AC 61-18

AIRLINE TRANSPORT PILOT (airplane) WRITTEN EXAMINATION GUIDE

FEDERAL AVIATION AGENCY

airline transport pilot (airplane)

written examination guide

Revised
January 1965

FEDERAL AVIATION AGENCY
FLIGHT STANDARDS SERVICE

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C., 20402 - Price 35 cents

CONTENTS

Appendix

AIRLINE TRANSPORT PILOT (AIRPLANE) WRITTEN EXAMINATION GUIDE

INTRODUCTION

In a continuing effort to provide guidance and assistance the Federal Aviation Agency offers this examination guide to applicants who are preparing for the Airline Transport Pilot (Airplane) Written Examination. It supersedes the guide issued in 1962, and is issued as Advisory Circular 61–18.

The guide describes the type and scope of aeronautical knowledge covered by the written examination, lists appropriate references for study, and presents sample examination questions. As a further convenience to the applicant, those portions of the present Federal Aviation Regulations concerning general eligibility and aeronautical experience requirements for the certificate have been included. Applicants should be aware, however, that regulations are subject to amendment. Any question regarding the currency of these quoted regulation excerpts may be checked with the appropriate FAA office.

The written examination for the Airline Transport Pilot (Airplane) Certificate places major emphasis on the specific requirements and duties of an airline transport pilot, in accordance with the requirements stipulated in Federal Aviation Regulations Part 61. This examination guide outlines the aeronautical knowledge needed to obtain an Airline Transport Pilot Certificate and stresses requirements relating specifically to airline operations. Pilots wishing to acquire this certificate only for its advantage to them in their line of aviation activity must expect to be examined on the same basis as an applicant seeking the certificate for use in an airline pilot's job.

ELIGIBILITY REQUIREMENTS FOR CERTIFICATE

The following excerpts from the Federal Aviation Regulations Part 61, pertaining to eligibility, are given for the convenience of the applicant.

§ 61.141 *Eligibility requirements: general.*

To be eligible for an airline transport pilot certificate, a person must—

(*a*) Be at least 23 years of age;

(*b*) Be of good moral character;

(*c*) Be able to read, write, and understand the English language and speak it without accent or impediment of speech that would interfere with two-way radio conversation;

(*d*) Be a high school graduate, or its equivalent in the Administrator's opinion, based on the applicant's general experience and aeronautical experience, knowledge, and skill.

(*e*) Have a first-class medical certificate issued under Part 67 of this chapter within the 6 months before the date he applies; and

(*f*) Comply with the sections of this Part that apply to the rating he seeks.

§ 61.145 *Airplane rating: aeronautical experience.*

(*a*) An applicant for an airline transport pilot certificate with an airplane rating must hold a commercial pilot certificate or a foreign airline transport pilot or commercial pilot license without limitations, issued by a member state of ICAO, or he must be a pilot in an Armed Force of the United States whose military experience qualifies him for a commercial pilot certificate under 61.31 of this Part.

(*b*) An applicant must have had—

(1) At least 250 hours of flight time as pilot in command, or as copilot performing the duties and functions of a pilot in command under the supervision of a pilot in command, or any combination thereof, at least 100 hours of

which were cross-country time and 25 hours of which were night flight time; and

(2) At least 1,200 hours of flight time as a pilot within the 8 years before the date he applies, including at least—

(i) 5 hours within the 60 days before the date he applies;

(ii) 500 hours of cross-country flight time;

(iii) 100 hours of night flight time; and

(iv) 75 hours of actual or simulated instrument time, at least 50 hours of which were in actual flight.

Flight time used to meet the requirements of subparagraph (1) of this paragraph may also be used to meet the requirements of subparagraph (2) of this paragraph.

(*c*) If an applicant with less than 250 hours of pilot-in-command time otherwise meets the requirements of paragraph (*b*)(1) of this section, his certificate will be endorsed "Holder does not meet the pilot-in-command flight experience requirements of ICAO," as prescribed by article 39 of the "Convention on International Civil Aviation." Whenever he presents satisfactory written evidence that he has accumulated the 250 hours of pilot-in-command time, he is entitled to a new certificate without the endorsement.

TYPE OF EXAMINATION

The Airline Transport Pilot (Airplane) Written Examination is an integrated, single-section type which takes a practical, operational approach to the problems that arise in planning and conducting air transport flight operations. Test items present a progression of problems from flight planning to arrival at destination.

When the applicant takes the examination, appropriate planning materials in a supplementary booklet are issued to him. Similar materials for illustrative purposes are included in the appendix of this examination guide.

Examination Test Items and Scoring

Examination test items are of the multiple-choice type, similar to those shown in the sample examination in this guide.

The applicant marks his answers on a special answer sheet. He should read the directions very carefully before beginning the examination. Incomplete or erroneous personal information entered on the scoring sheet delays the scoring process.

All answer sheets graded below passing (70 percent) are rechecked for verification before the results are mailed to the applicant on FAA Form 578A. An applicant who receives a failing grade must present this form for re-examination.

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 applicant must surrender the answer sheet, together with any papers used for computations or notations, to the proctor before leaving the examination room.

When taking the examination, the applicant should keep in mind these points:

1. Each question or problem should be read carefully before looking at the possible answers. The applicant should clearly understand the problem before attempting to solve it.

2. After formulating his own answer, the applicant should then determine which of the alternatives most nearly corresponds with his answer. The answer chosen should completely resolve the problem.

3. From the answers given it may appear that there is more than one possible answer; however, there is only one answer that 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. After the less difficult questions have been answered, the others should then be reconsidered.

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

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 of 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 study materials appropriate to his needs.

The Civil Air Regulations (CARs) are being recodified as Federal Aviation Regulations (FARs). The FARs are not altering the CARs in intent by this recodification, but the rules and regulatory materials are being restated in a new subject matter arrangement. During the interim before completion of the recodification, the old CARs with their corresponding CAMs will remain in effect until superseded by the new FARs. On the effective date of each new FAR, the old regulation and any relating CAM will become obsolete. Each of the new FAR parts will contain a cross reference between the old and new section numbers.

Federal Aviation Regulations:

Part 61, Certification; Pilots and Instructors	$0.30
Part 91, General Operating and Flight Rules	.30
Part 95, IFR Altitudes	.20
Part 97, Standard Instrument Approach Procedures	.20

Civil Aeronautics Manuals:

4b Airplane Airworthiness—Transport Categories	1.50
40 Scheduled Interstate Air Carrier Certification and Operation Rules (includes SR 422, 422A, and 422B)	2.00

NOTE: CAM 4b will be recodified as FAR 25. CAM 40 will be recodified as FAR 121.

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

Air Navigation, AF Manual 51–40, Volume I ($3.00). This U.S. Air Force publication is an excellent reference for basic navigation.

Aerodynamics for Naval Aviators, NAVWEPS 00–80T–80 ($3.50). This U.S. Navy publication presents elements of aerodynamics of interest to all pilots.

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.

Aviation Weather. (In press). This comprehensive handbook will soon be issued by the Federal Aviation Agency and will be available from the Superintendent of Documents, U.S. Government Printing Office. It will give basic information on meteorology explained from the viewpoint of the pilot's needs.

Charts

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

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

Low-Altitude Area Charts (10¢ each). These

charts supplement the Instrument 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., 20230

Domestic prices are given; for foreign delivery, add approximately 25 percent.

EXAMINATION STUDY OUTLINE

I. General Regulatory Knowledge Areas

A. *Scheduled Interstate Air Carrier Certification and Operation Rules—CAM 40* (NOTE: CAM 40 will be recodified as FAR 121.)

1. Applicability and definitions (40.1, 40.2, 40.5).
2. Certification rules and operations specifications:
   - a. Issuance of certificate (40.13).
   - b. Operations specifications — contents (40.19).
   - c. Services and facilities requirements:
     - (1) Airports (40.33).
     - (2) Communications facilities (40.34).
     - (3) Weather reporting facilities (40.35).
     - (4) Enroute navigational facilities (40.36).
     - (5) Servicing and maintenance facilities (40.37).
     - (6) Dispatch centers (40.38).
   - d. Manual requirements:
     - (1) Contents (40.51).
     - (2) Airplane flight manual (40.53).
   - e. Airplane performance operating limitations—transport category:
     - (1) Operating limitations (40.70).
     - (2) Weight limitations (40.71).
     - (3) Takeoff limitations to provide for engine failure (40.72).
     - (4) Enroute limitations (40.73, 40.74, 40.75, 40.76).
     - (5) Landing distance limitations—destination and alternate (40.77, 40.78).
     - (6) Differences—transport and non-transport category operating limitations.
     - (7) Differences —non turbine-powered and turbine-powered transport category performance requirements (SR 422, 422A, 422B).
   - f. Airman and crewmember requirements:
     - (1) Composition of flight crew (40.261).
     - (2) Assignment of emergency functions (40.267).
     - (3) Initial pilot ground training (40.281).
     - (4) Initial pilot flight training (40.282).
     - (5) Emergency training (40.286).
     - (6) Recurrent training (40.289).
   - g. Pilot qualification requirements:
     - (1) Recent experience (40.301).
     - (2) Pilot checks (40.302).
     - (3) Pilot route and airport qualification requirements (40.303).
     - (4) Maintenance and reestablishment of qualifications (40.304).
     - (5) Proficiency check; second-in-command (40.305).
     - (6) Flight time limitations (40.320).
   - h. Flight operations:
     - (1) Operational control (40.351).
     - (2) Flight crewmembers at controls (40.354).
     - (3) Emergency decisions (40.360).
     - (4) Reporting mechanical irregularities (40.362).
     - (5) Engine failure or precautionary stoppage (40.363).
     - (6) Briefing of passengers (40.370).
   - i. Dispatching rules:
     - (1) Dispatching authorization (40.381).
     - (2) Dispatching under VFR, IFR or over-the-top (40.386, 40.387).
     - (3) Alternate airports—departure (40.388).
     - (4) Alternate airports—destination (40.389).
     - (5) Alternate airport weather minimums (40.390).
     - (6) Continuance of flight (40.391).
     - (7) Operation in icing conditions (40.392).
     - (8) Redispatch (40.393).
     - (9) Fuel supply—all operations (40.396).
     - (10) Takeoff and landing minimums—VFR, IFR (40.405, 40.406).
     - (11) Flight altitude rules (40.408, 40.409).
     - (12) Dispatch release (40.411).
     - (13) Load manifest (40.412).
   - j. Records and reports:
     - (1) Dispatch release form (40.503).
     - (2) Load manifest (40.504).

758-848 O—65——2

(3) Disposition of forms (40.505).
(4) Maintenance release form (40.511).
(5) Communications records (40.512).
(6) Mechanical reliability reports.

B. *General Operating and Flight Rules—Part 91*
1. Subpart A—General
2. Subpart B—Flight Rules
3. Subpart C—Maintenance

C. *Certification: Pilots and Flight Instructors—Part 61*
1. Subpart A—General
2. Subpart E—Airline Transport Pilots

D. *Airplane Airworthiness, Transport Categories—Civil Aeronautics Manual 4b*
1. Definitions (4b.1):
   a. General design.
   b. Weights.
   c. Speeds.
   d. Structural.
   e. Powerplant installation.
2. Flight—general (4b.100 through 4b.105).
3. Performance—(4b.110 through 4b.123).
4. Structure—flight loads (4b.210 through 4b.216).
5. Fire protection (4b.380).
   a. Classes of fires.
   b. Cabin interiors.
   c. Cargo compartment classification.

II. Flight Planning Knowledge Areas

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—interpetation of chart symbols.
2. Minimum IFR altitudes
3. Enroute and terminal radio aids:
   a. VHF omnirange:
      (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.
4. Flight information publications:
   a. Contents—*Airman's Information Manual* (Successor to the *Airman's Guide* and the *Flight Information Manual*).
   b. Contents—*Air Traffic Control Procedures.*

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 dispatch requirements.
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. (40.110 through 40.153).

III. Operational Knowledge Areas

A. *Air Traffic Control Procedures and Air Traffic Rules*
1. Altitude and route assignment:
   a. Minimum enroute altitude (MEA).
   b. Altimeter setting information.
   c. Altitudes and flight levels below and above 29,000 feet.
   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 instructions—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.
2. Radio navigation
   a. Orientations—ADF, VOR, etc.
   b. Tracking—ADF, VOR.
   c. Positioning:
      (1) Fixes by bearing plots.
      (2) Off course corrections.
      (3) Time and distance to station.
      (4) Quick distance to a fix.
   d. Compressibility effects on TAS.
   e. Determination of wind experienced—resultant heading and ETA correction.
   f. 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.

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. It is for this reason that you should concentrate on the section entitled "Examination Study Outline." A knowledge of all of the topics presented in this outline—not just the ability to answer these few sample test items—should be your goal as you prepare for the written examination.

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 an airline captain, employed by Lunar Airlines whose home base is Chicago, Ill. The company is a certificated air carrier, authorized to operate in scheduled air transportation under the provisions of Part 40 of the Civil Air Regulations. The equipment used is typical of most four-engine, nonturbine powered transport aircraft in present service.

The crew scheduling office assigns you to Flight 45 which operates between Chicago-O'Hare International Airport and John F. Kennedy International Airport, Jamaica, N.Y. As pilot-in-command, you are expected to make judgments based upon compliance with pertinent regulations, good operating procedures, and information supplied with this examination.

Flight 45 is scheduled to depart Chicago-O'Hare at 1200 Greenwich Mean Time on Wednesday, February 19. With your crew, you report to the dispatch office at 1100 GMT (0500 CST).

1. As pilot-in-command of this flight, your recent experience (within the preceding 90 days), must include at least—
   1. 6 hours of flight duty in a similar type aircraft.
   2. 3 takeoffs and 3 landings in any type of aircraft.
   3. 5 takeoffs and 5 landings to a full stop in a similar type aircraft.
   4. 3 takeoffs and 3 landings in the same type of aircraft.

2. The pilot who is to serve as second-in-command of Flight 45 must hold—
   1. An airline transport pilot certificate.
   2. A commercial pilot certificate only.
   3. At least a commercial pilot certificate and instrument rating.
   4. An airline transport pilot certificate and appropriate ratings.

3. The date of your last proficiency check is December 20. Your next scheduled proficiency check may be given as early as—
   1. June 1.
   2. June 20.
   3. May 1.
   4. May 20.

4. Choose the correct statements from the list below regarding emergency equipment.
   A. Protective breathing equipment, or smoke masks, must be provided for each flight crewmember on duty.
   B. Flight crewmembers need only be aware of the location of emergency equipment in the immediate flight deck area.
   C. Each crewmember must have in his possession a flashlight in good working order.
   D. A hand fire extinguisher must be provided on the flight deck for use by the flight crew.
   E. A crash ax is not required in this operation.

F. All passenger emergency exit markings must be capable of illumination by the main lighting system for night operations only.
1. A, C, D.
2. A, D, F.
3. B, E, F.
4. B, C, E.

5. What classification is assigned to a fire in electrical equipment?
1. Class A.
2. Class B.
3. Class C.
4. Class A or B.

6. The duty aircraft dispatcher briefs you on the weather pattern affecting this flight by directing your attention to the surface weather map. Choose the correct statements from the list below. (See Appendix, Figure 1.)
A. Visibility at Chicago is 6 miles in haze.
B. Fog reported at the center of the "LOW" is most likely of the radiation type.
C. Barometric pressure at Nantucket is 1005.4 millibars.
D. Sky is obscured at Pittsburgh.
1. A and D.
2. B and C.
3. B and D.
4. A and C.

7. Which of the following terms describes the flow of air in a low-pressure system?
1. Converging and descending.
2. Diverging and descending.
3. Converging and ascending.
4. Diverging and ascending.

8. Consider the pressure change in the preceding 3-hour period at each of the following stations as shown on the surface weather map:

Syracuse	*New York*	*Pittsburgh*
−39	−71	−15
falling	falling	falling

The "Low" center will most likely move from its present position—
1. Toward New York.
2. Toward Syracuse.
3. Toward Pittsburgh.
4. Due east.

9. An aircraft is maintaining a constant pressure altitude of 18,000 feet between Chicago and New York. The true altitude of the aircraft will (see Appendix, Figure 2)—
1. Decrease.
2. Increase, then decrease.
3. Increase.
4. Decrease, then increase.

10. The presence of abnormally strong winds at the 500-millibar level over the Southeastern States suggests the possibility of a jet stream. Which of the following statements is correct with regard to jet stream characteristics?
1. Maximum winds are generally located at the 500-millibar level.
2. Jet core is located in the vicinity of the tropopause.
3. Maximum horizontal wind shear is encountered south of the core.
4. Wind speeds are stronger in summer than in winter.

11. With respect to temperatures at the level of the polar tropopause, temperatures at the tropical tropopause level are—
1. Colder.
2. Warmer.
3. The same.
4. Colder in the winter.

12. A portion of the Area Forecast pertaining to southern New York and adjacent coastal waters is reproduced below:
. . . C5–1Ø⊕1–2S–F. PCPN MXD SNW RAIN SLEET CSTL SECS. IPVG BTN Ø8E–1ØE TO C15⊕2S–F . . . CLD TOPS 3ØØ LWRG AFT 1ØE TO 1ØØ. SFC WNDS CSTL SECS Ø625G4Ø. . . .
Which of the following statements is correct?
1. Between 08E and 10E, cloud bases are expected to be 1,500 feet, MSL.
2. Surface winds along coastal sections are forecast to be 060°/25 knots, gusting to 40 knots.
3. Cloud tops will lower after 10E to 1,000 feet.
4. Visibility is reduced by heavy snow and light fog.

13. The JFK scheduled airway observation for 0400 CST appears as follows:
JFK M1ØⒹ15⊕3E–F 893/32/29/Ø428G33/92Ø PRESFR EB35.
Select the statement below which correctly interprets certain elements of this observation.
1. Temperature/dew point spread is 3° C.
2. Barometric pressure is 992.0 millibars.
3. Pressure is falling rapidly.
4. Ceiling is 1,500 feet.

14. The maintenance crew assigned to the aircraft scheduled for this flight reports that No. 2 engine tachometer indicator is inoperative. What decision is appropriate? (See Appendix, Minimum Dispatch List.)
1. Proceed with dispatch if No. 2 engine manifold pressure gage and BMEP indicator are operative.
2. Tachometer *must* be replaced.
3. Proceed with dispatch since only 3 tachometer indicators are required.
4. Proceed with dispatch if unit can be replaced at the next stop.

15. For this IFR operation, regulations specify that ceilings and visibilities at the destination airport must be at or above approved minimums—
1. Prior to departure.
2. During the entire flight.
3. At the estimated time of arrival.
4. During the period 2 hours prior, to 2 hours after, the estimated time of arrival.

Flight planning data for this flight is outlined below:
Altitude—19,000 feet.
Route—J90, J34, J60 JFK.
Alternate—Philadelphia International Airport.
You are to complete the flight time analysis form in the Appendix, Figure 8. Appropriate chart segments for this routing are also enclosed in the Appendix, Figures 3, 4, 5, and 6.

NOTE: *There is a wide variety of flight plan and/or flight log forms in current use. The flight time analysis form used in Figure 8 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.*

16. The computed flight plan time from ORD to JFK is—
1. 2 hours 21 minutes.
2. 2 hours 30 minutes.
3. 2 hours 39 minutes.
4. 2 hours 48 minutes.

17. The weight of the fuel required for this flight, including 550 gallons of extra fuel for possible traffic delay, is—
1. 11,070 pounds.
2. 11,480 pounds.
3. 11,960 pounds.
4. 12,530 pounds.

18. In view of the fuel calculations previously made and assuming no operating limitations, what is the maximum allowable gross weight for this flight? (See Appendix, Aircraft Particulars, for aircraft weights.)
1. 97,530 pounds.
2. 98,160 pounds.
3. 98,560 pounds.
4. 107,000 pounds.

19. The basic operating weight for this aircraft is 60,830 pounds. Based on the previous fuel load calculations, what is the maximum allowable payload for Flight 45?
1. 24,500 pounds.
2. 25,530 pounds.
3. 26,010 pounds.
4. 26,250 pounds.

20. The actual payload for Flight 45 consists of the following:

Passengers	80 @ 165 pounds each.
Baggage and cargo	7,500 pounds.

What is the actual takeoff gross weight?
1. 92,360 pounds.
2. 93,010 pounds.
3. 94,850 pounds.
4. 107,000 pounds.

21. You review the weight and balance manifest and note that the center of gravity for the actual takeoff gross weight is located 436.6 inches aft of the datum line. What is the equivalent location in terms of percent of mean aerodynamic chord? (See Appendix, Aircraft Particulars.)
1. 20% MAC.
2. 25% MAC.
3. 27% MAC.
4. 33% MAC.

22. Assume a takeoff gross weight of 100,000 pounds with the C.G. located at 25% MAC. Five hundred pounds of cargo is shifted from the aft belly compartment to the forward belly compartment—a distance of 500 inches. The new C.G. location is—

1. 21.5% MAC.
2. 22.1% MAC.
3. 23.5% MAC.
4. 27.5% MAC.

23. Select the proper V_1 and V_2 speeds for a flight, based upon the following data (see Appendix, Aircraft Particulars).

Takeoff Gross Weight: 100,000 pounds.
Wet power.
Auto-feather operative.
Headwind Component: 25 knots.
Field elevation: 2,000 feet.
Level runway.

1. 102 knots and 117 knots.
2. 106 knots and 113 knots.
3. 98 knots and 109 knots.
4. 101 knots and 113 knots.

24. In the event of engine failure at the V_1 speed, the aircraft must be capable of attaining a height of 50 feet before passing the end of the runway and, thereafter, to clear all obstacles by—

1. 50 feet vertically and 300 feet horizontally.
2. 50 vertically without banking.
3. At least 50 feet vertically and 200 feet horizontally within the airport boundaries.
4. At least 50 vertically or 200 feet horizontally within the airport boundaries.

25. The maximum permissible crosswind component for takeoff and landing applicable to this aircraft is 25 knots. Assuming a runway heading of 045° (Variation 10° E), which of the following tower reported winds would cause this limitation to be exceeded?

1. 010°/35 knots.
2. 090°/40 knots.
3. 100°/25 knots.
4. 020°/50 knots.

TVMDC

26. With respect to aircraft structural limitations, an ultimate load is—

1. A limit load multiplied by the appropriate factor of safety.
2. The maximum load anticipated in normal conditions of operation.
3. The maximum certificated gross weight.
4. The maximum load at which structural deformation will occur.

27. The maintenance department releases the Flight 45 aircraft to the operations department. Which procedure is applicable?

1. A separate release form must be prepared.
2. An appropriate entry must be made in the airplane maintenance log.
3. An appropriate entry may be made in the airplane maintenance log or a separate release form may be issued.
4. The release may be made verbally.

28. Which of the items listed below must be contained in the dispatch release for this flight?

A. Takeoff gross weight.
B. Aircraft identification number.
C. Number of passengers.
D. Minimum fuel supply.
E. Type of operation.
F. Flight altitude.

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

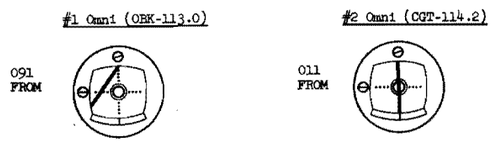
After boarding the passengers and completing all predeparture checks, you receive the following ATC clearance at the end of the runway:

ATC CLEARS LUNAR 45 TO THE JOHN F. KENNEDY AIRPORT VIA J90, J34, J60 JFK. TURN RIGHT AFTER DEPARTURE—HEADING 070 FOR VECTOR TO J90.

29. The air traffic clearance issued to you provides—

1. Authorization to proceed under specified traffic conditions in controlled airspace.
2. Priority over all other traffic.
3. Adequate separation from all traffic.
4. Authorization for flight in uncontrolled airspace.

30. After takeoff at 1205 GMT, departure control confirms your heading of 070° to intercept J90 (see Appendix, Figure 3). As you approach J90, you check your position relative to WHITEFISH Intersection, noting the following omni indications—



Your approximate location is—

1. West of WHITEFISH.
2. South of WHITEFISH.
3. North of WHITEFISH.
4. Southeast of WHITEFISH.

31. Unless otherwise cleared by ATC, your climb to cruising altitude is—

1. Restricted between 18,000 and 19,000 feet.
2. Unrestricted to 19,000 feet.
3. Restricted between 17,000 and 19,000 feet.
4. Unrestricted to 18,500 feet.

32. Flight 45 reaches Jet Route 34 at 1245 GMT. Based on the flight planning data in the Appendix, Figure 8, the ETA at CLE is—

1. 1313 GMT.
2. 1320 GMT.
3. 1317 GMT.
4. 1310 GMT.

33. Which of the following statements are correct with regard to operations within positive control areas?

1. VFR activities are prohibited.
2. Radio equipment must be capable of providing direct pilot/controller communication.
3. Aircraft must be equipped with a coded radar beacon transponder.
4. All of the above.

758-848 O—65——3

34. You are anticipating moderate icing in clouds and precipitation over the eastern sector of the route. To control airfoil icing, the wing and tail heaters should be operated—

1. Continuously at cruising altitude regardless of the presence of visible moisture.
2. Prior to entering and during flight in icing conditions.
3. After visible ice accumulation on airfoil surfaces.
4. Periodically to remove accumulated ice on airfoil surfaces.

35. The most severe structural icing is normally encountered in visible moisture between which of the following temperature ranges?

1. +2° F and −10° F.
2. −10° C and −40° C.
3. +2° C and −10° C.
4. −10° F and −40° F.

36. Assume that you shut down No. 1 engine due to low oil pressure. Which of the following courses of action are you, as pilot-in-command of this flight, expected to adopt in conformance with regulations?

1. Proceed to the nearest suitable airport in point of time.
2. Return to departure point.
3. Proceed to destination.
4. Proceed to an airport of your selection if, upon consideration of certain factors, you believe such action to be safe.

37. Determine the average wind experienced between Cleveland (CLE) and Phillipsburg (PSB) using the data below—

Time over CLE	1318 GMT.
Time over PSB	1403 GMT.
Average TAS	252 knots.
Average MH to maintain course	112°
Variation	5° W.

The average wind was—

1. 180°/20 knots.
2. 200°/40 knots.
3. 230°/30 knots.
4. 020°/40 knots.

45

38. On the basis of the wind computed in the previous test item with no change in TAS, the average compass heading between PSB and ABE is approximately (variation 9° W; deviation 4° E)—

1. 105°.
2. 095°.
3. 109°.
4. 117°.

39. At 1400 GMT, the gross weight is 88,460 pounds. The fuel flow at your cruise power of 1100 BHP is 495 pounds/hour/engine. At what time will you enter the next lower gross weight bracket which is 85,000 to 80,000 pounds?

1. 1545 GMT.
2. 1550 GMT.
3. 1540 GMT.
4. 1535 GMT.

40. You note a gradual decrease in outside air temperature. Which of the following will increase, assuming no change in engine controls and a constant pressure altitude?

1. True airspeed.
2. BMEP.
3. RPM.
4. Manifold pressure—initial increase followed by a decrease.

41. Assume a pressure altitude of 19,000 feet. At what temperature value will the density altitude be the same as the pressure altitude?

1. −26° C.
2. −19° C.
3. −30° C.
4. −23° C.

42. Before reaching PSB, you are advised to reduce speed so as to arrive over ABE at 1432 GMT. Compute the IAS which must be maintained between PSB and ABE to comply with this instruction using the data below—

Time over PSB	1403 GMT.
Pressure altitude	19,000 feet.
Airspeed position and instrument correction.	+5 knots.
Outside air temperature (indicated).	−33° C.
Temperature correction	7°
Compressibility correction	2.
Wind component	−10 knots (headwind).

The required IAS is—

1. 189 knots.
2. 194 knots.
3. 198 knots.
4. 183 knots.

43. Flight 45 reports over ABE at the specified time of 1432 GMT. What is the state of progress with respect to the original flight plan?

1. On time.
2. 6 minutes late.
3. 6 minutes early.
4. 10 minutes late.

44. You plan to make an ILS approach to runway 4R at JFK. Which of the following statements correctly interpret certain information on the instrument approach chart (see Appendix, Figure 7)?

A. Glide slope interception altitude is 1,000 feet.
B. Circling minimums provide standard clearance.
C. Descent below 212 feet is authorized if in visual contact with approach lights and RVR is 2,000 feet.
D. Distance from LOM to the airport is 2.1 miles.
E. Rate of descent on glide slope varies directly with ground speed.
F. Width of runway 4R is 200 feet.

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

45. Which of the following ATC reports are you expected to make without request?

1. Time reaching a newly assigned altitude.
2. Time at completion of procedure turn.
3. Time leaving a previously assigned altitude for a newly assigned altitude.
4. Time reaching minimum altitude on final approach.

Test Items 46 through 53 pertain to certain features of high altitude operations.

46. The speed of sound in the atmosphere is a function of—

1. Air temperature.
2. Pressure altitude.
3. Density altitude.
4. True altitude.

47. Mach number is the relationship of the speed of sound to—

1. EAS.
2. TAS.
3. CAS.
4. IAS.

48. An aircraft is cruising at 35,000 feet at TAS 485 knots. The speed of sound at this altitude is 576.6 knots. What is the Mach number?

1. Mach 1.0.
2. Mach 0.92.
3. Mach 0.88.
4. Mach 0.84.

49. An aircraft establishes .82 Mach cruise at pressure altitude 33,000 feet. Ambient temperature is −60° C. What is the TAS?

1. 466 knots.
2. 445 knots.
3. 462 knots.
4. 471 knots.

50. At 1535 GMT the gross weight of the aircraft in the previous test item is 212,560 pounds. The total fuel flow is 13,800 pounds/hour. What is the gross weight at 1650 GMT?

1. 195,310 pounds.
2. 196,530 pounds.
3. 198,070 pounds.
4. 198,960 pounds.

51. Compute the "nautical air miles/1,000 pounds of fuel" during the period 1535 GMT to 1650 GMT for the aircraft in the previous test items.

1. 33.8 NAM/1,000 pounds of fuel.
2. 34.5 NAM/1,000 pounds of fuel.
3. 35.6 NAM/1,000 pounds of fuel.
4. 36.1 NAM/1,000 pounds of fuel.

52. Which of the following phrases correctly describes "critical Mach number"?

1. Boundary between transonic and supersonic flow.
2. Limiting level flight cruise speed.
3. Boundary between subsonic and transonic flow.
4. Maximum design dive speed.

53. What effect does the use of a swept wing have on "critical Mach number" when compared to a straight wing?

1. Decreases critical Mach number.
2. Critical Mach number remains constant—no effect.
3. Decreases critical Mach number as altitude increases.
4. Increases critical Mach number.

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 turboprop and turbojet transport type aircraft. Sample problems and instructions are included in the Appendix material.

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.

54. Given the following data:

Runway slope	+2% (uphill).
Reported wind—knots	10 (headwind).
Available field length	6,000 feet.
Pressure altitude	5,000 feet.
Ambient temperature	+15° C.

What is the maximum takeoff weight permitted under the above conditions (see Appendix, Figure 9)?

1. 92,500 pounds.
2. 93,000 pounds.
3. 94,500 pounds.
4. 105,000 pounds.

55. If the ambient temperature were reduced by a 20 degree increment, the resultant maximum takeoff gross weight would (see Appendix. Figure 9)—

1. Remain the same.
2. Decrease by 5,000 pounds.
3. Increase by 5,000 pounds.
4. Increase by 10,500 pounds.

56. Determine the V_1 speed under the following conditions:

Takeoff gross weight	100,000 pounds.
Pressure altitude	5,000 feet.
Ambient temperature	+25° C.
Runway slope	−2% (downhill).
Reported wind—knots	10 (headwind).

The V_1 speed is (see Appendix, Figure 10)—

1. 104 knots (CAS).
2. 109 knots (CAS).
3. 113 knots (CAS).
4. 119 knots (CAS).

57. Assume a runway slope of +1% (uphill) in connection with the data in the previous test item. Determine the new V_1 speed.

1. 115 knots (CAS).
2. 123 knots (CAS).
3. 125 knots (CAS).
4. 129 knots (CAS).

58. The takeoff gross weight is 105,000 pounds at a sea level airport and the ambient temperature is +20° C. What is the V_2 speed (see Appendix, Figure 11)?

1. 117 knots (CAS).
2. 120 knots (CAS).
3. 125 knots (CAS).
4. 128 knots (CAS).

59. Given the following data:

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.

What is the effective takeoff distance for the "all engines operating" condition (see Appendix, Figure 13)?

1. 6,800 feet.
2. 7,100 feet.
3. 7,500 feet.
4. 7,900 feet.

60. 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 (see Appendix, Figure 14)?

1. 197,000 pounds.
2. 199,000 pounds.
3. 201,000 pounds.
4. 204,000 pounds.

ANSWERS TO SAMPLE EXAMINATION ITEMS

Item	Answer	Item	Answer
1	4	31	1
2	3	32	3
3	3	33	4
4	1	34	2
5	3	35	3
6	4	36	4
7	3	37	2
8	1	38	3
9	3	39	1
10	2	40	2
11	1	41	4
12	2	42	1
13	3	43	2
14	1	44	1
15	3	45	3
16	3	46	1
17	2	47	2
18	3	48	4
19	4	49	1
20	2	50	1
21	2	51	1
22	3	52	3
23	2	53	4
24	4	54	3
25	2	55	4
26	1	56	2
27	3	57	3
28	3	58	3
29	1	59	3
30	2	60	1

ANALYSES OF ANSWERS TO SAMPLE EXAMINATION ITEMS

Item *Answer*

1 4 The reference is CAR 40.301.

2 3 The reference is CAR 40.300(a).

3 3 The reference is CAR 40.302(b). The proficiency check *may* be administered at any time during the month preceding or following the month in which it becomes due. Earliest date is, therefore, May 1.

4 1 The following comments pertain to the lettered statements:

A. Correct; the reference is CAR 40.205a.

B. Incorrect; flight crewmembers must be aware of the location of all emergency equipment. Reference is CAR 40.286a.

C. Correct as stated; the reference is CAR 40.357b.

D. Correct as stated; the reference is CAR 40.173b–2.

E. Incorrect; a crash ax must be carried. Reference CAR 40.173d.

F. Incorrect; an independent lighting source must be provided for *both* day and night operation. Reference is CAR 40.173f–2.

5 3 The reference is CAR 4b.380.

6 4 The following comments pertain to the lettered statements:

A. Correct as stated.

B. Incorrect; fog shown at coastal stations is of the advection type resulting from the on-shore flow of warm, moist air over the cooler land surfaces.

C. Correct as stated.

D. Incorrect; sky condition is *overcast* at Pittsburgh.

7 3 The net flow of air about a low center is inward, toward low pressure. This *convergence* can only be accompanied by a resultant *ascending* flow.

8 1 The low center will tend to move toward the area of greatest pressure drop—in this case, New York. Other factors to consider in forecasting future movement of low centers are the direction of wind in the warm sector and the past trajectory as plotted on the weather map.

9 3 The 500-millibar surface slopes upward between Chicago and New York. True altitude of the aircraft will increase in conformance with the slope of this surface.

10 2 Jet streams occur in connection with a cold front or cold outbreak aloft. The core, or zone of maximum winds, is found in the warm air, in the vicinity of the tropopause.

11 1 The tropical tropopause is higher than the polar tropopause. In view of the normal decrease in temperature with altitude in the troposphere, the temperature is, therefore, colder at the tropical tropopause.

12 2 Note the changes in presenting wind direction and velocity.

13 3 Choice 1; spread is 3° F.
Choice 2; barometric pressure is 989.3 millibars.
Choice 3; correct as stated. The abbreviation for pressure rising rapidly is PRESRR.
Choice 4; official ceiling is measured 1000 feet.

14 1 Dispatch is permissible in this situation as explained in the notes in connection with the Minimum Dispatch List.

15 3 The reference is CAR 40.387.

16 3 Note the column marked "EAS or Mach No." on the form. Applicants who possess computers that incorporate compressibility corrections in their scales will, of course, be concerned with CAS rather than EAS. The pertinent section of the flight time analysis form is reproduced on page 19.

17 2 The time and fuel summary is reproduced below:

Enroute	2:39/6200 lbs.
Alternate	0:21/630 lbs.
Reserve	0:45/1350 lbs.
Extra	1:50/3300 lbs.
Total	5:49/11,480 lbs.

True course	Airspeed-kts.		Winds aloft direction velocity temperature	Drift corr angle	Ground speed	Distance N.M.	Time		Fuel consumption lbs./gals.	
	EAS or mach No.	TAS					Leg	Total	Leg	Total
Var.	--------	180	+10 kts	--------	190	88	0:28	--------	1750	
091°	190	251	240°/20/−30°	2° R	269	47	0:11	0:39		
117°	190	251	240°/20/−30°	4° R	261	78	0:18	0:57		
095°	190	251	240°/20/−30°	3° R	268	62	0:14	1:11		
098°	198	256	200°/30/−40°	7° R	262	191	0:44	1:55		
095°	198	256	200°/30/−40°	7° R	263	116	0:26	2:21		
094°	198	256	200°/30/−40°	7° R	263	77	0:18	2:39	4450	6200
ALTERNATE DATA										
Var.	--------	220	+20 kts.	--------	240	82	0:21			

Section of flight time analysis form.

Item *Answer*

18 3 Fuel calculations indicate that 6200 pounds of fuel are required for the flight to destination. The maximum allowable takeoff gross weight should not exceed the sum of this fuel weight and the maximum landing gross weight of 92,360 pounds.

19 4 We have established the maximum allowable takeoff gross weight in the previous test item. Deduct from this value the total fuel load of 11,480 pounds. This results in the maximum zero fuel weight for this flight (87,080 lbs.). The difference between the maximum zero fuel weight and the basic operating weight is the maximum allowable payload which can be carried by this flight.

20 2 Combined weight of passengers, baggage and cargo is 20,700 pounds. The actual takeoff gross weight is resolved as follows:

Basic operating weight	60,830 lbs.
Actual payload	20,700 lbs.
Zero fuel weight	81,530 lbs.
Fuel load	11,480 lbs.
Actual TOGW	93,010 lbs.

21 2 Since the LEMAC is known, we can determine the relative position of the C.G. on the MAC—in this case, 41 inches, aft of LEMAC. Dividing this value by the MAC (164 inches) and multiplying by 100 yields the C.G. location in terms of percent of MAC.

22 3 The problem can be solved on the slide rule side of your computer by using the following ratio:

$$\frac{\text{Weight moved}}{\text{Gross weight}} :: \frac{\text{C.G. movement}}{\text{Distance moved}}$$

The C.G. moves a distance of 2.5 inches in this case, resulting in a new location of 23.5% MAC.

23 2 The basic value for V_1 is increased 4 knots as noted in the table of speeds.

24 4 The reference is CAR 40.72b.

25 2 Note that runway headings and tower reported winds are in terms of magnetic direction.

26 1 The reference is CAR 4b.1(e).

27 3 The reference is CAR 40.511.

28 3 See CAR 40.503.

29 1 See *Airman's Information Manual.*

30 2 You are crossing the CGT 011 radial and have not yet reached the OBK 091 radial. The approximate location is therefore south of WHITEFISH.

Item	Answer	
31	1	See *Airman's Information Manual.* Climb between 18,000 and 19,000 feet, in this case, should not exceed 500 feet per minute.
32	3	The distance from J34 to CLE is 140 n.m. The flight plan time is 32 minutes.
33	4	See *Airman's Information Manual.*
34	2	Proper use of anti-icing equipment requires operation prior to and during flight in icing conditions.
35	3	Although there are exceptions, the most severe icing is encountered in this temperature range.
36	4	The reference is CAR 40.363.
37	2	The time interval between CLE and PSB is 45 minutes for the distance of 191 n.m. Groundspeed is, therefore, 255 knots. Application of variation to magnetic course and magnetic heading precedes the solution outlined below:

True Heading..... 107°.
TAS..... 252 knots.
True Course..... 098°.
Groundspeed..... 255 knots.

The resultant wind is 200°/40 knots.

38	3	The average magnetic course is 104°. After converting to true direction, the following facts are known:

True Course..... 095°.
TAS..... 252 knots.
W/V..... 200°/40 knots.

Resultant solution yields:

True Heading..... 104°.
Groundspeed..... 259 knots.

Application of variation and deviation to the true heading yields compass heading 109°.

39	1	Total fuel flow is 1,980 lbs./hr. Time to consume 3,460 pounds at this fuel flow is 1 hour; 45 minutes.
40	2	Power output, as measured by BMEP, will increase as a result of increasing air density. TAS will decrease while RPM and fuel flow remain constant, assuming no change in engine controls.
41	4	When existing temperature is the same as standard at a particular pressure altitude, density and pressure altitude are equal. In this case the temperature is −23° C.
42	1	The distance of 116 nautical miles must be covered in 29 minutes. Groundspeed is, therefore, 240 knots. The headwind of 10 knots requires a TAS of 250 knots. Computer solution yields EAS 192 knots. Application of compressibility and position corrections with reversed signs yields IAS 189 knots.
43	2	Takeoff was at 1205 GMT. Flight plan ETA, over ABE is 1426 GMT. Flight is running 6 minutes late.
44	1	The following comments apply to the lettered statements:

A. Correct.
B. Incorrect; circling minimums do not provide standard clearance SSE of runway 4R. See note.
C. Correct; see note.
D. Incorrect; distance is 2.7 miles.
E. Correct.
F. Incorrect; width of Runway 4R is 150 feet.

45	3	See *Airman's Information Manual.*
46	1	The speed of sound is the rate at which small pressure disturbances will be propagated through the air and this propagation speed is solely a function of temperature.
47	2	The relationship is expressed as the ratio between the TAS and the speed of sound.
48	4	Mach 0.84 results from dividing TAS (485 knots) by speed of sound (576.6 knots).
49	1	The mechanics of finding the TAS of a Mach number vary among current navigation computers. You should be familiar with this procedure on your particular computer.
50	1	The gross weight is reduced by the amount of fuel burn during the period of 1 hour; 15 minutes at a total fuel flow of 13,800 pounds. Fuel burn is 17,250 pounds.
51	1	Air miles flown in 1 hour; 15 minutes at TAS 466 knots are 583 n.m. Dividing by 17.25 (thousands of pounds) yields 33.8 NAM/1,000 pounds. The problem can also be solved on an hourly basis; i.e. TAS 466 knots divided by 13.8 (thousands of pounds).
52	3	The Mach number which produces first evidence of local sonic flow is the critical Mach number. It is, therefore, described as the boundary between subsonic and transonic flow.
53	4	The velocity component of the free air stream perpendicular to the leading edge of the swept wing is reduced as a result of the sweep angle of the wings. One of the effects of this sweep angle is to increase the critical Mach number.
54	3	This turboprop performance chart shows the effect of the operating variables on takeoff weight. Note that the temperature entry is shown as the "difference" from standard temperature. Note that pressure altitude for the field elevation is used.
55	4	The significant effect of temperature on takeoff weight is well illustrated in this example.
56	2	This turboprop performance chart shows the range of V_1 speeds at varying takeoff weights and operating variables. Difference from standard temperature is also used here.
57	3	The effect of runway slope on V_1 speed is illustrated in this example.
58	3	This turboprop chart shows V_2 and V_{mc} speeds. Regulations state for this aircraft that the V_2 speed may never be less than $1.15V_{s1}$ or $1.1V_{mc}$. This requires selection of the larger of these two values from the referenced chart. Note that ambient temperature is used in the $1.1V_{mc}$ section of the chart.
59	3	Figures 12, 13, and 14 are turbojet performance charts. This example illustrates the effect of operating variables on effective takeoff distance. Note that the usable amount of clearway varies with gradient and runway length available.
60	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.

758-848 O—65——4

APPENDIX

This section contains supplementary data necessary for use with the sample examination. Additional material of value to the applicant for the Airline Transport Pilot (Airplane) Written Examination is also included.

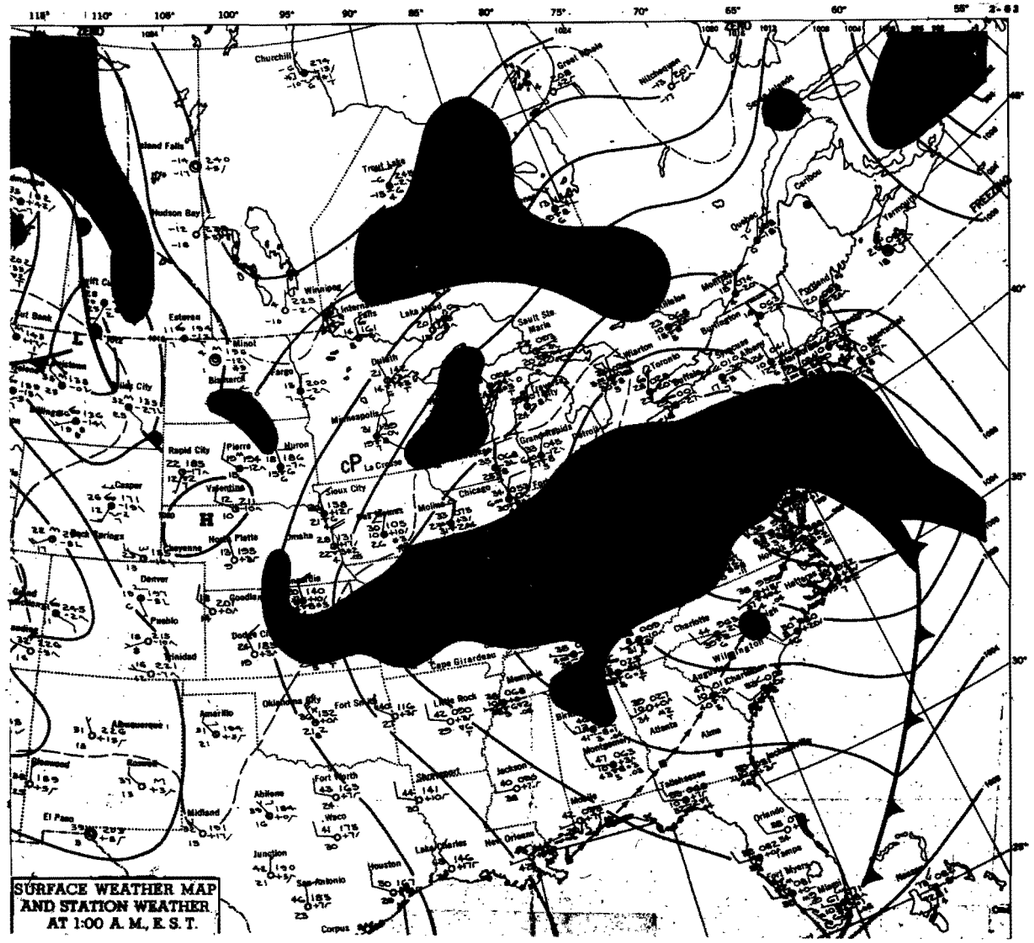
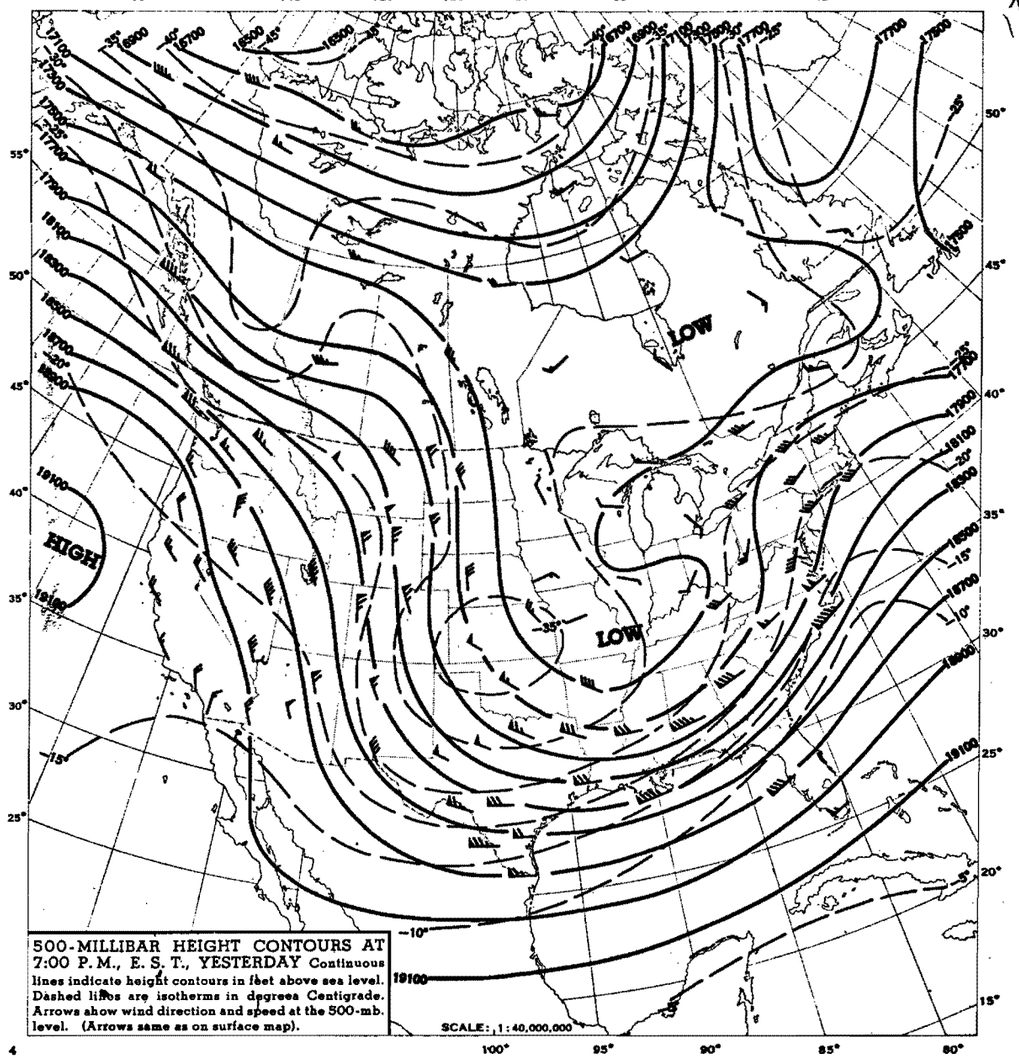


FIGURE 1.—*Surfoce weather map.*



500-MILLIBAR HEIGHT CONTOURS AT 7:00 P.M., E. S. T., YESTERDAY Continuous lines indicate height contours in feet above sea level. Dashed lines are isotherms in degrees Centigrade. Arrows show wind direction and speed at the 500-mb. level. (Arrows same as on surface map).

FIGURE 2.—*500-millibar chart.*

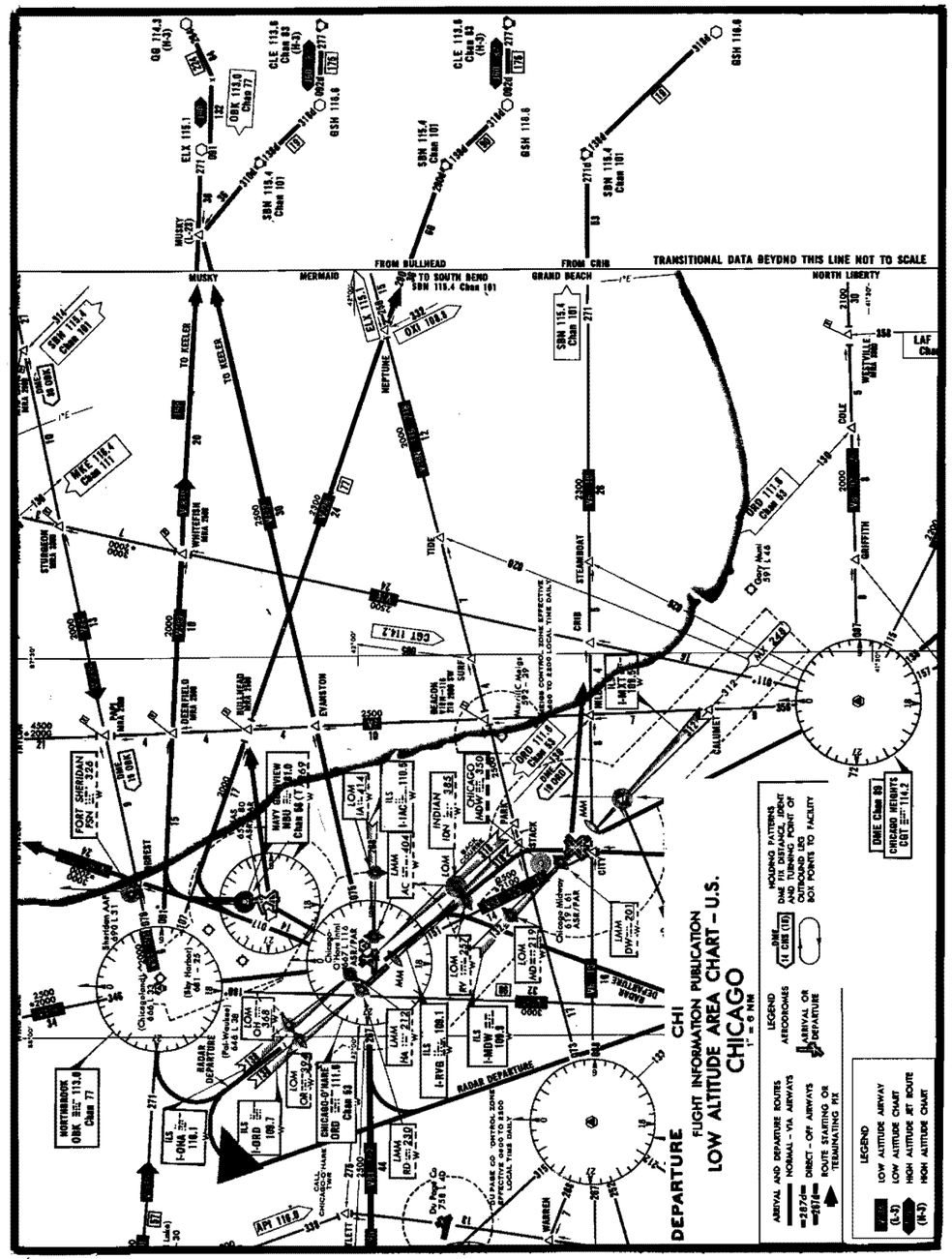


FIGURE 3.—*Segment of low-altitude area chart—Chicago.*

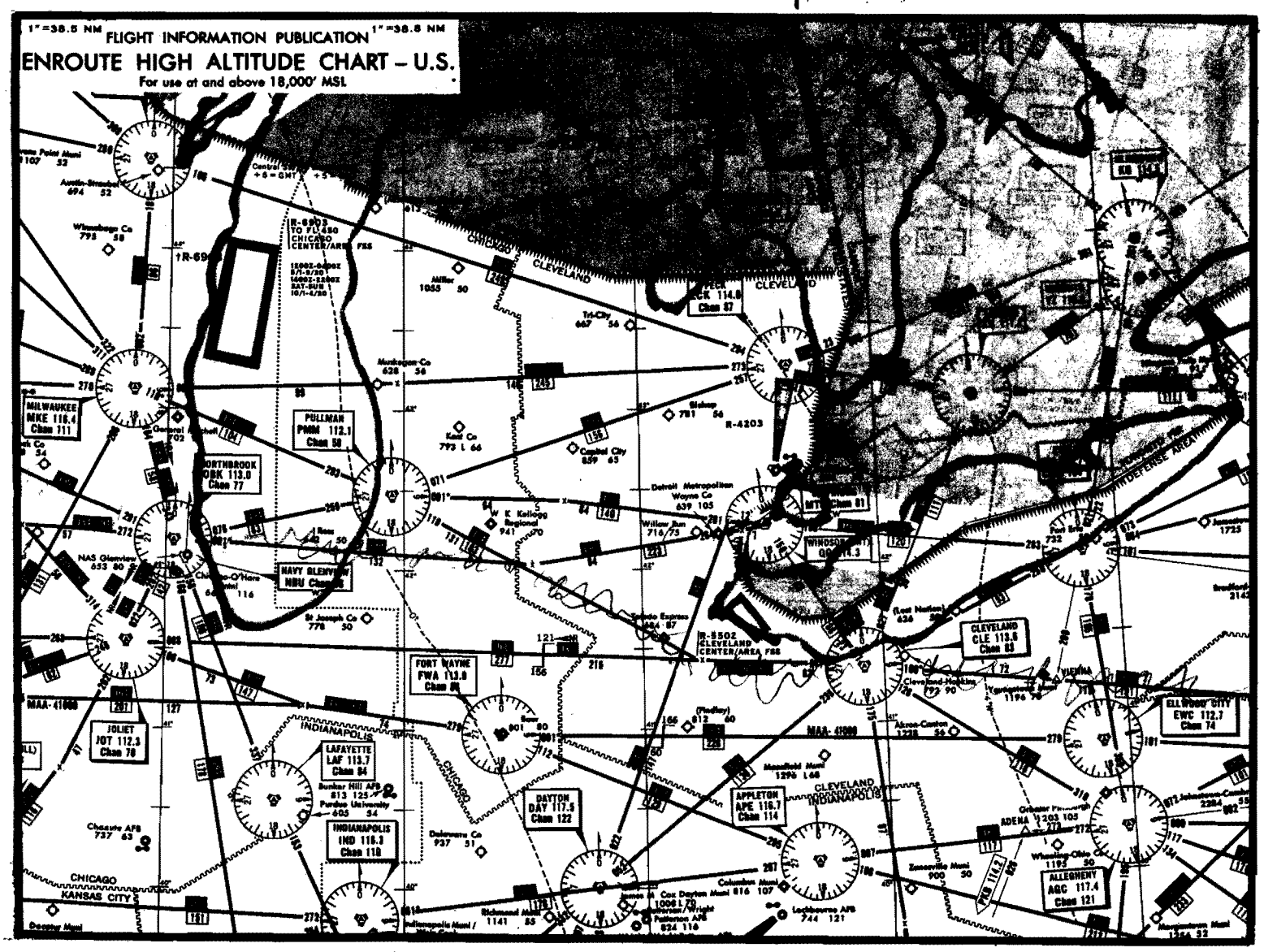


FIGURE 4.—*Segment of enroute high-altitude chart—ORD–CLE.*

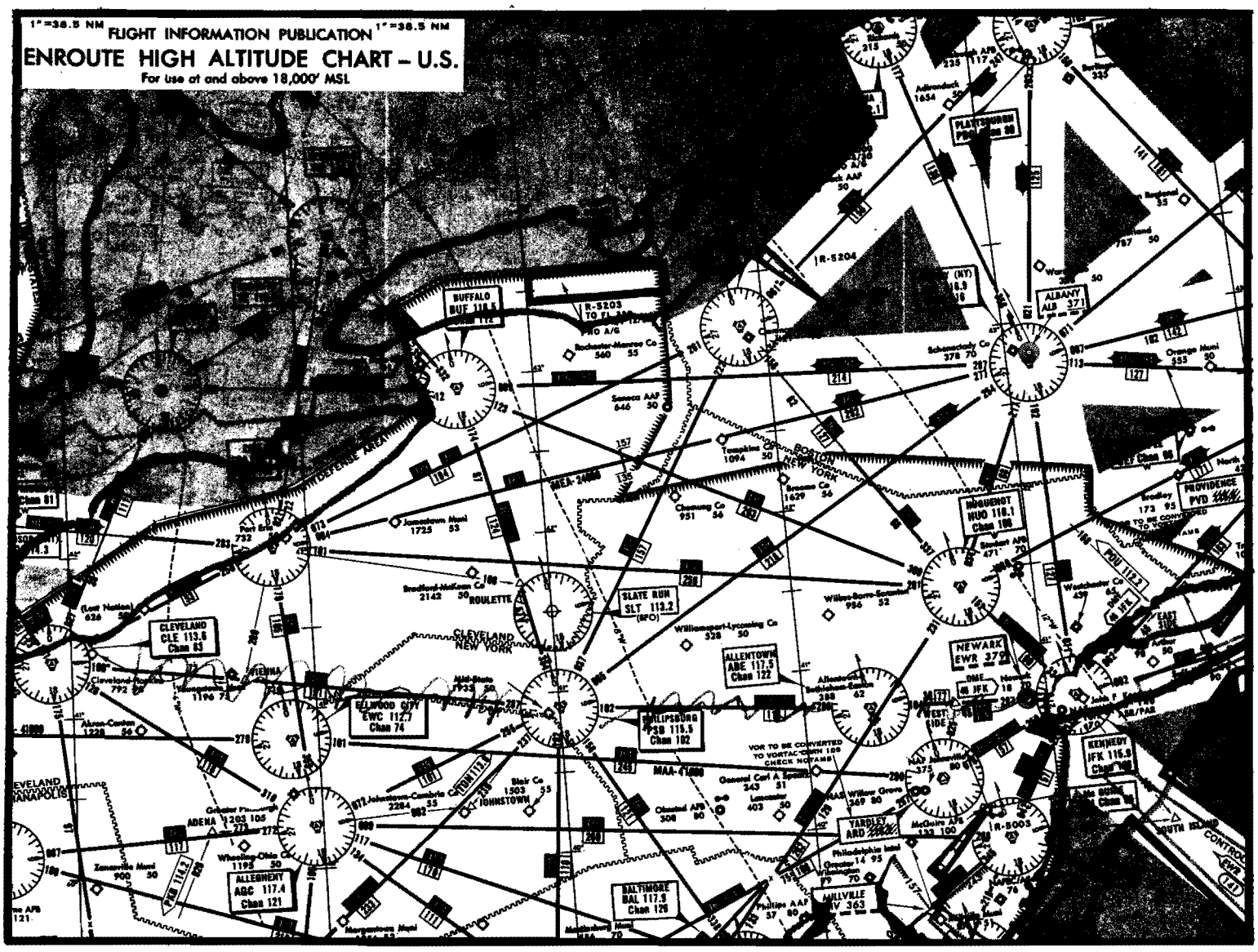


FIGURE 5.—*Segment of enroute high-altitude chart—CLE–JFK.*

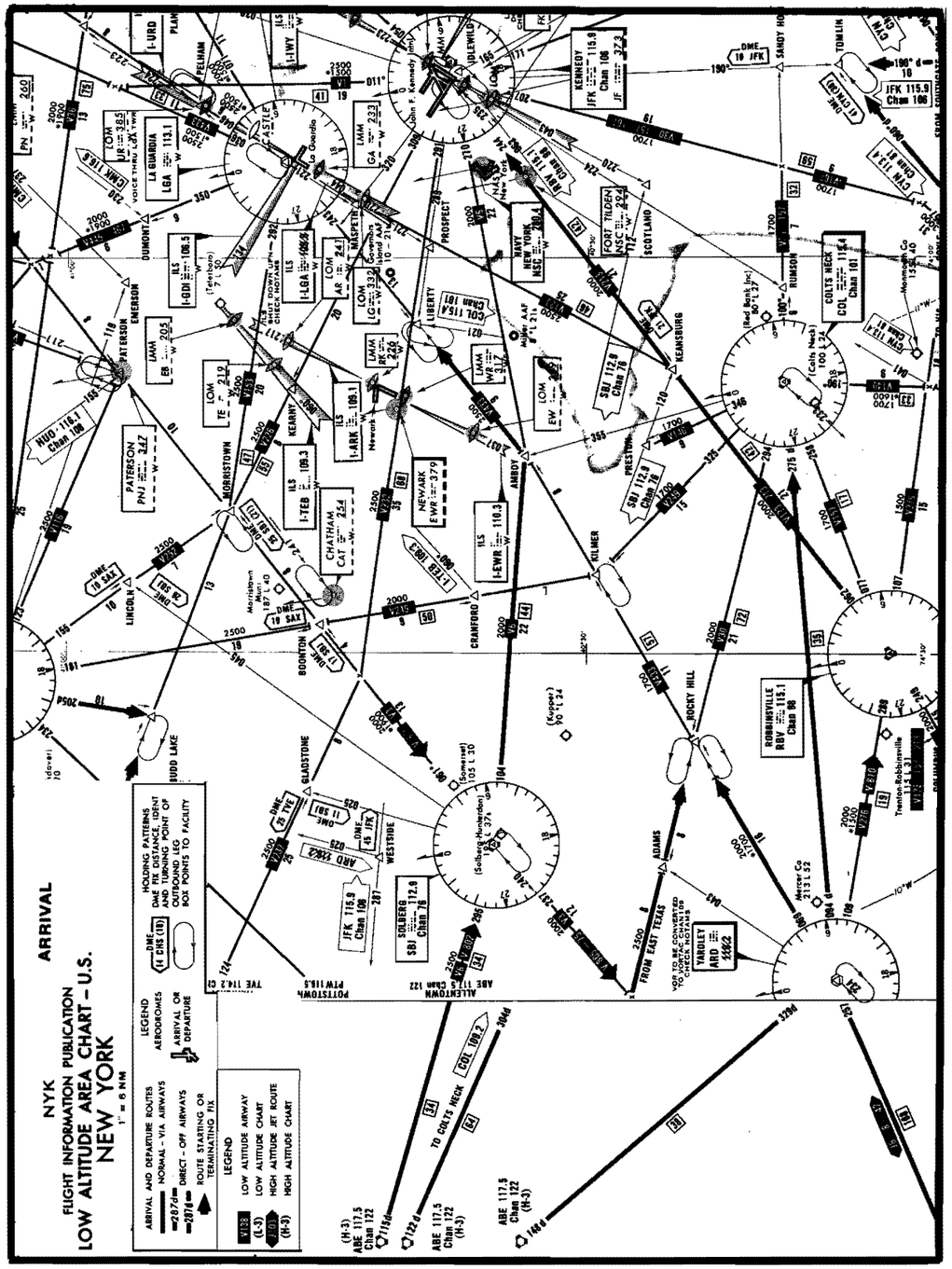


FIGURE 6.—*Segment of low-altitude area chart—New York.*

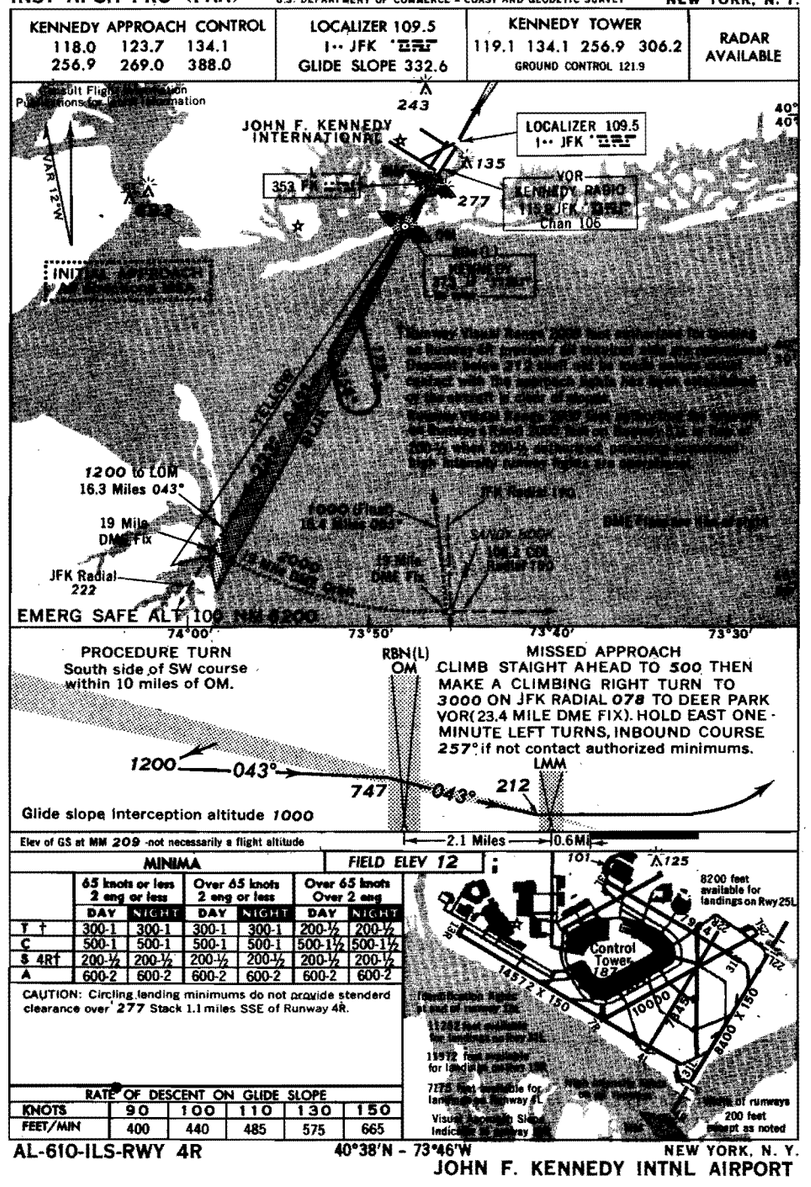


FIGURE 7.—*Instrument approach chart—John F. Kennedy International Airport.*

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.
ORD	TOC*		VAR.	--	180	+10 kts.	--		88			1750		
TOC	J34	19,000				240°/20/-30°			47					
J34	J60	"				"			78					
J60	CLE	"				"								
CLE	PSB	"				200°/30/-40°								
PSB	ABE	"				"								
ABE	JFK	"				"								
	*Top-Of-Climb													

ALTERNATE DATA

JFK	PHL	4,000	VAR.	--	220	+20 kts.			82					

AIRSPEED DATA

TOC - CLE . . . . . .186 knots
CLE - JFK . . . . . .194 knots

FUEL FLOW

Cruise . . . . . 510 lb/hr/eng.
Alt/Res/Extra . . 450 lb/hr/eng.
Instrument and Position Correction . . . . . +5 knots. Fuel Weight: 6.0 lb/gal.
Compressibility Correction . . . . . 1 knot
Temperature Correction . . . . . 7°.

FUEL SUMMARY

	TIME	LBS./GALS.
ENROUTE		
ALTERNATE		
RESERVE		
EXTRA		
TOTAL		

FIGURE 8.—*Flight time analysis form.*

Aircraft Particulars

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.

V_1 and V_2 Speeds (knots):

Wet power.

Auto feather operative.

WEIGHT	*V_1 (IAS) Sea level*	*V_1 (IAS) 2,000 feet*	*V_2 (IAS)*
70,000	67	68	95
75,000	73	74	98
80,000	78	80	102
85,000	84	85	104
90,000	90	91	107
95,000	95	97	110
100,000	101	102	113
105,000	105	107	116
107,000	108	110	116

Increase V_1 speeds by 1 knot for a 10-knot headwind and by 4 knots for a 25-knot headwind.
Decrease V_1 speeds by 3 knots for a 5-knot tailwind.

Minimum Dispatch List

(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.

SAMPLE PROBLEMS—TURBOPROP PERFORMANCE CHARTS

Maximum Takeoff Weight Permitted—Figure 9

		Answer
I. Problem		
Runway Slope	−1% (downhill)	
Reported Wind—knots	10 (tailwind)	
Available Field Length	4,000 feet	
Ambient Temperature	+15° C	80,150 pounds.
II. Problem		
Runway Slope	+2% (uphill)	
Reported Wind—knots	30 (headwind)	
Available Field Length	4,600 feet	
Ambient Temperature	+5° C	95,000 pounds.

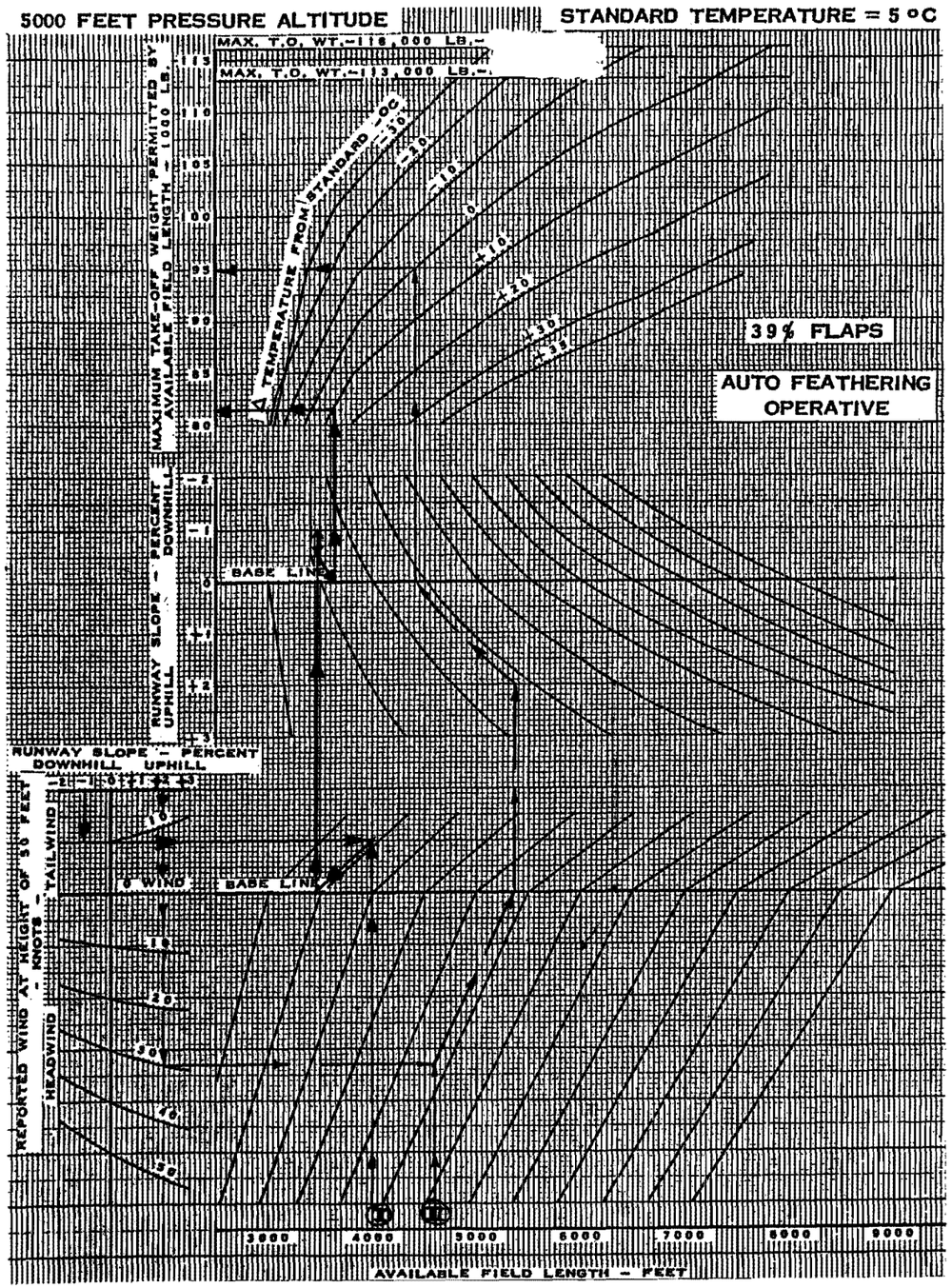
NOTE.—Temperature lines on the chart are for degrees difference from standard.

V_1 Speeds—Figure 10

I. Problem		
Takeoff Weight	90,000 pounds	
Ambient Temperature	+15° C	
Runway Slope	+1% (uphill)	
Reported Wind—knots	40 (headwind)	107 knots.
II. Problem		
Takeoff Weight	90,000 pounds	
Ambient Temperature	+5° C	
Runway Slope	−1% (downhill)	
Reported Wind—knots	10 (tailwind)	95 knots.

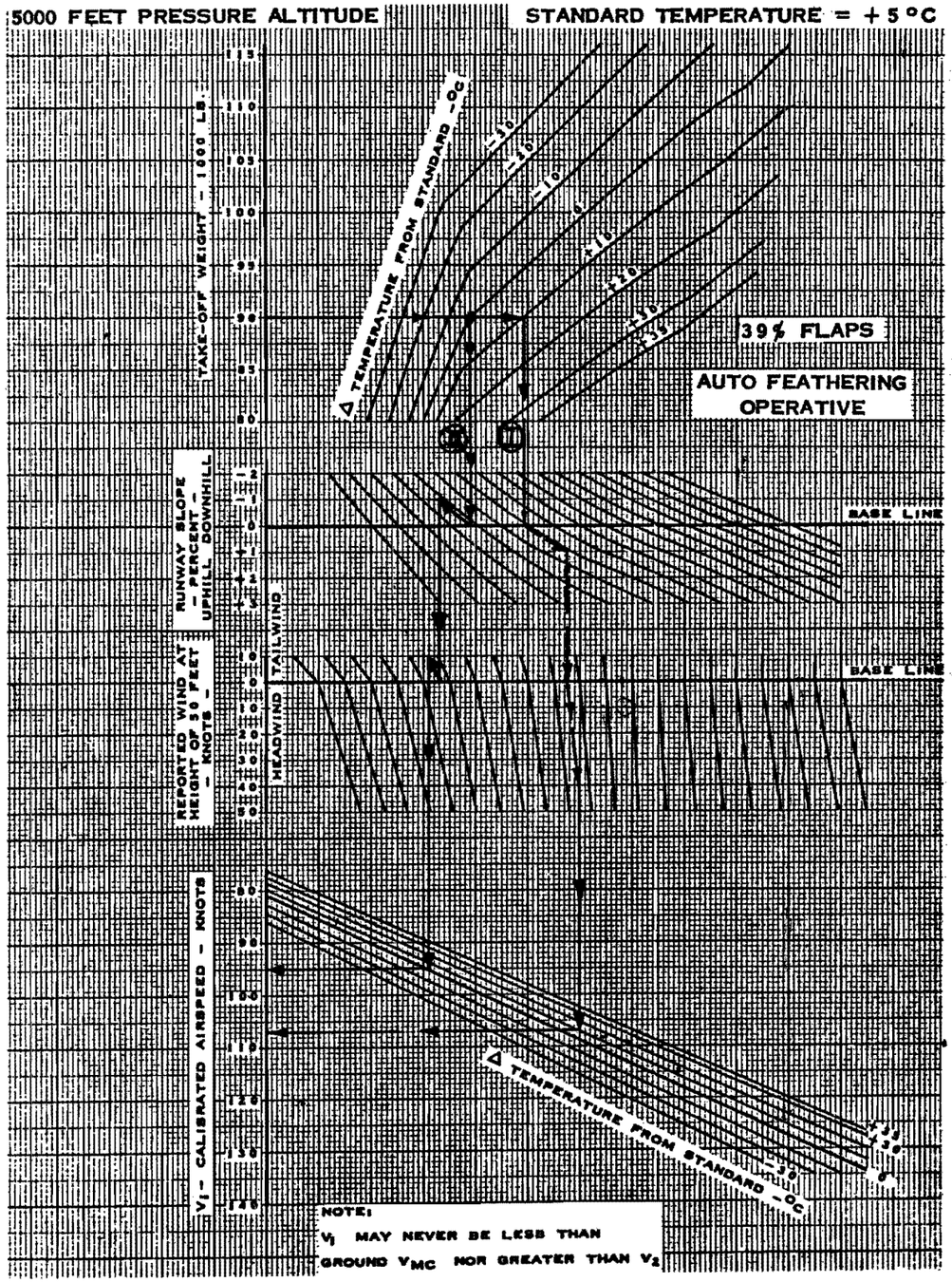
V_2 Speeds—See Figure 11

NOTE.—V_2 may never be less than 1.15 VS1 or 1.1 V_{mc}. Compare plots on both charts and use the higher value.



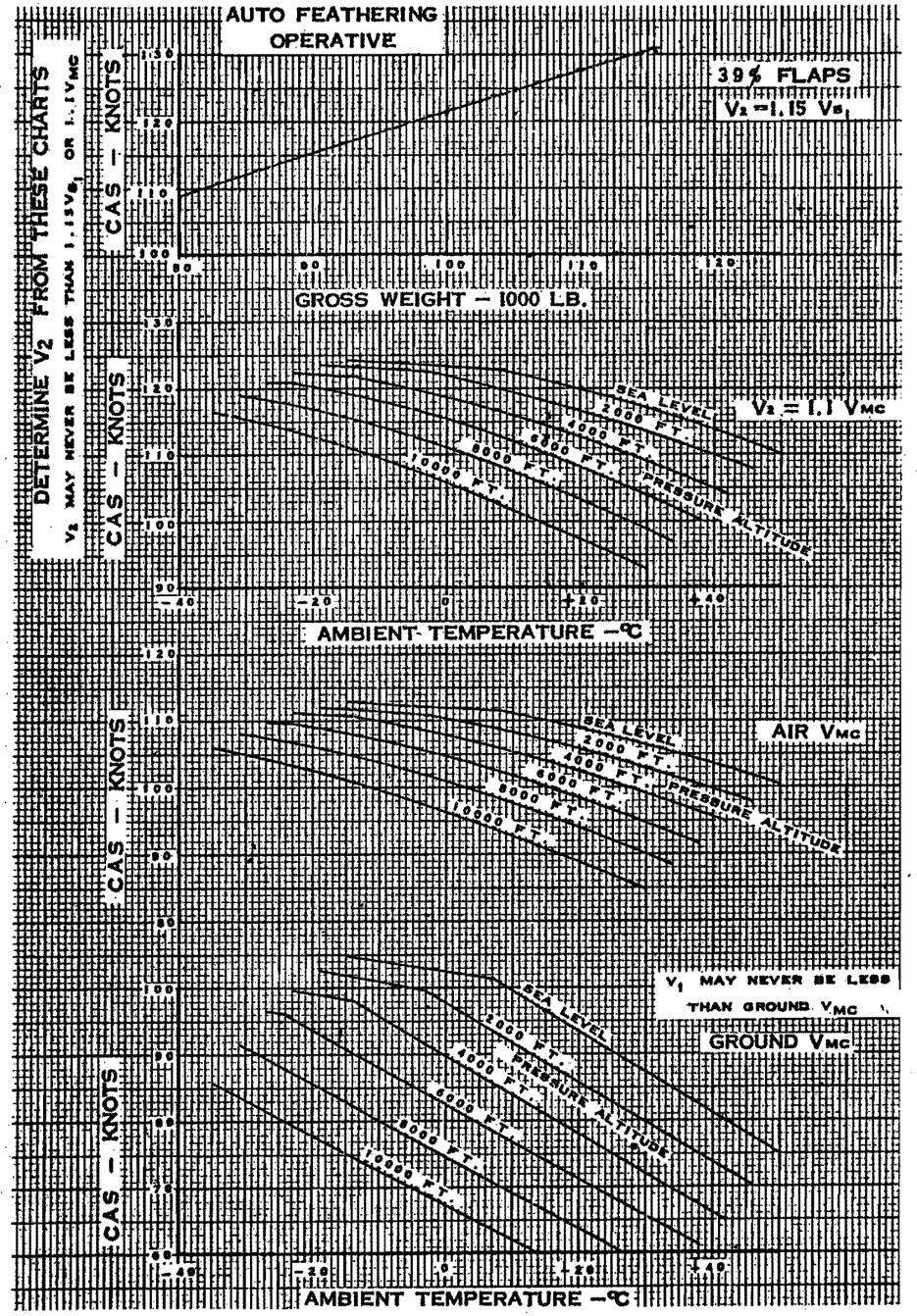
MAXIMUM TAKEOFF WEIGHT PERMITTED

FIGURE 9



V_1 SPEEDS

FIGURE 10



V_2 AND V_{MC} SPEEDS

FIGURE 11

EXPLANATION OF TURBOJET PERFORMANCE CHARTS

Definitions

Engine Failure Speed for Balanced Field Length, V_{1B}—The speed at which, if an engine failure occurs, the distance to continue the takeoff to a height of 35 feet is equal to the distance to stop under zero runway slope, zero wind conditions.

Engine Failure Speed Ratio, V_1/V_{1B}—The ratio of the engine failure speed, V_1, for actual runway dimensions and conditions, to the engine failure speed, V_{1B}, on an equivalent balanced field length. (Corrected for wind and slope.)

Balanced Field Length—The condition where the takeoff distance is equal to the accelerate-stop distance.

The takeoff distance available is the sum of the runway length plus the actual or maximum allowable clearway length.

The accelerate-stop distance must not exceed the length of the runway plus the length of the stopway, if stopway is available.

Use of Charts (Figures 12, 13, and 14)

Enter the Effective Takeoff Distance, One Engine Inoperative Chart with the runway length available, and the accelerate-stop distance available. When clearway is available the takeoff distance is obtained by graphically adding the clearway length to the runway length along the 45-degree guide lines. If the maximum allowable takeoff distance line for the applicable runway slope is crossed before reaching the available clearway length, it means that the takeoff run requirement is limiting and the full clearway length cannot be used to obtain the takeoff distance. Correct each distance separately for slope and wind. On making these "sliding scale" corrections always go directly to the reference line, then follow the sloping guide lines to the appropriate value of slope or wind. The intersection of the two corrected distances in the "web" chart determines a balanced field length and an engine failure speed ratio. The balanced field length must be converted in the lower left center of the chart to an effective takeoff distance, using the anti-icing line when this system is in operation.

Enter the Effective Takeoff Distance, All Engines Operating Chart with runway length available. Add clearway length, if present, to obtain takeoff distance along the 45-degree guide lines, observing the maximum allowable lines where takeoff run is limiting. Correct the takeoff distance for anti-icing, slope and wind as applicable, and read the effective takeoff distance. Compare this with the number obtained from one-engine-inoperative chart and use the smaller number.

Enter Takeoff Weight for Effective Takeoff Distance Chart with the smaller of the two effective takeoff distances. Proceed to temperature, altitude and gross weight. This is the maximum takeoff weight as limited by field length requirements for the existing runway data and atmospheric conditions.

Illustrative Example

Use of the takeoff charts to determine maximum takeoff weight and the associated speeds. This example is reflected by the arrowed lines on each relevant chart.

Given: *Airport Conditions.*

Runway length available—8,300 feet.
Clearway length available—1,000 feet.
Stopway length available—300 feet.
Airport elevation—2,000 feet (pressure altitude).
Runway and clearway slope— −2.0% (downhill).
Reported wind component—10 knots (tailwind).
Air temperature— +40° F.
Icing conditions—Anti-icing ON.
Procedure:

A. Determine effective takeoff distance with anti-icing ON for available runway, clearway length, and accelerate-stop distance.
   3-Engine—8,000 feet V_1/V_{1B} Ratio—.93
   4-Engine—8,100 feet
B. Determine maximum takeoff weight for smaller effective distance—211,000 lbs.

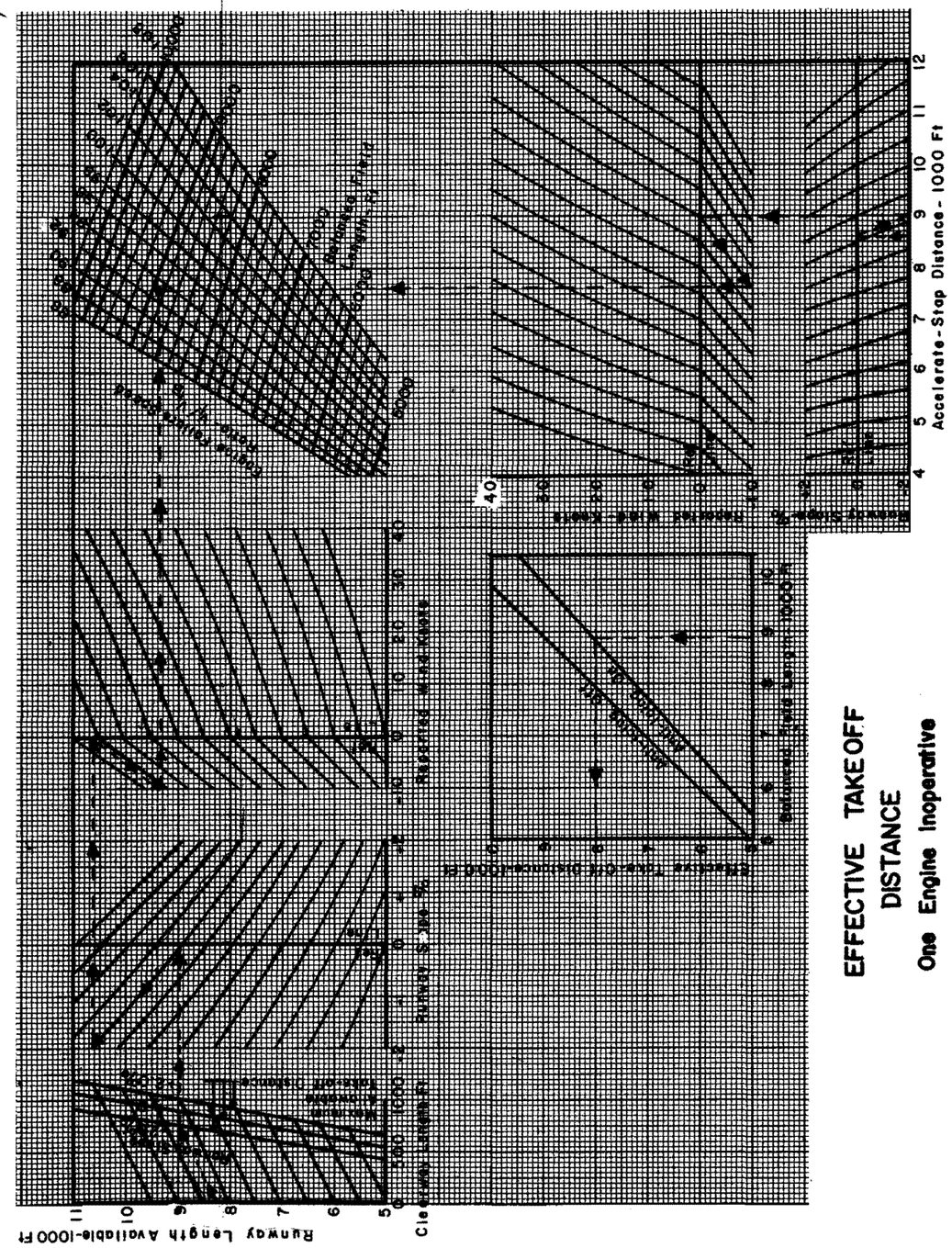
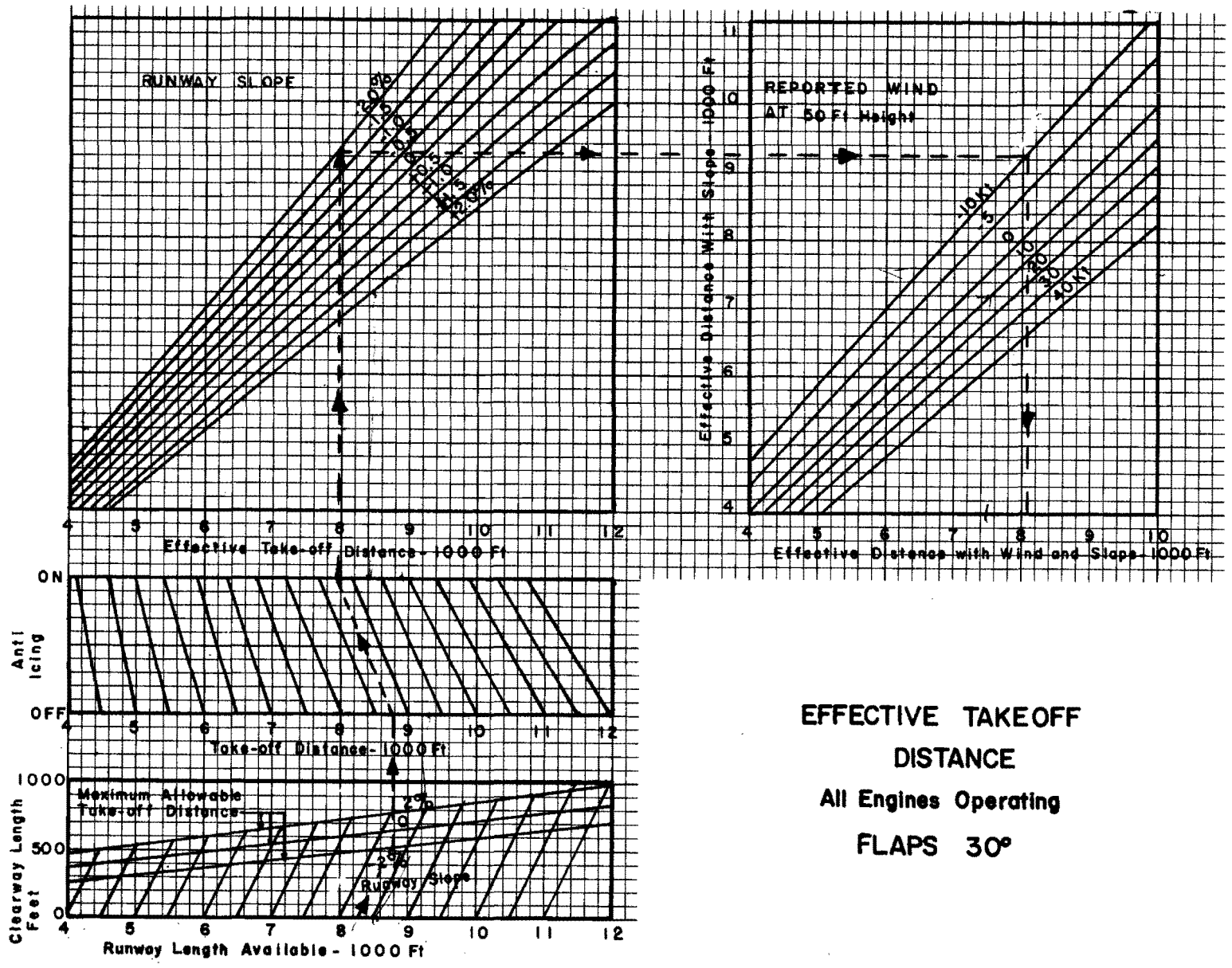


FIGURE 12

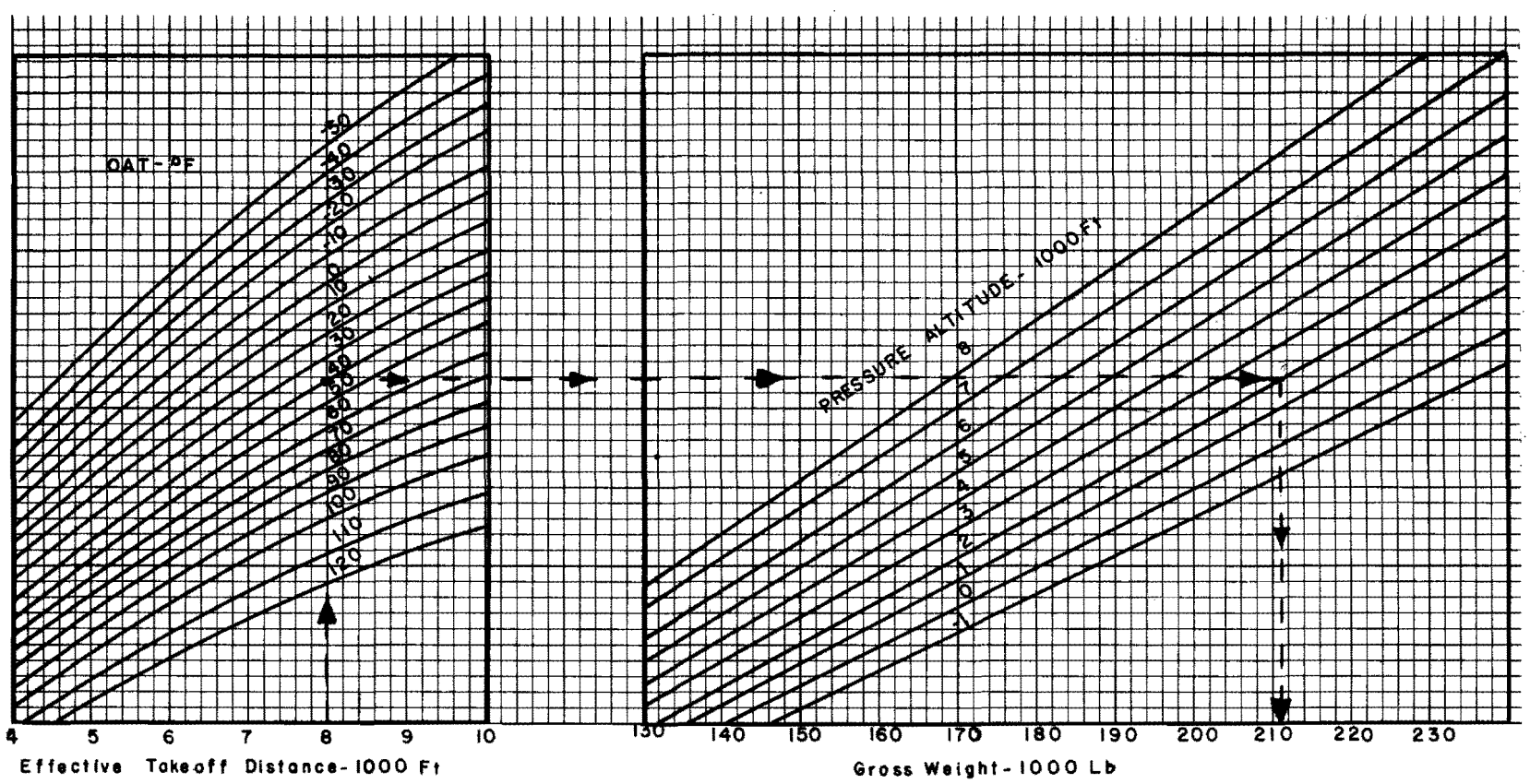


EFFECTIVE TAKEOFF DISTANCE

All Engines Operating

FLAPS 30°

FIGURE 13



TAKEOFF WEIGHT FOR EFFECTIVE TAKEOFF DISTANCE — FLAPS 30°

FIGURE 14

U.S. GOVERNMENT PRINTING OFFICE: 1965 O - 758-848