio Aids – cont'd.

DISTANCE MEASURING EQUIPMENT (DME)

1. In the operation of DME, paired pulses at a specific spacing are sent out from the aircraft (this is the interrogation) and are received at the ground station. The ground station (transponder) then transmits paired pulses back to the aircraft at the same pulse spacing but on a different frequency. The time required for the round trip of this signal exchange is measured in the airborne DME unit and is translated into distance (Nautical Miles) from the aircraft to the ground station.

2. Operating on the line-of-sight principle, DME furnishes distance information with a very high degree of accuracy. Reliable signals may be received at distances up to 199 NM at line-of-sight altitude with an accuracy of better than ¼ mile or 2% of the distance, whichever is greater. Distance information received from DME equipment is SLANT RANGE distance and not actual horizontal distance.

3. DME operates on frequencies in the UHF spectrum between 962 MHz and 1213 MHz. Aircraft equipped with TACAN equipment will receive distance information from a VORTAC automatically, while aircraft equipped with VOR must have a separate DME airborne unit.

4. VOR/DME and VORTAC navigation facilities established by the FAA provide azimuth and distance information from co-located components under a frequency pairing plan. Frequency pairing allows the use of a single receiver tuning selector capable of simultaneously selecting a paired VOR and TACAN (DME) receiver frequency.

5. Due to the limited number of available frequencies, assignment of frequency pairs has been required for certain military noncollocated VOR and TACAN facilities which serve the same area but which may be separated from a few to many miles. Additional frequency assignments have been made for remotely located military TACAN facilities which may be within reception range of a randomly paired ILS localizer. Selection of a DME channel while tuned to a randomly paired VOR or ILS frequency could result in the reception of distance information from a source which is remotely located from the VOR or ILS facility.

6. VOR/DME, VORTAC and ILS/DME facilities are readily identified by synchronized identifications which are transmitted on a time share basis. Identification of noncollocated VOR or ILS and TACAN facilities are not synchronized, resulting in intermixing and apparent distortion during TACAN identification whenever simultaneous aural monitoring of VOR or ILS and TACAN identification is attempted. DME equipment has been installed at only a few ILS locations and any DME presentation while using an ILS frequency which does not have an associated DME would be originating from a randomly paired remote location.

7. Aircraft receiving equipment which provides for automatic DME selection assures reception of azimuth and distance information from a common source whenever designated VOR/DME, VORTAC and ILS/DME navigation facilities are selected. Until further advised, pilots are cautioned to disregard any distance displays from automatically selected DME equipment whenever VOR or ILS facilities, which do not have the DME feature installed, are being used for position determination.

CLASS OF VOR/VORTAC/TACAN

VOR, VORTAC, and TACAN aids are classed according to their operational use. There are three classes:

T (Terminal
L (Low altitude)
H (High altitude)

T class facilities are used to provide service at terminal locations where it is not practical to frequency protect the larger service range of an L class facility. The normal service range for the T, L, and H class aids is included in the following table. Certain operational requirements make it necessary to use some of these aids at greater service ranges than are listed in the table. Extended range is made possible through flight inspection determinations. Some aids also have lesser service range due to location, terrain, frequency protection, etc. Restrictions to service range are listed in Part 3 of this manual.

VOR/VORTAC/TACAN NAVAIDS

Normal Usable Altitudes and Radius Distances

Class	Altitudes	Distance (miles)
T	12,000′ and below	25
L	Below 18,000′	40
H	Below 18,000′	40
H	14,500′ — 17,999′	100*
H	18,000′ — FL 450	130
H	Above FL 450	100

*Applicable only within the conterminous U.S.

L/MF RADIO BEACON (RBN)

Usable Radius Distances for all Altitudes

Class	Power (watts)	Distance (miles)
Compass Locator	Under 25	15
MH	Under 50	25
H	50 — 1999	*50
HH	2000 or more	75

*Service range of individual facilities may be less than 50 miles. See Restrictions to Enroute Navigation Aids, Part 3.

L/MF RADIO RANGES

Usable Radius Distances for all Altitudes

Power (watts)	Distance (miles)
Under 100	40
101 — 200	50
201 — 400	60
Over 400	75

Figure 63. AIM – Air Navigation Radio Aids – cont'd.

FREQUENCY PAIRING PLAN

VOR—ILS (even) (odd) Frequency	TACAN Channel	VOR Frequency	TACAN Channel
108.0 MHz	17	112.0 MHz	57
108.1	18	112.1	58
108.2	19	112.2	59
108.3	20	112.3	70
108.4	21	112.4	71
108.5	22	112.5	72
108.6	23	112.6	73
108.7	24	112.7	74
108.8	25	112.8	75
108.9	26	112.9	76
109.0	27	113.0	77
109.1	28	113.1	78
109.2	29	113.2	79
109.3	30	113.3	80
109.4	31	113.4	81
109.5	32	113.5	82
109.6	33	113.6	83
109.7	34	113.7	84
109.8	35	113.8	85
109.9	36	113.9	86
110.0	37	114.0	87
110.1	38	114.1	88
110.2	39	114.2	89
110.3	40	114.3	90
110.4	41	114.4	91
110.5	42	114.5	92
110.6	43	114.6	93
110.7	44	114.7	94
110.8	45	114.8	95
110.9	46	114.9	96
111.0	47	115.0	97
111.1	48	115.1	98
111.2	49	115.2	99
111.3	50	115.3	100
111.4	51	115.4	101
111.5	52	115.5	102
111.6	53	115.6	103
111.7	54	115.7	104
111.8	55	115.8	105
111.9	56	115.9	106
		116.0	107
		116.1	108
		116.2	109
		116.3	110
		116.4	111
		116.5	112
		116.6	113
		116.7	114
		116.8	115
		116.9	116
		117.0	117
		117.1	118

VOR—ILS (even)(odd) Frequency	TACAN Channel	VOR Frequency	TACAN Channel
		117.2	119
		117.3	120
		117.4	121
		117.5	122
		117.6	123
		117.7	124
		117.8	125
		117.9	126

EXCERPTS

FREQUENCY UTILIZATION PLAN

AIR NAVIGATION AIDS

108.1–111.9 MHz: ILS localizer with or without simultaneous radio-telephone channel operating on odd-tenth decimal frequencies (108.1, 108.3 etc)

108.2–111.8 MHz: VOR's operating on even-tenth decimal frequencies (108.2, 108.4 etc.).

112.0–117.9 MHz: Airway track guidance. (VORs)

COMMUNICATIONS

118.0–121.4 MHz: Air Traffic Control Communications
121.5 MHz: Emergency (World-Wide)
121.6–121.9 MHz: Airport Utility (Ground Control)
121.95 MHz: Flight Test
122.0 MHz: FSS's, Weather, Selected Locations, Private Aircraft and Air Carriers
122.1 MHz: Private Aircraft to Flight Service Stations
122.2, 122.3 MHz: FSS's, Private Aircraft, Selected Locations
122.4, 122.5, 122.7 MHz: Private Aircraft to Towers
122.6 MHz: FSS's, Private Aircraft
122.8, 123.0, 122.85, 122.95 MHz: Aeronautical Advisory Stations (UNICOM)
122.9 MHz: Aeronautical Multicom Stations
123.1 MHz: Search and Rescue (SAR) Scene of Action
123.05 MHz: Aeronautical Advisory Stations (UNICOM) Heliports
123.15–123.55 MHz: Flight Test
123.3, 123.5 MHz: Flying School
123.6 MHz: FSS's, Airport Advisory Service
123.6–128.8 MHz: Air Traffic Control Communications
128.85–132.0 MHz: Aeronautical Enroute Stations (Air Carrier)
132.05–135.95 MHz: Air Traffic Control Communications

Figure 64. AIM – Air Navigation Radio Aids – cont'd.

AIRMAN'S INFORMATION MANUAL
EXCERPT

WEATHER

GENERAL

1. The Weather Bureau maintains a comprehensive surface and upper air weather observing program and a nation-wide aviation weather forecasting and pilot briefing service.

2. Weather observations are made each hour or more often at over 600 locations in the United States. These observations may be used to determine the present weather conditions for flight planning purposes.

3. Every six hours the Weather Bureau's Aviation Forecasting Centers prepare detailed flying weather forecasts for 12-hour periods for about 420 air terminals in the United States including Alaska and Hawaii. In addition, 24-hour terminal forecasts are provided for about 130 major airports throughout the country. Every six hours a detailed 12-hour area forecast is prepared for each of the 20 areas into which the conterminous United States has been divided for forecasting purposes. Area forecasts are also issued for Alaska and Hawaii. Winds aloft forecasts are provided for about 120 locations in the United States and Alaska for flight operational purposes. All of the above flying weather forecasts are given wide distribution via teletypewriter circuits.

4. Available aviation weather reports and forecasts are displayed at each Weather Bureau Station and FAA Flight Service Station. Pilots should feel free to help themselves to this information or to ask the assistance of the duty employee.

5. When telephoning for information, use the following procedures:

a. Identify yourself as a pilot and give aircraft identification if known. (Many persons calling WB stations want information for purposes other than flying.)

b. State your intended route, destination, proposed departure time, and estimated time en route.

c. Advise if prepared to fly IFR.

6. Direct pilot-to-weather briefer service is available by radio contact with any Flight Service Station operated by the FAA. Flight Service Specialists are qualified and certificated by the ESSA/WB as Pilot Weather Briefers. They are not authorized to make original forecasts but are authorized to adapt, translate and interpret available forecasts and reports directly into terms of the weather conditions which you can expect along your flight route and at destination. They also will assist you in selecting an alternate course of action in the event adverse weather is encountered. It is not necessary to be thoroughly familiar with the standard phraseologies and procedures for air/ground communications. A brief call stating your message in your own words will receive immediate attention.

7. Combined station/tower (CS/T) personnel are not certificated pilot weather briefers; however, they can assist you by providing factual data from weather reports and forecasts.

TRANSCRIBED WEATHER BROADCASTS

1. Equipment is provided at selected FAA FSSs by which meteorological and Notice to Airmen data is recorded on tapes and broadcast continuously over the low-frequency (200–415 kHz) navigational aid (L/MF range or H facility) and VOR.

2. Broadcasts are made from a series of individual tape recordings. The first three tapes identify the station, give general weather forecast conditions in the area, pilot reports (PIREP), radar reports when available, and winds aloft data. The remaining tapes contain weather at selected locations within a 400-mile radius of the central point. Changes, as they occur are transcribed onto the tapes.

3. Automatic transcribed broadcasts service is available on class H facilities and VORs designated as follows:

a. H-SAB—A class H radio beacon required for IFR radio navigation and/or air traffic control and for automatic transcribed weather broadcast service. This class facility will be depicted on radio facility, Sectional and WAC type charts.

b. SABH—A class H radio beacon having limited navigational use in that it is not flight inspected for IFR certification or primarily used for air traffic control. This aid will provide the automatic transcribed weather broadcast service and will be depicted on Sectional and WAC type charts, only.

c. VORs designated as ABVOR or (H)ABVORTAC.

4. Operation of either H-SAB or SABH is essentially the same. All have a code identification sent at frequency intervals keyed simultaneously with the voice signals. Although not essential, it may be advantageous to listeners to equip their receivers with a 1020 cycle code rejection filter which, when switched to the "voice" position, will silence the keyed code identification signal.

5. The AB (automatic transcribed service) component of H-SAB's, SABH's and ABVORs will operate continuously except during those periods when the transcription equipment is inoperative. During these periods manual broadcasts, scheduled (H+15 hourly) and nonscheduled will be made on the AB facilities.

SCHEDULED WEATHER BROADCASTS

1. All flight service stations having voice facilities on radio ranges (VORs) or radio beacons (NDBs) broadcast weather reports and Notice to Airmen information at 15 minutes past each hour from reporting points within approximately 150 miles from the broadcast station.

Figure 65. AIM – Weather – (Broadcasts).

2. The material and the order in which it is broadcast by each station:

a. Alert notice (ALNOT) announcement.

b. Hourly sequence weather reports, including remarks.

c. Significant Meteorology (SIGMET) or Advisory for Light Aircraft (AIRMET) (if available).

d. Pilot Reports (PIREPS) when available.

e. Radar Reports (RAREPS) when available.

f. Lost or overdue aircraft notice.

g. NOTAMS or AIRADS not published in the AIM.

NOTE.—Winds aloft forecast will be transmitted only on pilot's request.

3. The time of observation of weather reports included in a scheduled broadcast normally is 58 minutes past the hour preceding the broadcast. When the time of observation is otherwise, the observation time is given.

WEATHER BROADCAST FORMAT

1. SCHEDULED WEATHER BROADCAST

a. The broadcast begins with the announcement "Aviation Broadcast, weather."

b. The name of the location to which the weather report or other data applies is spoken twice, and followed by:

(1) The state name once, when the location name is duplicated within 500 miles.

Example:

Springfield, Springfield, Missouri.

(2) The airport or origin once, when weather reports originate at more than one airport at the same geographical location.

Examples:

New York, New York, LaGuardia
New York, New York, Kennedy

c. The broadcast is terminated with a statement of the time in two digits indicating minutes only and a fraction to the nearest quarter minute.

Example:

"The time is one eight and one quarter."

2. UNSCHEDULED BROADCASTS

These broadcasts will be made at random times and will begin with the announcement "Aviation broadcast" followed by identification of the data. The location name will be spoken as set forth in 1b above.

Example:

Aviation Broadcast, Special Weather Report, (Notice to Airmen, Pilot Report, etc.) (location name twice) three seven (past the hour) observation . . . etc.

IN-FLIGHT WEATHER ADVISORIES

1. The Weather Bureau issues in-flight safety advisories designated as SIGMETs and AIRMETs.

2. The purpose of this service is to make available to any aircraft in-flight information on weather which may be hazardous to the flight. Whether or not the condition described is potentially hazardous to a particular flight is for the pilot himself to evaluate on the basis of his own experience and the operational limits of his aircraft.

3. SIGMET advisories include weather phenomena potentially hazardous to *all* aircraft, specifically:

a. Tornadoes.

b. Line of thunderstorms (squall lines).

c. Embedded thunderstorms.

d. Hail ¾" or more.

e. Severe and extreme turbulence.

f. Heavy icing.

g. Widespread duststorms/sandstorms, lowering visibilities to less than two miles.

4. AIRMETs include weather phenomena of less severity than that covered by SIGMETs which are potentially hazardous to aircraft having limited capability because of lack of equipment or instrumentation, or pilot qualifications and are at least of operational interest to *all* aircraft, specifically:

a. Moderate icing.

b. Moderate turbulence over an extensive area.

c. Extensive areas of visibilities less than two miles and/or ceilings less than 1000 feet, including mountain ridges and passes.

d. Winds of 40 knots or more at or within 2000 feet of the surface.

NOTE.—SIGMETs apply to *all categories of aircraft.* When SIGMET and AIRMET weather categories apply simultaneously for approximately the same area, the advisories are combined and identified with the SIGMET designation. The words "Adnly" or "Also" area used to connect a combined advisory.

5. Identification of SIGMETs and AIRMETs—Advisories are identified by a letter and number beginning 0000 GMT in the Flight Advisory Service (FAWS) office where issued. The first SIGMET or AIRMET is identified as "Alfa 1" and each succeeding *related* advisory retains the same letter designator until cancelled but is given the next number, i.e., "Alfa 2," "Alfa 3," etc. A SIGMET or AIRMET automatically cancels a preceding advisory of the same category and lettering. For example, SIGMET Bravo 2 supersedes SIGMET Bravo 1 and AIRMET Alfa 4 cancels AIRMET Alfa 3. If a SIGMET or AIRMET condition develops in a second distinctly separate sector of the FAWS area, the advisory is identified as "Bravo 1," "Bravo 2," etc. Similarly, a third area is identified as "Charlie 1," "Charlie 2," etc.

6. The following are examples of a SIGMET, AIRMET, and a combination of the two:

a. KANSAS CITY SIGMET ALFA 2. SOLID LINE THUNDERSTORMS 50 MILES WIDE FROM WEST OF GRAND ISLAND NEBRASKA TO HILL CITY TO GARDEN CITY KANSAS AT 2000 GMT MOVING EAST AT 35 KNOTS REACHING LINCOLN-SALINA-HUTCHINSON LINE BY 0100 GMT. THUNDERSTORMS LOCALLY SEVERE WITH TOPS TO 45 THOUSAND.

b. MEMPHIS AIRMET BRAVO 1. TENNESSEE SOUTH OF LINE FROM DYERSBURG TO NASHVILLE TO CROSSVILLE CONDITIONS LOWERING RAPIDLY IN RAIN AND FOG TO BELOW 1 THOUSAND FEET AND BELOW 2 MILES BY NOON WITH HIGHER TERRAIN OBSCURED. CONDITIONS CONTINUING BEYOND 2000 GMT.

Figure 66. AIM – Weather – (In-Flight Advisories).

c. WASHINGTON AIRMET ALFA 1 CANCELED. SIGMET ALFA 2. MODERATE OR MORE CLEAR AIR TURBULENCE EXTENDING FROM SOUTH CENTRAL VIRGINIA THROUGH DELAWARE AT 14 THOUSAND TO 24 THOUSAND FEET CONTINUING TO 1300 GMT OR LATER. ADDITIONAL AIRMET. OVER EASTERN VIRGINIA EASTERN MARYLAND AND DELAWARE MODERATE ICING 2 THOUSAND TO 8 THOUSAND FEET DECREASING BUT WITH WINDS LOWER LEVELS BECOMING 40 TO 50 KNOTS BY 1300 GMT WITH MODERATE TURBULENCE.

7. FAA flight service stations (FSSs) broadcast SIGMETs and AIRMETs during their valid period when they pertain to the area within 150 NM of the FSS as follows:

TURBULENCE REPORTING CRITERIA TABLE

Intensity	*Aircraft Reaction*	*Reaction Inside Aircraft*	*Reporting Term Definition*
LIGHT	Turbulence that momentarily causes slight, erratic changes in altitude and/or attitude (pitch, roll, yaw). Report as *Light Turbulence*;* or Turbulence that causes slight, rapid and somewhat rhythmic bumpiness without appreciable changes in altitude or attitude. Report as *Light Chop.*	Occupants may feel a slight strain against seat belts or shoulder straps. Unsecured objects may be displaced slightly. Food service may be conducted and little or no difficulty is encountered in walking.	Occasional—Less than 1/3 of the time. Intermittent—1/3 to 2/3. Continuous—More than 2/3.
MODERATE	Turbulence that is similar to Light Turbulence but of greater intensity. Changes in altitude and/or attitude occur but the aircraft remains in positive control at all times. It usually causes variations in indicated airspeed. Report as *Moderate Turbulence*;* or Turbulence that is similar to Light Chop but of greater intensity. It causes rapid bumps or jolts without appreciable changes in aircraft altitude or attitude. Report as *Moderate Chop.*	Occupants feel definite strains against seat belts or shoulder straps. Unsecured objects are dislodged. Food service and walking are difficult.	NOTE—Pilots should report location(s), time (GMT), intensity, whether in or near clouds, altitude, type of aircraft and, when applicable, duration of turbulence. Duration may be based on time between two locations or over a single location. All locations should be readily identifiable. Example: a. Over Omaha, 1232Z, Moderate Turbulence, in cloud, Flight Level 310, B707. b. From 50 miles south of Albuquerque to 30 miles north of Phoennx, 1210Z to 1250Z, occasional Moderate Chop, Flight Level 330, DC8.
SEVERE	Turbulence that causes large, abrupt changes in altitude and/or attitude. It usualy causes large variations in indicated airspeed. Aircraft may be momentarily out of control. Report as *Severe Turbulence.**	Occupants are forced violently against seat belts or shoulder straps. Unsecured objects are tossed about. Food service and walking are impossible.	
EXTREME	Turbulence in which the aircraft is violently tossed about and is practically impossible to control. It may cause structural damage. Report as *Extreme Turbulence.**		

* High level turbulence (normally above 15,000 feet ASL) not associated with cumuliform cloudiness, including thunderstorms, should be reported as CAT (clear air turbulence) preceded by the appropriate intensity, or light or moderate chop.

Figure 67. AIM – Weather (Turbulence Reporting Criteria).

a. SIGMETs—At 15 minute intervals (H+00, H+15*, H+30 and H+45); and AIRMETs—at 30 minute intervals (H+15* and H+45) during the first hour after issuance.

b. Thereafter, an alert notice will be broadcast at H+15* and H+45 during the valid period of the advisories.

Example:

"Washington SIGMET (or AIRMET) Bravo 3 is current."

*Included in the scheduled weather broadcast.

8. Pilots, upon hearing the alert notice, if they have not received the advisory or are in doubt, should contact the nearest FSS and ascertain whether the advisory is pertinent to their flights.

PILOT WEATHER REPORTS (PIREPS)

1. Whenever ceilings are at or below 5,000 feet, visibilities at or below five miles, or thunderstorms are reported or forecast, FAA Stations are required to solicit and collect PIREPS which describe conditions aloft. Pilots are urged to cooperate and volunteer reports of cloud tops, upper cloud layers, thunderstorms, ice, turbulence, strong winds, and other significant flight condition information. Such conditions observed between weather reporting stations are vitally needed. The PIREPS should be given to the FAA ground facility with which communication is established, i.e., FSS or Air Route Traffic Control Center. In addition to complete PIREPS, pilots can materially help round out the in-flight weather picture by adding to routine position reports, both VFR and IFR, the type of aircraft and the following phrases as appropriate:

ON TOP
BELOW OVERCAST
WEATHER CLEAR
MODERATE (or HEAVY) ICING
LIGHT, MODERATE, SEVERE, EXTREME TURBULENCE
FREEZING RAIN (or DRIZZLE)
THUNDERSTORM (location)
BETWEEN LAYERS
ON INSTRUMENTS
ON AND OFF INSTRUMENTS

2. If pilots are not able to make PIREPS by radio, reporting upon landing of the in-flight conditions encountered to the nearest Flight Service Station or Weather Bureau Airport Station will be helpful. Some of the uses made of the reports are:

a. The airport traffic control tower uses the reports to expedite the flow of air traffic in the vicinity of the field and also forwards reports to other interested offices.

b. The Flight Service Station uses the reports to brief other pilots.

c. The local Weather Bureau Office uses the reports in briefing other pilots and in forecasting.

d. The Air Route Traffic Control Center uses the reports to expedite the flow of en route traffic and determine most favorable altitudes.

e. The Weather Bureau forecast office finds pilot reports very helpful in issuing advisories of hazardous weather conditions. This office also uses the reports to brief other pilots, and in forecasting.

CLEAR AIR TURBULENCE (CAT)

Clear air turbulence (CAT) has become a very serious operational factor to flight operations at all levels and especially to jet traffic flying in excess of 15,000 feet. The best available information on this phenomena must come from pilots via the PIREPS procedures. All pilots encountering CAT conditions are urgently requested to report *time*, *location* and *intensity* (light, moderate, severe or extreme) of the element to the FAA facility with whom they are maintaining radio contact. If time and conditions permit, elements should be reported according to the standards for other PIREPS and position reports. See Turbulence Reporting Criteria Table on preceding page.

REPORTING OF CLOUD HEIGHTS

1. Ceiling, by definition in Part I Federal Aviation Regulations, and as used in Aviation Weather Reports and Forecasts, is the height *above ground (or water) level* of the lowest layer of clouds or obscuring phenomenon that is reported as "broken", "overcast", or "obscuration" and not classified as "thin" or "partial". For example, a forecast which reads "CIGS WILL BE GENLY 1 TO 2 THSD FEET" refers to heights *above ground level* (AGL). On the other hand, a forecast which reads "BRKN TO OVC LYRS AT 8 TO 12 THSD MSL" states that the height is *above mean sea level* (MSL).

2. Pilots usually report height values above mean sea level, since they determine heights by the altimeter. This is taken in account when disseminating and otherwise applying information received from pilots. ("Ceilings" heights are always above ground level.) In reports disseminated as PIREPS, height references are given the same as received from pilots, that is above mean sea level (MSL or ASL). In the following example, however, a pilot report of the heights of the bases and tops of an overcast layer in the terminal area is used in two ways in a surface aviation weather report:

A12⊕2FK 132/49/47/0000/ØØ2/⊕23

3. In this example the weather station has converted the pilot's report of the height of base of the overcast from the height (MSL) indicated on the pilot's altimeter to height above ground and has shown by the prefix "A" that the ceiling height was determined by an aircraft. The height of cloud tops shown in remarks (⊕23) is *above mean sea level* (ASL or MSL) as initially reported by the pilot.

4. In aviation forecasts (Terminal, Area, or In-flight Advisories), ceiling are denoted by the prefix "C" when used with sky cover symbols as in "LWRG TO C5⊕-1TRW", or by the contraction "CIG" before, or the contraction "AGL" after, the forecast cloud height value. When the cloud base is given in height above mean sea level, it is so indicated by the contraction "MSL" or "ASL" following the height value. The heights of clouds tops, freezing level, icing and turbulence are always given in heights above means sea level (ASL or MSL).

5. Attention is invited to the Weather Bureau publication "Key to Aviation Weather Reports and Forecasts." This is an easy-reference card which explains how to

Figure 68. AIM – Weather (PIREPS).

MARKING

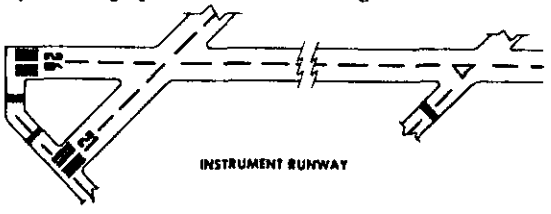
1. In the interest of safety, regularity, or efficiency of aircraft operations, the FAA has recommended for the guidance of the public the following airport marking. (Runway numbers and letters are determined from the approach direction. The number is the whole number nearest one-tenth the magnetic azimuth of the centerline of the runway, measured clockwise from the magnetic north.) The letter or letters differentiate between parallel runways:

For two parallel runways "L" "R"
For three parallel runways "L" "C" "R"

a. Basic Runway Marking—markings used for operations under Visual Flight Rules: centerline marking and runway direction numbers.

BASIC RUNWAY

b. Instrument Runway Marking—markings on runways served by a nonvisual navigation aid and intended for landings under instrument weather conditions: basic runway markings plus threshold marking.

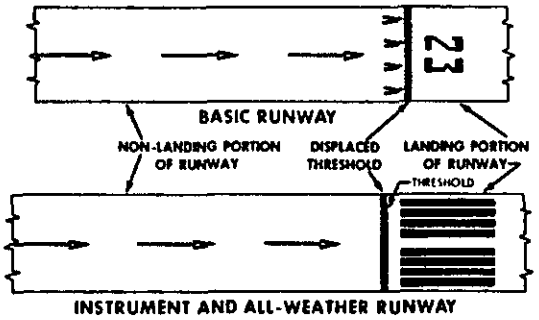


INSTRUMENT RUNWAY

c. All-Weather Runway Marking—markings on runways served by non-visual precision approach aids and on runways having special operational requirements: instrument runway marking, landing zone marking, plus side stripes.

ALL-WEATHER RUNWAY

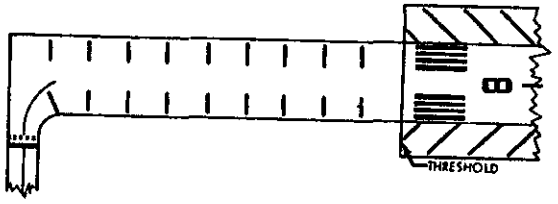
d. Threshold—A line perpendicular to the runway centerline designating the beginning of that portion of a runway usable for landing.



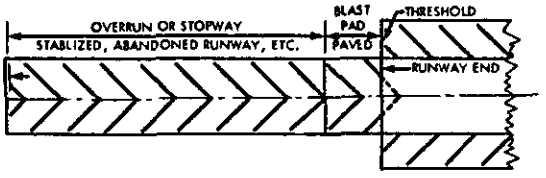
INSTRUMENT AND ALL-WEATHER RUNWAY

e. Displaced Threshold—A threshold that is not at the beginning of the full strength runway pavement.

f. Deceptive Area—Any surface or area which appears usable but which, due to the nature of its structure, is not intended for normal operational use by aircraft.



1. RELOCATED THRESHOLD



2. OVERRUN/STOPWAY AND BLAST PAD AREA

3. CLOSED RUNWAY OR TAXIWAY

g. Aiming Marker—to provide an aiming point for turbojet aircraft on other than all-weather marked runways, three stripes on either side of the runway centerline 75 feet long. This pattern of stripes will be located 1,000 feet from the landing threshold. n

h. Detailed Airport Marking information is published in FAA Advisory Circulars 150/5340-1B "Marking of Serviceable Runways and Taxiways" and 150/5340-7 "Marking of Deceptive, Closed, and Hazardous Areas on Airports.

HELICOPTER LANDING AREA

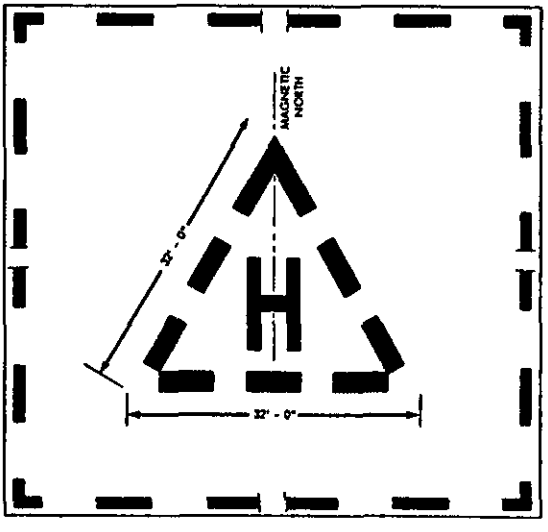


Figure 69. AIM – Airport, Air Navigation Lighting and Marking Aids.

EXCERPT

AIRPORT/FACILITY DIRECTORY

LOCATION

The airport location is given in nautical miles (to the nearest mile) and direction from center of referenced city.

ELEVATION

Elevation is given in feet above mean sea level and is based on highest usable portion of the landing area. When elevation is sea level, elevation will be indicated as "00." When elevation is below sea level, a minus sign (−) will precede the figure.

RUNWAYS

The runway surface length, and weight bearing capacity are listed for the longest instrument runway or sealane, or the longest active landing portion of the runway or strip, given to the nearest hundred feet, using 70 feet as the division point, i.e., 1468 feet would be shown as "14"; 1474 feet would be shown as "15". Runway lengths prefixed by the letter "H" indicates that runways are hard surfaced (concrete; asphalt; bitumen, or macadam with a seal coat). If the runway length is not prefixed, the surface is sod, clay, etc. The total number of runways available is shown in parenthesis. (However, only hard surfaced runways are counted at airfields with both hard surfaced and sod runways.)

RUNWAY WEIGHT BEARING CAPACITY

Add 000 to figure following S, T, TT and MAX for gross weight capacity, e.g., (S-000).

S-Runway weight bearing capacity for aircraft with single-wheel type landing gear. (DC-3), etc.

T-Runway weight bearing capacity for aircraft with twin-wheel type landing gear. (DC-6), etc.

TT-Runway weight bearing capacity for aircraft with twin-tandem type landing gear. (707), etc.

Quadricycle and twin-tandem are considered virtually equal for runway weight bearing considerations, as are single-tandem and twin-wheel.

A blank space following the letter designation is used to indicate the runway weight bearing capacity to sustain aircraft with the same type landing gear, although definite figures are not available, e.g., (T-).

Omission of weight bearing capacity indicates information unknown. Footnote remarks are used to indicate a runway with a weight bearing greater than the longest runway.

LIGHTING

B: Rotating Light (Rotating beacon). (Green and white, split-beam and other types.) Omission of B indicates rotating light is either not available or not operating standard hours (sunset-sunrise).

NOTE.—Code lights are not codified, and are carried in Remarks.

L: Field Lighting. An asterisk (*) preceding an element indicates that it operates on prior request only (by phone call, telegram or letter). Where the asterisk is not shown, the lights are in operation or available sunset to sunrise or by request (radio call). L by itself indicates temporary lighting, such as flares, smudge pots, lanterns.

1—Portable runway lights (electrical)

2—Airport Boundary

3—Runway Floods

4—Low Intensity Runway

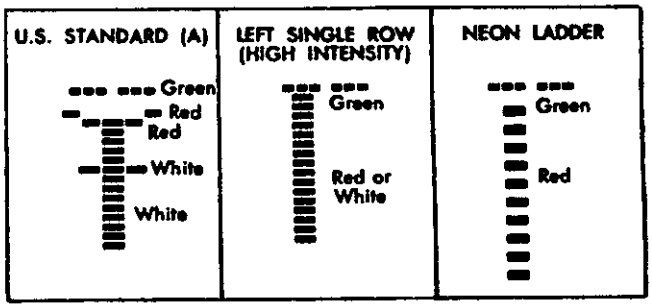
5—Medium Intensity Runway

6—High Intensity Runway

7—Instrument Approach (neon)

7A—Medium Intensity Approach Lights (MALS)

8A, B, or C—High Intensity Instrument Approach (ALS)



9—Sequence Flashing Lights (SFL)

10—Visual Approach Slope Indicator (VASI)

11—Runway end identifier lights (threshold strobe) (REIL)

12—Short approach light systems (SALS)

13—Runway alignment lights (RAIL)

14—Runway centerline

15—Touchdown zone

Because the obstructions on virtually all lighted fields are lighted, obstruction lights have not been included in the codification.

Figure 70. AIM – Airport/Facility Directory.

SERVICING

S1: Storage.
S2: Storage, minor airframe repairs.
S3: Storage, minor airframe and minor powerplant repairs.
S4: Storage, major airframe and minor powerplant repairs.
S5: Storage, major airframe and major powerplant repairs.

FUEL

Code	Grade
F12	80/87
F15	91/98
F18	100/130
F22	115/145
F30	Kerosene, freeze point −40°F
F34	Kerosene, freeze point −58°F
F40	Wide-cut gasoline, freeze point −60°F
F45	Wide-cut gasoline without icing inhibitor, freeze point −60°F

● OXYGEN

Ox1 High Pressure
Ox2 Low Pressure
Ox3 High Pressure—Replacement Bottles
Ox4 Low Pressure—Replacement Bottles

OTHER

AOE—Airport of Entry.
FSS—The name of the associated FSS is shown in all instances. When the FSS is located on the named airport, "on fld" is shown following the FSS name. When the FSS can be called through the local telephone exchange, (Foreign Exchange) at the cost of a local call, it is indicated by "(LC)" (local call) with the phone number immediately following the name of the FSS, i.e., "FSS: WICHITA (LC481-5867)." When an Interphone line exists between the field and the FSS, it is indicated by "(DL)" (direct line) immediately following the name of the FSS, i.e., "FSS: OTTO (DL)."
RVV—Runway Visibility Values, applicable runway provided.
RVR—Runway Visual Range, applicable runway provided.
VASI—Visual Approach Slope Indicator, applicable runway provided.

AIRPORT REMARKS

"FEE" indicates landing charges for private or nonrevenue producing aircraft. In addition, fees may be charged for planes that remain over a couple of hours and buy no services, or at major airline terminals for all aircraft.

"Rgt tfc 13–31" indicates right turns should be made on landings and takeoffs on runways 13 and 31.

Remarks data is confined to operational items affecting the status and usability of the airport, traffic patterns and departure procedures.

Obstructions.—Because of space limitations only the more dangerous obstructions are indicated. Natural obstructions, such as trees, clearly discernible for contact operations, are frequently omitted. On the other hand, all pole lines within at least 15:1 glide angle are indicated.

FLIGHT SERVICE STATIONS

Flight Service Stations are listed alphabetically by state in the Airport/Facility Directory RCO's and LRCO's where available shown at the facility site following the three letter identifier. If located at other than a facility site, they are listed alphabetically.

Flight Service Stations (FSS) and Combined Station/Tower (CS/T) provide information on airport conditions, radio aids and other facilities, and process flight plans. CS/T personnel are not certificated pilot weather briefers; however, they provide factual data from weather reports and forecasts. Airport Advisory Service is provided at the pilot's request on 123.6 by FSSs located at airports where there are no control towers in operation. (See Part 1 ARRIVALS.)

In addition, they provide an aviation weather briefing service. Flight and weather briefing services are also provided by calling the telephone numbers listed in the Chapter entitled "FSS-CS/T Information and Weather Bureau Telephone Numbers".

Civil communication frequencies used in the flight service station air/ground system are now operated simplex on 122.0, 122.2, 122.3, 122.6, 123.6 and emergency 121.5 plus 122.1 and 123.6 receive only as follows:

a. 122.0 is assigned at selected FSSs as a weather channel for both general aviation and air carriers.

b. 123.6 is designated as an airport advisory channel at all FSSs which provide this service at nontower locations. 123.6 is still in commission at some FSSs collocated with towers and may be used for en route communications at these locations.

c. Some FSS's use 123.65 or certain 50 KHz channels in the 122–123 MHz band (such as 122.05). Pilots using the FSS A/G system should refer to this directory or appropriate charts to determine frequencies available at the FSS or remoted facility through which they wish to communicate.

Part time FSS hours of operation are shown in remarks under facility name.

COMMUNICATIONS

Clearance is required prior to taxiing on a runway, taking off, or landing at a tower controlled airport.

When operating at an airport where the control tower is operated by the U.S. Government, two-way radio communication is required unless otherwise authorized by the tower. (When the tower is operated by someone other than the U.S. Government, two-way radio communication is required if the aircraft has the necessary equipment.)

Frequencies transmit and receive unless specified as: T—Transmit only, R—Receive only, X—On request. Primary frequencies are listed first in each frequency grouping, i.e., VHF, LF. Emergency frequency 121.5 is available at all TOWER, APPROACH CONTROL and RADAR facilities, unless indicated as not available in remarks.

Radar available is listed under "RADAR SERVICES" Radar beacons are indicated by "(BCN)" after "RADAR SERVICES", when available.

Figure 71. AIM – Airport/Facility Directory – cont'd.

COMMUNICATIONS REMARKS

Remarks data are confined to operational items affecting the status and usability of navigational aids, such as: ILS component restrictions, part time tower hours of operation, frequency sectorization, VOT frequencies, proposed changes to navigational aids, etc.

VOICE CALL

The voice call for contact with the traffic control services listed at each airport is the airport name followed by the call of the particular service desired, i.e., "LAGUARDIA TOWER." In these instances, only the name of the service is listed. When the voice call of the facility is not the same as the airport name, the complete voice call is listed.

SERVICES AVAILABLE

TOWER

Pre-Taxi Clearance Procedure
Clearance Delivery (CLRNC DEL).
Approach Control (APP CON) Radar and Non-Radar.
Departure Control (DEP CON) Radar and Non-Radar.
VFR Advisory Service (VFR ADV) Non-Radar.
Radar Advisory Service for VFR Acft (Stage I).
Radar Advisory and Sequencing Service for VFR Acft (Stage II).
Radar Sequencing and Separation Service for VFR Acft (Stage III).
Surveillance Radar Approach (ASR).
Precision Radar Approach (PAR).
Ground Control (GND CON).
VHF Direction Finding (VHF/DF).

RADIO NAVIGATION AIDS

Included in this section is a tabulation of all Air Navigation Radio Aids in the National Airspace System and those upon which the FAA has approved an instrument approach. Private or military Navigation Radio Aids not in the National Airspace System are not tabulated.

AUTOMATIC TERMINAL INFORMATION SERVICE (ATIS)

ATIS is continuous broadcast of recorded non-control information in selected areas of high activity. See Part 1.

RADAR APPROACH PROCEDURE MINIMA

Weather minima for precision and surveillance radar approaches (PAR/ASR) specify only the lowest straight-in authorized for the approach.

FLIGHT SERVICE STATION (FSS)

Airport Advisory Service (AAS).
Island, Mountain and Lake Reporting Service.
VHF Direction Finding (DF).

UNICOM

A private aeronautical advisory communications facility operated for purposes other than air traffic control, transmits and receives on one of the following frequencies:

U-1—122.8 MHz for Landing Areas (except heliports) without an ATC Tower or FSS;
U-2—123.0 MHz for Landing Areas (except heliports with an ATC Tower or FSS;
U-3—123.05 MHz for heliports with or without ATC Tower or FSS;
U-4—122.85 MHz for landing areas not open to the public;
U-5—122.95 MHz for landing areas not open to the public.

NOTE.—UNICOM used for communications must be licensed by the Federal Communication Commission in order to be listed in this publication.

RADIO CLASS DESIGNATIONS

Identification of VOR/VORTAC/TACAN Stations by Class (Operational Limitations):

Normal Usable Altitudes and Radius Distances

Class	Altitudes	Distance (miles)
T	12,000′ and below	25
L	Below 18,000′	40
H	Below 18,000′	40
H	14,500′ — 17,999′	100*
H	18,000′ — FL 450	130
H	Above FL 450	100

***Applicable only within the contiguous 48 States.**

H=High L=Low T=Terminal

NOTE: An H facility is capable of providing L and T service volume and an L facility additionally provides T service volume.

The term VOR is, operationally, a general term covering the VHF omnidirectional bearing type of facility without regard to the fact that the power, the frequency-protected service volume, the equipment configuration, and operational requirements may vary between facilities at different locations.

B ---------- Scheduled Broadcast Station (broadcasts weather at 15 minutes after the hour.
DME ------- UHF standard (TACAN compatible) distance measuring equipment.
H ---------- Non-directional radio beacon (homing), power 50 watts to less than 2,000 watts.
HH --------- Non-directional radio beacon (homing), power 2,000 watts or more.
H-SAB ----- Non-directional radio beacons providing automatic transcribed weather service.
ILS --------- Instrument Landing System (voice, where available, on localizer channel).
LMM ------- Compass locator station when installed at middle marker site.
LOM ------- Compass locator station when installed at outer marker site.
MA --------- Range (adcock, vertical raditors), power less than 50 watts.
MH --------- Non-directional radio beacon (homing) power less than 50 watts.
ML --------- Range (loop radiators), power less than 50 watts.
MRA ------- Range (adcock, vertical radiators), power 50 watts or more but less than 150 watts.
MRL ------- Range (loop radiators), power 50 watts or more, but less than 150 watts.
RA --------- Range (adcock, vertical radiators), power 150 watts or more.
RL --------- Range (loop radiators), power 150 watts or more.
S ---------- Simultaneous range, homing signal and/or voice.

Figure 72. AIM – Airport/Facility Directory – cont'd.

SABH ..... Non-directional radio beacon having limited navigational use. Provides automatic weather broadcasts.

TACAN ..... UHF navigational facility—omnidirectional course and distance information.

VOR ..... VHF navigational facility—omnidirectional, course only.

VOR/DME .. Collocated VOR navigational facility and UHF standard distance measuring equipment.

VORTAC ... Collocated VOR and TACAN navigational facilities.

W ..... Without voice facilities on range frequency.

Z ..... VHF station location marker at a LF range station.

NOTES

1. All FAA MH facilities operate continuously unless otherwise cited.
2. All FAA ranges operate continuously. Those which are not manned continuously are cited in the remarks with hours of operation in parentheses, e.g., (0600-2400).
3. LMF and VHF ranges listed at the same location are controlled by the same FSS.
4. Military navigational facilities which are not part of the common system are not listed in this publication.

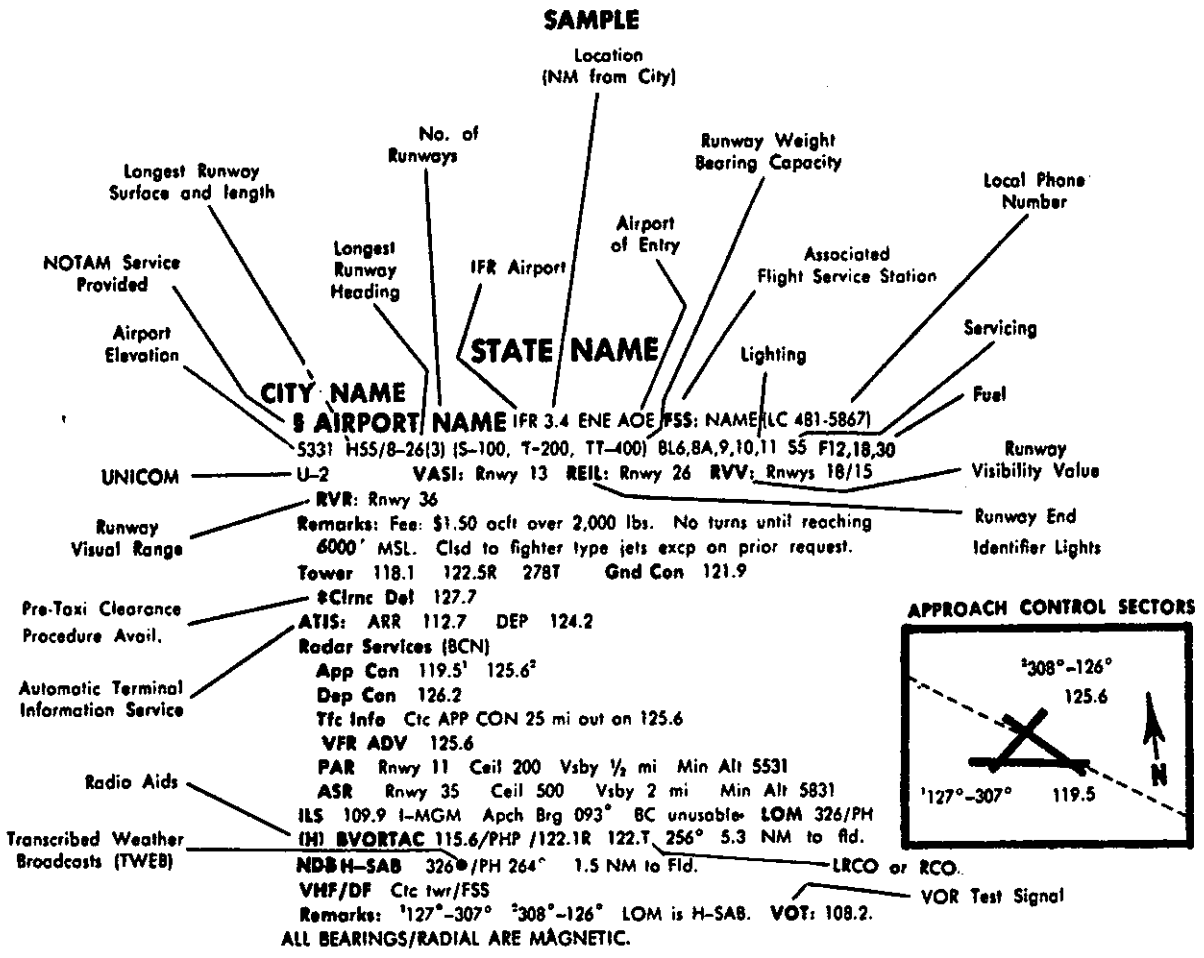


Figure 73. AIM – Airport/Facility Directory – Sample – Cont'd.

EXCERPTS

KENTUCKY

ABBOTT See FRANKLIN

ALBANY 4 SW FSS: London
1020 23 (1)
Remarks: P-line S.

ARNOLD See SPRINGFIELD

§ ASHLAND-BOYD COUNTY IFR 3 NW FSS: Huntington (LC GL 3-1412)
546 H50 (1) (525) BL4 F18 U-1

BARDSTOWN, SAMUELS FLD 2 W FSS: Louisville
664 H40/2-20 (1) (S-11.8, T-17.8) BL5 S5 F12, 18 U-1
Remarks: Attended 0800-dusk. Rdo twrs NE.

§ LEXINGTON, BLUE GRASS FIELD 5 W IFR FSS: London (LC 254-5143)
978 H55/4-22 (3) (S-82, T-107, TT-180) BL4, 6, 8A, 9 S5 F12,18, 22, 30 U-2 RVR: Rnwy 4
Remarks: (£) For additional info see Part 3.

§ LONDON, LONDON-CORBIN WAR, MEML 3 S IFR
1201 H60/5-23 (1) BL5 F12, 18, 30 FSS: London on Fld
VHF/DF: Ctc FSS
Remarks: P-line apch rnwy 5.

§ LOUISVILLE, BOWMAN FIELD 5 SE IFR FSS: Louisville on Fld
546 H43/6-24 (3) (Max 30) BL5¹, 11 S5 F12, 18, 40 U-2
REIL: Rnwy 24
Remarks: (£) For additional info see Part 3. ¹On req thru twr or "LOU" FSS.

§ LOUISVILLE, STANDIFORD FIELD 4 S IFR FSS: Louisville (DL)
497 H78/1-19 (3) (S-60, T-90, TT-200) BL4, 6, 8A, 9, 10, 14, 15 S-4 F12, 15, 30, 35 VASI: Rnwy 19¹ RVV: Rnwy 29 RVR: Rnwy 1
Remarks: (£) ¹Unusable below 400'. Fee. For additional info see Part 3.

MIDDLESBORO, BELL COUNTY 1 W FSS: London
1140 H36 (1) (520) S5 F12, 18
Remarks: P-line E.

MONTGOMERY See MT STERLING

MONTICELLO 1 NE FSS: London
920 22/3-21 (1) F12
Remarks: Attended by prior req—phone 606—348-3576.

MOREHEAD-ROWAN CO 5 SW FSS: London
840 H26 (1) (S-10) F18
Remarks: Unattended.

MT STERLING, MONTGOMERY 2 W FSS: London
1020 H28 (S-10) L4 F12, 18 U-1
Remarks: Attended 0830-dusk.

SKY See MANCHESTER

§ SOMERSET, PULASKI CO 3 S FSS: London
927 H39/4-22 (1) (S-12, T-25) BL4 S5 F18 U-1
Remarks: Attended 0800-1700 daily.

SPRINGFIELD, ARNOLD 3 SE FSS: Louisville
810 22 (2) L4 S3 F12 U-1
Remarks: Attended dalgt hrs.

MARYLAND

ABERDEEN ARPK 1 SW FSS: Washington
60 20/NW-SE (1) S3 F12
Remarks: Attended dalgt hrs April-Nov. Over ngt fee. P-line SE.

ALDINO See CHURCHVILLE

CUMBERLAND, MEXICO FARMS 3 S FSS: Martinsburg (LC 722-6225)
610 25 (2) S5 F12
Remarks: P-line S.

§ CUMBERLAND, MUNI 2 S IFR FSS: Martinsburg (LC 722-6225)
790 H58 (3) BL5 S5 F12, 18, 34 U-1
Remarks: Rgt tfc rnwy 1 and 6.

NEWBURG, AQUA-LAND SKYPARK 1 SW FSS: Washington
20 H28 (1) L4 F15 U-1
Remarks: P-line E. 300' turf overrun on W end. Lndg W rnwy 27 rgt tfc.

OAKLAND, GARRETT CO 2 NE FSS: Morgantown
2933 H25 (1) L4¹ F18
Remarks: Attended dalgt hrs. ¹Avbl by keying 122.8.

NORTH CAROLINA

ADVANCE, STRAWBERRY HILL GLIDERPORT 3 NW FSS: Hickory (LC 725-1731)
690 20/N-S (1) S3 F12 TPA: 800'
Remarks: Attended 0900-2100. Rgt tfc rnwy 34.

AHOSKIE, JERNIGAN 2 S FSS: Elizabeth City
60 19 (1) L4 S1 F12
Remarks: Attended dalgt hrs July-Oct, for svc call 332-3106.

BUIES CREEK, STEWART 2 SE FSS: Raleigh
250 17 (1) *L4 F12,18

BURLINGTON, MUNI 3 SW (S-30) FSS: Raleigh (LC 227-4114)
612 H37 (2) BL4 S5 F12, 18 U-1
Remarks: P-line S.

§ HENDERSON 4 SW IFR FSS: Terre Haute
385 H38/8-26 (1) (S12) BL5 S3 F18 U-1
VFR ADV: Ctc Evansville App Con
Remarks: Rnwy 8-26 open dalgt operns only. Sod strip unusable during winter.

HENDERSON, CITY-COUNTY 4 SW
387 34/18-36
Remarks: Unattended. Rnwy 8-26 limited to 9300 lbs GWT.

MT AIRY, MT AIRY-SURRY COUNTY 4 SE FSS: Hickory
1241 H35/18-36 (1) (S-10) BL4 S5 F12, 18 U-1

MT OLIVE, MUNI 3 NE FSS: Rocky Mount
167 H33/4-22 (1)
Remarks: Unattended.

WHITEVILLE, MUNI 3 SE FSS: Florence
80 32 (1) L4 F12, 18 U-1
Remarks: Attended weekdays 1500-dark and dalgt hrs week ends.

WILKESBORO, WILKES CO 2 SW FSS: Hickory
976 H36/6-24 (1) (S-23, T-33) BL4 S1 F12, 18 U-1
Remarks: Attended dalgt hrs.

Figure 74. AIM – Airport Directory.

AIRPORT DIRECTORY

AIM-

EXCERPTS

OHIO

ABERDEEN TYLER 1 W FSS: Cincinnati
513 25/17-35 (1) L4¹ S3 F12 U-1 VASI: Rnwy 17-35.
Remarks: Attended days. Lgts activated by voice call on unicom and stay on for eight minutes.

ADA 1 NW FSS: Findlay
949 19 (1) *L4 F12, 18
Remarks: Attended irregularly.

CHILLICOTHE, ROSS COUNTY 7 NW FSS: Columbus
724 H40/4-22 (1) L4
Remarks: Unattended.

CHILLICOTHE, SKY PARK 2 N FSS: Columbus
639 27/18-36 (2) F12, 18
Remarks: Attended dalgt hrs. P-lines S and SW.

CHILLICOTHE, VAUGHN 3 SE FSS: Columbus
740 24 (1) L4 S5 F12

CHILO, MELDAHL DAM LANDING STRIP 2 W FSS: Cincinnati
520 20/NW-SE (1)
Remarks: Unattended. Perforated steel plate rnwy.

CHIPPEWA See WILLISTON

CINCINNATI, CINCINNATI INC 9 NE FSS: Cincinnati
857 44 (2) S5 F12, 18
Remarks: Attended dawn-dusk. P-line N. Rgt tfc rnwys 23, 27.

§CINCINNATI, CINCINNATI MUNI-LUNKEN FLD 3 SE IFR FSS: Cincinnati on Fld
488 H61/2R-20L (4) (S-55, T-75, TT-167) BL4, 6, 8A, 9, 11 S5 F18, 40 U-2 REIL: Rnwy 2 R
Remarks: (E) U.S. Customs lndg rgts arpt. 1022' (1749' MSL) twr 6 nmi W. Rgt tfc rnwy 2R, 20R and 6. VFR arrivals avoid ILS epch area. Clsd to non-rdo eqpd acft wkends. Fee for non-based users. For additional info see Part 3.

GREEN SPRINGS, WEIKER AIRSTRIP 2 SE FSS: Findlay
740 16/N-S (1) S5 F12
Remarks: Attended 0800-dark. Fence N.

HAGERTY See VANLUE

HAMILTON, HAMILTON INC 3 SE IFR FSS: Cincinnati
668 H45 (2) (S-30, T-39) BL4, 11 S5 F18 U-1¹ REIL: Rnwy 11-29.
VFR ADV: Ctc Cincinnati App Con
Remarks: P-line S, NW. 300' overrun W end E/W rnwy. Rnwy 11-29 has 300' asphalt overrun on NW end. Rnwy 29 threshold displaced 280' for rgt operns; usable length 4500' days. 4220' ngts. ¹Within 5 mi for lndg info.

§NEWARK, LICKING COUNTY IFR 3 SW FSS: Columbus
880 H45/8-26¹ (1) (S-30) L4 S3 F12, 18 U-1
VFR ADV: Ctc Columbus App Con 119.0
Remarks: ¹200' displaced threshold each end.

OHIO—*Continued*

TONTOGANY, SMITH Adj SE FSS: Findlay
650 17/N-S (1) F12
Remarks: P-lines N, S.

UPPER SANDUSKY, WYANDOT 4 NW FSS: Findlay
830 H40/18-36 (1) (S-30) S3 F12, 18

URBANA, GRIMES FLD 1 N FSS: Dayton (LC 332-4562)
1060 H33 (1) BL4, 12 S5 F12, 18 U-1
Remarks: Attended dalgt hrs.

WARREN 5 NW FSS: Youngstown
910 34/4-22 (2) *B L4¹ S5 F12, 18 U-1
Remarks: Attended evenings only and irregularly in winter. P-line S. ¹On req with timer or prior req-phone 216-898-3882 or 898-6676.

WASHINGTON COURT HOUSE, FAYETTE COUNTY 2.5 N FSS: Columbus
980 H40/4-22 (1) (S-32, T-47) L4 S3 F12, 18 U-1

WATERVILLE, HANIFAN LANDING STRIP 2.5 W FSS: Findlay
650 22/7-25 (1)
Remarks: Unattended.

WAUSEON, EXIT 3 2.8 N FSS: Findlay
785 31/8-26 (1) F12, 18 U-1
Remarks: Attended 0800-dark. Rgt tfc rnwy 8. Additional 400' overrun rnwy 8. 400' displaced threshold rnwy 8.

WAUSEON, FULTON COUNTY 4.4 N FSS: Findlay
779 H39 9-27 (1) BL4 U-1
Remarks: Unattended.

§ZALESKI, ZALESKI STATE FOREST 1 SW FSS: Huntington
705 21 (1)
Remarks: Hills all sides.

ZANESVILLE, RIVERSIDE 2 NE FSS: Zanesville
700 34 (2) (S-98, T-135, TT-220) *L S3 F12, 18
Remarks: Attended dalgt hrs. Bndry lgts & flares on request thru FSS. 460' overrun rnwy 21.

§ZANESVILLE, MUNI 6 E IFR FSS: Zanesville on Fld
900 H50/4-22 (2) (S-98, T-135, TT-220) BL4¹ S5 F12, 18 U-2
Remarks: Attended 0800-dusk. ¹Via req to Zanesville rdo.

PENNSYLVANIA

ALBERT See PHILIPSBURG

ALBION, PORT ALBION 1 S FSS: Erie
985 27 (1) S3 F12
Remarks: Attended dalgt hrs. Clsd winter months. P-line E.

ALIQUIPPA, ALIQUIPPA-HOPEWELL 2 SW FSS: Pittsburgh (LC SP5-7080)
1198 H17/18-36 (1) S5 F12

Figure 75. AIM – Airport Directory – cont'd.

AIRPORT DIRECTORY

EXCERPTS

PENNSYLVANIA–*Continued*

CLIFFORD, CARBONDALE-CLIFFORD 1 E FSS: Wilkes-Barre
1400 22 (2) S3 F12, 18
Remarks: Attended dalgt hrs.

CONNEAUT LAKE 1.5 SW FSS: Erie
1250 19 NE-SW (2) S3 F12
Remarks: Attended 0800-dark.

CONNELLSVILLE 4 SW FSS: Pittsburgh
1267 H34/5-23 (3) (S-8) BL4 S5 F12, 18 U-1

MILTON 1 S FSS: Williamsport
493 25 (3) S3 F12 U-1
Remarks: P-line W, SW.

§ **MONONGAHELA, ROSTRAVER IFR 5.5 NE** FSS: Pittsburgh
1230 H40 7-25 (1) BL5 S5 F12
Remarks: Dalgt hrs only. 1066' (2049' MSL) twr 5 NM NNE. Acft parked on rnwys and txwys.

SLATINGTON, MUNI 1 N FSS: Wilkes-Barre
380 19 (1) S3 F15
Remarks: Attended irregularly.

SOMERSET COUNTY 3 NE FSS: Altoona
2274 H39/6-24[1] (1) (S-20) BL5, 10 S5 F12, 18 U-1
VASI: Rnwy 24
Remarks: Attended dalgt hrs. P-line NW. [1]800' overrun on SW end.

§ **WASHINGTON CO 3 SW IFR** FSS: Pittsburgh (LC 225-8380)
1186 H42/9-27 (1) (S-8) BL5 S5 F12, 18, 30 U-1
VFR ADV: Ctc Pittsburgh App Con
Remarks: Rnwy 9 threshold displaced 300'.

§ **WAYNESBURG, GREEN COUNTY 3 E** FSS: Morgantown
1065 H35/9-27 (1) (S-7) L5 S5 F12, 18 U-1
Remarks: Attended dalgt hrs. Hills SE. Ground drops off sharply E end rnwy 8-26.

••• TENNESSEE •••

ABERNATHY See **PULASKI**

ANDERSON See **TOONE**

ARLINGTON, MUNI 1 SW FSS: Memphis
320 H38/15-33 (1) (S-25) U-1
Remarks: Unattended.

§ **BRISTOL JOHNSON CITY KINGSPORT, TRI-CITY IFR 12 SW** FSS: Tri-City on Fld
1519 H66/4-22 (2) (S-24, T-94, TT-150) BL6, 8A, 9 S5 F22, 30 U2 RVR: Rnwy 22
Remarks: (L) Ctl twr unable to see aprxly 200' of apch area, and first 150' rnwy 9. For additional info see Part 3.

BROWNSVILLE, THORNTON 5 NE FSS: Jackson
350 21/17-35 (1)
Remarks: Attended dalgt hrs.

CAMDEN, BENTON COUNTY 2 S FSS: Jackson
468 H35 (1) BL4 F12, 18
Remarks: Attended dalgt hrs.

••• VIRGINIA •••

AARON PENSTON FLD See **SOUTH BOSTON**

ABINGDON, VIRGINIA HIGHLANDS 3 SW FSS: Tri-City
2070 H27 (1) *L4
Remarks: Unattended. Apch end rnwy 24 slopes up.

§ **CHARLOTTESVILLE, CHARLOTTESVILLE-ALBEMARLE 7 N IFR** FSS: Charlottesville on Fld
640 H60/3-21 (1) (S-72.5, T-100) BL6, 9, 11 S5 F18, 45 U1
REIL: Rnwy 3
VHF/DF: Ctc FSS
Remarks: (L) For additional info see Part 3.

§ **DANVILLE, MUNI 3 E IFR** FSS: Danville on Fld
582 H50 (3) BL4, 6, 11 S5 F12, 18, 34 U2 REIL:[2] Rnwy 2
VFR ADV: Ctc Greensboro App Con
Remarks: 143' AGL water tank NW. [1]On req DANVILLE FSS (test basis only).

§ **HOT SPRINGS, INGALLS FLD 3 S IFR** FSS: Roanoke
3801 H56 (1) BL4, 10 F12, 18, 34 U-1 REIL[1]: Rnwys 6-24
VASI[1]: Rnwys 6-24
Remarks: (L) Fee. [1]Avbl by unicom or keying mike 4 times within 5 seconds. Freq 123.0 for rnwy 6 and 128.0 for rnwy 24. Lgts remain on 15 mins; and for one hour by repeated keying. For additional info see Part 3.

WAYNESBORO 3 W FSS: Charlottesville
1450 H21 (1) *BL4 S5 F12, 18 U-1
Remarks: 425' turf overrun NE end; 675' SW end.

••• WEST VIRGINIA •••

§ **BECKLEY, RALEIGH CO MEML 3 E IFR** FSS: Charleston
2504 H50 (1) BL4 S3 F12, 18 U-1
VFR ADV: Ctc Charleston App Con
Remarks: Sharp dropoff both ends rnwy.

§ **BLUEFIELD, MERCER CO 4 NE IFR** FSS: Bluefield on Fld
2857 H47 (1) BL4 S3 F18[1] (S-30, T-48, TT-80)
VHF/DF: Ctc FSS
Remarks: [1]Dalgt hrs only.

§ **CLARKSBURG, BENEDUM 5 NE IFR** FSS: Morgantown (LC 622-2611)
1203 H52 (2) (S-67, T-90) BL4 S5 F15, 18, 30 U-1
Remarks: Attented dalgt hrs. Fence SE.

§ **ELKINS, ELKINS-RANDOLPH COUNTY 2 S IFR** FSS: Elkins on Fld
1987 H45 (2) *BL4 F12, 18 S5
Remarks: P-line SW.

§ **MORGANTOWN, MUNI 2 NE IFR** FSS: Morgantown on Fld
1248 H52/18-36 (2) B *L4, 10 S5 F12, 18, 30 VASI[2]: Rnwy 18
VHF/DF: Ctc FSS
Remarks: Attended 0700-dark. Acft restricted to hard surface areas. [1]Avbl during hrs of attendance. [2]Oper on req, in conjunction with rnwy lgts.

§ **PARKERSBURG, WOOD COUNTY 6 NE IFR** FSS: Parkersburg on Fld
858 H51 (3) (S-65, T-95, TT-170) BL4, 6, 11 S5 F18, 30
REIL: Rnwy 21.
Remarks: (L)

Figure 76. AIM – Airport Directory – cont'd.

EXCERPTS

AIRPORT/FACILITY DIRECTORY

KENTUCKY

BARDSTOWN NDB MHW 248/BRY **FSS:** LOUISVILLE
Remarks: Owned and operated by Bardstown-Nelson County Arpt.

CENTRAL CITY (L) BVOR 109.8/CCT/122.1R **FSS: BOWLING GREEN**

COVINGTON, GR CINCINNATI ARPT See Cincinnati, Ohio

FALMOUTH (H) BVOR 117.0/FLM/122.1R **FSS:** CINCINNATI

LEXINGTON
§BLUE GRASS FIELD *IFR* 5W **FSS:** LONDON (LC 254-5143)
978 H54/4-22(3) (S-82, T-107, TT-180) BL4,6,8A,9 S5
F22 U2 **RVR:** Rnwy 4
Lexington Tower 119.1 122.5R 112.6T 110.1T **Gnd Con** 121.9
Lexington App Con 125.0 122.5R 112.6T 110.1T
VFR Advisory Ctc twr
ILS 110.1 I-LEX Apch Brg 042° **LOM:** 242/LE
Lexington (L) BVORTAC[1] 112.6/LEX/121.1 304° 7.3 NM to fld
Lexington NDB MHW 242/LE 042° 3.5NM to fld.
Remarks: LOM is LE NDB.

LONDON FSS 121.5 122.1R 122.3 122.6 123.6 **DF**

LONDON (L) BVORTAC 116.1/LOZ **FSS:** LONDON

LOUISVILLE FSS 121.5 122.1R 122.2T 122.6 123.6

NEWCOMBE (L) BVOR 110.4/ECB/122.1R **FSS:** HUNTINGTON

SOMERSET NDB MHW 388/SME **FSS:** LONDON
Remarks: Owned and operated by Somerset-Pulaski County Arpt Board.

YORK (L) VORW 113.4/YRK **FSS:** HUNTINGTON

MARYLAND

CAMBRIDGE NDB MHW 257/CGE **FSS:** SALISBURY
Remarks: Owned and oper by East Coast Air Taxi Service.

CUMBERLAND NDB MHW 317/CBE **FSS:** MARTINSBURG

EASTON NDB MHW 212/ESN **FSS:** SALISBURY
Remarks: Owned and operd by Easton Arpt Authority.

ELLICOTT NDB MHW 371/FND **FSS:** WASHINGTON

FREDERICK (T) BVOR 109.0/FDK/122.1R **FSS:** MARTINSBURG

GAITHERSBURG NDB MHW 385/GAI **FSS:** WASHINGTON

GRANTSVILLE (L) BVORTAC 112.3/GRV **FSS:** MORGANTOWN

NORTH CAROLINA

ASHEVILLE FSS 121.5 122.1R 122.6

§GREENSBORO-HIGH POINT/WINSTON-SALEM REGIONAL *IFR* 7W
FSS: RALEIGH (LC BR 5634)
926 H71/5-23(2) (S-40, T-140) BL4,6,8A,9 S5
F12,18,34 U2 **RVR:** Rnwy 14
Greensboro Tower 119.1 126.2 122.5R **Gnd Con** 121.9
Radar Services: (BCN)
Greensboro App Con 118.5[2] 124.6[3] 120.9 122.5R 116.2T
Greensboro Dep Con 118.5[2] 124.6[3] 120.9 122.5R
Stage I Ctc apch ctl
ASR
ILS[1] 109.9 I-GSO Apch Brg 138° BC unusable **LOM:** 254/GS
Greensboro (H) BVORTAC 116.2/GSO/121.5 122.1R 122.3 122.6
030° 3.0 NM to fld.
Remarks: [1]G/S unusable below 1127' MSL. [2]003-176°. [3]177-002°.

HICKORY FSS 121.5 122.1R 122.2T 122.6 123.6 **DF**

NORTH CAROLINA—*Continued*

WINSTON-SALEM
§SMITH REYNOLDS *IFR* 2NE **FSS:** HICKORY (LC 725-1731)
969 H66/15-33(3) (S-110, T-135, TT-230) BL4,6,8A,9,12 S5
F12,18,30 U2 **RVV-** Rnwy 33.
Remarks: Rnwy 15 threshold displaced 600'. When twr unatnd apch lgts unmntrd—btwn 2300-0700 lcl time only rnwy 15-33 lgtd.
Winston-Salem Tower[1] 118.7 122.7R **Gnd Con** 121.7
Radar Services: (BCN)
Greensboro App Con 124.6[2] 120.9
Greensboro Dep Con 124.6[2] 120.9 122.5R
VFR Advisory Ctc twr
ILS[3] 110.3 I-INT Apch Brg 328° BC unusable **LOM:** 317/IN
Remarks: [1]Oper 0700-2300 lcl time. [2]G/S unusable below 1069' MSL. [3]177-002°.

OHIO

CINCINNATI FSS 121.5 122.1R 122.3 122.6 123.6

CINCINNATI, (COVINGTON, KY.)
§GREATER CINCINNATI *IFR* 9SW Cincinnati **FSS:** CINCINNATI
890 H95/18-36(3) (S-60, T-170, TT-330) BL4,6,8A,9,10,11,14,15 S5
F12,18,22,34 U-2 **VASI:** Rnwy 27L **REIL:** Rnwy 9R **RVR:** Rnwy 18-36
Remarks: Fee. Twr unable to see portions of first 2000' rnwy 18 and unable to see first 2400' of rnwy 9R. 1022' (1748' MSL) twr 7.5NM NE.
Cincinnati Tower 118.3 122.7R **Gnd Con** 121.7
¢ Clrnc Del 121.3
ATIS 117.3[1]
Radar Services:
Cincinnati App Con 119.7 124.9 122.7R
Cincinnati Dep Con 121.0 124.7
Tfc Info Ctc App Con
ASR
ILS 109.9 I-CVG[2] Apch Brg 360° **LOM:** 287/CV
111.5 I-SIC Apch Brg 180° **LOM:** 351/SI
Cincinnati (L) VORTAC 117.3/CVG 043° 2.3 NM to fld
VHF/DF Ctc twr or radar.
Remarks: [1]Opers 0700-2400. [2]G/S not usable below 1050' MSL; not usable beyond 10 mi below 1900' MSL. **VOT:** 108.4.

§CINCINNATI MUNI-LUNKEN FLD *IFR* 3SE **FSS:** CINCINNATI on Fld
488 H61/2R-20L(4) (S-55, T-75, TT-167) BL4,6,8A,9,12 S5 F18,40
U2 **REIL:** Rnwy 2R
Remarks: U.S. Customs lndg rgts arpt. 1022' (1748' MSL) twr 6 nmi W. Rnwy 2L threshold displaced 189' NE. 4795' avbl lndg rnwy 2L; tkof rnwy 20R. 4984' avbl lndg 20R; tkof rnwy 2L. Rnwy 15 threshold displaced 701' SE. 3331' avbl lndg rnwy 15; tkof rnwy 33. 4032' avbl tkof rnwy 15, lndg rnwy 33. Rgt tfc rnwy 2R, 20R and 6. Clsd to non-rdo eqpd acft wkends. Fee nonbased users.
Lunken Tower[1] 118.7 126.2 122.4R **Gnd Con** 121.9
Radar Services:
Cincinnati App Con 119.7 124.9 126.2 122.7R
Cincinnati Dep Con 121.0 124.7
Tfc Info Ctc Cincinnati App Con
ILS[2] 110.9 I-LUK Apch Brg 201°
Cincinnati NDB H-SAB 335◉/LUK 227° 4.5NM to fld
Remarks: [1]G/S unusable beyond 11 NM below 2700' MSL. BC unusable beyond 10 NM.

Figure 77. AIM – Airport/Facility Directory.

EXCERPTS

OHIO—Continued

COLUMBUS FSS 121.5 122.0 122.1R 122.2 122.6

§COLUMBUS
OHIO STATE UNIVERSITY *IFR* 7 NW **FSS:** COLUMBUS
905 H44/9-27(3) (S-21, T-32) BL5 S5 F12,18,34 U-2
Remarks: Ctl twr personnel unable to see acft on low final opch to rnwy 32. Fee over 4 hrs.
Tower[1] 121.1 **Gnd Con** 121.7
Radar Services:
Columbus App Con 119.0 125.4
Columbus Dep Con 123.8
VFR Advisory Ctc twr
NDB MHW 348/OSU on arpt
Remarks: [1]Opers 0700-2300 lcl time.

§COLUMBUS, PORT COLUMBUS INTL *IFR* 6E **FSS:** COLUMBUS on Fld
816 H107/10R-28L(5) (S-100, T-200, TT-370)* BL4,6,8A,9,11 S5 F12,18,22,34 U2 **REIL:** Rnwys 10R, 28R. **RVR:** Rnwys 10L, 28L.
Remarks: U.S. Customs lndg rgts arpt. *Rnwy 10L-28R (S-180, TT-400).
Tower 120.5 126.2 124.2 122.4R **Gnd Con** 121.9
Clrnc Del 121.3
ATIS: 109.1
Radar Services: (BCN)
App Con 119.0 125.9S 126.2 125.4 122.4R
Dep Con 123.8 126.2
Stage I Ctc twr
ASR
ILS[1] 109.1 I-CBP Apch Brg 096° **LOM:** 271/CB
109.5 I-CMH[1] Apch Brg 276° **LOM:** 245/CM
NDB H-SAB 391/CMH 070° 1.0NM to fld
VHF/DF Ctc App Con
Remarks: [1]Front crs unusable above 4000' MSL beyond 11 NM.
VOT: 111.0

CUYAHOGA NDB MHW 275/CUC **FSS:** CLEVELAND

DAYTON FSS 121.5 122.1R 122.2 122.6

DAYTON
§JAMES M COX-DAYTON MUNI *IFR* 9N **FSS:** DAYTON on Fld
1008 H70/6-24(2) (S-126, T-170, TT-354) BL4,6,8A,9,11 S5 F22,30 U2 **REIL:** Rnwy 24 **RVV:** Rnwy 6
Remarks: U.S. Customs lndg rgts arpt. P-line SE. 1096' TV twr 10 NM S.
Dayton Tower[1] 119.9 122.5R **Gnd Con** 121.9
Clrnc Del 120.35
ATIS: 114.5
Radar Services: (BCN)
Dayton App Con 118.0[1] 126.5[2] 122.7R 111.6T 110.3T
Dayton Dep Con 125.8[2] 134.45[1]
VFR Advisory Ctc twr
ILS[3] 110.3 I-DAY Apch Brg 056° **LOM:** 356/DA
Dayton (L) BVORTAC 114.5/DAY 131° 10.8 NM to fld.
Remarks: [1]Dayton Sector. [2]Patterson Sector. [3]Unusable from MM inbnd. [4]Freq 121.5 not avbl. **VOT:** 111.0

MIDDLETOWN
HOOK FLD MUNI *IFR* 2 N **FSS:** DAYTON (LC 422-5551)
648 H51/5-23(1) (S-40, T-60) BL4,11 S3 F12,18,30 U-1
REIL: Rnwy 5-23
Remarks: Rgt tfc W & SW. 895' and 827' MSL smokestacks SW corner of fld.
Radar Services:
Dayton App Con 118.4 126.5
Dayton Dep Con 118.4 123.75
ILS[1] 111.1 I-MWO Apch Brg 230° **LOM:** 223/MW
Remarks: [1]BC unusable, G/S not avbl.

OHIO—Continued

§SPRINGFIELD MUNI *IFR* 5S **FSS:** DAYTON (LC FA 2-4562)
1052 H90/5-23(3) (S-85, T-110, TT-180)[3] BL6,7 S5 F18,40 U2 **REIL:** Rnwy 5-23
Remarks: J-bar and A-gear rnwy 5-23. [3](S-110, T-140, TT-230 for rnwy 14-32).
Tower[5] 120.7 126.2 122.7R **Gnd Con** 121.7
Radar Services: (BCN)
Dayton App Con[1] 118.4
Dayton Dep Con 118.4 123.75 134.1
Tfc Info Ctc Dayton App Con
NDB MHW 341/SGH 237° 2.6NM to fld.
Remarks: [1]All IFR tfc lndg this area call Dayton App Con. [5]Oper 1330-2130Z, clsd holidays, call Dayton rdo 122.6 for possible evening hrs.

ZANESVILLE FSS 121.5 122.1R 122.3 122.6 123.6

ZANESVILLE (L) BVORTAC 111.4/ZZV **FSS:** ZANESVILLE
NDB BMH 275/ZZV

TENNESSEE

BOONE NDB HW 221/BON **FSS:** TRI CITY

BRISTOL
§TRI-CITY *IFR* 12SW **FSS:** TRI-CITY on Fld
1519 H66/4-22(2) (S-95, T-125, TT-215) BL6,8A,9 S5 F[1]22,30 U2 **RVR:** Rnwy 22
Remarks: Ctl twr unable to see aprxly 200' of apch area & first 150 rnwy 9. [1]Avbl 0630-2200 lcl time only.
Tower[1] 119.5 122.5T **Gnd Con** 121.7
Radar Services: (BCN)
App Con 118.4[2] 125.6[2] 122.5R 114.6T
Dep Con 118.4[2] 125.6[2]
Tfc Info Ctc App Con. Stage II radar svc within 20 nmi.
ASR Rnwy 4 Ceil 600 Vsby 1 mi Min Alt 2119
Rnwy 22[4] Ceil 700 Vsby 1 mi Min Alt 2219'
ILS 109.9 I-TRI Apch Brg 224° BC unusable **LOM:** 299/TR
Remarks: [1]Oper 0600-2400. [2]225-044°. [3]045-224°. [4]Maintain 2300' til passing 2.5 mi radar fix on final.

KNOXVILLE FSS 121.5 122.1R 122.2 122.6

KNOXVILLE
§McGHEE TYSON *IFR* 11S **FSS:** KNOXVILLE on Fld
989 H90/4L-22R(3) (S-84, T-90, TT-200) BL4,6,8A,9 S5 F22,30 U2 **RVR:** Rnwy 4L.
Remarks: Rgt tfc rnwys 4R and 22R. 200' displaced threshold at rnwy 18 end, tkof rnwy 18 4998' day, 4798' ngt, lndg rnwy 18 4798' day/ngt tkof rnwy 36 4798' day/ngt lndg rnwy 36 4998' day 4798' ngt.
Knoxville Tower 118.7 126.2 122.5R 116.4T **Gnd Con** 121.9
Radar Services: (BCN)
Knoxville App Con 123.9 122.5R 116.4T
Knoxville Dep Con 120.2
Tfc Info Ctc App Con 25 mi out.
ASR
ILS 110.3 I-TYS Apch Brg 046° BC unusable **LOM:** 353/TY
Knoxville (H) BVORTAC 116.4/TYS 222° 6.6 NM to rnwy 22R.
VHF/DF Ctc App Con
VOT: 112.0.

LIVINGSTON (L) BVOR 108.4/LVT/122.1R **FSS:** CROSSVILLE

McKELLER (T) BVOR 112.0/MKL **FSS:** JACKSON

MEMPHIS FSS 121.5 122.1R 122.2T 122.6 123.65 **DF**

Figure 78. AIM – Airport/Facility Directory – cont'd.

VIRGINIA

BLACKFORD (L) BVOR 110.2/BLA/122.1R **FSS:** BLUEFIELD

BLACKSBURG NDB MHW 257/BCB **FSS:** ROANOKE
Remarks: State owned.

BLACKSTONE FSS 121.5 122.1R 122.6 123.6

BLACKSTONE NDB MHW 326/BKT
Remarks: Opers 0600–2200 lcl time, other hrs ctc Richmond FSS.

CHARLOTTESVILLE FSS 121.5 122.1R 122.3 122.6 123.6 **DF**

CHARLOTTESVILLE
§CHARLOTTESVILLE-ALBEMARLE *IFR* 7N
FSS: CHARLOTTESVILLE on fld
640 H60/3-21(1) BL6, 9, 11 S5 F18,45 U1 **REIL:** Rnwy 3
Remarks: Rnwy 21 threshold displaced 270' SW.
ILS[1] 111.7 I-CHO Apch Brg 027°
Charlottesville NDB MHW 229/AOM 027° 7.7NM to rnwy 03.
VHF/DF Ctc FSS
Remarks: [1]G/S not avbl.

DANVILLE FSS 121.5 122.1R 122.3 122.6 123.6

DANVILLE (L) BVOR 113.1/DAN **FSS:** DANVILLE

§LYNCHBURG MUNI-PRESTON GLENN FLD *IFR* 6SW
FSS: ROANOKE (LC 846-3942)
942 H58/3-21(3) (S-31, T-41, TT-60) BL6,8A,9 S5 F18,30 U2 **RVV:** Rnwy 3.
Remarks: After 2300 rnwy lgts remain on 3-21 only. Apch lgts 0700-2300 lcl time.
Lynchburg Tower[3] 120.7 122.5R **Gnd Con** 121.9
Lynchburg App Con[3] 118.0 122.5R 120.7
VFR Advisory Ctc twr
ILS[1] 110.1 I-LYH Apch Brg 032°
Lynchburg (L) BVORTAC 109.2/LYH/122.1R 109.2T 025° 4.0NM to fld.
VHF/DF: Ctc twr
Remarks: [1]BC unusable below 3500' MSL beyond 20 NM. [2]Opers 0700-2300 lcl time.

ROANOKE FSS 121.5 122.1R 122.2 122.6

§ROANOKE MUNI *IFR* 3 NW
FSS: ROANOKE on Fld
1175 H58/15-33(2) (S-70, T-100, TT-150) BL6,8A,9,11 S5 F12,18,30 U2 **REIL:** Rnwy 23
Remarks: (S-10) rnwy 9-27. Fuel avbl 0600-2300 lcl time only. Lndg fee commercial acft only.
Tower 118.3 120.2 122.5R **Gnd Con** 121.9
‡Clrnc Del 121.9
Radar Services: (BCN)
App Con 126.9 122.5R 120.2 114.9T
Dep Con 126.0 114.9T
Stage I Ctc apch ctl
ASR Rnwy 33 Ceil 700 Vsby 2 mi Min Alt 1800
ILS[1] 109.7 I-ROA Apch Brg 332° BC unusable.
Roanoke (L) BVORTAC 109.4/ROA 107° 4.5 NM to fld.
Roanoke NDB H-SAB 371●/ROA 354° 1.5NM to fld.
Remarks: [1]Lclzr unusable from MM inbnd.

SOUTH BOSTON (L) BVORTAC 110.4/SBV/122.1R **FSS:** DANVILLE

SPRINGFIELD NDB MHW 353/SRI **FSS:** WASHINGTON

VINTON NDB MHW 277/VIT **FSS:** ROANOKE

WOODRUM (T) VOR 114.9/ODR **FSS:** ROANOKE

WEST VIRGINIA

CHARLESTON FSS 121.5 122.0 122.2 122.6

CHARLESTON
§KANAWHA *IFR* 2 NE **FSS:** CHARLESTON on Fld
982 H56/5-23(2) (S-150, T-200, TT-320) BL4, 6, 8A, 9, 11 S5 F22,45 U2 **REIL:** Rnwy 5 **RVV:** Rnwy 23
Charlestown Tower 120.3 122.4R **Gnd Con** 121.9
‡Clrnc Del 121.9
Radar Services:
Charleston App Con 119.2 122.4R
Charleston Dep Con 124.1
Stage I Ctc apch ctl
ASR Rnwys 5, 14, 23 Ceil 600 Vsby 1 mi Min Alt 1582
ILS[1] 110.3 I-CRW Apch Brg 230° BC unusable **LOM:** 303/CR
Charleston (H) BVORTAC 117.4/CRW 084° 8.1 NM to fld
VHF/DF Ctc twr.
Remarks: [1]Unusable below 2400' MSL beyond 12 nmi.
VOT: 111.0

ELKINS FSS 121.5 122.1R 122.6 123.6

ELKINS (L) BVORTAC 114.5/EKN/122.1R **FSS:** ELKINS

HUNTINGTON FSS 121.5 122.1R 122.6 **DF**

HUNTINGTON
§TRI-STATE (WALKER LONG FLD) *IFR* 6 SW
FSS: HUNTINGTON on Fld
828 H53/11-29(1) (S-70, T-100, TT-170) BL6,8A,9 S5 F18,30 U2
Remarks: Landing fee in lieu of gas purchase. Fee for acft 12,500 lbs & above.
Huntington Tower[3] 118.5 122.5R **Gnd Con** 121.9
‡Clrnc Del 121.9
Huntington App Con[3] 120.9 122.5R
VFR Advisory Ctc twr
ILS[1] 109.9 I-HTS[3] Apch Brg 114° **LOM:** 287/HT
VHF/DF: Ctc FSS
Remarks: [1]Lclzr unusable MM inbnd. [2]Opers 0800-2400 lcl time. [3]G/S not available.

MORGANTOWN FSS 121.5 122.1R 122.3 122.6 123.6 **DF**

MORGANTOWN (L) BVORTAC 111.6/MGW **FSS:** MORGANTOWN
NDB[1] **MHW** 269/MGW
Remarks: [1]Unusable 170-285 and 300-320° beyond 15 NM.

PARKERSBURG FSS 121.5 122.1R 122.3 122.6 123.6 **DF**

§ PARKERSBURG, WOOD COUNTY *IFR* 6NE **FSS:** PARKERSBURG on fld
858 H51/(3) (S-65, T-95, TT-170) BL4,6,11, S5 F18,30 **REIL** Rnwy 21
Tower[1] 123.7 122.5R **Gnd Con** 121.7
VFR Advisory Ctc twr
(L) BVORTAC 114.2/PKB
Remarks: [1]Opers 0700-2300 lcl time.

WHEELING FSS 121.5 122.1R 122.6

§WHEELING-OHIO COUNTY *IFR* 7 N **CS/T:** WHEELING on Fld
1196 H50/3-21(3) (S-120, T-170, TT-290) BL4,6,10,11,12
F12,18,30 **VASI:** Rnwy 21 **REIL:** Rnwy 21 **RVV:** Rnwy 3
Remarks: Fee acft 12,500 GWT and over. Fuel avbl 0800-2130 lcl time, svc charge other hrs.
Wheeling Tower 118.1 122.4R **Gnd Con** 121.9
VFR Advisory Ctc twr
ILS[1] 109.7 I-HLG Apch Brg 030° BC unusable **LOM:** 212/HL
Wheeling (L) BVORTAC 112.2/HLG 220° 5.8 NM to fld.
Remarks: [1]Glide slope unusable below 1496' MSL.

WHITE SULPHUR SPRINGS (T) VOR 108.4/SSU/122.1R
FSS: ROANOKE, VA.

Figure 79. AIM – Airport/Facility Directory – cont'd.

EXCERPT

HEAVY WAGON LOW LEVEL ROUTES

Introduction

The USAF and U.S. Navy conducts day and night low-level operations in aircraft in both IFR and VFR weather conditions along routes nicknamed "Heavy Wagon", at airspeeds from 125 K to 500 K indicated. These routes are generally located in areas designated as uncontrolled airspace. Flights may be conducted only during the hours specified for each route. The current operational status of a route may be determined by calling a Flight Service Station near the route. Scheduling Agency: Hq USAF (AFXPPS), Washington, D.C. 20330.

Two different categories or series of "Heavy Wagon" routes are defined as follows:

300 Series. (Example: "Heavy Wagon 305") These are low level all-weather routes for the purpose of navigational and electronic equipment evaluation. Operations are contained within 9 nautical miles either side of the centerline except that on VFR segments they will be contained within 4 nautical miles of the centerline. When route widths shown on the chart are less than those indicated above, the operation will be confined to the route width shown. Aircraft will operate at the altitude specified on the route charts. On some route segments when the weather conditions are 3000 feet ceiling and 5 miles visibility or better, aircraft will descend to an altitude of not less than 500 feet above the terrain.

400 Series. (Example: "Heavy Wagon 401") These are low level all-weather routes for the purpose of conducting low level navigation and weather evaluation. Operations will be performed between 500 feet above the terrain and the minimum obstruction clearance altitudes (MOCA) as given in the route description, in controlled and uncontrolled airspace. The route widths are two nautical miles either side of centerline at the contour altitude and four nautical miles either side of centerline at the MOCA.

OIL BURNER ROUTES

MILITARY LOW-LEVEL OPERATION "OIL BURNER": The USAF and the U.S. Navy conduct low-level navigation/bombing training flights in jet aircraft in both VFR and IFR weather conditions along the routes shown in the following pages. Operations are contained within 9 nautical miles on either side of the centerline except that on the VFR segments they will be contained within 4 nautical miles of the centerline. When route widths shown on the chart are less than those indicated above, the operation will be confined to the route width shown. Aircraft will operate at the altitudes specified on the route charts. Near the end of the low-level navigation portion of the route, aircraft will conduct simulated bomb release maneuvers within a "Bomb Run Corridor" at and between the altitudes shown. "Short Look" and "Lay Down" bomb runs are generally conducted from 4,000 to 6,000 feet MSL "Long Look" bomb runs are generally conducted from 18,000 to 21,000 feet MSL. On some route segments when the weather conditions are 3,000 feet ceiling and 5 miles' visibility or better, aircraft may descend to an altitude of not less than 500 feet above terrain in daylight hours or 800 feet above terrain during hours of darkness. Flights are conducted only during the times specified for each route. The current operational status of a particular route may be obtained by calling a Flight Service Station near the route.

Figure 80. AIM – Heavy Wagon/Oil Burner Routes.

Figure 81. AIM – Index of Heavy Wagon/Oil Burner Routes.

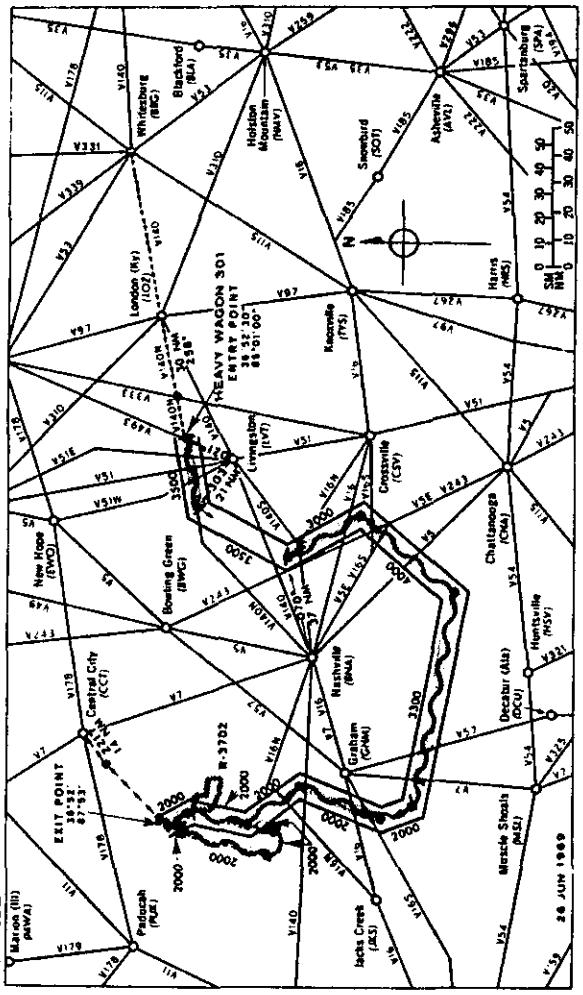
EXCERPT

KENTUCKY/TENNESSEE

HEAVY WAGON 301

Whitesburg, Kentucky VORTAC Entry

Aircraft shall cross the Whitesburg, Kentucky VORTAC at 6,000' MSL or as assigned by ARTCC; then maintain assigned altitude via V140 to the London, Kentucky VORTAC; then via V140N to 36°56'N, 84°43'W (London VORTAC 258°/30 NM DME Fix–V333); then descend via V140N to cross the route entry point, 36°52.5'N, 85°01'W at 3,500' MSL (Livingston, Kentucky VOR 021° radial); then via V140N to 36°47'N, 85°32'W (Livingston VOR 303°/21 NM) (reporting point contact Memphis ARTCC); then direct 36°15'N, 85°53'W (Nashville Tennessee VORTAC 070°/37 NM DME Fix) then descend to 3,000' MSL direct 35°49'N, 85°32'W; then climb to 4,000' MSL direct 35°15'N, 86°05'W; then descend to 3,300' MSL direct 35°26'N, 87°39'W; then descend to 2000' MSL direct 35°37'N, 87°46'W (reporting point contact Memphis ARTCC); then at 2,000' MSL direct 36°-06'N, 87°33'W; then direct 36°24'N, 87°51'W; then direct 36°44'N,87°47'W; then direct route exit point at 36°52'N, 87°53'W; then direct 36°55'N, 87°49'W; then climb direct to cross 37°13'N, 87°28'W (CCT 221°/14 nm DME Fix) at 15,000' MSL or as assigned by ARTCC; then maintain assigned altitude direct Central City, Kentucky VOR (Reporting Point).



Re-Entry—After crossing 36°44'N, 87°47'W, aircraft that are scheduled for additional evaluation shall turn left, maintaining 2,000' MSL, to 36°46'N, 87°57'W; then direct 36°16'N, 88°03'W; then turn left, maintaining 2,000' MSL, to 36°15'N, 87°53'W; then direct 36°24'N, 87°51'W; thence via the published route.

VFR Contour—If encountered weather conditions along the route are ceiling 3,000' visibility five miles or better, pilots may descend VFR and operate VFR between the published IFR altitudes and 500' above the terrain from: 36°52.5'N, 85°01'W to 36°47'N, 85°32'W; from 36°15'N, 85°53'W to 36°52'N, 87°53'W; and along the reentry rout from 36°44N, 87°47'W to 36°15'N, 87°53'W.

Route Width—The entire IFR route width is reduced to four nautical miles either side of centerline. The entire VFR route width is reduced to two nautical miles either side of centerline.

Hours of operation—0030Z to 1300Z daily, seven days per week.

Restriction—Aircraft will not enter R-3702 unless prior approval is obtained from the Commanding General, Fort Campbell, Kentucky.

Figure 82. AIM — Heavy Wagon Route.

OIL BURNER ROUTES

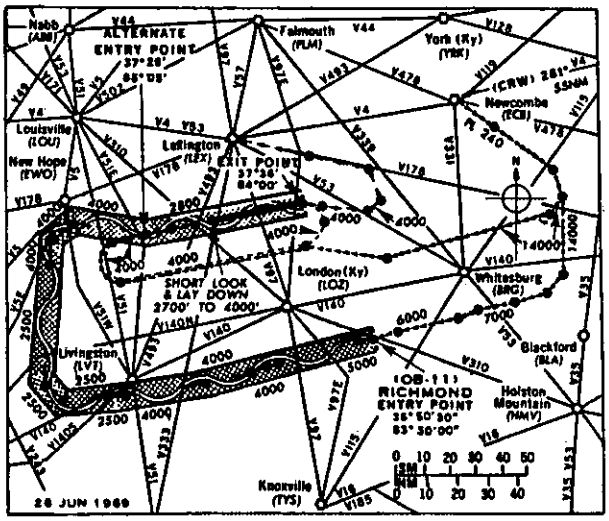
EXCERPT

KENTUCKY/TENNESSEE

RICHMOND OB–11

Revised Effective July 6, 1969

Aircraft shall cross the Charleston, West Virginia VORTAC 261/55 DME Fix (Newcombe, Kentucky VOR)



at FL–240; maintain FL–240 direct to 38°00'N, 82°38'W; then descend direct to 37°45'N, 82°13'W; then turn right and continue descent so as to cross 37°36'N, 82°10'W at 14,000' MSL; maintain 14,000' MSL direct to 37°10'30''N, 82°11'W; then turn right and descend to 37°04'N, 82°18'W; then continue descent so as to cross 37°01'30''N, 82°31'30''W at 7,000' MSL; then at 7,000' MSL direct to 36°58'30''N, 82°47'W; then descend so as to cross 36°57'N, 82°55'W at 6,000' MSL; then at 6,000' MSL direct to 36°52'30''N, 83°20'W; then descend so as to cross 36°50'30''N, 83°30'W, (low level entry point) at 5,000' MSL; then at 5,000' MSL direct to 36°42'30''N, 84°10'W; then descend direct so as to cross 36°40'N, 84°21'W at 4,000' MSL then at 4,000' MSL direct to 36°36'N, 84°40'W; then at 4,000' MSL direct to 36°32'N, 85°15'W; then descend direct so as to cross 36°32'N, 85°21'W at 2,500' MSL; then at 2,500' MSL direct to 36°31'N, 85°40'W; then turn right to 36°36'N, 85°49'W; then at 2,500' MSL direct to 37°16'N, 85°45'W; then climb direct so as to cross 37°24'N, 85°44'30''W at 4,000' MSL; then at 4,000' MSL turn right to 37°30'N, 85°35'W; then at 4,000' MSL direct to 37°26'N, 85°05'W; then descend so as to cross 37°27'-30''N, 84°54'30''W at 2,800' MSL; then at 2,800' MSL direct to 37°30'N, 84°38'W.

Short Look and Lay Down—After passing 37°30'N, 84°38'W, aircraft shall maintain between 2,800' and 4,000' MSL through the bomb run corridor (on centerline from 37°30'N, 84°38'W to 37°36'N, 84°00'W). After exiting the route at 37°36'N, 84°00'W, aircraft shall climb to or maintain 4,000' MSL direct to 37°35'N, 83°50'W; then maintain 4,000' MSL direct to 37°33'-30''N, 83°32'W, then at 4,000' MSL turn left to 37°36'N, 83°26'W; then start climb and continue turn to 37°-47'N, 83°30'W; then continue climb so as to cross 37°52'N, 83°56'W at FL–180; then at FL–180 or as assigned by ARTCC direct to the Lexington, Kentucky VORTAC.

Re-Entry—After completing the initial bomb run, aircraft that are scheduled to execute an additional bomb run shall, after exiting the route at 37°36'N, 84°00'W, turn right and climb to or maintain 4,000' MSL to 37°30'N, 83°50'W; then at 4,000' MSL continue turn to 37°22'N, 83°58'W; then at 4,000' MSL direct to 37°-10'30''N, 85°15'W; then at 4,000' MSL turn right to 37°24'N, 85°18'30''W; then at 4,000' MSL direct to 37°26'N, 85°05'W; thence via the published route.

VFR and Contour—If the encountered weather conditions along the VFR segment of the route are equal to or better than ceiling 3,000' visibility 5 miles, the pilot may descend VFR and operate VFR between the IFR altitude and 800' above the immediate terrain between the following points: from 38°50'30''N, 83°30'W to 37°26'N, 85°05'W; then from 37°26'N, 85°05'W to 37°36'N, 84°00'W aircraft may operate VFR between IFR altitude and 1,000' above the immediate terrain. VFR operations will not be conducted during the hours of darkness.

Alternate Entry—Aircraft shall cross the Charleston, West Virginia VORTAC 261/55 DME Fix (Newcombe, Kentucky VOR) at FL–240; then at FL–240 direct to 38°00'N, 82°38'W; then descend direct to 37°45'N, 82°13'W; then continue descent and turn right so as to cross 37°36'N, 82°10'W at 14,000' MSL; then at 14,000' MSL turn right to 37°30'N, 82°16'W; then at 14,000' MSL direct to 37°17'N, 83°24'W; then descend direct so as to cross 37°22'N, 83°58'W at 4,000' MSL then at 4,000' MSL direct to 37°10'30''N, 85°15'W; then at 4,000' MSL turn right to 37°24'N, 85°18'30''W; then at 4,000' MSL direct to 37°26'N, 85°05'W; thence via the published route.

Route Width—The entire IFR route width is reduced to 4 NM either side of centerline. The VFR route width is reduced to 2 NM on the north side of centerline from 37°27'30''N, 84°54'30''W to 37°36'N, 84°00'W.

Hours of Operation—24 hours daily, 7 days per week.

Figure 83. AIM – Oil Burner Route.

EXCERPTS

RESTRICTIONS TO ENROUTE NAVIGATION AIDS

AIM-

OHIO

AKRON VORTAC: VOR portion unusable 030–080°. For V72 use published YNG VOR rad from ACO to YNG. SW bnd determine station passage at ACO by TO/FROM indication above 2,500′ MSL.

ALLEN COUNTY VOR: Unusable 205–290° and 330–340° beyond 15 NM.

BELLAIRE VORTAC: VOR portion unusable 325–345° below 6000′ MSL.

BRIGGS VORTAC: VOR portion unusable 330–010°, 120–145° 305–325°. 100–120° unusable beyond 10 NM below 4000′ MSL.

MONTGOMERY VOR: Unusable in the following areas: 033–070°, 085–135°, 155–225°, 250–280° and 295–023°.

SANDUSKY VORTAC: VOR portion unusable 260–285°.

STRONGSVILLE VOR: Unusable 080–200° beyond 35 nmi below 3000′ MSL.

TENNESSEE

KNOXVILLE VORTAC: VOR portion unusable 140–175° all alts, 175–186° above 17,000′ MSL.

VIRGINIA

BROOKE VORTAC: DME portion unusable 230–270° beyond 30 mi below 1,500′ MSL.

GORDONSVILLE VORTAC: VOR portion unusable below 5000′ MSL 055–075°.

HERNDON VORTAC: VOR portion unusable 050–075° below 2500′ and beyond 20 nmi below 3500′ and beyond 30 nmi below 6000′ MSL. 075–095° beyond 20 nmi below 2500′. 105–120° beyond 35 nmi below 2500′. 165–215° beyond 20 nmi below 2500′ MSL. 005–040° beyond 27 NM below 5000′.

LAWRENCEVILLE VOR: Unusable 215–250° beyond 8 mi below 1,800′ MSL.

LINDEN VORTAC: DME portion unusable 140–180° beyond 25 mi below 3,500′ MSL and 180–225° beyond 25 mi below 5,000′ MSL.

MONTEBELLO VOR: Unusable 110–220° beyond 35 mi below 5,000′ MSL.

PULASKI DME: Unusable 320–360° below 7000′ beyond 30 mni.

WOODRUM VOR: Unusable 286–360° beyond 20 mi below 5,500′ MSL.

WEST VIRGINIA

BECKLEY VOR: Unusable 325–350° beyond 20 mi below 5,000′ MSL excluding 335° radial at Montgomery Int.

ELKINS VORTAC: DME portion unusable 110–160° beyond 48 nmi, 160–193° beyond 42 nmi below 8000′; 193–205° beyond 60 nmi below 9000′.

Figure 84. AIM – Restrictions to Enroute Navigation Aids.

VOR RECEIVER CHECK POINTS

AIM-

NOTE: The information is provided in the following order: Facility name (plus airport name, if needed); bearing in degrees magnetic from the VOR; location of the check point (distances in nautical miles); and altitude (in feet MSL, if any).

KENTUCKY

Airborne—

Lexington (Blue Grass): 305°; 7.6 mi over arpt ctl twr, 2500′.

Ground—

Covington (Greater Cincinnati): 043°; rnwy 27R E of int rnwys 27R and txwy G.

OHIO

Airborne—

Dayton (Muni): 131°; over new trml bldg, 10.76 nmi;

Ground—

Cincinnati: (See Covington, Ky.).

EXCERPTS

WEST VIRGINIA

Ground—

Martinsburg: 281°; near apch end of rnwy 35.

Morgantown: 337°; on txwy in front of Term Bldg.

Parkersburg (Wood County): Lctn #1—209°; runup area N side of rnwy 28. Lctn #2—207°; on txwy near intersection rnwys 16 and 21.

Wheeling (Wheeling-Ohio County): 219°; txwy on E side of ramp.

Figure 85. AIM – VOR Receiver Check Points.

EXCERPTS

NOTICES TO AIRMEN

AIM-

KENTUCKY

COVINGTON, GREATER CINCINNATI ARPT: Rnwy Alignment Indicator System Experimental (RAISE) lctd extended cntr line rnwy 18, 8,680' N of threshold. System appears as an inverted T with 5 lgt stations forming the cross of the T, and 2 additional lgt stations forming the leg of the T. All lgts are red and system opers in steady burning mode. Min crossing height 1800' MSL for visual approaches from N. ILS Glide Path alt is 1800' MSL over (RAISE).

FORT KNOX, GODMAN AAF RDO: VOR inop UFN.

LEXINGTON, BLUE GRASS ARPT: ILS, G/S, ALS/SFL, rnwy 4 shtdn UFN due rnwy constr. SW 500' of rnwy 4-22 clsd excp for tkof rnwy 4 0600 to sunset lcl Mon thru Sat UFN.

PADUCAH, BARKLEY FLD: WIP parallel to S side rnwy 4-22 til aprxly Nov 1969.

OWENSBORO, OWENSBORO-DAVIESS CO ARPT: REIL and Apch Lgt System rnwy 35 operg tests basis UFN.

RUSSELL SPRINGS, RUSSELL COUNTY ARPT: Clsd

OHIO

AKRON, AKRON-CANTON ARPT: Constr of parallel twy in progresss dalgt hrs only, apch end rnwy 19 UFN.

CINCINNATI: Moored mrkd balloon will be flown day or ngt up to an alt 1500' MSL. Site of operns 7½ mi NE Greater Cincinnati Arpt and 6½ mi W Lunken Arpt. Balloon will be tethered aprxly ½ mi W of Cincinnati Union Trml Bldg.

CINCINNATI, GREATER CINCINNATI ARPT: See Covington, Ky for current information.

CINCINNATI, CINCINNATI MUNI LUNKEN FLD: Rnwy 2L-20R clsd to acft over 12,500 lbs.

CLEVELAND, BURKE LAKEFRONT ARPT: Three 140' unlgtd cranes operg apch rnwy 6R UFN. 100' barge mounted crane and vessels working from shoreline to a point 500' N of cntrln rnwy 24R then parallel shoreline E 1800', crane lowered ngts. Two lgtd 120' cranes 300' N of cntrln of first 1000' rnwy 24R 0700-2300 daily. Rnwy 24L clsd to lndg daily 0700-1730 lcl wk days UFN. WIP on apch end rnwy 24L.

CLEVELAND, CLEVELAND-HOPKINS INTL ARPT: Rnwy 36 clsd UFN. Rnwy 5R-23L clsd 0700-1730 UFN.

COLUMBUS, PORT COLUMBUS INTL ARPT: Intermittent kite flying up to 10,000' and above aprxly 10 miles W of arpt during dalgt hrs. Voice on LOC freq 109.5 unavbl UFN. (10-69)

DAYTON, JAMES M COX DAYTON MUNI ARPT: WIP on new rnwy 6L-24R until November 1969, rnwy clsd to all tfc. ILS system under const rnwy 6L now operg test basis only and not to be used for nav purposes.

EAST LIVERPOOL, COLUMBIANA ARPT: Clsd UFN. (9-69)

JEFFERSON, ASHTABULA-JEFFERSON ARPT: 400' overrun W end rnwy 27 for rollout ngts only; 315' displaced threshold E end rnwy 27 ngts only UFN.

LANCASTER, FAIRFIELD COUNTY: WIP on rnwy 9-27 lgts—full length—UFN.

VIRGINIA

BLACKSTONE: Restricted Area R-6602, Camp Pickett, Va., in continuous use sfc to 18,500' thru 1 Jan 1970. (10-69)

BUMPASS, REST-A-WHILE ARPT: Rnwy 6 threshold displaced 200'. Rnwy 24 threshold displaced 400'. WIP both sides of rnwy 6-24 UFN.

CULPEPER MUNI ARPT: WIP on fld UFN. Clsd to ngt operns UFN. (10-69)

HOT SPRINGS, INGALLS FLD: ILS rnwy 24 operg on test basis only UFN; not to be used for navigation purposes.

LYNCHBURG, LYNCHBURG MUNI-PRESTON GLEN FLD: Rnwy 6-24 clsd ngts UFN.

MT VERNON SPECIAL NOTICE: Low flying acft requested to avoid immediate vcnty Mount Vernon estate lctd W bank Potomac River, 10 mi S Washington Natl Arpt.

NEWPORT NEWS-PATRICK HENRY ARPT: ILS rnwy 6 shutdown for lclzr relctn. (10-69)

NORFOLK REGIONAL ARPT: Rnwy 1-19 clsd to all acft in excess of 50,000 lbs GWT; open dalgt operns only.

WAKEFIELD ARPT: NDB "AKQ" operg 274 on test basis only; not to be used for navigation purposes.

WEST VIRGINIA

CHARLESTON, KANAWHA COUNTY ARPT: ILS LOC G/S and MM rnwy 23 shutdown until aprxly 3 Nov 69. Rnwy 5-23 clsd, REIL and RVV shutdown until aprxly 1 Nov 69. Rnwy 5 thr will be dspled 100' efctv 1 Nov 69. (10-69)

HUNTINGTON, TRI-STATE ARPT: Shoals BC rnwy 29 inop UFN. (8-69)

PARKERSBURG, WOOD COUNTY ARPT: Rnwy 16-34 closed UFN repairs.

WESTON, LOUIS BENNETT FLD: Clsd due constr UFN. (9-69)

WHEELING-OHIO COUNTY ARPT: Rnwy 8-21, E txwy and first 500' rnwy 27 clsd for repairs. Rnwy 16-34 will be clsd for short periods durg constr. (9-69)

Figure 86. AIM — NOTAMS.

FSS–CS/T AND WEATHER BUREAU TELEPHONE NUMBERS

Flight Service Stations (FSS) and Combined Station/Tower (CS/T) provide information on airport conditions, radio aids and other facilities, and process flight plans. CS/T personnel are not certificated pilot weather briefers; however, they provide factual data from weather reports and forecasts. Airport Advisory Service is provided at the pilot's request on 123.6 by FSSs located at airports where there are not control towers in operation. (See Part 1 ARRIVALS.)

The telephone area code number is shown in parentheses. Each number given is the preferred telephone number to obtain flight weather information. Automatic answering devices are sometimes used on listed lines to given general local weather information during peak workloads. To avoid getting the recorded general weather announcement, use the selected telephone number listed.

◆ Indicates Pilot's Automatic Telephone Weather Answering Service (PATWAS) or telephone connected to the Transcribed Weather Broadcast (TWEB) providing transcribed aviation weather information.

● Indicates a restricted number, use for aviation weather information

▬ Call FSS for "one call" FSS/WBAS briefing service.

★ Automatic Aviation Weather Service (AAWS).

EXCERPTS

Location and Identifier		Area Code	Telephone
KENTUCKY			
Bowling Green BWG (Warren County)	FSS	(502)	843-1152
Erlanger (Gtr Cincinnati Arpt)	WB	(513)	684-2129◆
London LOZ	FSS	(606)	864-4410
	FSS	(606)	254-5143
	WB	(606)	255-1774◆
Louisville LOU (Bowman)	FSS	(502)	451-5344
	WB	(502)	368-2188◆
Paducah PUK (Barkley)	FSS	(502)	442-1551
OHIO			
Akron AKR	WB	(216)	896-2246◆
Canton	WB	(216)	499-7933◆
Cincinnati LUK (Lunken)	FSS	(513)	321-1434
	FSS	(513)	871-6200★
(Greater Cincinnati)	WB	(513)	684-2129◆
Cleveland CLE (Hopkins)	FSS	(216)	267-3700▬
	WB	(216)	267-3410★
Columbus CMH	FSS	(614)	237-8478▬
	FSS	(419)	526-2132
Dayton DAY	FSS	(513)	898-3692
	WB	(513)	898-4620◆
Findlay FDY	FSS	(419)	422-3237
Mansfield MFD	WB	(419)	522-7070 (0600-1800)
Toledo TOL (Express)	WB	(419)	385-4921◆
Youngstown YNG	FSS	(216)	539-5121
	WB	(216)	545-2447◆
Zanesville ZZV	FSS	(614)	452-8611
TENNESSEE			
Knoxville TYS (McGhee Tyson)	FSS	(615)	577-6651
	WB	(615)	577-4805◆
(from Maryville)		(615)	982-3682
Tri City TRI (Bristol)	FSS	(615)	323-6204
	WB	(615)	323-6200
VIRGINIA			
Blackstone BKT	FSS	(703)	292-3826
Bristol	WB	(615)	323-8242◆
Chantilly (Dulles)	WB	(703)	661-8526◆
Charlottesville CHO (Charlottesville/Albermarle)	FSS	(703)	973-3909
Danville DAN	FSS	(703)	793-1163
Lynchburg (Muni-Preston Glenn	WB	(703)	239-5811◆ (0600-1930)
Newport News PHF (Patrick Henry)	*FSS*	*(703)*	*877-0200▬*
Norfolk (Newport News)	FSS	(703)	855-3029▬
Richmond RIC (Byrd Flying Field)	FSS	(703)	737-7369▬
Roanoke ROA (Woodrum)	FSS	(703)	362-1668▬
WEST VIRGINIA			
Beckley	WB	(304)	252-3171◆
Bluefield BLF (Mercer County)	FSS	(304)	325-6521
Charleston CRW (Kanawha)	FSS	(304)	343-8919▬
Elkins EKN (Randolph)	FSS	(304)	636-0810▬
Huntington HTS (Tri-State)	FSS	(304)	453-3951▬
Martinsburg MRB	FSS	(304)	AM 3-9353
Morgantown MGW	FSS	(304)	292-9489
Parkersburg PKB (Wood Co)	FSS	(304)	485-6421
	WB	(304)	422-3661 (0700-1400 Mon-Fri) (0700-1200 Sat)
Wheeling HLG (Ohio Co)	CS/T	(304)	CR 7-1252

Figure 87. AIM – Telephone Numbers.