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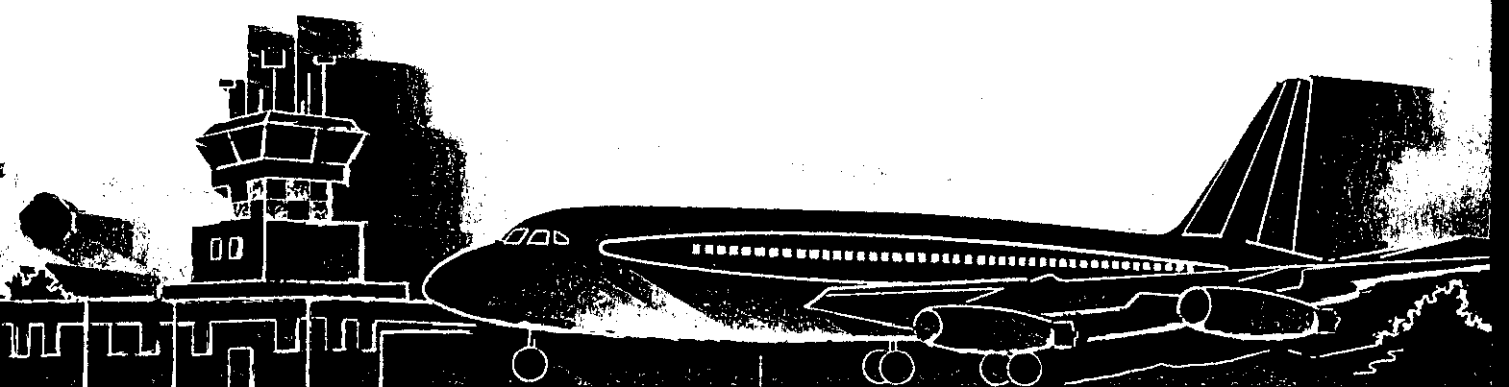
AC 65-4

FEDERAL AVIATION AGENCY

AIRCRAFT DISPATCHER

examination guide



AIRCRAFT DISPATCHER EXAMINATION GUIDE

Revised 1966

FEDERAL AVIATION AGENCY

Flight Standards Service

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PREFACE

This guide is prepared by the Flight Standards Service of the Federal Aviation Agency to assist the applicant preparing for the Aircraft Dispatcher Written Examination. It describes the type and scope of aeronautical knowledge covered by the written examination, lists reference materials available from the U.S. Government Printing Office, and presents sample questions. As a convenience to the applicant, those portions of the Federal Aviation Regulations concerning general eligibility and aeronautical experience requirements for the certificate have been included. The applicant should be aware, however, that regulations are subject to amendment. Any question regarding the currency of these quoted excerpts may be checked with the appropriate FAA office.

This guide is included in the Agency's Advisory Circular System as AC 65-4 and supersedes the *Aircraft Dispatcher Examination Guide* dated July 1961.

INTRODUCTION

The Aircraft Dispatcher is an important member of the airline operation team and must be able to speak the language of the operating crews as well as that of management. He shares responsibility with the pilot for flight planning details that affect the safe conduct of the planned operation. After dispatching the flight, he performs important coordination functions involving the aircraft and other departments of the airline. He also provides the pilot with advisory information affecting the safe progress of the flight.

The Aircraft Dispatcher should, therefore, possess knowledge across the broad spectrum of airline operation as reflected in the section of this guide titled "Aeronautical Knowledge Covered by the Examination." It is recognized that certain topics concerning domestic flight operations have no counterpart in international flight operations and vice versa; however, the applicant who is fully educated in the subject areas listed will be adequately prepared for the written examination.

AIRCRAFT DISPATCHER CERTIFICATE REQUIREMENTS

Certification requirements for the Aircraft Dispatcher Certificate are reprinted from the Federal Aviation Regulations, Part 65, effective November 1, 1962.

65.51 Certificate required.

a. No person may serve as an aircraft dispatcher (exercising responsibility with the pilot in command in the operational control of a flight) in connection with any civil aircraft in air commerce unless he has in his personal possession a current aircraft dispatcher certificate issued under this subpart.

b. Each person who holds an aircraft dispatcher certificate shall present it for inspection upon the request of the Administrator or an authorized representative of the Civil Aeronautics Board, or of any State or local law enforcement officer.

65.53 Eligibility requirements: general.

To be eligible for an aircraft dispatcher certificate, a person must—

a. Be at least 23 years of age;

b. Be able to read, speak, and understand the English language, or have an appropriate limitation placed on his certificate;

c. Comply with §§ 65.55, 65.57, and 65.59.

65.55 Knowledge requirements.

a. An applicant for an aircraft dispatcher certificate must pass a written test on—

(1) The regulations of this chapter that apply to the duties of an aircraft dispatcher;

(2) The general system of collecting and disseminating weather information;

(3) Interpreting aviation weather reports, including abbreviations and symbols, as prescribed in Department of Commerce Weather Bureau Circular N, "Manual of Surface Observations," as amended;

(4) The fundamentals of meteorology as applied to aircraft operations, particularly as to—

(i) Surface and upper air weather maps and general characteristics of air masses, pressure systems, and frontal systems, including their symbols and nomenclature;

(ii) Cloud forms and their significance; and

(iii) Icing, turbulence, thunderstorms, fog and low ceilings, winds aloft, pressure pattern flying, the influence of terrain on meteorological conditions, and general principles of forecasting and analysis;

(5) Principles of aircraft navigation with particular respect to instrument operation and procedures;

(6) Communications facilities and procedures;

(7) Air navigation facilities and procedures; and

(8) Air traffic control procedures.

b. A report of the test is sent to the applicant. A passing grade is evidence, for a period of 24 months after the date the test is given, that the applicant has complied with this section.

65.57 Experience requirements.

An applicant for an aircraft dispatcher certificate must present documentary evidence satisfactory to the Administrator that he has the experience prescribed in any one of the following paragraphs:

a. A total of at least 2 of the 3 years before the date he applies, in scheduled air carrier operations, scheduled military aviation operations, or any other aircraft operations that the Administrator finds provides equivalent experience—

(1) As a pilot member of a flight crew;

(2) As a flight radio operator or ground radio operator;

(3) As a flight navigator;

(4) As a meteorologist;

(5) Performing the duties of an aircraft dispatcher or his assistant; or

(6) Performing other duties that the Administrator finds provide equivalent experience.

b. A total of at least 2 of the 3 years before the date he applies, as an air route traffic con-

troller or a certificated air traffic control tower operator.

c. A total of at least 1 of the 2 years before the date he applies, as an assistant in dispatching scheduled air carrier aircraft performing the duties of an aircraft dispatcher under the direct supervision of a certificated dispatcher.

d. Within 90 days before the date he applies, successful completion of a course of instruction approved by the Administrator as adequate for the training of an aircraft dispatcher.

An applicant is entitled to credit any combination of experience in paragraph (a), or paragraphs (a) and (b), of this section, if the aggregate of that experience is at least 2 years.

65.59 Skill requirements.

An applicant for an aircraft dispatcher certificate must pass a practical test—

a. With respect to any one type of large aircraft used in air carrier operations, on—

(1) Weight and balance limitations;

(2) Performance operating limitations;

(3) Using cruise control charts;

(4) Fuel and oil capacities and rates of consumption; and

(5) Using the operations manual;

b. On the characteristics of air routes and airports with particular reference to—

(1) Landing areas;

(2) Lighting facilities; and

(3) Approach and landing facilities and procedures;

c. On the use and limitations of sensitive-type altimeters;

d. On applying available weather forecasts and reports to determine whether a flight can be made safely;

e. On using the *Airman's Information Manual;*

f. On dispatching and assisting a flight under adverse weather conditions; and

g. On emergency procedures.

REFERENCE MATERIALS

The following list of publications and materials is provided as a basic guide for the benefit of persons who wish to prepare for the written examination. Except for charts, all these items may be obtained from the Superintendent of Documents, U.S. Government Printing Office. Textbooks and other reference materials are also available from many commercial publishers. It is the responsibility of each applicant to obtain the study materials appropriate to his needs.

FEDERAL AVIATION REGULATIONS:

Part 25, Airworthiness Standards: Transport Category Airplanes—$0.75.

Part 65, Certification: Airmen Other Than Flight Crewmembers—$0.20.

Part 91, General Operating and Flight Rules—$0.45.

Part 121, Certification and Operations: Air Carriers and Commercial Operators of Large Aircraft—$1.00.

FLIGHT INFORMATION PUBLICATIONS

Airman's Information Manual—(Annual subscription $15 domestic; $19 foreign). This publication presents in a single document all information necessary for the planning and conduct of a flight in the U.S. Airway system. It is designed to be used in the cockpit for preflight and inflight operations by pilots, and contains both instructional and procedural information. The AIM replaces the former *Airman's Guide*, the *Directory of Airports and Seaplane Bases*, and the *Flight Information Manual*. The subscription consists of the basic manual with monthly, quarterly, and semi-annual revisions of complete sections, plus a biweekly NOTAM element.

Air Traffic Control Procedures, AT P 7110.1B ($4.00 for basic manual with supplements as issued). An FAA publication prescribing procedures and standard phraseology to be used by personnel of all facilities providing air traffic control service. Although written for the air traffic controller, the text is excellent for the study of standard communications procedures by others who need to be familiar with them.

STUDY MANUALS

Aviation Weather, AC 00-6 ($2.25). An excellent reference treating all phases of meteorology of interest to the Aircraft Dispatcher. Aviation weather reports and forecasts are also covered in detail with respect to format and content.

Air Navigation, AF Manual 51-40, Volume I ($3.25). This U.S. Air Force publication is an excellent reference for basic navigation.

Aircraft Performance—Reciprocating and Turboprop Engine Aircraft, AF Manual 51-9 ($2.50). This U.S. Air Force publication contains much material having civil aviation applications.

CHARTS

Instrument Approach Procedure Charts (10¢ per airport set). Individual charts give detailed information on procedure for each type of approach at the airport.

Enroute Charts (25¢ each). These charts provide the necessary aeronautical information for enroute instrument navigation (IFR) in the established airway structure.

Low-Altitude Area Charts (10¢ each). These charts supplement the Enroute Charts by giving departure, arrival, and holding procedures at principal airports.

Aeronautical Charts (30¢ each). These charts include World Aeronautical Charts, Sectional Charts, and Local Area Charts.

HOW TO OBTAIN REFERENCE MATERIALS

The study materials listed, except the charts, may be obtained by remitting check or money order to:

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

Charts may be obtained at your local airport or by sending a check or money order to:

U.S. Coast and Geodetic Survey
Washington, D.C. 20235

To cover foreign mailing for those publications not showing a foreign price, add 25 percent to the publication's listed price. Remittances from a foreign country may be made by International Money Order or draft on a United States bank payable to the issuing Agency.

AERONAUTICAL KNOWLEDGE COVERED BY THE EXAMINATION

I. Regulations

A. Airworthiness Standards: Transport Category Airplanes—FAR 25.

1. Subpart B—Flight.
2. Subpart G—Operating Limitations and Information.

B. Certification: Airmen Other Than Flight Crewmembers—FAR 65.

1. Subpart A—General.
2. Subpart C—Aircraft Dispatchers.

C. General Operating and Flight Rules—FAR 91.

1. Subpart A—General.
2. Subpart B—Flight Rules.

D. Certification and Operations: Air Carriers and Commercial Operators of Large Aircraft—FAR 121.

1. Subpart B—Certification Rules for Domestic and Flag Air Carriers.
2. Subpart E—Approval of Routes: Domestic and Flag Carriers.
3. Subpart G—Manual Requirements.
4. Subpart I—Airplane Performance Operating Limitations.
5. Subpart K—Instrument and Equipment Requirements.
6. Subpart M—Airman and Crewmember Requirements.
7. Subpart N—Training Program.
8. Subpart P—Aircraft Dispatcher Qualifications and Duty Time Limitations: Domestic and Flag Air Carriers.
9. Subpart Q—Flight Time Limitations: Domestic Air Carriers.
10. Subpart R—Flight Time Limitations: Flag Carriers.
11. Subpart T—Flight Operations.
12. Subpart U—Dispatching and Flight Release Rules.
13. Subpart V—Records and Reports.

II. Flight Planning

A. Weather information.

1. Survey—surface weather map:
   a. Winds and pressure distribution.
   b. Air masses and stability.
   c. Fronts.
   d. Factors affecting visibility.
   e. Forecasting weather movement.
   f. Interpretation of map symbols.
2. Survey—enroute weather conditions:
   a. Regional (FN) and area (FA) forecasts:
      (1) Times and periods of issuance.
      (2) Interpretation of contents.
   b. PIREPS:
      (1) Turbulence.
      (2) Icing.
      (3) Cloud layers.
      (4) Hazardous conditions.
   c. Constant pressure charts—standard heights of 700, 500, and 300 mb. surfaces:
      (1) Location of jet streams.
      (2) Areas of clear air turbulence.
3. Survey—terminal weather conditions:
   a. Terminal forecasts (FT_1 and FT_2):
      (1) Times and periods of issuance.
      (2) Interpretation of contents.
   b. Hourly sequence reports and NOTAMS:
      (1) Teletypewriter symbols.
      (2) Use in weather forecasting.
      (3) Interpretation of NOTAM code.
   c. Winds aloft forecasts (FD):
      (1) Times and periods of issuance.
      (2) Interpretation of contents.

B. Route and altitude selection.

1. Choice of airways:
   a. Standard instrument departures.
   b. Airway structure.
   c. Terminal area departure and arrival charts—interpretation of chart symbols.
2. Minimum IFR altitudes.

3. Enroute and terminal radio aids:
   a. VHF omnirange and DME.
      (1) Frequency allocation.
      (2) General operating principles.
      (3) Classification.
   b. Homing facilities and fan markers:
      (1) Frequency allocation.
      (2) Classification.
   c. Instrument landing system (ILS):
      (1) Frequency allocation.
      (2) General operating principles.
      (3) Components.
   d. Radar facilities.
      (1) Ground control approaches:
         a. Precision Approach Radar (PAR).
         b. Surveillance Approach (ASR).
      (2) Arrival, departure, and enroute radar traffic control.

C. Flight time analysis.
   1. Computations:
      a. Flight time.
      b. Fuel requirements including reserve.
      c. Mach number terminology.
      d. Enroute fuel management.

D. Aircraft loading.
   1. Observance of weight limitations:
      a. Takeoff gross weight.
      b. Landing gross weight.
      c. Zero fuel weight.
      d. Operating weight (empty weight plus operating load).
   2. Calculation of Center of Gravity location and observance of C. G. operating range.

E. Aircraft performance—all types.
   1. Consideration of operating variables:
      a. Runway length.
      b. Runway gradient.
      c. Field elevation.
      d. Wind.
      e. Temperature.
   2. Takeoff flight path:
      a. Takeoff distance.
      b. Takeoff speeds (V speeds).
      c. Obstruction clearance requirements.
   3. Enroute limitations on aircraft weight:
      a. All engines operating.
      b. One engine inoperative.
      c. Two engines inoperative.
   4. Landing distance and weight limitations:
      a. Destination airport.
      b. Alternate airport.
   5. Characteristics of high performance aircraft:
      a. Critical Mach number.
      b. Subsonic, transonic, supersonic ranges.
      c. Compressibility effects.

F. Instruments and equipment—all operations.
   1. Minimum equipment requirements for dispatch.
   2. Flight and navigational equipment.
   3. Oxygen requirements—crew, passengers.
   4. Emergency equipment:
      a. Hand fire extinguishers—required number.
      b. Fire extinguishing systems.
      c. First aid equipment.
      d. Means for emergency evacuation.
      e. Miscellaneous—crash ax, emergency lighting, etc.

III. Operations

A. Air Traffic Control Procedures and Air Traffic Rules.
   1. Altitude and route assignment:
      a. Minimum en route altitude (MEA).
      b. Altimeter setting information.
      c. Altitudes and flight levels.
      d. Determination of lowest usable flight level.
      e. Airway routes and intersections.
   2. Separation Standards:
      a. Vertical.
      b. Longitudinal.
      c. Lateral.
      d. DME.
   3. Procedures for—
      a. Departing aircraft.
      b. Enroute aircraft.
      c. Holding aircraft.
      d. Arriving aircraft—instrument approaches.
      e. Emergency radio failure.
   4. Clearances and instruction—standard phraseologies.
   5. Radar procedures for—
      a. Departing aircraft.
      b. Arriving aircraft approaches—ASR and PAR.
      c. Enroute aircraft.
      d. Loss of communications.
   6. Airport traffic procedures:
      a. Clearances, instructions, information.
      b. Weather information.
      c. Separation minima.
      d. Airport lighting.
      e. Use of runways.

B. Enroute navigation techniques—
1. Dead reckoning.
a. Chart reading.
b. Measuring course and distance.
2. Radio Navigation.
a. Fixes by bearing plots.
b. Off course corrections.
3. Compressibility effects on TAS.
4. Determination of wind experienced—resultant heading and ETA correction.
5. Airspeed adjustments to maintain schedule.

C. Enroute operational procedures.
1. Operation in icing conditions.
2. Cruising control techniques and power settings.
3. Reclearances involving weather changes.
4. Exercising emergency authority.

D. Instrument approach procedures.
1. Types of facilities used:
a. ADF.
b. VOR.
c. ILS.
d. TACAN.
e. Radar.
f. VASI.
2. Types of approaches:
a. Straight in.
b. Circling.
c. Visual.
3. Elements of the approach:
a. Initial approach altitude.
b. Procedure turn.
c. Final approach.
d. Missed approach.
e. Holding.
4. Interpretation of instrument approach procedure charts.
5. Lighting aids.

IV. Postflight

A. Debriefing the flight crew.
1. Unusual weather encountered.
2. Irregular operation of radio aids.
3. Aircraft mechanical reports.
4. Future schedule coordination of aircraft and crew.

B. Filing of required records and reports.

THE WRITTEN EXAMINATION

NATURE OF THE EXAMINATION

The Aircraft Dispatcher Written Examination is a single-section type, which permits a practical or operational approach to the problems that arise in planning and conducting transport flight operations.

The multiple choice questions in this guide are developed from typical situations involving preflight, inflight, and postflight duties of the Aircraft Dispatcher.

Material furnished the applicant for use during the examination includes the following:

Significant Weather Map; Constant Pressure Charts; Regional Forecasts; Area Forecasts; Terminal Forecasts; Sequence Reports; Segments of Enroute Charts; Instrument Approach and Landing Charts; excerpts from *Airman's Information Manual;* Aircraft Particulars; Minimum Equipment List for Dispatch.

TAKING THE EXAMINATION

The written examination may be taken at FAA General Aviation and Air Carrier District Offices of the Flight Standards Service. After completing the examination, the answer sheet and papers used for computations or notations will be surrendered to the proctor before leaving the examination room.

All answer sheets graded below passing (70 percent) are hand checked for verification before the results are mailed to the applicant on Form FAA–578A; an applicant who receives a failing grade MUST present this form before reexamination.

The applicant should keep in mind the following points when taking the examination:

1. Each question or problem should be carefully read, without looking at the possible answers. The applicant should clearly understand the problem before formulating the steps toward its solution.

2. He should then determine which of the alternatives most nearly corresponds with the answer he has formulated. The answer chosen should completely solve the problem.

3. From the answers given it may appear that there is more than one possible answer; however, only one answer is correct and complete. The other answers are either incomplete or derived from popular misconceptions.

4. If a particular test item proves difficult, it is best to proceed to another question. When the less difficult questions have been answered, the others should then be reconsidered.

5. There are no "trick" questions in the examination.

SAMPLE EXAMINATION

The following sample examination is similar in format to the official FAA written examination. It is important to remember, however, that these test items do not direct attention to all of the topics on which you will be tested in the official examination. For this reason, you should concentrate on the section entitled "Aeronautical Knowledge Covered by the Examination." A knowledge of all of the topics presented in the outline—not just the ability to answer these few sample test items—should be your goal as you prepare for the written examination.

The increased performance of present day transport category aircraft requires greater emphasis on high-altitude meteorology, high-speed aerodynamics, and turbine equipment. Applicants should, therefore, expect to encounter test items dealing with these areas in the written examination.

Answers to the sample test items are given at the end of the examination. A separate section also includes a detailed analysis, or explanation, of each test item.

NOTE.—The reader should be aware that the sample test items are based on regulations and procedures in effect at the time of final editing of this guide. Similar test items in the official FAA written examinations should always be answered in terms of current regulations and procedures.

SITUATION

You are a certificated Aircraft Dispatcher employed by an airline whose central dispatch office is located at the San Franciso International Airport in California. The company is an air carrier, authorized to operate in scheduled transportation under pertinent regulations.

The domestic route structure provides service to metropolitan areas in the States of California, Washington, Oregon, and Colorado, while the international structure provides service to the State of Hawaii. The equipment used for both route patterns is typical of most four-engine reciprocating air transport aircraft in present use.

* * * * *

You report to the Dispatch Office at 0200 Pacific Standard Time, Friday, April 13 (1000 GMT, Friday, April 13). One of your first duties is to survey weather conditions in the dispatch area.

* * * * *

1. The San Franciso Regional Forecast (Fig. 1—Appendix) indicates that icing in clouds and in precipitation is expected over northern California above—

1—5000 feet, AGL.
2—7000 feet, MSL.
3—5000 feet, MSL.
4—7000 feet, AGL.

2. According to the San Francisco Area Forecast (Fig. 1—Appendix), which of the statements below is correct?

1—The frontal system off the northern California coast is expected to intensify.
2—Ceilings over northern California are expected to be 3000 feet to 5000 feet broken, variable overcast.
3—Surface visibilities over the entire area are forecast to be less than 8 miles.
4—Occasional light rain is forecast for central California after 0500 PST.

3. Terminal Forecasts for San Francisco (SFO), Seattle (SEA), Portland (PDX), and Denver (DEN) are listed below.

FT1 Ø5Z–17Z
SFO 2ØⒹC3Ø⊕1415G25 OCNL R–.
SEA 8ØⒹC3ØØ⊕. Ø2ØØP 3ØⒹC8Ø⊕. Ø5ØØP 3ØⒹC5Ø⊕ OCNL R–.
PDX 3ØⒹC8Ø⊕. Ø3ØØP 3ØⒹC4Ø⊕ OCNL R–. Ø8ØØP 15ⒹC25⊕RW– Ⓓ OCNLY ◍
DEN 16Ø◑25Ø–◍. 1ØØØM C16Ø◍ 1415G25

Which of the statements below correctly interpret certain portions of these reports?

A. Ceiling at SFO is forecast to be 300 feet overcast for the entire period.

B. Surface wind velocity at SEA is expected to be less than 10 knots during the forecast period.

C. Ceiling at DEN prior to 1000 MST is 25,000 feet.

D. Light rain showers are expected at PDX after 0800 PST.

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

4. The latest Scheduled Airway report for SEA appears as follows;

SEA E14ØⒹ15 144/47/44/36Ø8/994

Which of the statements below is correct with regard to this report?

1—Altimeter setting is 1014.4 millibars.
2—Temperature/dew point spread is 3°C.
3—Ceiling is 1400 feet, broken.
4—Wind is 360°/08 knots.

5. The statements below refer to the Surface Weather Map (Fig. 2—Appendix). Select the correct statements.

A. Barometric pressure at San Francisco is 1016.3 millibars.

B. Pressure change at Seattle in the preceding 3-hour period was 8 millibars.

C. Surface wind direction and velocity at Salt Lake City is approximately 180°/5 knots.

D. At Burns, Oregon, the wind report is missing.

E. The front extending northward from southeast Oregon is shown to be occluded.

F. Low clouds at San Francisco are stratocumulus at 500 feet.

1—B, C, F.
2—A, D, F.
3—B, D, E.
4—A, C, E.

6. In order to maintain qualification for dispatching duty under the operating rules of FAR 121, you are required to make a—

1—round trip over the dispatch area every 6 months.
2—round trip over the dispatch area every 12 months.
3—one-way trip over the dispatch area within the preceding 12 months.
4—one-way trip over the dispatch area within the preceding 6 months.

7. At 0230 PST, you receive the following message via company radio from your Flight 85, which is enroute from San Francisco to Seattle:

"Feathered No. 2 engine due low oil pressure. Position: Portland Omni at 0225 PST, 16,000 feet—proceeding to SEA."

The pilot's decision to proceed to SEA, rather than land at PDX (which is operational) is—

1—good judgement since the flight has passed the half-way point.
2—not good judgement since PDX is the nearest airport in point of time.
3—a direct violation of regulations.
4—valid, if—upon consideration of certain factors—he considers such action to be as safe as landing at PDX.

8. The distance from PDX to SEA is 106 n.m. Assuming a three-engine TAS of 200 knots and a tailwind component of 25 knots, Flight 85 should arrive SEA at—

1—0245 PST.
2—0251 PST.
3—0253 PST.
4—0301 PST.

9. Upon completion of the trip, the pilot of Flight 85 is required to—

1—submit a written report to the Operations Manager stating his reasons for proceeding to SEA.
2—appear at the nearest FAA office within 48 hours with a written report of the incident.
3—make a verbal report to the Chief Pilot regarding this incident.
4—submit a written report to the nearest FAA office within 7 days.

* * * * *

You are directed to complete flight planning arrangements for your company's Flight 55 which is scheduled to depart San Francisco International Airport for Denver, Colorado, at 0430 PST. (Aircraft weight limitations and standard operating loads are listed under "Aircraft Particulars" in the appendix.)

* * * * *

10. The maintenance crew assigned to the aircraft scheduled for this flight reports that the fuel pressure indicator on No. 3 engine is inoperative. In view of the minimum dispatch requirements which have been approved for this operation (see—Minimum Equipment List for Dispatch), you would—

1—request substitution of the standby airplane.
2—request a positive fix on the unit at the expense of a delay to the flight.
3—accept the airplane if the fuel pressure warning light for No. 3 engine is operative.
4—accept the airplane since only 3 fuel pressure indicators are required.

* * * * *

The route and altitude for this IFR flight between SFO and DEN are planned as follows:
Altamont Two Departure—Isleton Transition J84, J56, DEN.
Alternate Airport—Cheyenne Municipal.
Altitude—19,000 feet.
You are to complete the flight time analysis form in the Appendix, Figure 12. Appropriate chart segments for this routing are also included in the Appendix, Figures 7, 8, 9, and 10.

NOTE.—The flight time analysis form used in Figure 12 is not intended to be an operational form. It is used here for an orderly presentation of flight planning data. Similar forms are made available to applicants when they take the official written examination. Applicants may use these forms or any other flight planning form of their selection.

* * * * *

11. The computed flight time from SFO to DEN is—

1—2 hours, 51 minutes.
2—3 hours, 06 minutes.
3—3 hours, 16 minutes.
4—3 hours, 25 minutes.

12. The weight of the fuel required for this flight, including 1800 pounds of "extra" fuel, is—

1—10,390 pounds.
2—11,240 pounds.
3—11,760 pounds.
4—12,190 pounds.

13. Assume that you wish to carry maximum fuel and maximum payload on this flight. If there are no operating limitations, what is the maximum allowable takeoff gross weight? (See "Aircraft Particulars" for Airplane Weights.)

1—98,650 pounds.
2—100,710 pounds.
3—102,000 pounds.
4—107,000 pounds.

14. The crew for this flight consists of two pilots, flight engineer, and three flight attendants. What is the maximum allowable payload for this flight? (See "Aircraft Particulars" for Operating Load.)

1—19,640 pounds.
2—23,600 pounds.
3—25,300 pounds.
4—26,530 pounds.

15. The actual payload for this flight is as follows: 85 passengers at 165 pounds each, and 7145 pounds of baggage and cargo. Compute the actual takeoff gross weight of Flight 55.

1—93,450 pounds.
2—94,190 pounds.
3—100,710 pounds.
4—107,000 pounds.

16. Loading personnel advise you that they wish to put a box which weighs 840 pounds in the forward belly compartment. Dimensions of the box are 4 feet long, 3 feet wide, and 2 feet high. Determine the minimum compartment floor loading of the box.

1—35 pounds/square foot.
2—70 pounds/square foot.
3—105 pounds/square foot.
4—140 pounds/square foot.

17. You determine the position of the Center of Gravity (C.G.) to be 436.6 inches aft of the datum line. (See "Aircraft Particulars.") Compute the C.G. location in terms of percentage of the Mean Aerodynamic Chord (MAC).

1—25% MAC.
2—27% MAC.
3—29% MAC.
4—33% MAC.

18. Flight 55 leaves the ramp at 0430 PST and receives ATC clearance to the Denver Airport via Altamont Two Departure—Isleton Transition, J-84/SLC, J-56. What VOR radials de-

fine the Standard Instrument Departure routing to Sacramento? (Fig. 7—Appendix)

1—SFO/047; OAK/060; SAC/174.
2—SFO/227; OAK/240; SAC/354.
3—SFO/047; OAK/060; SAC/354.
4—OAK/060; SAC/174.

19. San Francisco Tower clears Flight 55 for takeoff on runway 10L, reporting the wind as 140°/30 knots. What is the crosswind component of the wind in this situation? (Variation 18°E)

1—10 knots from the right.
2—20 knots from the right.
3—25 knots from the right.
4—30 knots from the right.

20. What direction reference and speed units are used by Control Tower personnel to report surface winds?

1—True direction and nautical miles per hour.
2—Magnetic direction and statute miles per hour.
3—Magnetic direction and nautical miles per hour.
4—True direction and statute miles per hour.

21. The critical engine failure speed (V_1) for this flight is 101 knots. What action is the pilot expected to take if an engine failure occurs exactly at the V_1 speed?

1—Continue the takeoff.
2—Either continue or abort the takeoff.
3—Abort the takeoff.
4—Abort the takeoff only if sufficient runway is available for deceleration.

22. The Minimum Enroute Altitude (MEA) between the Altamont and Isleton Intersections (Fig. 7—Appendix) is 4500 feet. Which of the following phrases correctly defines the MEA?

1—Assures adequate signals to determine specific VOR fixes.
2—Provides enroute obstruction clearance and assures navigation signal reception within 50 miles of a VOR.
3—Provides enroute obstruction clearance for IFR flight.
4—Assures adequate navigation signal coverage and obstruction clearance between airway radio fixes.

23. Flight 55 reports over SAC at 1305 GMT. Compute the True Airspeed (TAS) using the following information.

Pressure altitude	19,000 feet
Indicated airspeed (IAS)	177 knots
Airspeed position and instrument correction	+6 knots
Outside air temperature (indicated)	−20°C
Temperature correction	6°
Compressibility correction	2 knots

The TAS is—

1—234 knots.
2—238 knots.
3—242 knots.
4—248 knots.

24. The Mach number for the TAS computed in the previous test item is—

1—0.39.
2—0.41.
3—0.43.
4—0.45.

25. In connection with Mach number terminology, which of the statements below do you consider accurate?

1—Mach number is the ratio of the speed of sound relative to standard sea level conditions.
2—A specific Mach number determines speed directly, regardless of air temperature.
3—The true airspeed of a Mach number varies directly with air temperature.
4—The true airspeed of a Mach number varies inversely with air temperature.

26. Flight 55 reports over BAM at 1359 GMT (Fig. 8—Appendix). Assuming takeoff from San Francisco at 1237 GMT, the flight is operating—

1—5 minutes early.
2—on time.
3—5 minutes late.
4—10 minutes late.

27. Compute the average wind experienced between BAM and BVL based on the following data.

Time over BAM	1359 GMT
Time over BVL	1431 GMT
Average Compass Heading to maintain course	075°

Average TAS	242 knots
Variation	17°E.
Deviation	0°

1—160°/45 knots.
2—180°/35 knots.
3—230°/40 knots.
4—260°/60 knots.

28. On the basis of the wind computed in the previous test item, with no change in TAS, the compass heading between BVL and SLC should be approximately (variation 17°E., deviation 0°)—

1—078°.
2—084°.
3—107°.
4—073°.

29. The ETA at SLC, using the previously computed wind, is—

1—1439 GMT.
2—1442 GMT.
3—1445 GMT.
4—1449 GMT.

30. Assume a tailwind component of 35 knots through the remaining distance from BVL to DEN. Compute the TAS which must be maintained in order to arrive over the Denver VOR-TAC at 1555 GMT. (Fig. 9—Appendix)

1—263 knots.
2—268 knots.
3—282 knots.
4—298 knots.

31. Which of the statements below is correct with respect to Air Traffic Control Procedures?

1—Aircraft operating IFR on a Federal airway must always be flown along the centerline of the airway.
2—Standard separation is assured between all aircraft operating on IFR flight plans.
3—Increasing or decreasing the true airspeed by 10 knots constitutes a change in flight plan.
4—Clearances authorizing "VFR Conditions-on-top" are issued to IFR flights at the discretion of the Controller only.

32. Choose the statements below which correctly interpret certain data on the ILS instrument approach chart for runway 26L at Stapleton International Airport. (Fig. 11—Appendix)

A. All transitions are to the LOM.

B. RVR 2600 feet is authorized only for landing on runway 26L.

C. Glide Slope interception altitude is 7000 feet.

D. Straight-in minimums to runway 26L are 400 feet and 1 mile if the glide slope receiver is inoperative.

E. Distance from outer marker to the airport is 5½ miles.

F. Aircraft executing missed approaches always proceed direct to the DEN VOR.

1—C, D, E.
2—A, C, E.
3—B, D, F.
4—A, B, F.

33. You are now directed to compute the maximum allowable payload for Flight 200, scheduled to depart San Francisco for Honolulu at 1000 PST. The following data is relevant:

Pressure altitude	18,000 feet
Total fuel required	30,000 pounds
Aircraft empty weight	61,500 pounds
Operating crew	8

No operating limitations.

The maximum allowable payload is—

1—10,000 pounds.
2—12,200 pounds.
3—14,100 pounds.
4—15,500 pounds.

34. The statements below refer to the Significant Weather Prognostic Chart (Fig. 3—Appendix). Select the correct statements.

A. Barometric pressure at the "LOW" center (45°N./130°W.) is 998.1 millibars.

B. Occasional light turbulence to 22,000 feet is expected near the cold front west of SFO.

C. At flight altitude of 18,000 feet, enroute SFO to HNL, Flight 200 should be above all clouds.

D. The freezing level over SFO is shown to be about 8000 feet.

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

35. By inspection of the 500-millibar chart (Fig. 4—Appendix), the least time, or minimum

flight path, between SFO and HNL would be experienced on which of the following routes?

1—Great circle route.
2—SFO direct 40°N./135°W. direct HNL.
3—Rhumb line route.
4—SFO direct 30°N./130°W. direct HNL.

36. Assume that a flight is maintaining a pressure altitude of 18,000 feet on the great circle route between SFO and HNL. After reaching 35°N./135°W., the true altitude of the flight would—

1—remain constant.
2—decrease.
3—increase.
4—decrease, then increase.

37. The wind direction and velocity at the 300-millibar level (Fig 5—Appendix) over Ocean Station "NOVEMBER"—30°N./140°W. is approximately—

1—290°/130 knots.
2—270°/120 knots.
3—290°/105 knots.
4—270°/80 knots.

38. Assume the following flight plan times for Flight 200:

SFO—HNL ---------- 10 hours, 24 minutes
HNL—Alternate ------ 1 hour

What is the required fuel reserve in this situation?

1—45 minutes.
2—90 minutes.
3—2 hours, 13 minutes.
4—3 hours.

39. Refer now to the Tropopause/Vertical Wind Shear Chart (Fig. 6—Appendix). A jet flight, maintaining flight level 290 on the great circle route between Gander, Newfoundland (CYQX) and Paris, France (LFPO) would be flying—

1—above the tropopause on the entire route.
2—below, then above the tropopause.
3—below the tropopause between 43°W. and 20°W.
4—below the tropopause on the entire route.

40. At which of the positions listed below would an aircraft at flight level 310 expect to experience clear air turbulence?

1—35°N./48°W.
2—53°N./35°W.
3—59°N./19°W.
4—43°N./20°W.

* * * * *

The following test items are based on the performance charts in the Appendix. These charts have been excerpted from FAA-approved Airplane Flight Manuals for reciprocating engine, turboprop, and turbojet transport type aircraft. Charts such as these portray the performance characteristics of the particular airplane as they are influenced by operating variables. These include runway slope or gradient, wind, field elevation, and temperature. In turbojet aircraft the effect of anti-icing system operation is also considered.

It should be noted that individual airlines and operators use these charts to develop charts and tables of varying format to fit the needs of their service.

* * * * *

41. Determine the minimum takeoff runway length required, given the following data:

Reciprocating engine transport type (Fig.13—Appendix)
Takeoff Gross Weight ------ 98,000 pounds
Airport Altitude ---------- 1,000 feet
Wing flap setting ---------- 20 degrees
Reported wind (knots) ----- 25 (headwind)
Standard Atmospheric Conditions
Level runway

The minimum takeoff runway length is—

1—4500 feet.
2—4800 feet.
3—5000 feet.
4—5150 feet.

42. Consider now the effect of runway slope on the minimum effective runway length determined in test item 41. Assume that the runway has an uphill slope of 2% (+.02). In this situation, the minimum effective runway length is (Fig. 14—Appendix)—

1—5000 feet.
2—5500 feet.
3—6000 feet.
4—6200 feet.

43. What is the maximum permissible takeoff gross weight under the following conditions (Fig. 13—Appendix):

Minimum takeoff runway length	4500 feet
Reported wind (knots)	15 (headwind)
Airport altitude	6000 feet
Wing flap setting	20 degrees

Level runway
Standard atmospheric conditions

The maximum permissible takeoff gross weight is—

1—80,800 pounds.
2—82,000 pounds.
3—83,000 pounds.
4—85,400 pounds.

44. The critical engine failure speed (V_1) for a transport type aircraft on a level runway is 100 knots. What is the corrected V_1 speed for a 2% (−.02) downhill slope? (Fig. 16—Appendix)

1—85 knots.
2—88 knots
3—91 knots.
4—96 knots.

45. Consider the following data regarding destination landing requirements for a reciprocating engine transport type aircraft. (Fig. 17—Appendix)

Landing gross weight	84,500 pounds
Airport altitude	3,000 feet
Reported wind (knots)	30 (headwind)

Level runway
Standard atmospheric conditions

The minimum effective landing runway length for the intended destination is—

1—4200 feet.
2—4350 feet.
3—4450 feet.
4—4600 feet.

46. What is the maximum permissible landing gross weight for a reciprocating engine transport type aircraft at an airport altitude of 7000 feet (Fig. 17—Appendix)?

1—80,200 pounds.
2—82,500 pounds.
3—83,800 pounds.
4—88,200 pounds.

47. The following data refers to the turboprop performance chart in the Appendix—Figure 18:

Runway Slope	+1% (uphill)
Reported wind (knots)	20 (headwind)
Available field length	4,500 feet
Ambient temperature	+25°C

Sea level pressure altitude
Auto feathering operative 39% flaps

What is the maximum takeoff weight permitted under these conditions?

1—96,000 pounds.
2—101,000 pounds.
3—104,000 pounds.
4—107,000 pounds.

48. Change the ambient temperature in the test item 47 data to +15°C. In this situation, the maximum takeoff gross weight permitted by the available field length will—

1—remain the same.
2—decrease by 6,000 pounds.
3—increase by 3,000 pounds.
4—increase by 6,000 pounds.

49. Using the data below, determine the minimum effective landing runway length required for a turboprop transport type aircraft at a scheduled destination airport. (Fig. 19—Appendix)

Airport pressure altitude	4,000 feet
Landing gross weight	95,650 pounds
Reported wind (knots)	25 (headwind)
Flap setting	78%

The minimum effective landing runway length is—

1—4,500 feet.
2—4,650 feet.
3—4,750 feet.
4—4,950 feet.

50. Under the conditions outlined in test item 49, the minimum effective landing runway length required for an alternate airport is (Fig. 20—Appendix)

1—4,070 feet.
2—4,200 feet.
3—4,500 feet.
4—4,750 feet.

51. The aircraft referred to in test items 49 and 50 must be capable of being brought to a full stop landing within a certain percentage of the minimum effective landing runway length

required. The stopping distance for this aircraft at the destination and alternate airports in the referenced test items is correctly shown in which of the following responses?

1—Destination: 3325 feet; Alternate: 2442 feet.

2—Same distance both airports: 2850 feet.

3—Destination: 2442 feet; Alternate: 3325 feet.

4—Same distance both airports: 2580 feet.

52. The data below refers to the turbojet performance chart in the Appendix—Figure 21:

Runway length available	8,500 feet
Clearway length available	1,000 feet
Stopway length available	500 feet
Airport elevation (pressure altitude)	3,000 feet
Runway and clearway slope	+2.0% (uphill)
Reported wind (knots)	10 (headwind)
Ambient temperature	+45°F.
Icing conditions	Anti-icing ON
Flaps	30°

What is the effective takeoff distance for the "all engines operating" condition?

1—6,800 feet.

2—7,100 feet.

3—7,500 feet.

4—7,900 feet.

53. The effective takeoff distance has been calculated to be 8,400 feet at a pressure altitude of 3,000 feet. The ambient temperature is +60°F. What is the takeoff weight for this turbojet type aircraft (Fig. 22—Appendix)?

1—197,000 pounds.

2—199,000 pounds.

3—201,000 pounds.

4—204,000 pounds.

54. What is the landing field length required for a turbojet type aircraft at a destination airport under the following conditions (Fig. 23—Appendix)?

Landing gross weight	155,000 pounds
Field pressure altitude	4,000 feet
Reported wind (knots)	20 (headwind)
Dry Runway	

The destination landing field length required is—

1—4,800 feet.

2—5,100 feet.

3—5,600 feet.

4—5,900 feet.

55. The landing field length required for an alternate airport under the same conditions listed in test item 54 is—

1—4,800 feet.

2—5,100 feet.

3—5,600 feet.

4—5,900 feet.

ANSWERS TO SAMPLE EXAMINATION ITEMS

Item	*Answer*	*Item*	*Answer*	*Item*	*Answer*
1	2	20	3	38	2
2	4	21	2	39	4
3	2	22	4	40	1
4	4	23	3	41	3
5	4	24	1	42	4
6	3	25	3	43	2
7	4	26	3	44	3
8	3	27	3	45	1
9	1	28	4	46	2
10	3	29	4	47	3
11	3	30	1	48	4
12	4	31	3	49	3
13	2	32	1	50	1
14	4	33	2	51	2
15	2	34	4	52	3
16	2	35	2	53	1
17	1	36	3	54	3
18	1	37	3	55	1
19	2				

ANALYSES OF ANSWERS TO SAMPLE EXAMINATION ITEMS

1—(2) Heights are referenced to Mean Sea Level unless otherwise noted.

2—(4) Choice 1—incorrect; the frontal system is expected to become *indefinite* as it moves inland.

Choice 2—incorrect; heights are referenced to MSL and therefore cannot be classified as ceilings.

Choice 3—incorrect; surface visibilities of more than 8 statute miles are omitted from FA's. Since no visibility forecasts appear in the text, we assume that surface visibilities are more than 8 statute miles.

Choice 4—correct as it appears in the text.

3—(2) A—incorrect; ceiling is 3000 feet for the period.

B—correct; surface winds of less than 10 knots are not reported in FT's.

C—incorrect; "ceiling" is defined as the lowest layer of clouds or obscuring phenomena aloft that is reported as *broken* or *overcast* and not classified as *thin* or *partial*. The layer of clouds at 25,000 feet over DEN *is* reported as *thin broken* and therefore does not constitute a ceiling.

D—correct as reported in the text for Portland.

4—(4) Choice 1—incorrect; altimeter setting is 29.94".

Choice 2—incorrect; spread is 3°F.

Choice 3—incorrect; ceiling is 14,000 feet, broken.

Choice 4—correct; wind direction is now reported to the nearest 10 degrees by a 2-digit number.

5—(4) A—correct.

B—incorrect; pressure change is recorded in tenths of millibars. In this case the change is eight-tenths of a millibar in the preceding 3-hour period.

C—correct.

D—incorrect; the large circle drawn around the station circle indicates that the wind is calm.

E—correct.

F—incorrect; low clouds are stratocumulus but the height is 2500 feet.

6—(3) FAR 121.463(b) is the reference.

7—(4) FAR 121.565 is the reference.

8—(3) The time is 28 minutes for 106 n.m. at a groundspeed of 225 knots.

9—(1) FAR 121.565(d) is the reference.

10—(3) The notes applicable to engine units in the "Minimum Equipment List for Dispatch" indicate that the fuel pressure warning light *must* be operative in this case. Choices 1 and 4 are not acceptable for obvious reasons; Choice 2 might be argued, but Choice 3 is more permissive.

11—(3) The flight time from SFO to DEN is 3 hours, 16 minutes.

12—(4) The time and fuel summary is reproduced below:

Enroute	3:16/	8350 lbs.
Alternate	0:23/	690 lbs.
Reserve	0:45/	1350 lbs.
Extra	1:00/	1800 lbs.
Total	5:24/12,190	lbs.

13—(2) In this case, the maximum allowable takeoff gross weight is limited by the maximum landing gross weight as shown below:

	Pounds
Maximum zero fuel weight	87,360
Alt./res./extra (total)	+5,000
Landing gross weight	92,360
Fuel to destination	+8,350
Maximum allowable takeoff gross weight	100,710

14—(4) The maximum allowable payload represents the difference between the maxi-

mum zero fuel weight and the operating weight as shown below:

	Pounds
Airplane empty weight	57,000
Operating load (6 in crew)	+2,930
Operating weight	60,830
Maximum zero fuel weight	87,360
Operating weight	−60,830
Maximum allowable payload	26,530

15—(2) Combined weight of the actual payload is 21,170 pounds. Actual takeoff gross weight may be resolved as follows:

	Pounds
Operating weight	60,830
Actual payload	+21,170
Zero fuel weight	82,000
Alt./res./extra fuel	+3,840
Landing gross weight	85,840
Fuel to destination	+8,350
Actual takeoff gross weight	94,190

16—(2) Minimum floor loading is achieved by distributing the weight over the largest floor area, in this case—the product of the length and width of the box is 12 sq. ft. Weight (840 pounds) divided by the area, or "footprint" of the box (12 sq. ft.), results in the minimum floor loading of 70 pounds per square foot. This is below the maximum floor loading specified in the Loading Limits listed in the "Aircraft Particulars."

17—(1) The solution is outlined below:

	Inches
C.G. (aft of datum line)	436.6
LEMAC (aft of datum line)	395.6
C.G.	41.0
MAC	164

C.G. (% MAC) =

$$\frac{41}{164} \times 100 = 25\%$$

18—(1) Correct as shown on referenced chart.

19—(2) Computer solution or a plot of this problem yields a crosswind component of 20 knots, from the right.

20—(3) Runways are numbered with reference to magnetic north. Magnetic wind direction is therefore more meaningful to the pilot who is approaching to land or preparing to takeoff. Wind speeds are reported in nautical miles per hour.

21—(2) The pilot may continue or abort the takeoff at his discretion.

22—(4) The MEA provides *both* navigation signal coverage and obstruction clearance between radio fixes.

23—(3) Note that signs are *not* given for temperature and compressibility corrections. You should be aware that the outside air temperature indicator reads too warm and the airspeed indicator reads too *high* due to the effects of compressibility. The solution is outlined below:

	Knots
IAS	177
Position and instrument correction	+6
CAS	183
Compressibility correction	−2
EAS	181

Outside air temperature (indicated)	−20°C.
Temperature correction	−6°C.
Outside air temperature (corrected)	−26°C.

The resultant TAS is 242 knots. Some computers have incorporated in their scales the compressibility corrections so that certain of these steps need not be taken. You should be familiar with the details of your particular computer.

24—(1) Most computers now have Mach Indexes so that the conversion of a TAS to a Mach number is a simple step.

25—(3) Mach number is defined as the *ratio* of the speed of the aircraft to the speed of sound in the air existing at flight altitude. As air temperature increases, the TAS of a Mach number increases—i.e., directly. The reverse is also true.

26—(3) The flight planned time from SFO to BAM is 1 hour, 17 minutes. Flight plan ETA at BAM is therefore 1354 GMT. Actual time at BAM is 1359 GMT which is 5 minutes late.

27—(3) The time interval between BAM and BVL is 32 minutes for the distance of 145 nautical miles. Groundspeed is therefore 272 knots. Application of variation to magnetic course and magnetic heading precedes the solution outlined below:

True heading	092°
TAS	242 knots
True course	086°
Groundspeed	272 knots

Resultant wind direction and velocity is 230°/40 knots.

28—(4) The average magnetic course between BVL and SLC (Fig. 9—Appendix) is 067°. After converting to true direction, the following items are known:

True course	084°
TAS	242 knots
W/V	230°/40 knots

Solution yields:

True heading	090°
Groundspeed	273 knots

Application of variation and deviation to true heading yields compass heading 073°.

29—(4) Distance to SLC is 81 nautical miles. Time interval at the groundspeed of 273 knots is 18 minutes. The ETA at SLC is therefore 1449 GMT.

30—(1) The remaining distance of 417 nautical miles must be covered in 1 hour, 24 minutes. Groundspeed is therefore 298 knots. The tailwind, or plus component of the wind, will require a TAS of 263 knots.

31—(3) Reference: *Airman's Information Manual*, "Air Traffic Control Procedures" section.

Choice 1—incorrect; IFR flights shall maintain the center line of the airway, *unless* otherwise advised by ATC, maneuvering to pass other aircraft, or maneuvering in VFR conditions to visually clear the intended flight path prior to and during climb or descent.

Choice 2—incorrect; standard separation is assured between all aircraft operating on IFR flight plans except when "VFR Conditions-on-Top" or outside of controlled airspace has been requested by a pilot and authorized by ATC. A further exception occurs when clearances are issued specifying that climb or descent or any other portion of the flight shall be conducted in "VFR conditions."

Choice 3—correct.

Choice 4—incorrect; clearances authorizing "VFR Conditions-on-Top" are issued when specifically requested by the pilot or if filed in the IFR flight plan.

32—(1) A—incorrect; all transitions are to the LOM, *except* as indicated.

B—incorrect; RVR 2600 feet is authorized for takeoff *and* landing on 26L under the stipulated conditions.

C—correct.

D—correct.

E—correct.

F—incorrect; note "or as directed by ATC" in the missed approach procedure.

33—(2) Solution is outlined below:

	Pounds
Takeoff gross weight	107,000
Fuel	−30,000
Zero fuel weight	77,000
Operating weight	−64,800
Maximum allowable payload	12,200

34—(4) A—incorrect; pressure at the low center is 981 millibars.

B—correct as indicated.

C—incorrect, some cumulus clouds are expected between 2500 feet to 25,000 feet with a few cumulonimbus from 1500 feet to 40,000 feet.

D—correct as indicated.

35—(2) The routing via 40°N./135°W. eliminates a large percentage of the headwind component in the early portion of the flight, resulting in less time.

36—(3) The height of the 500-millibar surface at 35°N./135°W. is 17,600 feet, sloping upward to a height of about 19,100 feet over HNL. As the aircraft maintains the constant pressure altitude of 18,000 feet, the true altitude (actual height above sea level) will increase in conformance with the slope of the pressure surface.

37—(3) Wind direction is approximately 290°; velocity is interpolated between the 100 knot and 120 knot isotachs. The wind arrow shows the wind at *250* millibars.

38—(2) Reference is FAR 121.641. Fuel supply for this operation must include fuel to destination and alternate and, thereafter, sufficient fuel to fly for at least 30 minutes plus 15% of the total time required to fly to destination and alternate or 90 minutes, whichever is lesser.

In this case, 90 minutes reserve meets the requirement.

39—(4) The Tropopause Vertical Wind Shear Chart, when used in conjunction with the 300 millibar chart, provides wind and temperature information—vertically and horizontally—within the layer from 300 millibars to 150 millibars. The following data is shown on this chart:

1. Intersections of the tropopause in 50-millibar intervals from 300 to 150. Standard heights of the pressure surfaces are given in the inset box at the bottom of the chart.
2. Mean vertical wind shear for the layer from 300 to 150 millibars at intervals of 2 knots/1000 feet, shown by dashed lines. The mean vertical wind shear is an arithmetic mean of the forecast values of the shear below and above the layer of maximum wind. It is not drawn for values less than 2 knots.
3. Tropopause and 150-millibar level temperatures are enclosed in rectangles and squares, respectively.

In this problem, the aircraft is flying at FL 290, or pressure altitude 29,000 feet. Over a portion of the route, the tropopause is shown to be slightly below the 250-millibar level (pressure altitude 34,000 feet). The flight will therefore be well below the tropopause over the entire route.

40—(1) Clear air turbulence is associated with areas of maximum wind flow and results from changes in vertical and horizontal wind shear. An aircraft at position 1 would be located in a wind shear area and might therefore experience some form of clear air turbulence.

41—(3) Locate Takeoff Gross Weight of 98,000 pounds: proceed vertically to intersect the 1,000 foot airport altitude line. Proceed horizontally to the left to intersect the 25 knot head wind line.

The minimum effective takeoff runway length is the distance from the start of the takeoff run to a height of 50 feet with one engine failing at the critical engine failure speed. It is also equal to the distance to accelerate to the critical engine failure speeed and then decelerate to a stop.

42—(4) Find the intersection of the 5000 feet "no slope line" and the +.02 slope line. Proceed horizontally to the left to intersect the "with slope" line.

43—(2) Find the intersection of the 15 knot wind line and the 4,500 foot runway length line. Proceed horizontally to the right to intersect the 6,000 foot line. Read 82,000 pounds on the gross weight scale.

44—(3) Proceed horizontally to the left from the intersection of the 100 knot "no slope" line and the 2% slope line. Read the corrected V_1 of 91 knots.

45—(1) Find the intersection of the 84,500 pound gross weight line and the 3000 foot airport altitude line. Proceed horizontally to the left to intersect the 30 knot headwind line and read 4200 feet.

46—(2) Note that the maximum permissible landing gross weight is 88,200 feet from sea level through 4,500 feet. At this point, the maximum landing gross weight limiting line slopes sharply to the left. The 7,000 foot airport altitude line intersects the limit line at a gross weight of 82,500 pounds.

47—(3) Follow the plotted example on the referenced chart to arrive at the maximum weight of 104,000 pounds. Available Field Length refers to the runway length. Note that the temperature entry at the top of the chart is for the *difference* from the standard value. In this example, the standard temperature is +15°C. at sea level. The given ambient temperature is +25°C. so that the entry is the +10°C. difference line.

48—(4) The effect of temperature on the maximum takeoff gross weight permitted is clearly evident. Since the ambient temperature is the same as the standard value, the entry is on the zero difference line, resulting in a maximum weight of 110,000 pounds. The 10° change in ambient temperature permits an increase of 6,000 pounds.

49—(3) Follow the plotted example to select the proper value of 4750 feet. It should be noted that 50% of the reported headwind

and 150% of the reported tailwind has been considered in the construction of these charts.

50—(1) Correct as shown on the referenced chart.

51—(2) The stopping distance percentage values of the minimum effective landing runway lengths for the destination and alternate airports are 60% and 70% respectively. The references are FAR 121.195 and FAR 121.197. Multiplication of these values times the appropriate runway lengths obtained in test items 49 and 50 results in stopping distances of 2850 feet and 2849 feet. For practical purposes these may be considered equal and the answer listed is 2850 feet.

52—(3) Use the plotted example for guidance in arriving at the effective takeoff distance of 7500 feet. Note that the usable amount of clearway varies with gradient and runway length available. Regulations permit the use of clearway, where available, in determining the takeoff distance of turbojet transport aircraft. The length of any clearway included, however, must not be greater than one-half the length of the runway. See FAR 121.189(c)(2).

53—(1) The required effective takeoff distance is subjected to temperature and pressure altitude considerations to arrive at a takeoff weight. The pressure altitude is that which exists at the field elevation. Note that Fahrenheit temperature is used.

54—(3) Use the plotted example for guidance.

55—(1) Note the variation in landing field length required between the destination and alternate airports.

APPENDIX

FN SFO 130550
SAN FRANCISCO REGION 22P FRI-22P SAT

PROG. MAJOR RDG WILL CONT OVR RCKY MTN STAS WITH MAIN TROF AT 500 MBS CONTG OFF CST WRN US. SHORT WV TROF SRN PTN OF MAIN TROF WILL MOV NEWD DURG NEXT 24 HRS TO BE OVR PA CNW BY SAT EVE. WK FRONTAL SYST NRN IDA-ERN OREG NRN CALIF TO WV OFF NRN CALIF CST AT 22P WILL BCM INDFNT INLAND PTN WITH COLD PTN FRONT WKNG AS IT RCHS WRN OREG-NRN CALIF SAT AFTN. SFC LOW CONTG OFF CST

SIGNIFICANT WX. SVRL LYRS BRKN TO OVC CLDNS WITH INTMT PCPN MUCH OF NRN CALIF-WRN OREG-WRN WASH NEXT 24 HRS. BASES CLDNS BLO 80 AND TOPS 150-200. OCNL MDT ICGIC ICGIP ABV 50 WRN WASH TO ABV 70 NRN CALIF. OCNL MDT TURBC MAINLY OVR MTNS AND IN FRONTAL ZONE. GENLY BRKN CLDNS WITH SCTD SHWR ACTIVTY MAINLY OVR MTNS ERN WASH-ERN OREG EWD TO CONTDVD. BASES NEAR 100 AND MAIN TOPS 140-170. BRF MDT ICGIC ICGIP ABV 50

FA SFO 130645
23P FRI-11P SAT

NRN AND CNTRL CALIF CSTL WATERS WRN NEV

CLDS AND WX. FRONTAL SYSTEM OFF NRN CALIF CST BCMG INDEF AS MOVS INLAND WITH COLD PTN WKNG AS MOVS INTO WRN OREG-NRN CALIF LATE FORNN.
NRN CALIF. MSL 15-25⊙30-50⊙V⊕ 80-120⊙V⊕ TOPS 150-210. INTMT LGT RAIN WITH SNOW ABV 60.
CNTRL CALIF. MSL 40⊙80-120⊙V⊕ TOPS 160 BCMG MOSTLY MSL 30⊙60-80⊕ OCNL LGT RAIN AFT 05P. ELSW CLR TO VRBL CLDNS ABV 160

WRN NEV. MSL 80⊙120-140⊙V⊕ TOPS 160-210 LWRG 120⊕ TONOPAH NWD BY 11P.

ICG. OCNL MDT ICG SANTA ROSA-SUSANVILLE NWD. FRZG LVL 60 N 100S

TURBC. OCNL MDT TURBC BRFLY SVR UP AND DOWN DRAFTS E SLOPES.

OTLK. COLD FRONT MOVG ACRS NRN CALIF SANTA ROSA-SUSANVILLE LINE EARLY AFTN. PCPN NRN AND CNTRL CALIF WRN NEV NWD MONTEREY STOCKTON-RENO LINE DURG AFTN AND EVE. LTLCG GEN CONDS RMNDR AREA.

FIGURE 1. Airway Forecasts.

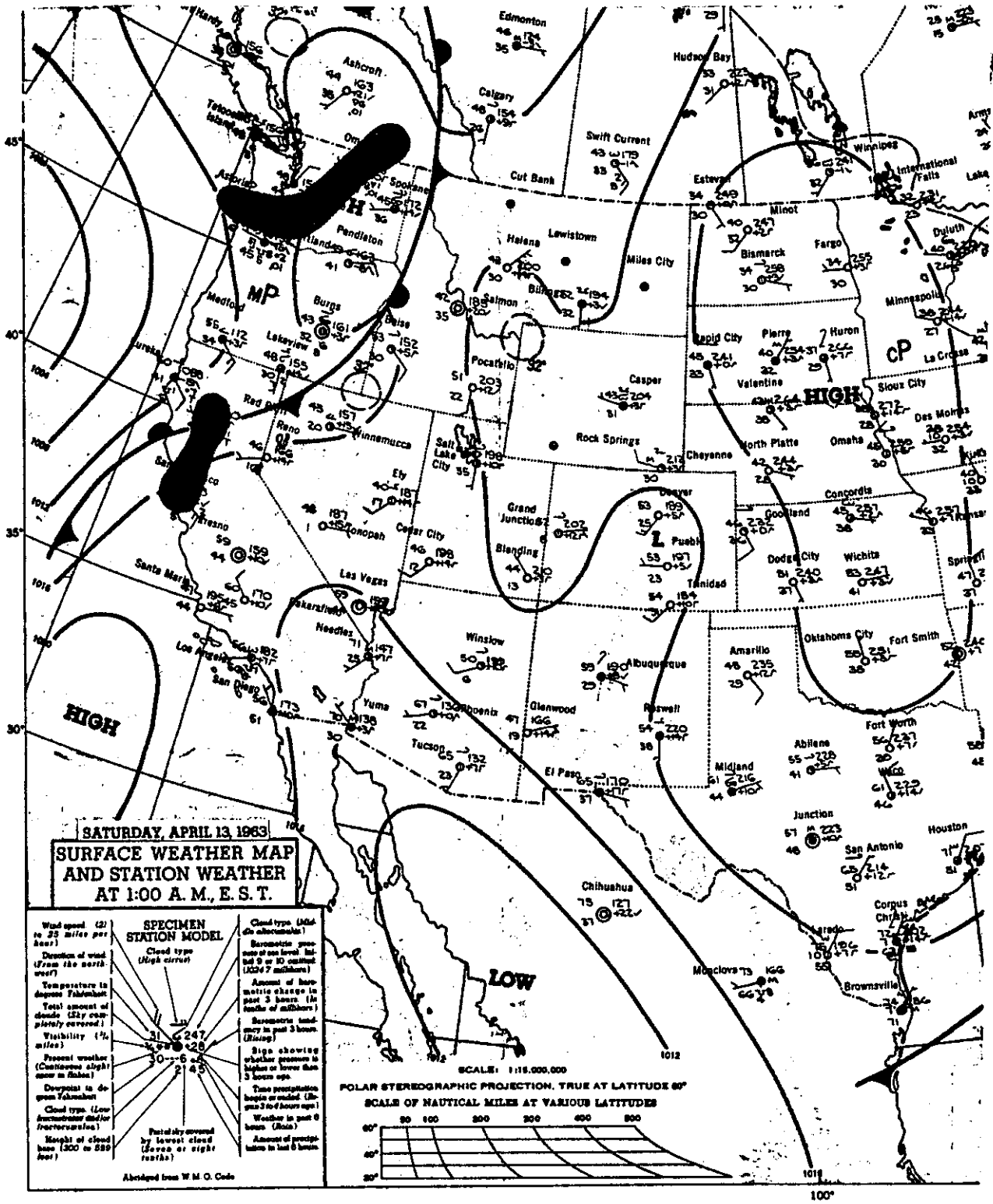


FIGURE 2. Surface Weather Map.

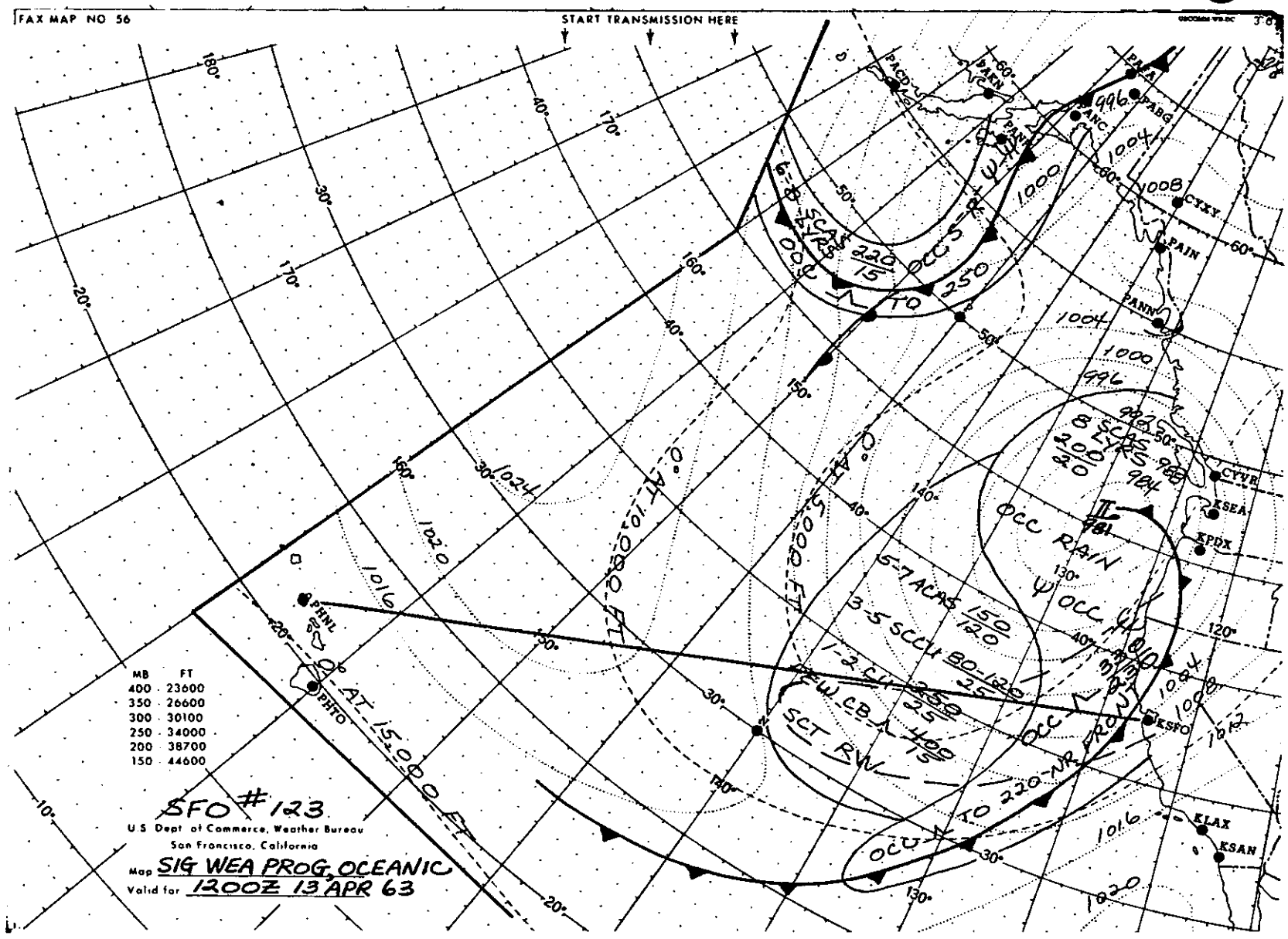


FIGURE 3. Significant Weather Chart—Ocean.

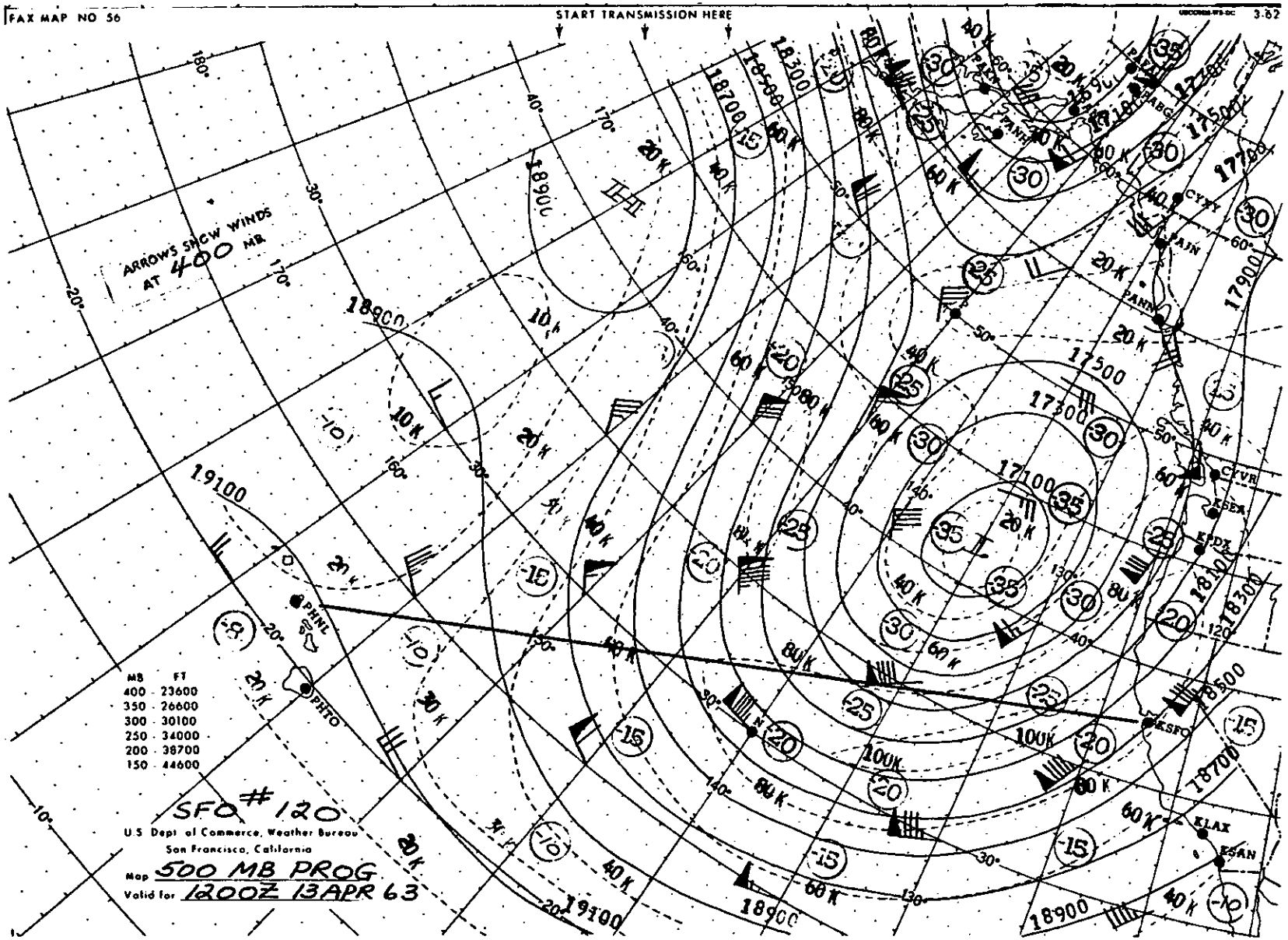


FIGURE 4. 500 Millibar Chart—Ocean.

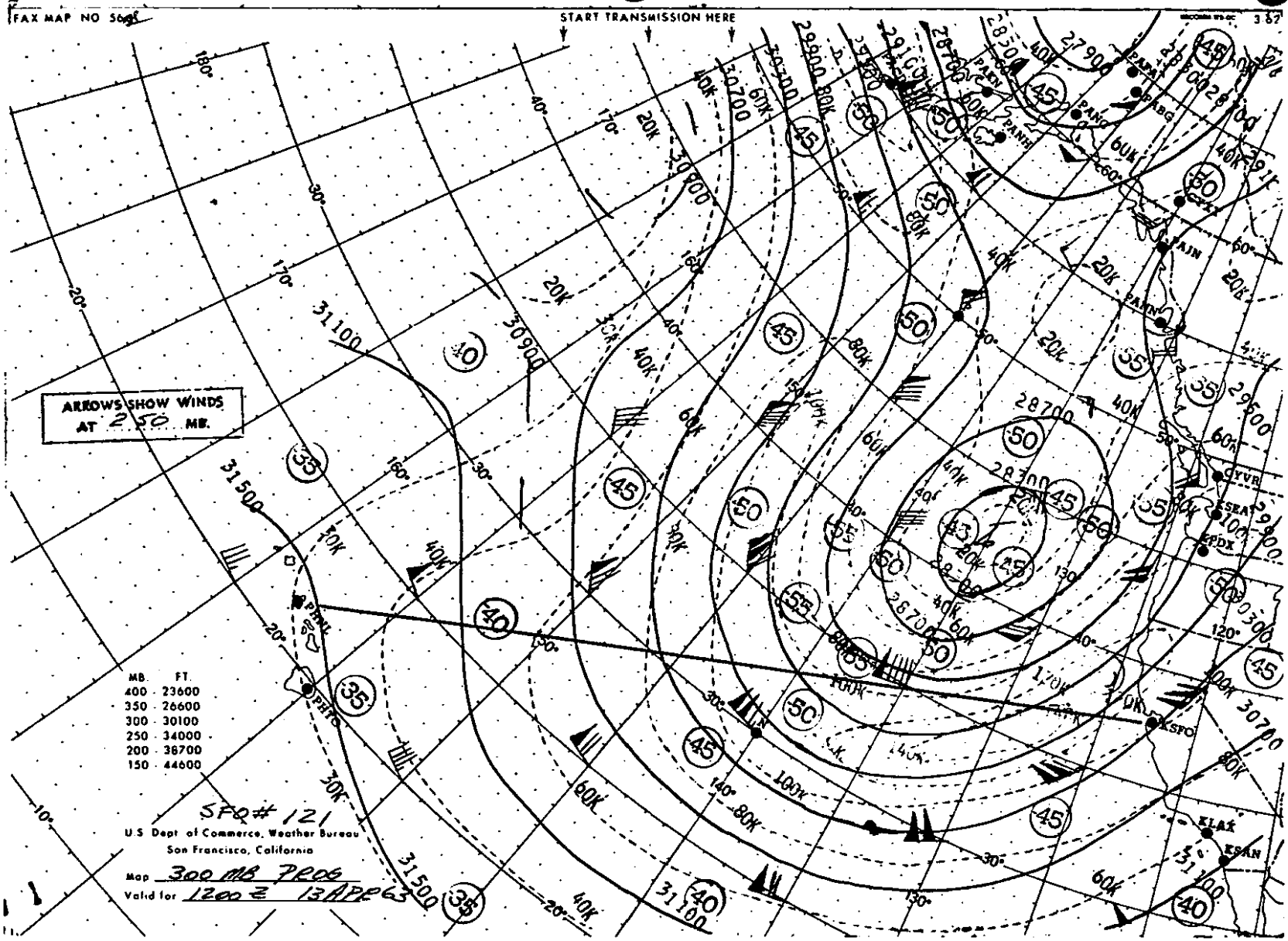


FIGURE 5. 300 Millibar Chart—Ocean.

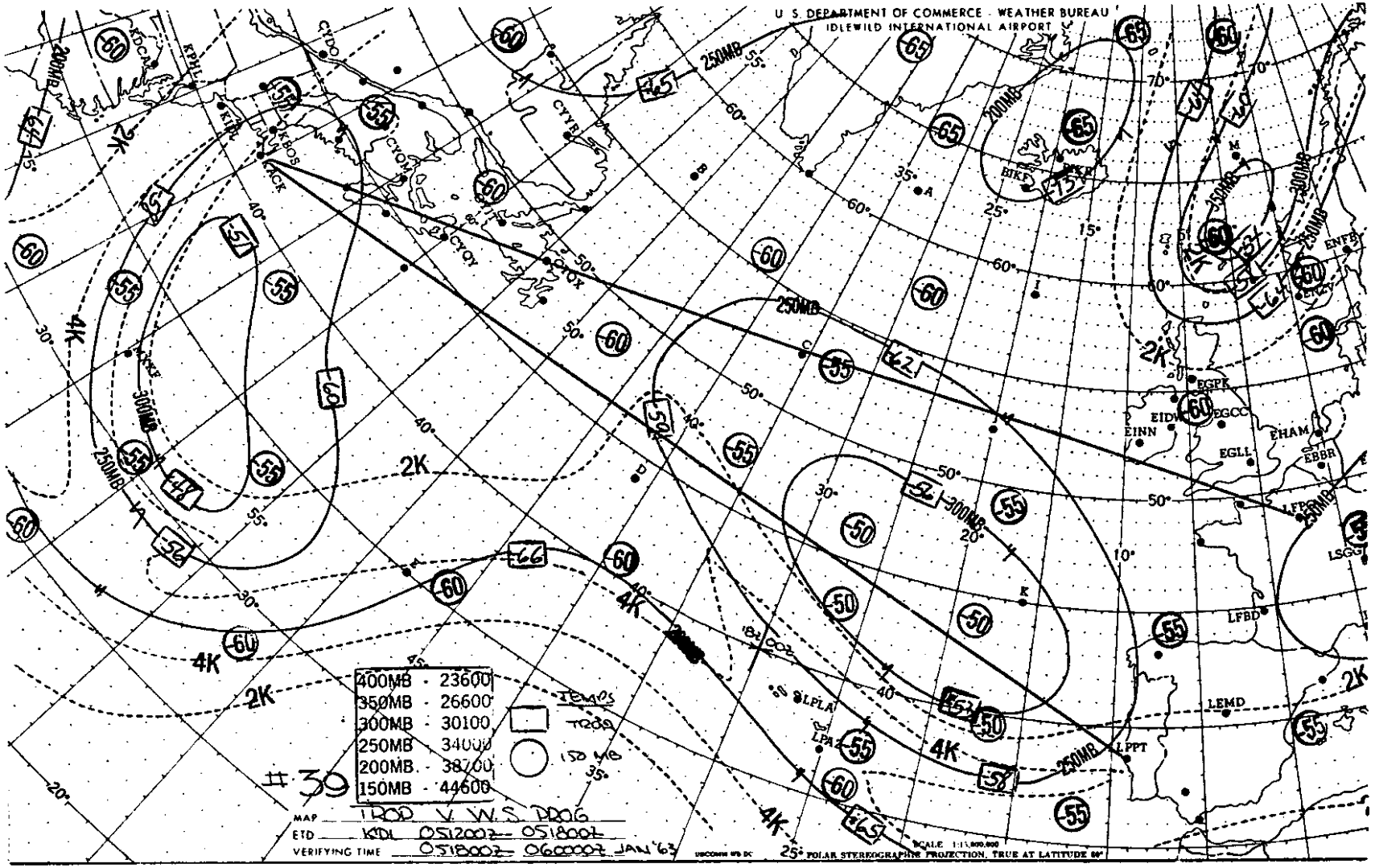


FIGURE 6. Tropopause/Vertical Wind Shear Chart.

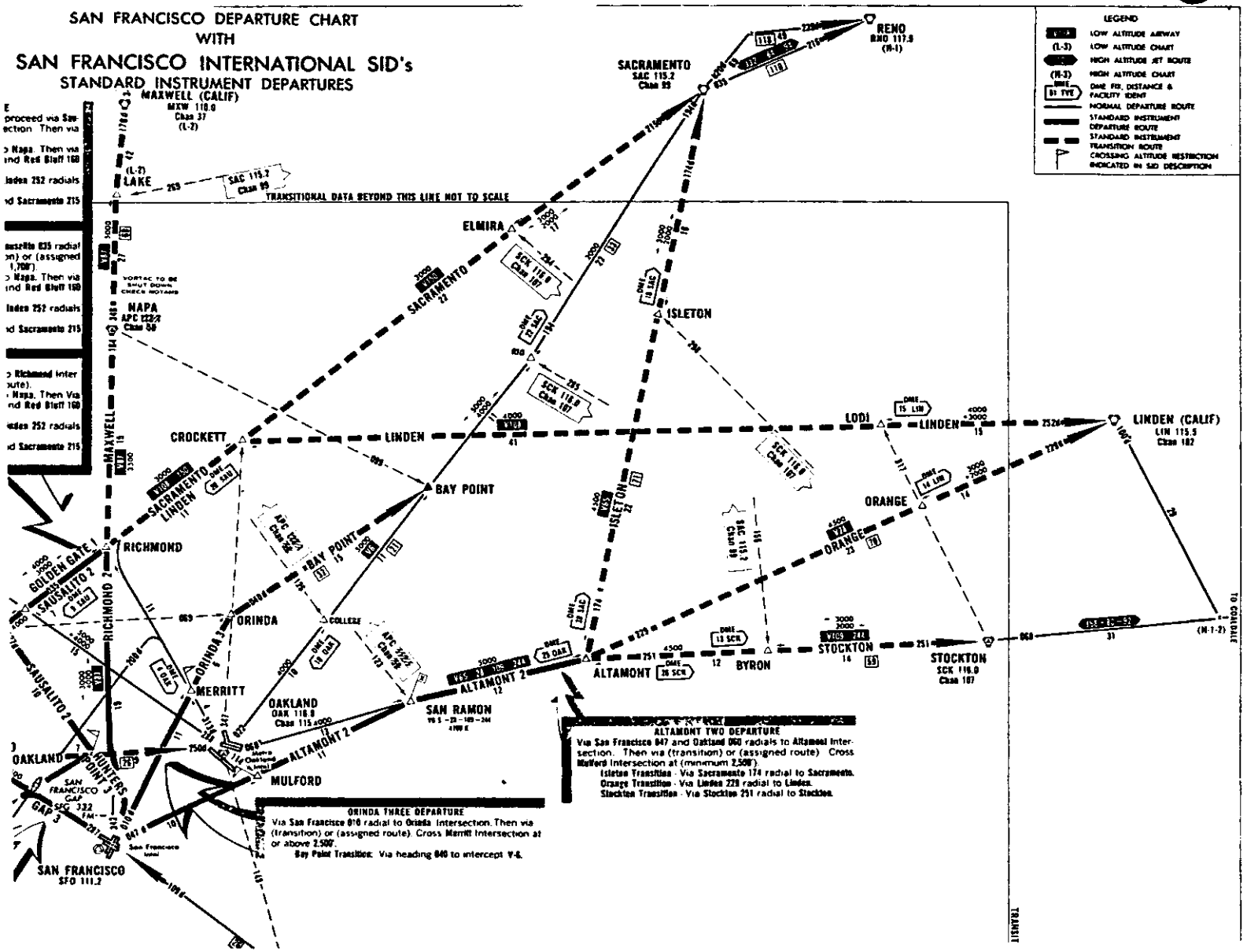


FIGURE 7. San Francisco Departure Chart.

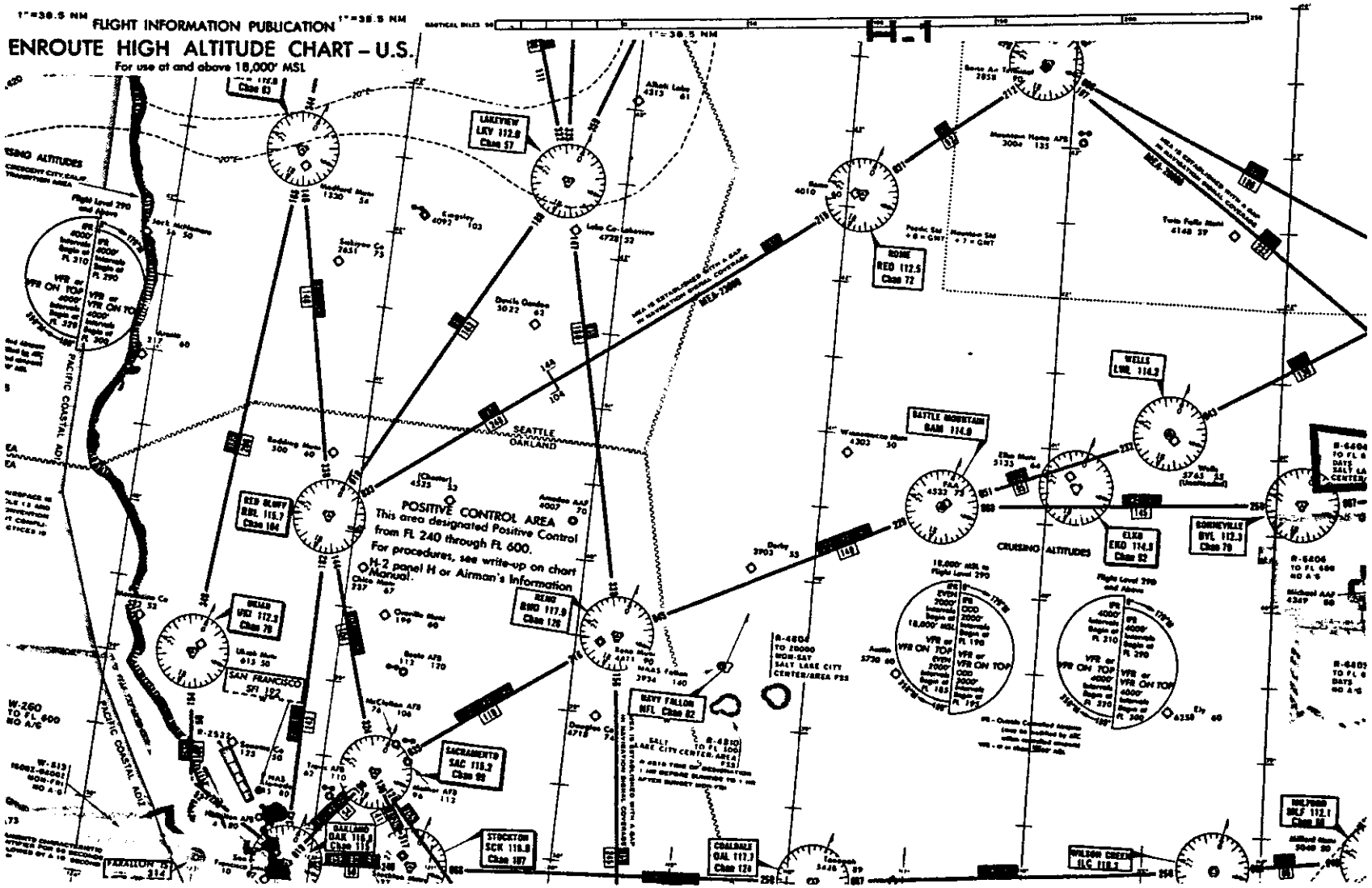


FIGURE 8. Enroute High Altitude Chart (SFO-BVL).

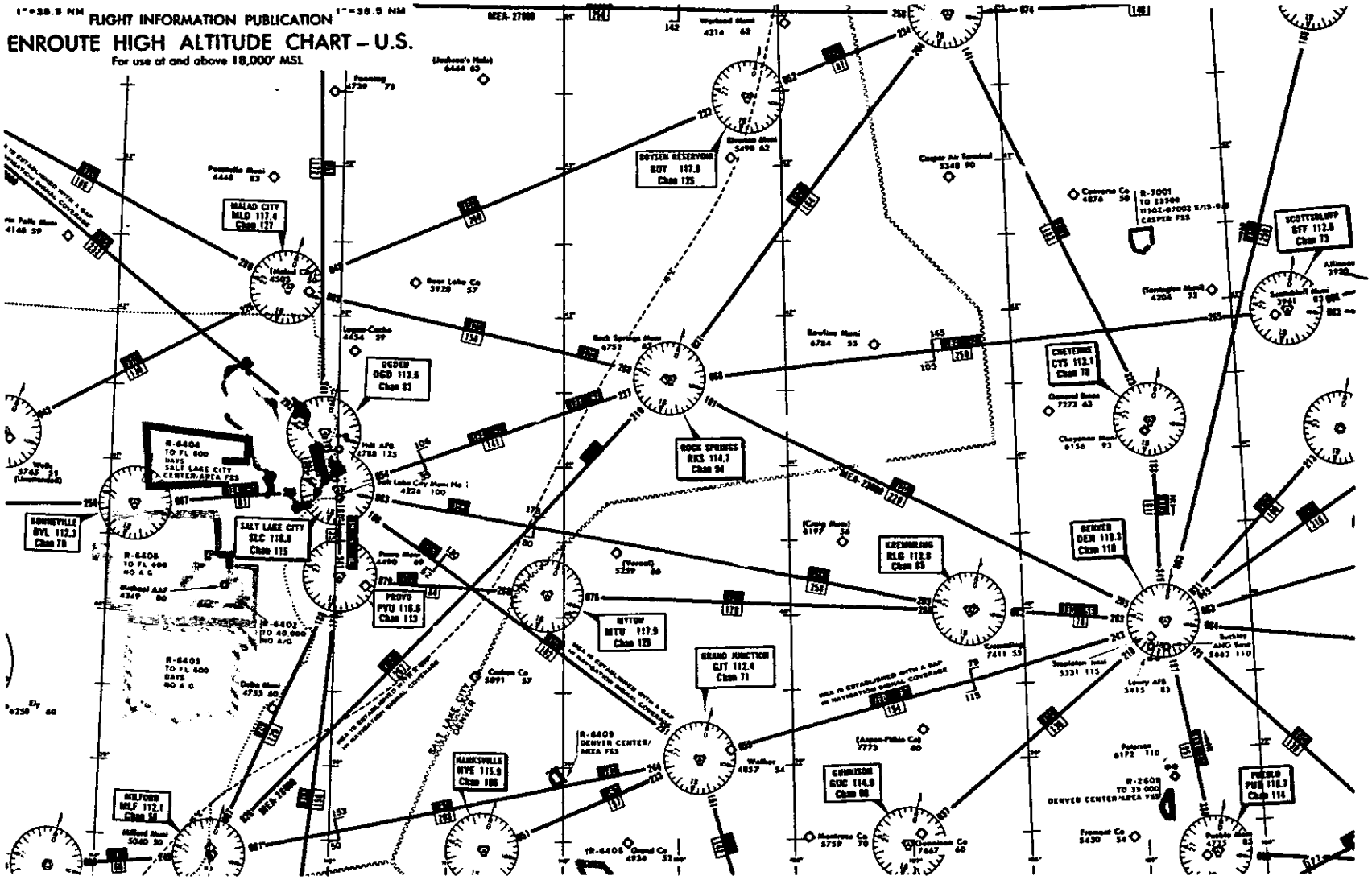


FIGURE 9. Enroute High Altitude Chart (BVL-DEN).

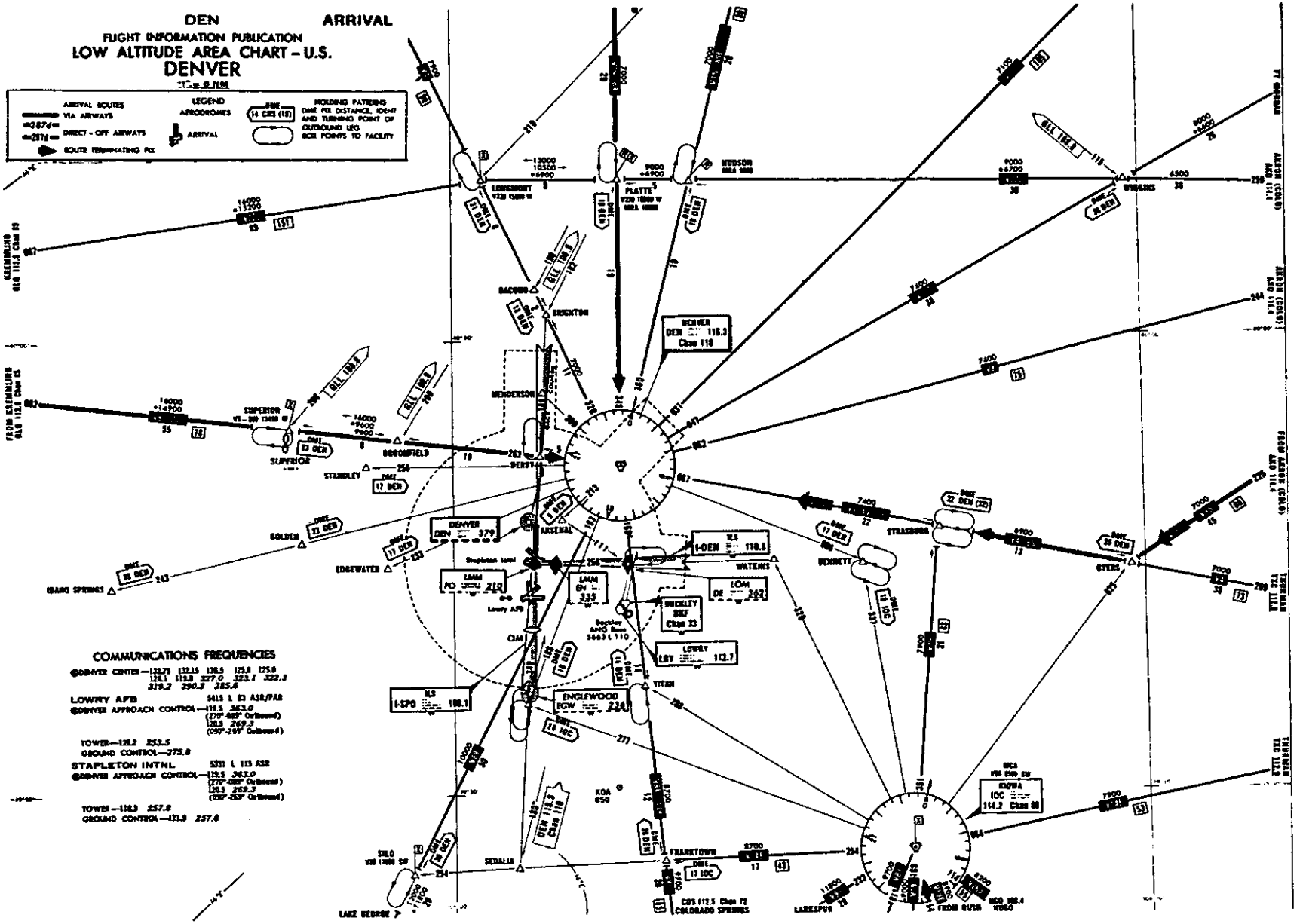


FIGURE 10. Denver Arrival Chart.

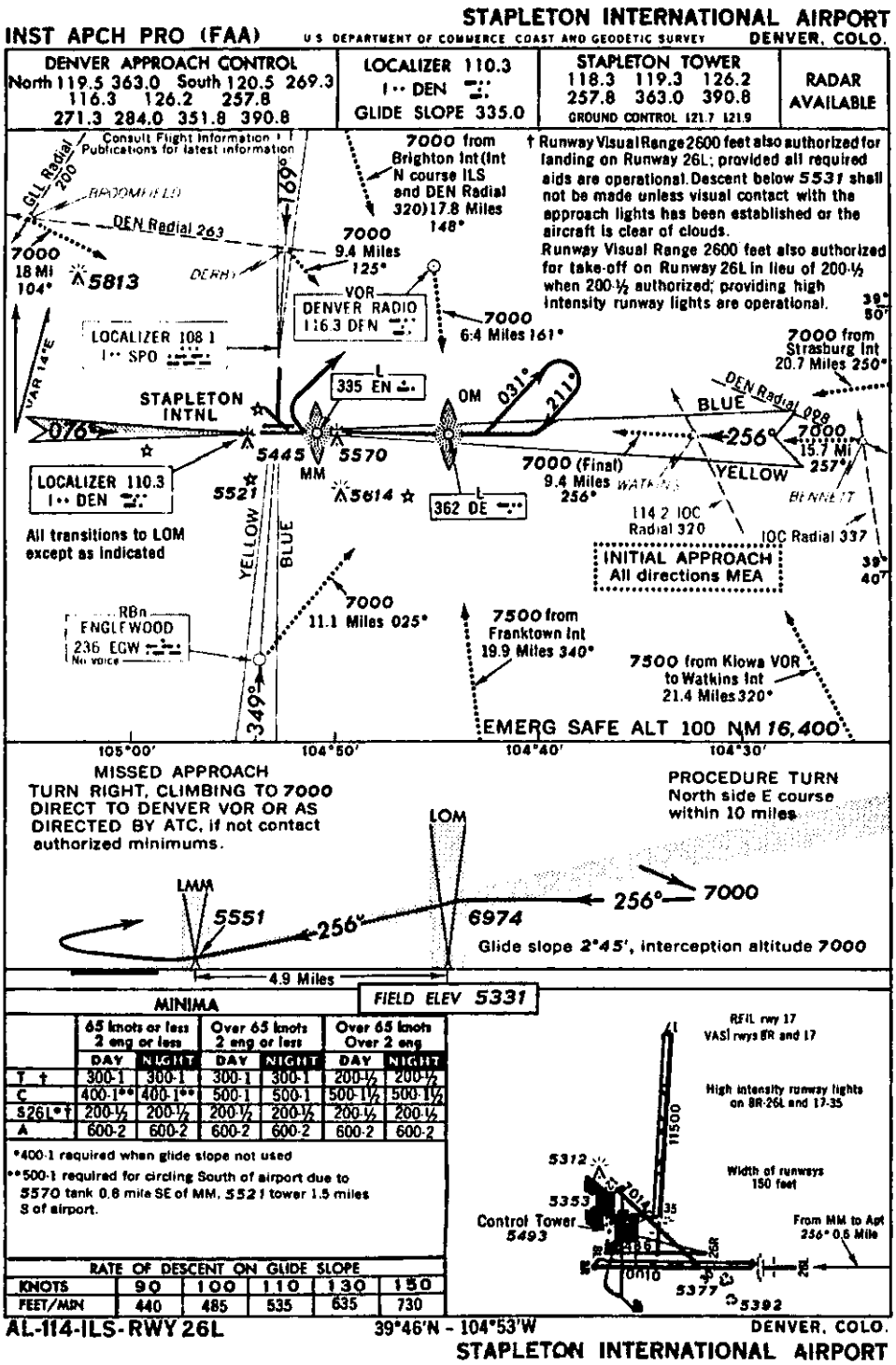


FIGURE 11. Instrument Approach and Procedure Chart—Denver.

FEDERAL AVIATION AGENCY

FLIGHT TIME ANALYSIS

CHECK POINTS FROM	CHECK POINTS TO	ROUTE CRUISE ALT./FLT. LEVEL	TRUE COURSE	AIRSPEED-KTS. EAS OR MACH NO.	AIRSPEED-KTS. TAS	WINDS ALOFT DIRECTION VELOCITY TEMPERATURE	DRIFT CORR ANGLE	GROUND SPEED	DISTANCE N.M.	TIME LEG	TIME TOTAL	FUEL CONSUMPTION LBS./GALS. LEG	FUEL CONSUMPTION LBS./GALS. TOTAL	MISC.
SFO	SAC	Climb	--	--	--	--	--	--	--	0:25				
SAC	RNO	19,000	053°	--	240	230°/50			110					
RNO	BAM	"	064°	--	245	230°/50			140					
BAM	BVL	"	086°	--	245	250°/40			145					
BVL	SLC	"	084°	--	250	250°/40			81					
SLC	RLG	"	102°	--	250	270°/35			258					
RLG	DEN	"	096°	--	255	270°/35			78					

ALTERNATE DATA

DEN	CYS	10,000	359°	--	220	280°/25			81					

Fuel Consumption Values:

Climb - - - - - - - - - - 4300#/hr.
Cruise - - - - - - - - - - 2300#/hr.
Alt./Res./Extra - - - - - 1800#/hr.

FUEL SUMMARY

	TIME	LBS./GALS.
ENROUTE		
ALTERNATE		
RESERVE		
EXTRA		
TOTAL		

FIGURE 12. Flight Time Analysis Form.

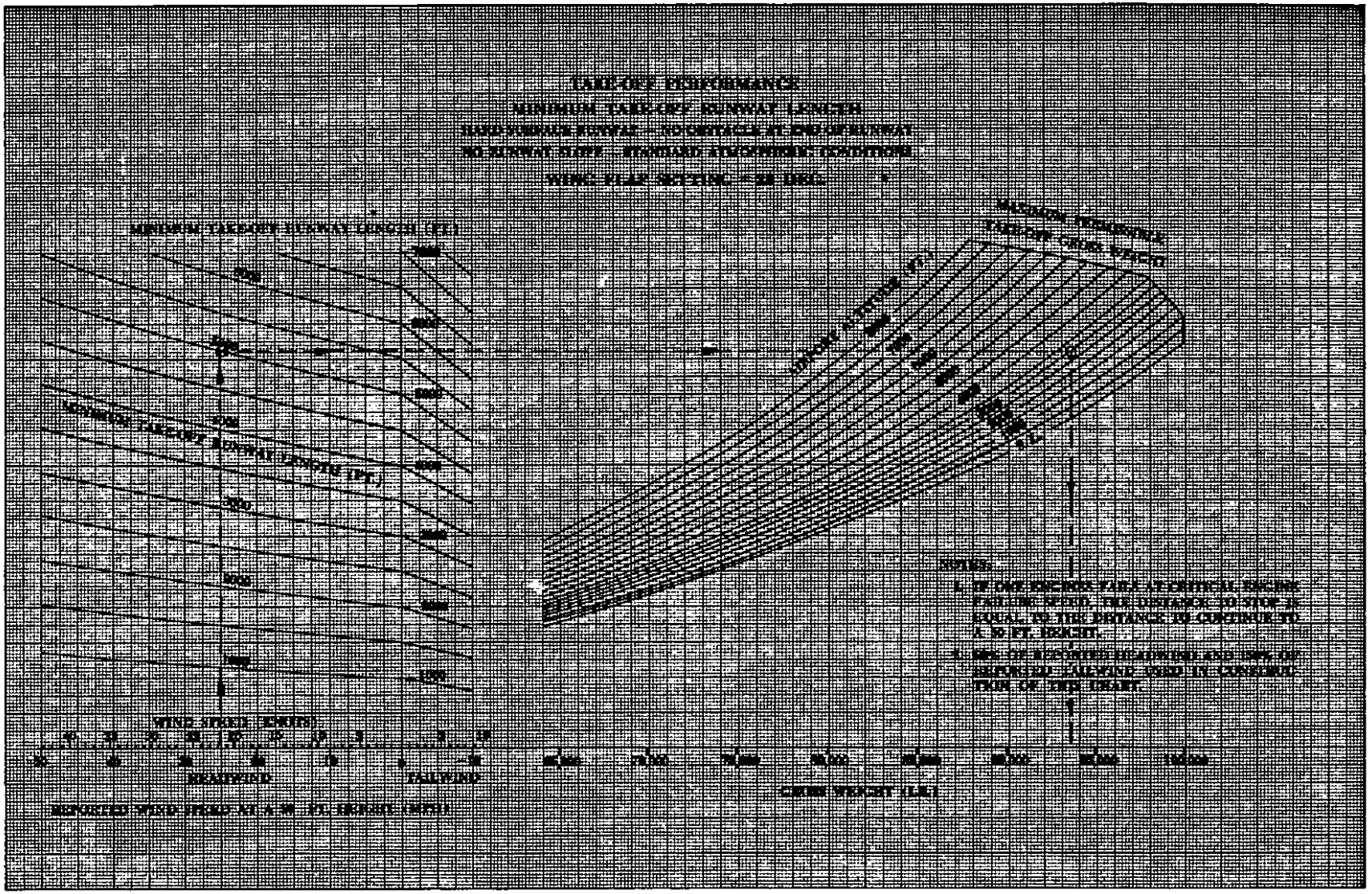


FIGURE 13. Aircraft Performance—Reciprocating Engine.

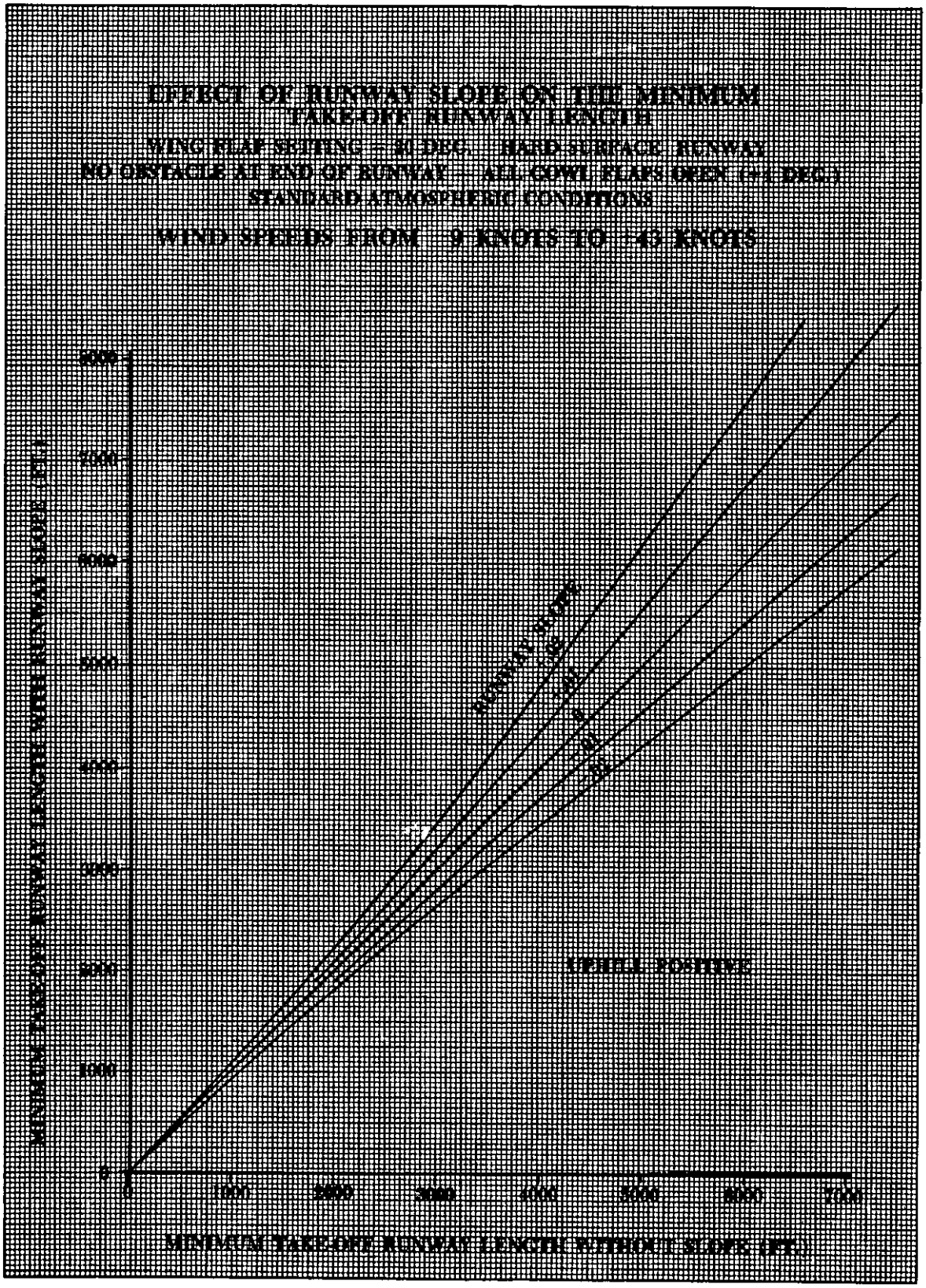


FIGURE 14. Aircraft Performance—Reciprocating Engine.

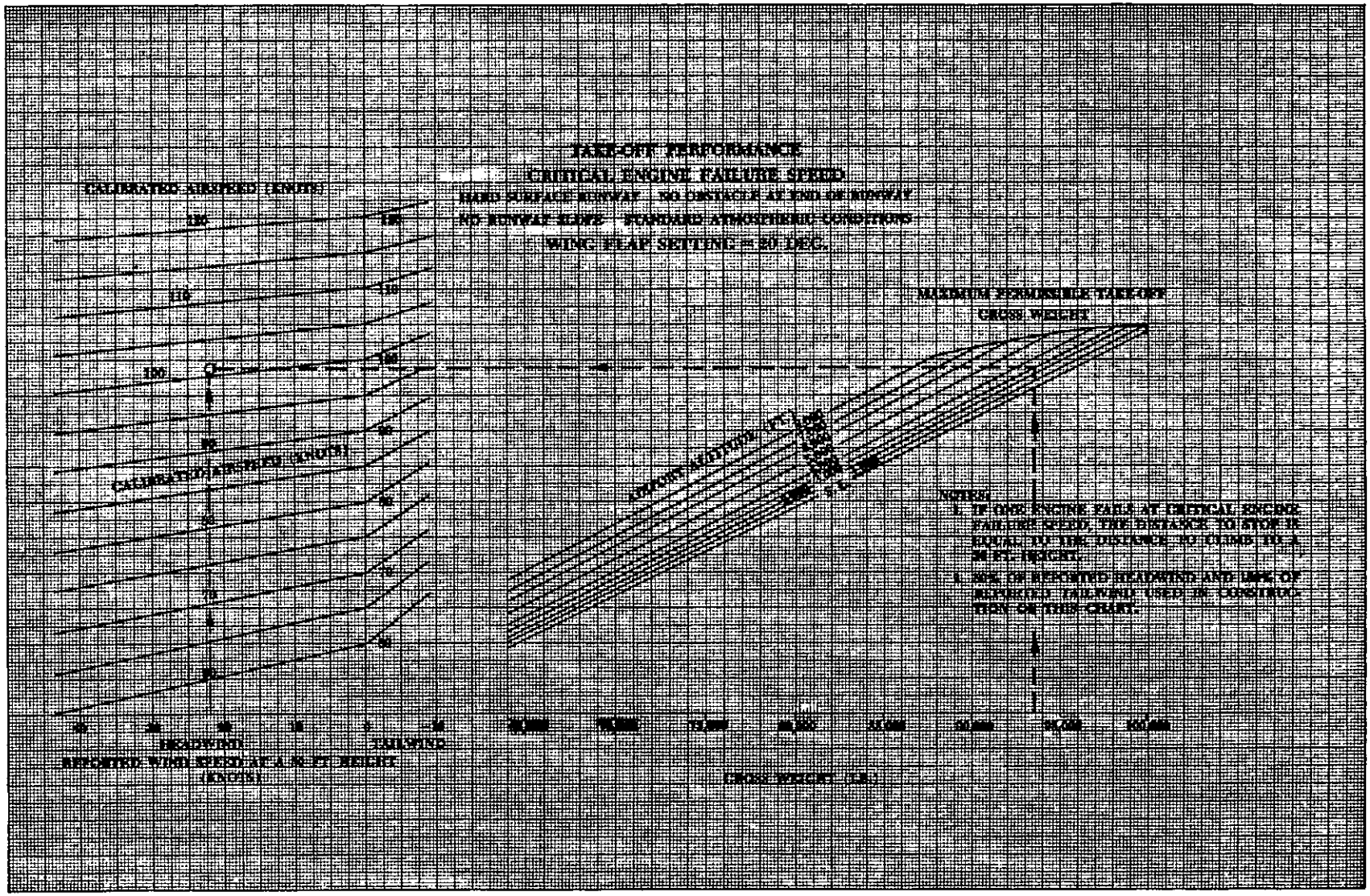


FIGURE 15. Aircraft Performance—Reciprocating Engine.

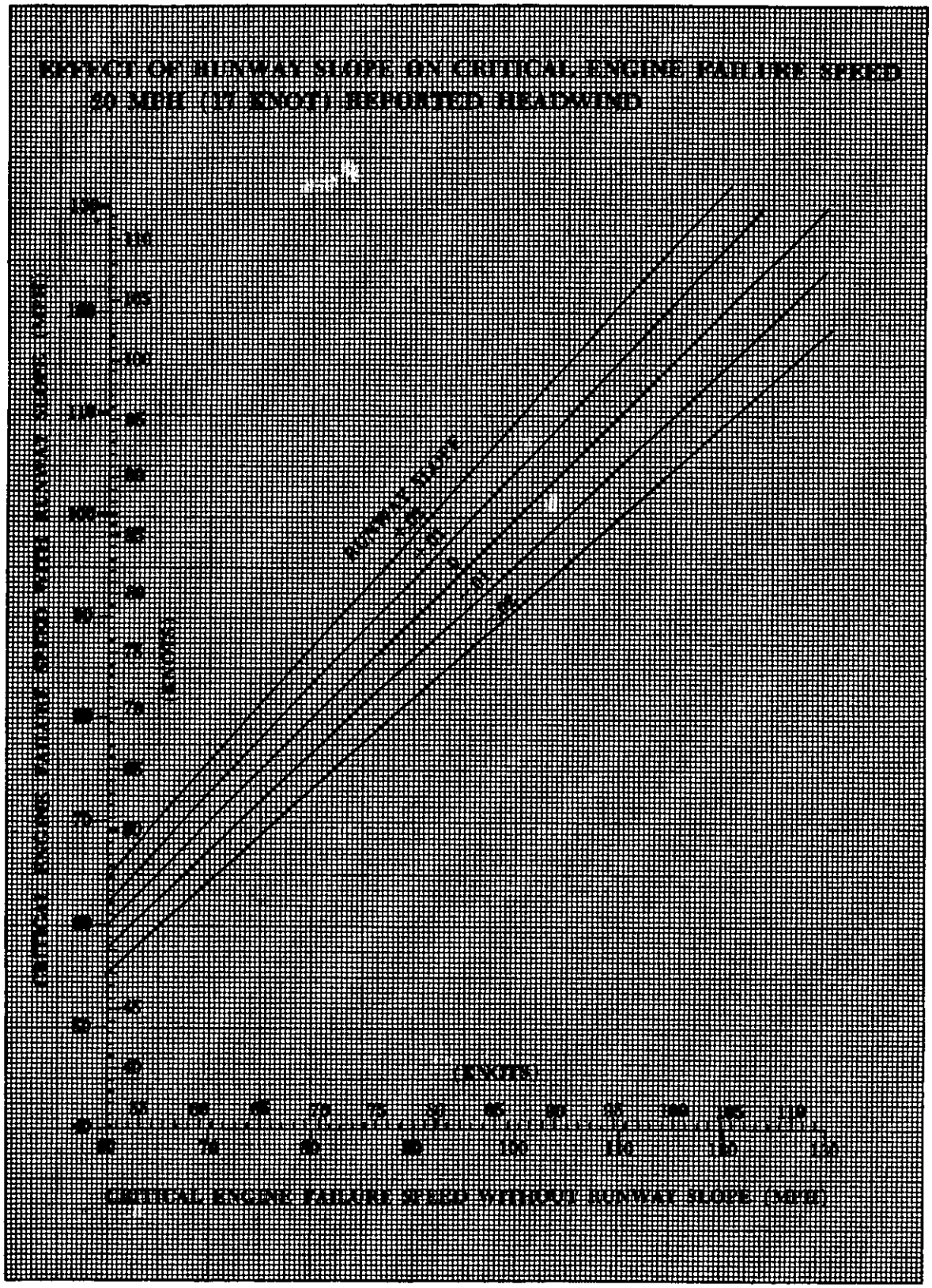


FIGURE 16. Aircraft Performance—Reciprocating Engine.

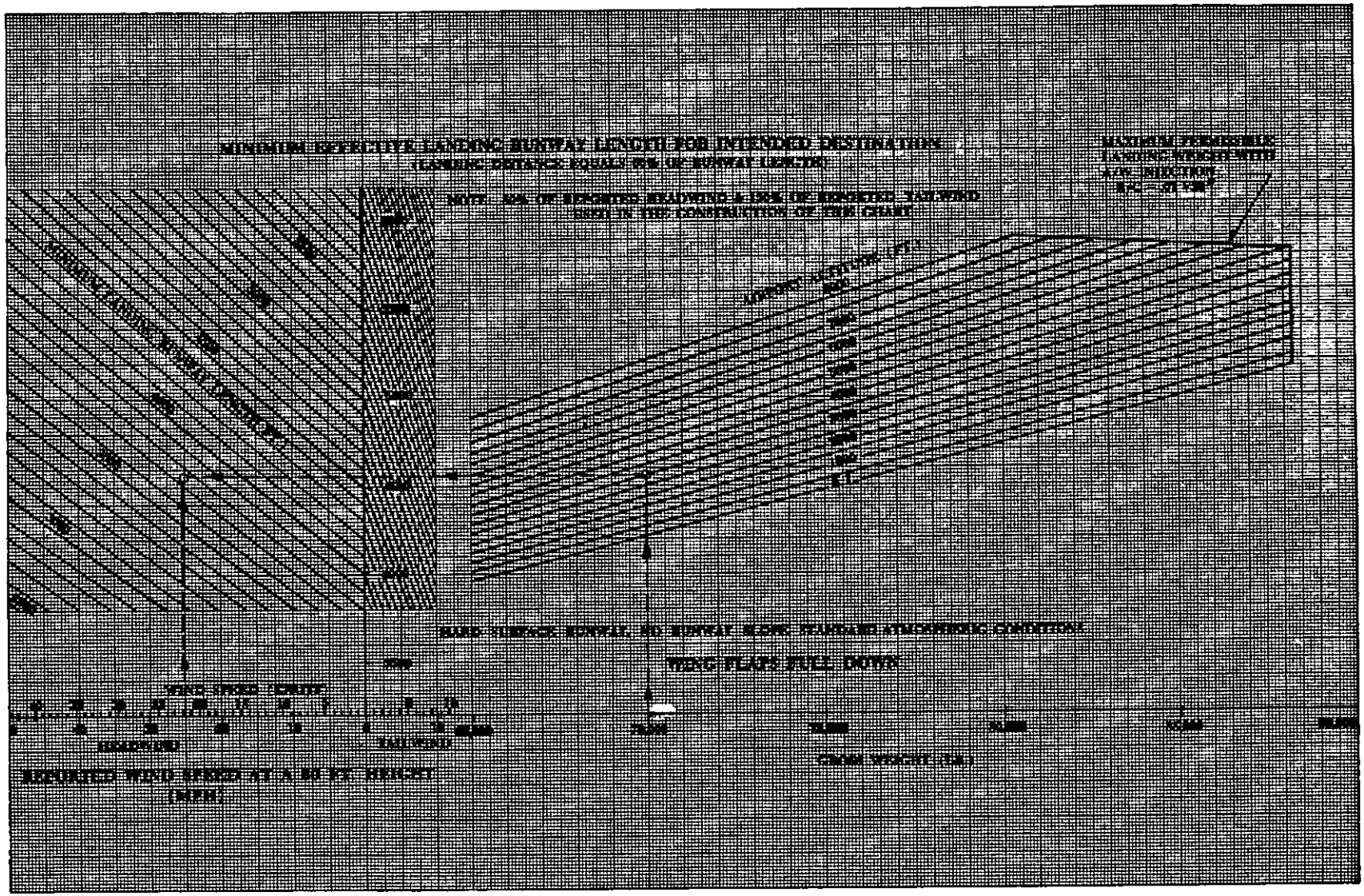


FIGURE 17. Aircraft Performance—Reciprocating Engine.

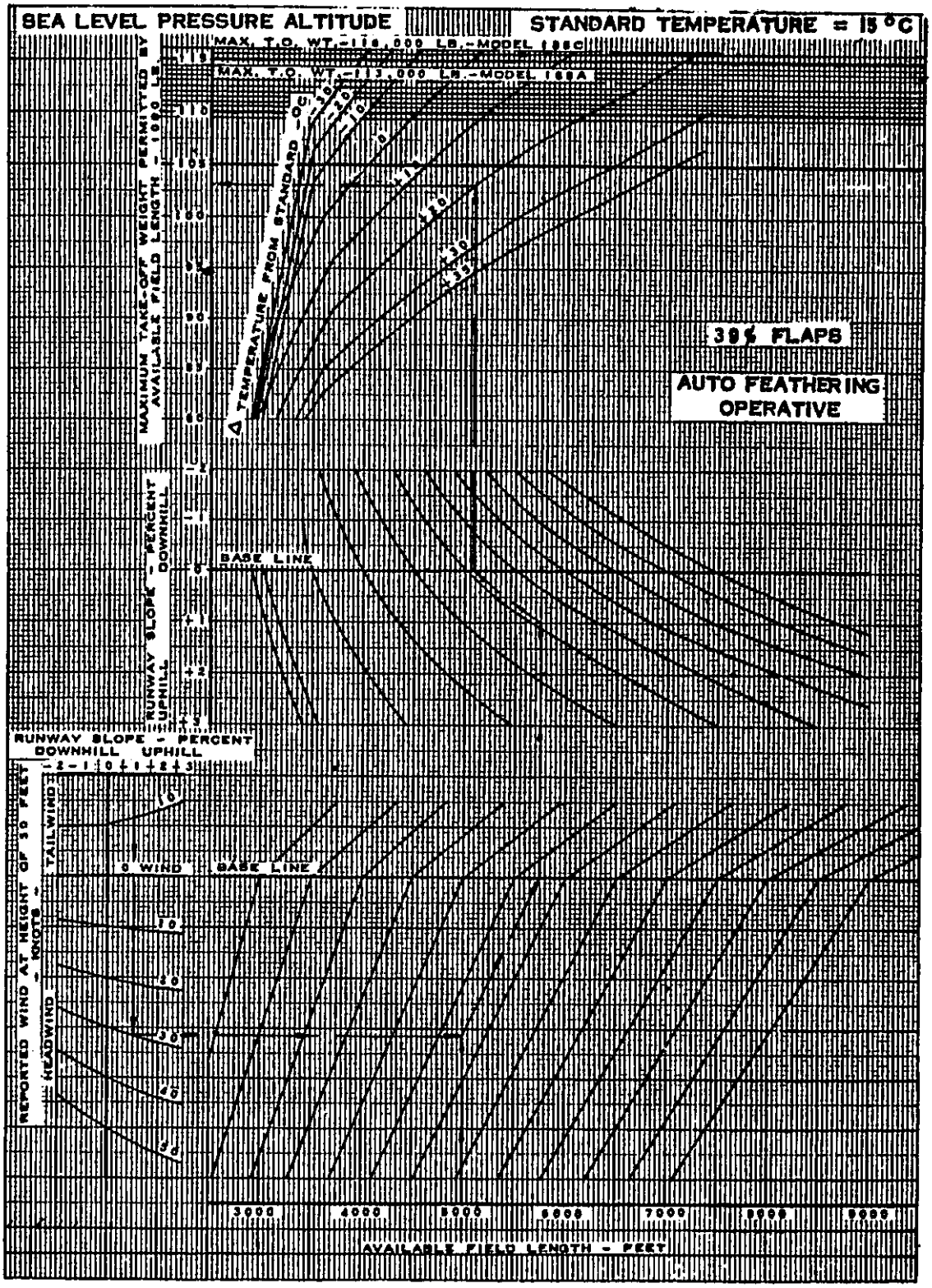


FIGURE 18. Aircraft Performance—Turboprop.

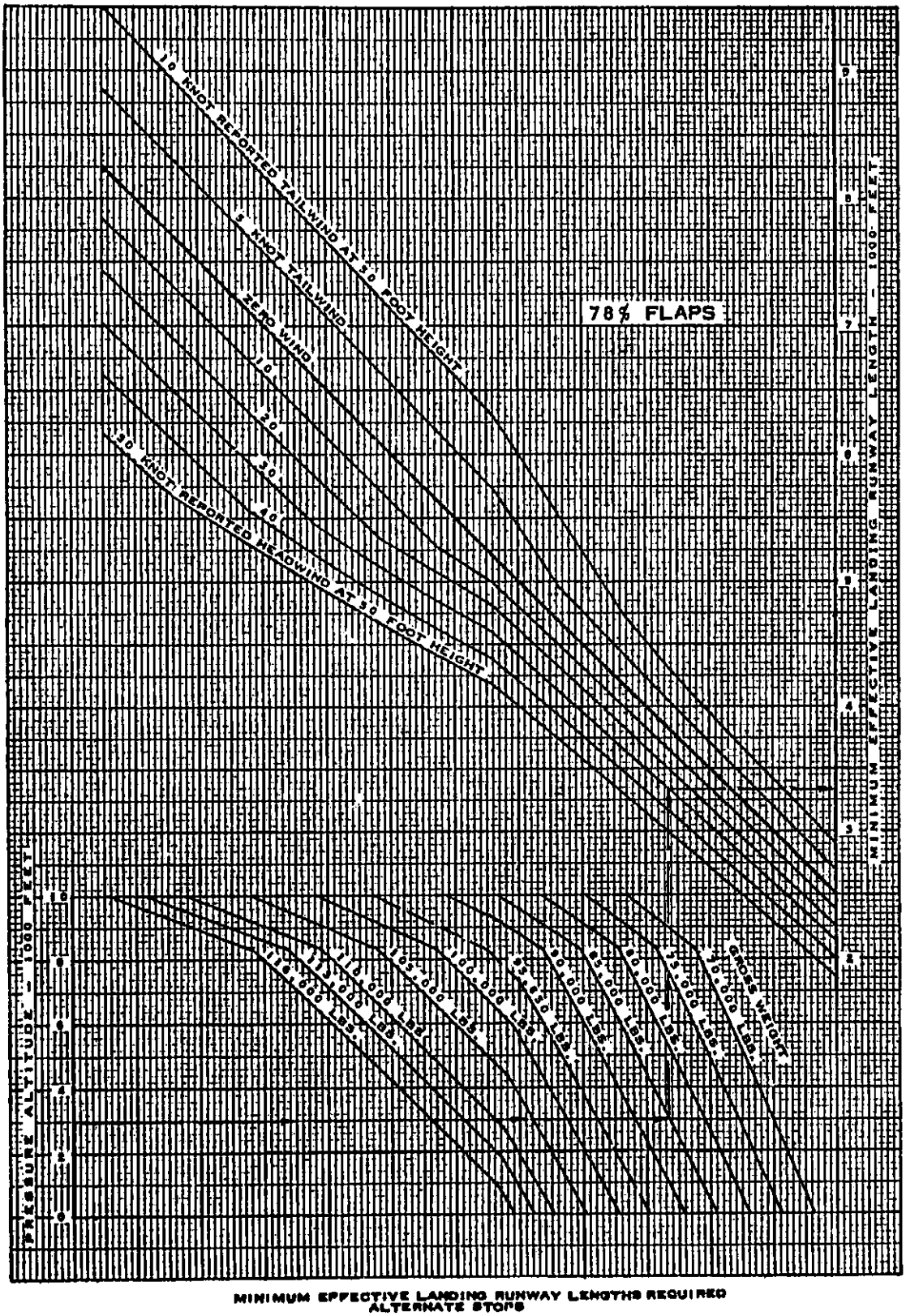


FIGURE 19. Aircraft Performance—Turboprop.

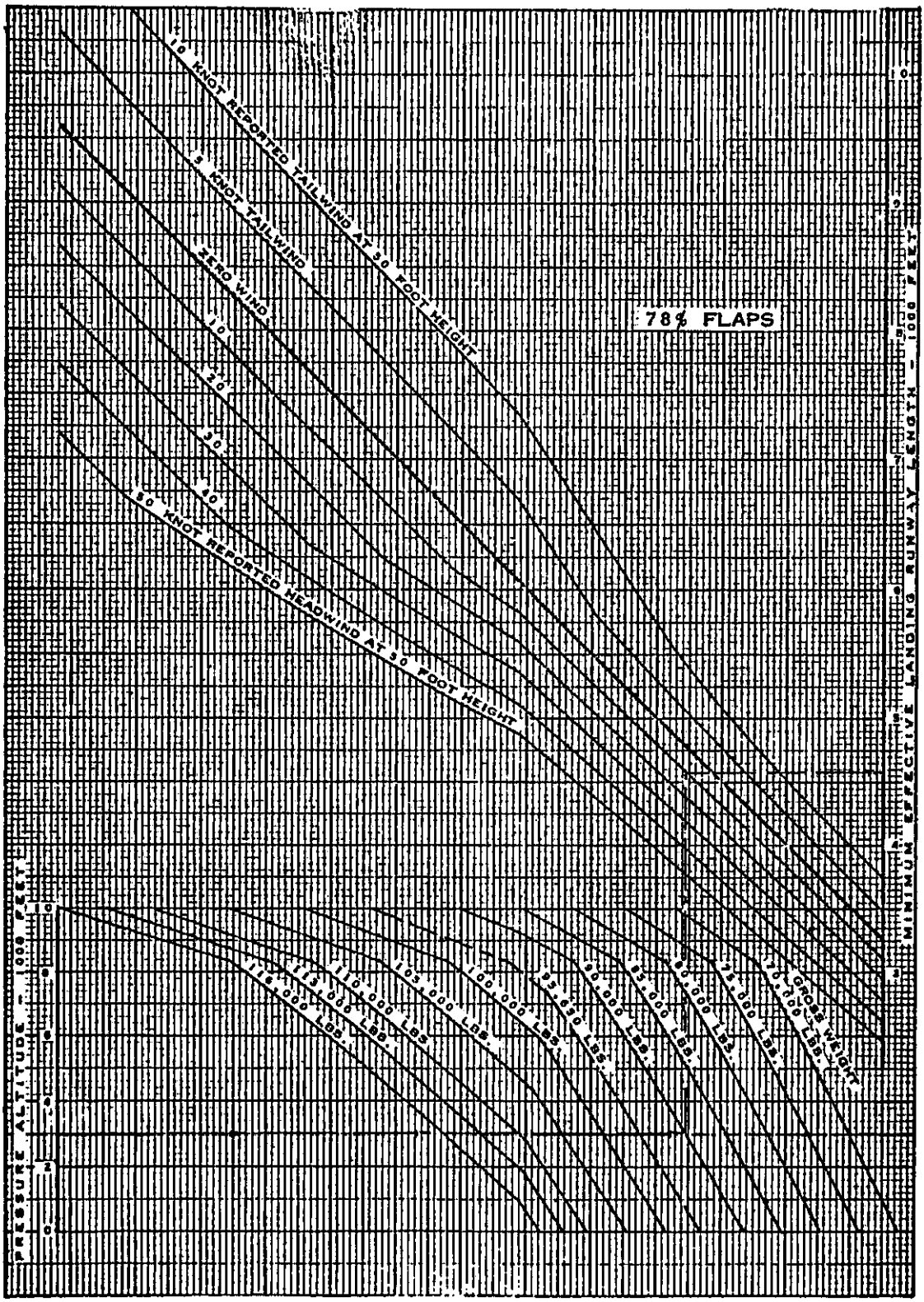


FIGURE 20. Aircraft Performance—Turboprop.

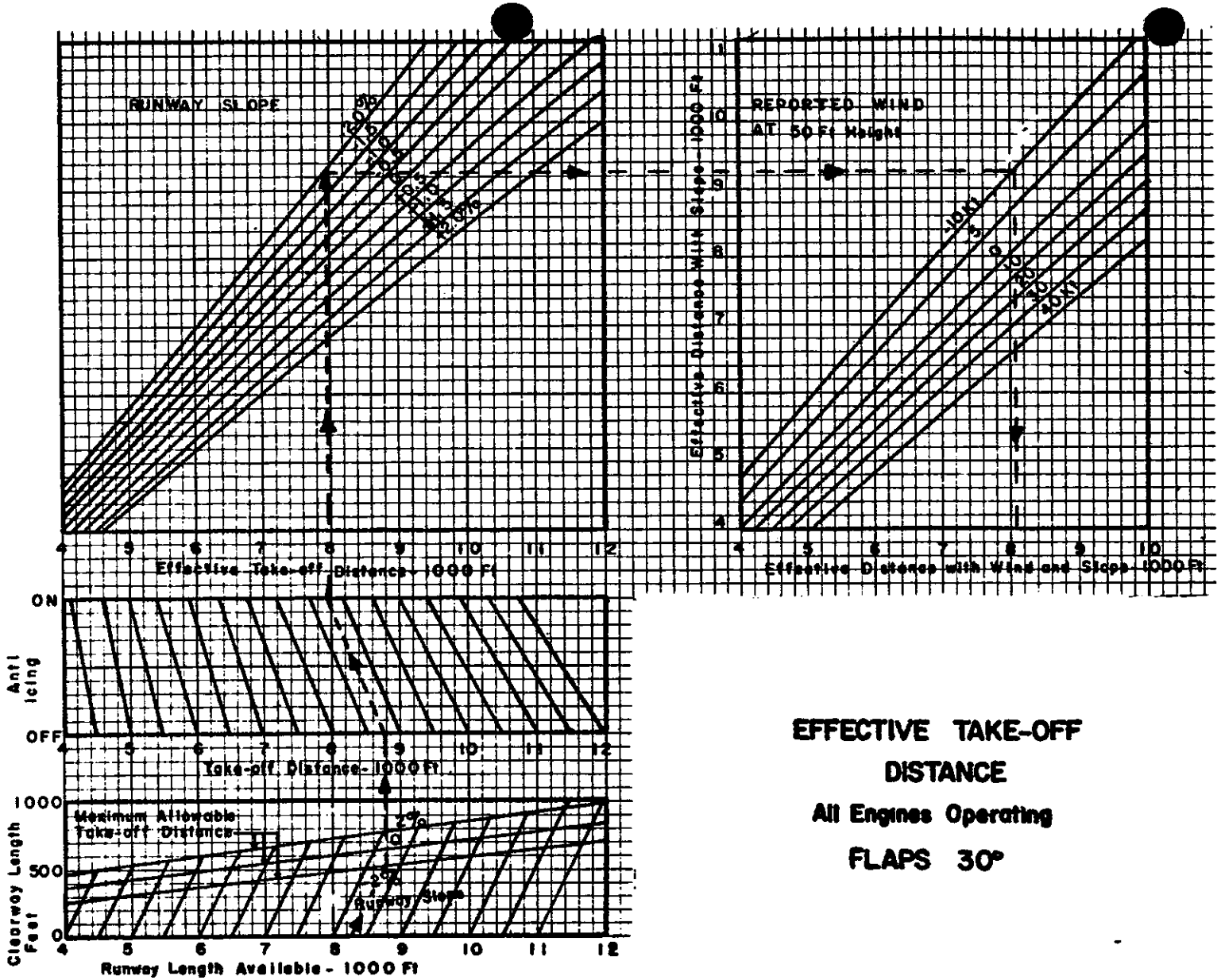
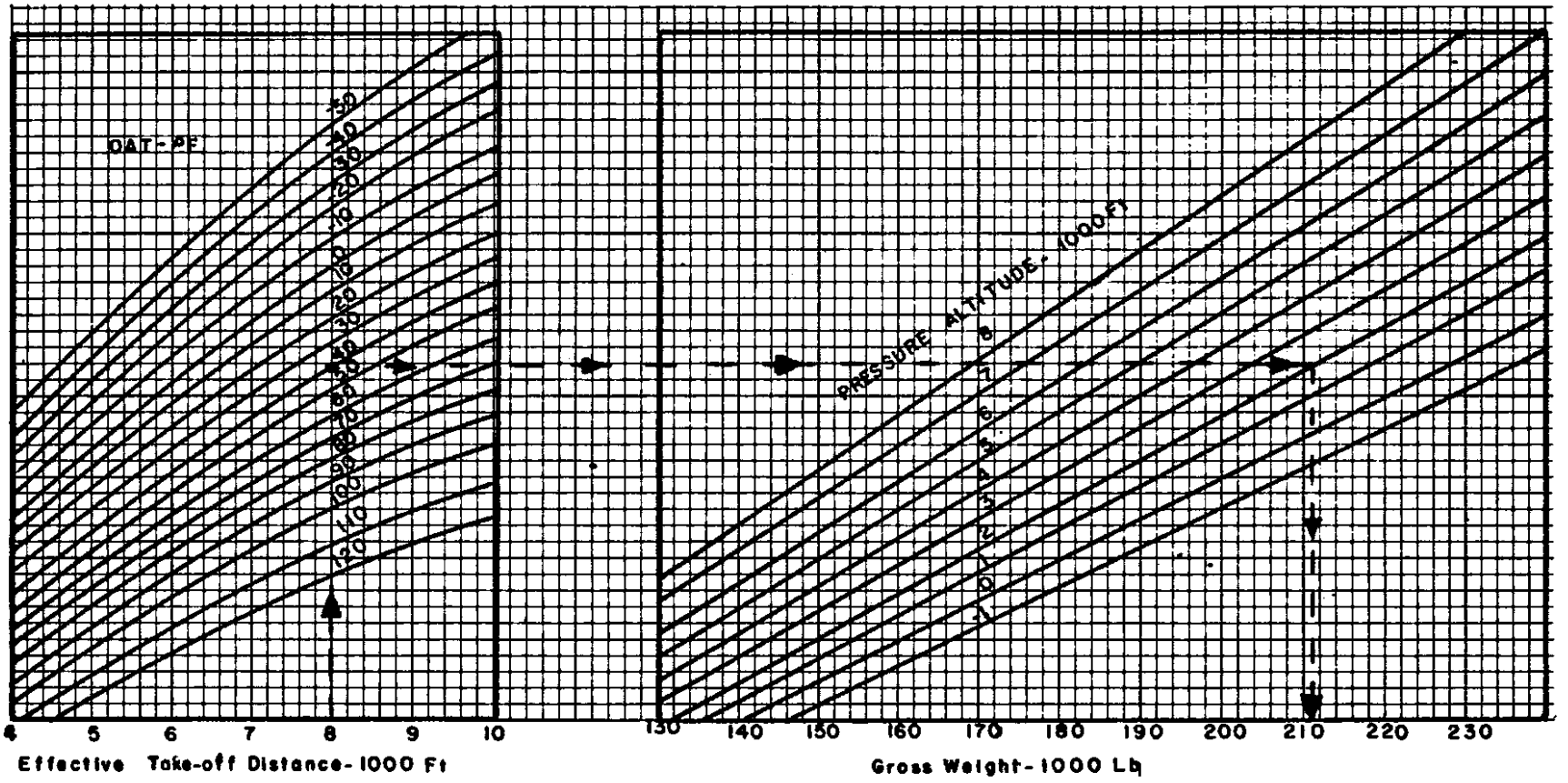


FIGURE 21. Aircraft Performance—Turbojet.



TAKE-OFF WEIGHT FOR EFFECTIVE TAKE-OFF DISTANCE FLAPS 30°

FIGURE 22. Aircraft Peformance—Turbojet.

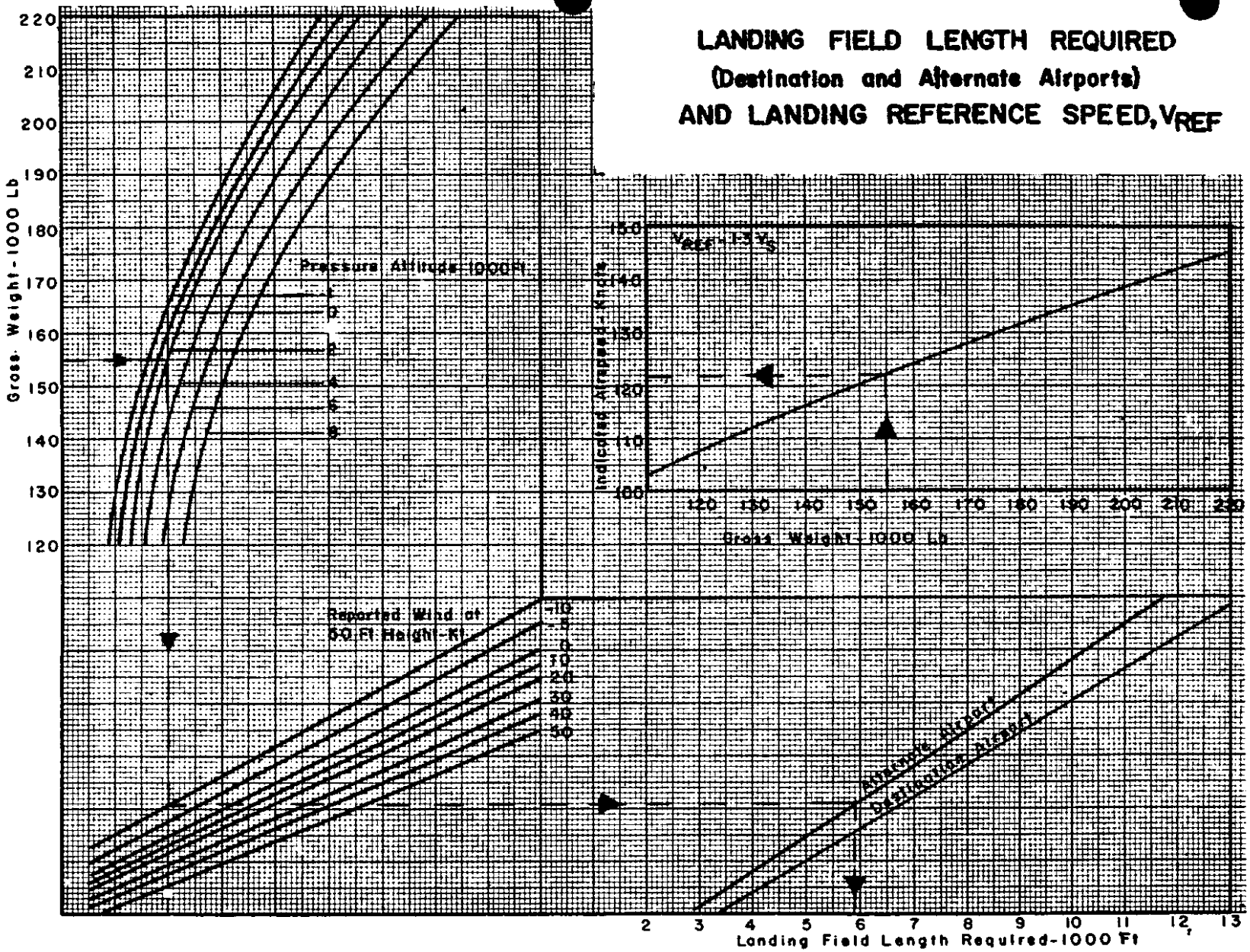


FIGURE 23. Aircraft Performance—Turbojet.

Instrument Flight:

These aircraft are certificated in the transport category for instrument night flight when the required equipment is installed.

Altitude:

Maximum operating altitude is 25,000 feet.

Crew:

This airplane shall be operated with a minimum crew of three: pilot, copilot, and flight engineer.

Wind:

Maximum permissible cross-wind component: 25 knots. Maximum tailwind component for takeoff and landing: 8.7 knots.

Icing:

These aircraft are limited to operation in LIGHT icing conditions as defined by NACA CHART NO. A-11408. Wing and tail anti-icing heaters should not be turned on when the outside air temperature is above 10° C., except for in-flight and on-ground heater checks of not over 15 minutes' duration, provided that the limit temperature of 210° C. is not exceeded.

Powerplants:

The normal operating powers used on this engine for various portions of the flight are detailed in the table below.

Condition	*BHP*	*RPM*	*MAP*	*BMEP*	*Time limit*
Takeoff wet	2,500	2,800	62"_____	253	2 minutes.
Takeoff dry	2,200	2,800	60"_____	222	2 minutes.
Maximum continuous	1,800	2,600	51.5"___	207	None.
Maximum cruise	1,200	2,300	Var_____	------	None.
Standard cruise	1,100	2,000	Var_____	------	None.
Long-range cruise: All settings variable, changed every 5,000 lb.	------	------	--------	------	----------
Climb	1,400	2,400	41.8"___	177	None.

Fuel System:

All fuel must be distributed equally on both sides of the aircraft. All main tanks must be equally filled first, then the alternates in accordance with prescribed procedures.

Total capacity: 4,248 gallons.

Number of tanks: 10.

Tanks	*Capacity*
1 and 4 main	360 gal. each
1 and 4 alternates	519 gal. each
2 and 3 main	508 gal. each
2 and 3 alternates	527 gal. each
Left and right auxiliary	210 gal. each

Fuel dumping facilities are provided for the emergency jettisoning of fuel in flight to decrease airplane gross weight. A *standpipe* is installed in each main tank so that when all possible fuel is dumped, in level flight, sufficient fuel will remain in the main tanks for 45 minutes of flight at 75 percent of rated METO power.

Total time to dump from full tanks (4,248 gal.) to standpipes (430 gal.) is 8.5 minutes.

Ice Control Systems:

Airfoil anti-icing: accomplished by routing heated air to the leading edges of the wing and tail surfaces. Heated air is provided by three combustion heaters, one in each outboard nacelle and one in the tail.

Windshield heating: hot air is supplied from the cabin heater.

Carburetor anti-icing: accomplished by the use of engine heat.

Propeller deicing: accomplished by means of electrical heating elements which are installed on the leading edges of the blades.

Pitot and scoop anti-icing: electrical heating elements are provided for the pitot tubes, cabin heater combustion airscoop and the belly airscoop. The mouths of the wing and tail airscoops are heated by airfoil anti-icing heat.

Airplane Weights:

	Pounds
Maximum takeoff gross weight	107,000
Maximum landing gross weight	92,360
Maximum zero fuel weight	87,360
Empty weight	57,900

Operating Load:

The operating load consists of the following items:

1. Flight crew.
2. Flight attendants.
3. Crew baggage.
4. Food and beverage.
5. Nacelle engine oil.
6. Fillet engine oil.
7. ADI fluid.

Number of crew:	*Operating load (pounds)*
6	2,930
7	3,150
8	3,300

Seating configuration: Tourist.

Maximum seats: 85.

Baggage allowance: 40 pounds/person.

Loading Limits—Belly Compartments:

Forward belly:	
Volume	267 cubic feet.
Maximum floor loading	75 pounds/sq. ft.
Maximum allowable load	5,715 pounds.
Aft belly:	
Volume	242 cubic feet.
Maximum floor loading	75 pounds/sq. ft.
Maximum allowable load	3,390 pounds.

Center of Gravity:

Aircraft must be loaded in accordance with approved weight distribution tables. A range of C.G. movement must be computed prior to each flight for Takeoff Gross Weight down to the Zero Fuel Weight.

C.G. Limits:

Gear up: Forward C.G., 13 percent; Aft C.G., 33 percent.

Gear Down: Forward C.G., 14.6 percent; Aft C.G., 33 percent.

Mean Aerodynamic Chord (MAC): 164 inches.

Leading edge of MAC aft of the datum line (LEMAC): 395.6 inches.

MINIMUM EQUIPMENT LIST FOR DISPATCH

(Partial List)

NOTE: *In the following material the terms "IFR DAY" and "IFR NIGHT" refer to actual instrument flight conditions. For flights operated under VFR flight conditions and on an IFR flight plan, use the applicable VFR column.*

Flight instruments	*VFR day*	*VFR night*	*IFR day*	*IFR night*
Airspeed indicator	1	2	2	2
Altimeter, sensitive	1	2	2	2
Auto pilot	0 (A)	0 (A)	0 (A)	0 (A)
Clock, sweep second hand	1 (B)	1 (B)	1 (B)	1 (B)
Gyrosyn compass pilot's master indicator	(C)	(C)	1 (D)	1 (D)
Gyrosyn compass repeater, copilot's	(C)	(C)	1 (D)	1 (D)
Gyro horizon, electric and vacuum	1 (E)	1 (E)	2 (F)	2 (F)
Magnetic compass	1	1	1	1
Outside air temperature indicator	1	1	1	1
Pitot tube (electrically heated)	1 (G)	2	2	2
Rate of climb indicator (flight)	1	1	1	1
Turn and bank, electric	1	1	1	1
Vacuum gage	1	1	1	1
Wing flap position indicator	0 (G–1)	0 (G–1)	0 (G–1)	0 (G–1)

Notes Applicable To Flight Instruments

(A) May be dispatched with the auto pilot inoperative, provided the requirements of Note (D) below are adhered to and the auto pilot controls handles and ON-OFF switch are placarded INOPERATIVE. Equipment status must be agreed upon by pilot and dispatcher.

(B) Operative clock must be on the captain's side.

(C) Either the pilot's master indicator of the copilot's repeater indicator must be operative.

(D) Both gyrosyn systems (pilot's master and copilot's repeater) must be operative for IFR DAY and NIGHT flight, except that aircraft may be dispatched with the pilot's master indicator operating only as a directional gyro with slaving inoperative.

(E) Only one gyro horizon required; may be either electric or vacuum. (Only 1 vacuum pump is required; however, in case of vacuum pump failure, a thorough inspection shall be made of the pump to determine that the failure will not jeopardize the safety of future flight.)

(F) Two gyro horizons required, either 2 electric, or a combination of 1 electric and the vacuum drive horizon. (See note (E) above regarding vacuum pump failure.)

(G) With operative Airspeed Indicator.

(G–1) The aircraft may be dispatched with the Wing Flap Position Indicator inoperative under the provisions of "Dispatch with Wing Flap Position Indicator Inoperative" covered in sec. 2.5.13 of the Maintenance Manual.

Engine units (requirements shown are for systems per aircraft):	*VFR day*	*VFR night*	*IFR day*	*IFR night*
Blower Shift Actuator	3 (G–2)	3 (G–2)	3 (G–2)	3 (G–2)
Blower Shift Clutch	3 (G–2)	3 (G–2)	3 (G–2)	3 (G–2)
BMEP Indicator	3 (H–J)	3 (H–J)	3 (H–J)	3 (H–J)
Carburetor Temperature Indicator	3	3	4	4
Cylinder Temperature Indicator	3 (I)	3 (I)	3 (I)	3 (I)
Fuel Flow Indicator	3 (J)	3 (J)	3 (J)	3 (J)
Fuel Pressure Indicator	3 (K)	3 (K)	3 (K)	3 (K)
Fuel Quantity Indicator	7 (L)	7 (L)	7 (L)	7 (L)
Hydraulic Pressure Gage	1	1	1	1
Hydraulic Quantity Indicator	0 (M)	0 (M)	0 (M)	0 (M)
Ignition Analyzer System	0 (M–1)	0 (M–1)	0 (M–1)	0 (M–1)
Manifold Pressure Gage	3 (H)	3 (H)	3 (H)	3 (H)
Oil Pressure Indicator	4	4	4	4
Oil Quantity Indicator	0 (N)	0 (N)	0 (N)	0 (N)
Oil Temperature Indicator	3 (I)	3 (I)	3 (I)	3 (I)
Spark Advance Solenoid and System	0 (N–1)	0 (N–1)	0 (N–1)	0 (N–1)
Tachometer Indicator	3 (O)	3 (O)	3 (O)	3 (O)

Notes Applicable to Engine Units

(G–2) May be dispatched with 1 Blower Shift Actuator inoperative or 1 Blower Clutch stuck in Low Blower, under the provisions of "Dispatch with One Blower Shift Actuator inoperative or One Blower Clutch Stuck in Low Blower" as covered in sec. 2.5.14 of the Maintenance Manual.

(H) If the Manifold Pressure Gage is inoperative, the BMEP Indicator and Tachometer must be operative on each engine.

(I) Either the Oil Temperature or the Cylinder Temperature Indicator must be operative on each engine but no more than 1 oil Temperature or 1 Cylinder Temperature Indicator can be inoperative at any time.

(J) Either the BMEP or the Fuel Flow Indicator must be operative on each engine.

(K) If the Fuel Pressure Indicator is inoperative, the Fuel Pressure Warning Light must be operative for that engine.

(L) 1 Fuel Quantity Gage may be inoperative, *PROVIDED* the fuel tank is stuck and actual fuel quantity noted at time of refueling, and provided the BMEP and Fuel Flow Indicators are operative on each engine.

(M) A physical check must be made of the tank fluid level prior to each takeoff.

(M–1) The Ignition Analyzer is not required. The aircraft may be dispatched with the Analyzer inoperative, *PROVIDED:* In the case of Analyzer Synch. Generator malfunctioning, a thorough inspection is made to determine that the inoperative generator will not affect the continued airworthiness of the engine. Flight crew must be advised of equipment status.

(N) No Oil Quantity Gages required, *PROVIDED* the oil tank for the corresponding inoperative indicator is physically checked for level prior to each takeoff.

(N–1) May be dispatched with one or more Spark Advance Solenoids or systems inoperative, *PROVIDED:* Their use will not be required with reference to engine operation, that a thorough inspection is made to insure that no mechanical irregularity exists, and that the flight crew are advised of the condition.

(O) If the Tachometer is inoperative, the Manifold Pressure and BMEP must be operative on that engine.

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