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AC 61-18C

AIRLINE TRANSPORT PILOT (airplane)

WRITTEN TEST GUIDE

DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration

AIRLINE TRANSPORT PILOT (AIRPLANE)

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Revised 1971

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APPENDIX

(Can be removed and used for flight planning computations.)

AIRLINE TRANSPORT PILOT (AIRPLANE) WRITTEN TEST GUIDE

INTRODUCTION

In a continuing effort to provide guidance and assistance, the Federal Aviation Administration offers this test guide to applicants who are preparing for the Airline Transport Pilot (Airplane) Written Test. It supersedes AC 61-18B, Revised 1968, and is issued as Advisory Circular 61-18C.

The guide describes the type and scope of aeronautical knowledge covered by the written test, includes study material, lists appropriate references for study, and presents sample test 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 test 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 test guide outlines the aeronautical knowledge needed to obtain an Airline Transport Pilot Certificate (ATPC) 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 as an airline pilot.

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

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.

§ 61.143 Airplane rating: aeronautical knowledge.

An applicant for an airline transport pilot certificate with an airplane rating must, after meeting the requirements of §§ 61.141 (except paragraph (a) thereof) and 61.145, pass a written test on—

(a) The sections of this Part relating to airline transport pilots and Part 121, subpart C of Part 65, and §§ 91.1 through 91.9 and subpart B of Part 91 of this chapter, and so much of Parts 21 and 25 of this chapter as relate to the operations of air carrier aircraft;

(b) The fundamentals of air navigation and use of formulas, instruments, and other navigational aids, both in aircraft and on the ground, that are necessary for navigating aircraft by instruments;

(c) The general system of weather collection and dissemination;

(d) Weather maps, weather forecasting, and weather sequence abbreviations, symbols, and nomenclature;

(e) Elementary meteorology, including knowledge of cyclones as associated with fronts;

(f) Cloud forms;

(g) Department of Commerce Weather Bureau Circular N, "Manual of Surface Observations," as amended;

(h) Weather conditions, including icing conditions and upper-air winds, that affect aeronautical activities;

(i) Air navigation facilities used on Federal airways, including rotating beacons, course lights, radio ranges, and radio marker beacons;

(j) Information from airplane weather observations and meteorological data reported from observations made by pilots on air carrier flights;

(k) The influence of terrain on meteorological conditions and developments, and their relation to air carrier flight operations;

(l) Radio communication procedure in aircraft operations; and

(m) Basic principles of loading and weight distribution and their effect on flight characteristics.

§ 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 of an airplane, or as copilot of an airplane 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 1500 hours of flight time as a pilot, including at least—

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

(ii) 100 hours of night flight time; and

(iii) 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. Also, an applicant who has made at least 20 night takeoffs and landings to a full stop may substitute one additional night takeoff and landing to a full stop for each hour of night flight time required by subparagraph (2)(ii) of this paragraph. However, not more than 25 hours of night flight time may be credited in this manner.

(c) If an applicant with less than 150 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 150 hours of pilot-in-command time, he is entitled to a new certificate without the endorsement.

(d) A commercial pilot may credit toward the 1500 hours total flight time requirement of subparagraph (b)(2) of this section the following flight time in operations conducted under Part 121 of this chapter:

(1) All second-in-command time acquired in airplanes required to have more than one pilot by their approved Aircraft Flight Manuals or airworthiness certificates; and

(2) Flight engineer time acquired in airplanes required to have a flight engineer by their approved Aircraft Flight Manuals, while participating at the same time in an approved pilot training program approved under Part 121 of this chapter.

However, the applicant may not credit under subparagraph (2) of this paragraph more than 1 hour for each 3 hours of flight engineer flight time so acquired, nor more than a total of 500 hours.

(e) If an applicant who credits second-in-command or flight engineer time under paragraph (d) of this section toward the 1500 hours total flight time requirement of subparagraph (b)(2) of this section—

(1) Does not have at least 1200 hours of flight time as a pilot including no more than 50 percent of his second-in-command time and none of his flight engineer time; but

(2) Otherwise meets the requirements of subparagraph (b)(2) of this section,

his certificate will be endorsed "Holder does not meet the pilot flight experience requirements of ICAO," as prescribed by Article 39 of the "Convention on International Civil Aviation." Whenever he presents satisfactory evidence that he has accumulated 1200 hours of flight time as a pilot including no more than 50 percent of his second-in-command time and none of his flight engineer time, he is entitled to a new certificate without the endorsement.

TYPE OF TEST

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

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

Test Items and Scoring

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

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

The passing grade is 70%. All answer sheets are graded by a computer which is programmed to indicate the areas missed. It prints the subject matter codes on the test result form, so that the applicant can determine the areas in which he had difficulty. A subject matter outline is mailed with the test result form. An applicant must present his form (AC Form 8060–37) for a flight test or for retesting if he fails the written test.

Taking the Test

The written test may be taken at FAA Flight Standards District Offices and other designated places. After completing the test, the applicant

must surrender the answer sheet (together with the supplementary booklet and any papers used for computations or notations) to the proctor before leaving the test room.

When taking the test, 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 either are incomplete or are 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. Do not make any marks in the test booklet or the supplementary booklet of information.

REFERENCE MATERIALS

The following list of publications and materials is provided for the benefit of individuals who wish to prepare for the written test. Except for free *advisory circulars* and *charts*, all of these items are available through the 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.

Free FAA publications may be obtained from "Department of Transportation, Distribution Unit, TAD–484.3, Washington, D.C. 20590."

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

Federal Aviation Regulations (FARs)

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

	Price	*Additional for Foreign Mailing*
Vol. I, Part 1, Definitions and Abbreviations	$1.50	$0.50
Vol. IX, Part 61, Certification: Pilots and Flight Instructors	$6.00	$1.50
Vol. VI, Part 91, General Operating and Flight Rules	$5.00	$1.25
Vol. VII, Part 121, Certification and Operations: Air Carriers and Commercial Operators of Large Aircraft	$6.50	$1.35

AIRMAN'S INFORMATION MANUAL (AIM)

Part 1—Basic Flight Manual and ATC Procedures. Issued quarterly, annual subscription $4.00, additional for foreign mailing $1.00.

AVIATION WEATHER, AC 00–6 ($4.00, GPO Catalog No. FAA 5.8/2:W37). This comprehensive handbook explains basic meteorology from the viewpoint of the pilot's needs.

PILOT'S WEIGHT AND BALANCE HANDBOOK, AC 91–23 (70 cents—GPO Catalog No. TD 4.408: P 64/3). An excellent treatment of the subject from the standpoint of the pilot and aircraft owner or operator.

CIVIL USE OF U.S. GOVERNMENT INSTRUMENT APPROACH PROCEDURE CHARTS, AC 90–1A (Free from FAA). Introduces revised instrument approach charts.

Charts

ENROUTE LOW AND HIGH ALTITUDE CHARTS (35 cents each). These charts provide necessary aeronautical information for enroute instrument navigation in the established airway structure.

INSTRUMENT APPROACH PROCEDURE CHARTS (10 cents per airport set). Individual charts give detailed information on procedure for each type of approach at the airport.

How To Get GPO Publications Promptly

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

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

2. Send separate orders for a subscription and a nonsubscription item.

3. Give the exact name of the publication, the agency number, and the GPO catalog number. (The GPO catalog number is not necessary when ordering a subscription publication.)

4. Send a check or money order (made payable to the "Supt. of Documents")—not cash. Send the exact amount.

5. Enclose a self-addressed mailing label if you have no order blank.

6. Use special delivery when needed.

7. Use GPO bookstores—they give priority mail order service.

GPO retail bookstores are located at the following addresses:

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

GPO Bookstore
Room G25
JFK Federal Building
Government Center
Boston, Mass. 02203

GPO Bookstore
Federal Office Building
Room 1463 14th Floor
219 S. Dearborn Street
Chicago, Ill. 60604

GPO Bookstore
Federal Building
Room 100
275 Peachtree St., N.E.
Atlanta, Ga. 30303

GPO Bookstore
Federal Building
300 N. Los Angeles St.
Los Angeles, Calif.
90012

GPO Bookstore
Federal Building
U.S. Courthouse
1100 Commerce Street
Dallas, Tex. 75202

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

Mail orders may also be directed to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Charts

Checks or money orders for charts should be made payable to "NOS, Dept. of Commerce" and sent to:

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

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AERONAUTICAL KNOWLEDGE COVERED BY THE WRITTEN TEST

I. FEDERAL AVIATION REGULATIONS

A. FAR 1, 61, and 65

1. General definitions (1.1)
2. Abbreviations and symbols (1.2)
3. Airline Transport Pilots—logging of instrument time and recency of experience (61.41, 61.47)
4. Medical certificates—duration (61.43)
5. Instruction and privileges (61.163, 61.165)
6. Aircraft Dispatcher (65)

B. FAR 91

1. VOR receiver checks (91.25)
2. Aircraft speed limitations (91.70)
3. Compliance with ATC clearances, etc. (91.75)
4. ATC light signals (91.77)
5. Altimeter settings (91.81)
6. Operating on or in the vicinity of an airport (91.85 through 91.89)
7. Operating in Positive Control and Jet Advisory areas (91.97, 91.99)
8. Visual Flight Rules (91.105 through 91.109)
9. Takeoff and landing under IFR (91.116, 91.117)
10. Minimum and cruising altitudes—IFR operations (91.119, 91.121)
11. IFR, radio communications (91.125)
12. IFR operations; two-way radio communications failure (91.127)
13. Operation under IFR in controlled airspace; malfunction reports (91.129)

C. FAR 121—Performance, Special Airworthiness, Instrument and Equipment Requirements

1. Manual requirements (121.131 through 121.141)
2. Performance, reciprocating engine powered airplanes (121.171 through 121.187)
3. Performance, turbine engine powered airplanes (121.189 through 121.197)
4. Fire precautions (121.221)
5. Cargo location and security (121.285 through 121.287)
6. Landing gear, aural warning (121.289)
7. Instruments and equipment (121.301 through 121.311 and 121.313 through 121.325)
8. Supplemental oxygen (121.327, 121.329, 121.333, 121.337)
9. Overwater operations and icing conditions (121.339 through 121.341)
10. Recorders, flight and voice (121.343, 121.359)
11. Radio equipment and weather radar (121.345 throough 121.357)

II. AIRMAN'S INFORMATION MANUAL

A. Basic Flight Manual and ATC Procedures

1. Chapter 1. General
2. Chapter 2. Navigation Aids
3. Chapter 3. The Airspace
4. Chapter 4. Air Traffic Control
5. Chapter 5. Safety of Flight

III. FLIGHT PLANNING AND AIR NAVIGATION

A. Aviation Weather

1. Elementary meteorology
2. Air masses and fronts
3. Thunderstorms
4. Icing hazards and ice formation
5. Common "IFR" producers
6. Aviation weather reports
7. Aviation weather forecasts
8. Weather charts: Surface, Depiction, Radar, Constant Pressure, Significant Weather, Upper Wind Progs.
9. High altitude weather features
10. Pressure, density, and true altitude details

B. Computations

1. Flight time enroute
2. Required fuel
3. Dispatched endurance

4. Actual and allowable payload determination
5. Weight and balance—weight limitations
6. Weight and balance—location of center of gravity (c.g.)
7. Weight and balance—shifting, adding, or removing weight
8. Performance charts—graphs
9. Performance information—tabulated
10. Off-course and return to course
11. Wind experienced enroute—direction and speed
12. Wind components—head, tail, crosswind
13. Airspeed adjustments to maintain schedule or arrival
14. Specific range—turbojet airplanes
15. Estimated time of arrival (ETA)
16. Pressurized airplane climb—cabin time or rate
17. Flight progress
18. Cruise control techniques

C. Miscellaneous
1. Definition of Mach number and critical Mach number
2. Subsonic, transonic, supersonic flight regimes
3. Determination of Mach number or True Airspeed from given information
4. Interpretation of Enroute and Instrument Approach Charts

D. FAR 121—Personnel requirements; qualifications and duty time limitations
1. Airman and crewmember requirements (121.381 through 121.395)
2. Emergency evacuation duties (121.397)
3. Crewmember and dispatcher training program (121.400; 121.411 through 121.419; 121.422, 121.424, 121.427)
4. Crewmember qualifications (121.431 through 121.434; and 121.437 through 121.447)
5. Aircraft dispatcher qualifications and duty limitations (121.461 through 121.465)
6. Flight time limitations: domestic air carrier (121.470, 121.471)
7. Flight time limitations: flag air carrier (121.480 through 121.491)
8. Flight time limitations: supplemental air carrier and commercial operator (121.500 through 121.509; 121.513 through 121.525)

E. FAR 121—Flight Operations
1. Responsibility for operational control (121.533 through 121.537)
2. Operation: flight deck duty, etc. (121.543 through 121.549)
3. Emergencies: domestic and flag air carriers (121.557)
4. Emergencies: supplemental air carriers (121.559)
5. Reporting conditions in flight (121.561, 121.563)
6. Engine inoperative: landing: reporting (121.565)
7. Briefing of passengers (121.333, 121.571, 121.573)
8. Minimum altitudes for use of the automatic pilot (121.579)

F. FAR 121—Dispatching and Flight Release Rules
1. Dispatching and flight release authority (121.591 through 121.597)
2. Familiarity with weather conditions and information to pilot in command (121.599, 121.601)
3. Equipment, facilities and service (121.603 through 121.609)
4. Dispatch and flight release (121.611 through 121.615)
5. Alternate airport for departure (121.617)
6. Alternate airports (121.619, 121.621, 121.623)
7. Alternate airport weather minimums (121.625)
8. Flight in unsafe conditions (121.627, 121.629)
9. Dispatch rules: original, redispatch, or amendment (121.631 through 121.635)
10. Takeoffs from unlisted and alternate airports (121.637)

11. Fuel supply: all operations: domestic air carriers (121.639, 121.647)
12. Fuel supply: (turbojet) flag and supplemental air carriers (121.641 through 121.645)
13. Takeoff and landing weather minimums (121.649 through 121.655)
14. Flight altitude rules (121.657 through 121.661)
15. Responsibility for dispatch release, load manifest, and flight plan (121.663 through 121.667)

G. FAR 121—Records and Reports
1. Records (121.683, 121.685, 121.711)
2. Releases (121.687, 121.689, 121.709)
3. Load manifests (121.691 through 121.697)
4. Reports (121.703, 121.705)

SAMPLE TEST

The following sample test includes a mixture of true-false, multiple choice, and completion-type test items, and in many aspects is similar in format to the official FAA written test. 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 test. It is for this reason that you should concentrate on the section titled "Aeronautical Knowledge Covered By The Written Test." A knowledge of all of the topics presented, not just the ability to answer these few sample test items, should be your goal as you prepare for the written test.

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 test.

Answers to the sample test items are given at the end of the test in a separate section, which includes an analysis 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 preparation of this guide. Similar test items in the official FAA written tests should always be answered in terms of current regulations and procedures.

Situation

You are concerned with the planning, dispatch, and operation of an air carrier flight from Albuquerque, New Mexico, to New Orleans, Louisiana. As pilot in command, you are expected to make judgments based upon compliance with pertinent regulations, sound operating procedures, and information supplied with this test.

* * * * * *

1. As pilot in command of this flight, you have full control and authority over other crewmembers in the operation of the airplane, *only* if you possess a valid airman certificate authorizing you to perform the duties of such crewmembers.

1—True
2—False

2. The pilot who is to serve as second in command of this domestic operation, which requires three pilots, must hold

1—an Airline Transport Pilot Certificate only.
2—at least a Commercial Pilot Certificate and Instrument Rating.
3—qualifications to be pilot in command except for operating experience.
4—a Commercial Pilot Certificate with type rating only.

3. Your next proficiency check is due in January. If you take this check in February, the record must indicate that you completed the check in

1—December.
2—January.
3—February.
4—March.

4. As pilot in command on 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—three takeoffs and three landings in any type of aircraft.
3—five takeoffs and five landings to a full stop in a similar type aircraft.
4—three takeoffs and three landings in the same type aircraft.

5. An airline transport pilot may log instrument flight time only when he flies the aircraft under instrument weather conditions, simulated instrument flight conditions, or over-the-top.

1—True
2—False

6. Which statement is correct concerning the VOR equipment check for IFR operations?

1—Dual VOR units may be checked against each other while tuned to the same VOR ground facility.
2—Approved test signal (VOT) must be used.
3—Equipment must be maintained and inspected under an approved procedure.
4—Equipment must be checked every 10 days.

7. During this flight, if you deviate from an ATC clearance in an emergency, you are required to notify ATC of that deviation as soon as possible after landing.

1—True
2—False

8. What is the meaning of a flashing green light from the tower?

1—Cleared for takeoff.
2—Cleared to taxi.
3—Taxi clear of runway.
4—Return to starting point.

9. During this flight at FL 310, the altitude must be maintained by reference to an altimeter which is set to the

1—current reported altimeter setting of a station within 100 miles.
2—altimeter setting for the lowest usable flight level.
3—current altimeter setting corrected for nonstandard temperature variation.
4—standard sea level pressure of 29.92 inches.

10. Which response correctly describes the IFR alternate airport weather minimums for an airport having no published instrument approach procedure?

1—Descent from lowest cruising altitude must be made under VFR conditions.
2—Ceiling 3,000 feet above emergency safe altitude and visibility 5 miles.
3—Ceilings and visibility must permit descent from MEA, approach, and landing under basic VFR minimums.
4—Ceiling 1,000 feet and visibility 2 miles.

* * * * * *

You will be referred to the weather data in the Appendix, Figures *20* through *25* as the basis for certain of the following test items.

* * * * * *

11. Review the New Orleans (MSY) Area Forecast, Figure *20,* and select the correct response.

1—Front will enter northern Gulf of Mexico area by 01Z.
2—Freezing level is expected to slope from 11,000 feet inland to 5,000 feet over Louisiana coastal waters.
3—Scattered thunderstorms are expected ahead of the front in northwestern Louisiana.
4—Clouds over western Louisiana and adjacent coastal waters will be layered to 3,500 feet.

12. Which response correctly interprets certain portions of the Terminal Forecasts (FT1), Figure *20?*

1—MSY: ceiling 4,000 feet, visibility 3 miles in light rain after 20Z.
2—ABQ: after 19Z, ceiling is expected to be 5,000 feet.
3—SHV: ceiling and visibility will improve after frontal passage.
4—MEM: ceiling is expected to be 300 feet overcast and visibility 7 miles after 20Z.

13. Select the response which correctly interprets certain elements of the aviation weather reports (SA) in Figure *21.*

1—MSY: temperature/dew point spread is increasing.
2—SHV: barometric pressure is increasing.
3—ABQ: ceiling is 6,000 feet.
4—FSM: visibility is decreasing.

14. Your review of the Weather Depiction and Radar Summary Charts, Figures *23* and *24,* provides information regarding

1—areas of low cloud cover and heights of cloud tops.
2—winds aloft and forecast weather conditions.
3—heights of cloud bases and areas of precipitation.
4—obstructions to vision and heights of cloud layers.

15. Refer to the Upper Wind Progs, Figure *25.* A well-defined jet stream is evident at the 500-millibar level.

1—True
2—False

16. The center of gravity operating range in percent of MAC at gross weight 145,000 pounds in the takeoff configuration is (Fig. 2)

1—8.5% to 36%.
2—10.5% to 34.5%.
3—10.0% to 35.5%.
4—13.0% to 35.0%.

17. The c.g. operating range in percent of MAC computed in test item 16, is equivalent to a linear range of _____ inches.

1—43.4
2—40.1
3—46.2
4—47.3

18. Compute the c.g. for this flight based on the loading schedule outlined below. Refer to Figures *1* and *2* for loading tables.

	Weight	*Moment/1000*
Basic operating weight (BOW)	88,350 pounds	80,552.3
Fuel* (total)	36,000 pounds	_____
Forward cargo	2,500 pounds	_____
Aft cargo	4,500 pounds	_____
Forward passengers	3,400 pounds	_____
Aft passengers	8,500 pounds	_____
	_____	_____

*Equal amount each tank.

The computed c.g. is

1—16.0%.
2—16.5%.
3—17.2%.
4—17.9%.

19. In the loading situation in test item 18, how much cargo must be shifted to achieve a c.g. location at 20% MAC (distance moved—485")?

1—1,148 pounds
2—1,275 pounds
3—1,477 pounds
4—1,680 pounds

20. The estimated time for this flight from takeoff at ABQ to landing at MSY is (Fig. 30)

1—1 hour, 51 minutes.
2—1 hour, 55 minutes.
3—1 hour, 59 minutes.
4—2 hours, 05 minutes.

21. The estimated fuel burn for the enroute portion of this flight is

1—17,300 pounds.
2—18,200 pounds.
3—19,100 pounds.
4—19,800 pounds.

22. Your fuel load is 36,000 pounds. After consideration of enroute, alternate, and reserve requirements, how much fuel is available for a missed approach and possible holding delay at MSY?

1—8,600 pounds
2—4,300 pounds
3—3,100 pounds
4—6,200 pounds

23. What is the zero fuel weight of this flight?

1—118,000 pounds
2—125,000 pounds
3—107,250 pounds
4—106,150 pounds

24. Assume the following fuel loading for a particular flight:

Fuel to destination _____ 15,500 pounds*
Alternate, reserve, extra ____ 26,500 pounds
*Taxi fuel included

The maximum allowable payload for this flight is _____ pounds.

1—27,650
2—29,650
3—30,650
4—31,500

25. Refer to the flight planning chart in the Appendix, Figure *3*, to select the "best" cruise pressure altitude for a jet flight based on the data below:

Trip distance _____ 1,200 miles
Wind component _____ 50 knots, headwind
Trip fuel _____ 28,000 pounds
Landing weight _____ 130,000 pounds

1—26,000 feet
2—27,000 feet
3—29,000 feet
4—30,000 feet

26. An increase of the wind component to 90 knots headwind can be tolerated without changing the trip fuel in test item 25 if the cruise pressure altitude is

1—increased to 35,000 feet.
2—decreased to 25,000 feet.
3—held constant at 29,000 feet.

27. With reference to the trip time in the flight planning chart, the effect of temperatures *warmer* than standard values acts to *increase* trip time.

1—True
2—False

28. Refer to the takeoff performance chart, Figure *4*. With respect to runway length available, the effect of a 20-knot headwind is very closely balanced by a 1.3% "up" runway slope.

1—True
2—False

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29. Select the runway limit gross weight for the conditions outlined below:

Runway length available	7,000 feet
Wind	12 kts. headwind
Slope	0
Average takeoff EPR	2.05
Airport pressure altitude	5,000 feet
Temperature (OAT)	+30° F.
c.g.	17%

The runway limit gross weight is

1—138,000 pounds.
2—141,000 pounds.
3—143,000 pounds.
4—145,000 pounds.

30. Determine the permissible gross weight at brake release under the following conditions:

Runway length available	9,000 feet
Wind	calm
Slope	0
Airport pressure altitude	6,000 feet
Average takeoff EPR	1.90
Temperature (OAT)	+40° F.
c.g.	17%

The permissible gross weight at brake release is

1—130,000 pounds.
2—135,000 pounds.
3—137,500 pounds.
4—140,000 pounds.

31. From the Takeoff EPR Table, Figure 5, select the #1 and #3 EPR settings for takeoff at ABQ based on the following conditions:

Temperature	+30° F.
Altimeter setting	30.06"
Air conditioning	OFF

1—1.95
2—2.05
3—2.08

32. Refer to Figure 5 to determine the V_R and V_2 speeds for your takeoff from ABQ:

Airport pressure altitude	4,800 feet
Temperature	+30° F.
Flaps	15°
Gross weight	145,000 pounds

1—V_R 131 kts.; V_2 149 kts.
2—V_R 124 kts.; V_2 141 kts.
3—V_R 126 kts.; V_2 140 kts.
4—V_R 133 kts.; V_2 149 kts.

33. For c.g. locations forward of 14%, add 1 knot to V_1 speed.

1—True
2—False

34. Assume that you find it necessary to exceed a 15° bank angle immediately after takeoff. Based on the V speed determinations in test item 32, you should maintain at least _____ knots for this maneuver with takeoff flaps.

1—134
2—147
3—149
4—151

35. With the c.g. at 18% MAC and takeoff flaps at 15°, the stabilizer trim setting is 7 units nose up.

1—True
2—False

36. Assume a runway length available of 8,000 feet, with a clearway of 5,000 feet, and a stopway of 1,000 feet. In determining takeoff weight limitations for a turbine engine powered airplane certificated after August 29, 1959, the maximum takeoff distance available in this situation is

1— 9,000 feet.
2—10,500 feet.
3—12,000 feet.
4—13,000 feet.

37. Based on the values stated in test item 36, the accelerate-stop distance is

1— 8,000 feet.
2— 9,000 feet.
3—10,500 feet.
4—12,000 feet.

38. Determine from Figure 6, the landing field length limit gross weight under these conditions:

Flaps	40°
Antiskid	OFF
Nose brakes	OFF
C.G.	14.5%
Weight below	160,000 pounds
Runway	Wet
Runway length available	6,000 feet
Wind component	10 knots (head)
Pressure altitude	0

1—102,000 pounds
2—142,500 pounds
3—157,000 pounds
4—185,000 pounds

39. Choose the response that correctly describes a feature of aircraft wake turbulence.

1—Vortex generation commences with the takeoff roll.

2—Vortices move laterally prior to settling below the flight path.

3—Vortex strength is maximum when aircraft is *heavy*, *clean*, and *slow*.

4—Vortex strength dissipates rapidly in ground effect.

40. Which of the listed winds would cause you to exceed the maximum tailwind component of 10 knots for this airplane for a runway 8 takeoff?

1—320°/25 knots

2—300°/10 knots

3—350°/15 knots

4—290°/10 knots

41. Assume that weather conditions at ABQ are below the landing minimums specified in the operations specification. A departure alternate airport

1—is not required.

2—is not required if ILS is available.

3—must be not more than 2 hours away, in still air at normal cruising speed, with one engine inoperative.

4—must be at least 1 hour away, in still air at normal cruising speed, with one engine inoperative.

42. Cargo may not be carried in the passenger compartment of an airplane operated under FAR 121.

1—True

2—False

43. The cockpit voice recorder must be switched on just prior to the instant the airplane commences the takeoff roll.

1—True

2—False

44. Select the correct statement regarding positive control airspace.

1—Vertical extent of PCA is from FL 240 to FL 600.

2—"VFR-ON-TOP" operations are not permitted in PCA.

3—Altitudes must be flown in accordance with hemispheric rules.

4—No operations are permitted in PCA without an operative radar beacon transponder.

45. Immediately after takeoff on this IFR operation, you are expected to adjust your transponder to reply on Mode C.

1—True

2—False

46. In the event you experienced two-way radio failure during flight, you should adjust your transponder to reply on Mode A/3, Code 7600.

1—True

2—False

47. The airborne weather radar equipment must be in satisfactory operating condition prior to dispatch of any IFR operation under FAR 121.

1—True

2—False

48. Your takeoff from ABQ is made at 1805 GMT. Assuming a gross weight at brake release of 151,000 pounds, determine the gross weight by 1845 GMT at your cruising flight level of 310—based on standard temperature conditions during climb and −45° C. after level-off. (Figs. 7, 8, and 9.)

1—146,676 pounds

2—145,000 pounds

3—144,145 pounds

4—143,260 pounds

49. During the period of time covered in climb and at cruise in test item 48, determine the nautical air miles (NAM) flown (assume no speed reduction at lower levels).

1—285 NAM

2—291 NAM

3—296 NAM

4—302 NAM

50. To fly at constant Mach cruise while maintaining a constant flight level requires periodic reduction in thrust as gross weight decreases.

1—True

2—False

51. At your cruising level (FL 310), you determine that the true air temperature is −45° C. What is the speed of sound in this situation?

1—588 knots

2—593 knots

3—600 knots

4—620 knots

52. Determine the specific range (NAM/1,000 pounds of fuel) based on the data below:

FL ---------- 300
Mach ---------- .82
OAT ---------- −10° C. (indicated)
Total fuel flow ---- 8,680 pounds/hour

1—53.2 NAM/1,000 pounds
2—55.1 NAM/1,000 pounds
3—56.7 NAM/1,000 pounds
4—57.8 NAM/1,000 pounds

53. You track outbound from TXO (Figure *12*) on radial 090, as requested by ATC. When you are 90 DME miles from TXO, what is your distance off course?

1— 4 miles
2— 6 miles
3— 8 miles
4—10 miles

54. To return to the centerline of J72, at a distance from SPS of 60 nautical miles, you must make a correction of approximately ____ degrees to the left.

1— 4°
2— 6°
3—10°
4—13°

55. Between SPS and GSW, you compute the wind direction and speed based on the data below:

Magnetic heading ---------- 130°
TAS ---------- 470 knots
Magnetic course ---------- 122°
GS ---------- 510 knots

1—235°/70 knots
2—245°/85 knots
3—255°/80 knots
4—240°/75 knots

56. Your time over GSW is recorded as 1906 GMT. The flight is, therefore, operating

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

57. As you fly directly over GSW, the absolute altitude (height above the surface) is 29,800 feet. The DME readout should be approximately ____ nautical miles.

1—0.8
2—2.5
3—4.9
4—6.5

58. Assume that ATC advised you to report over AEX not before 1935 GMT. Based on the reported time over GSW and the following operational data, what indicated Mach should you fly between GSW and AEX?

Wind factor ---------- +70 knots
Temperature (true) ---------- −32° C.

1—Mach .74
2—Mach .77
3—Mach .79
4—Mach .81

59. Choose the response which correctly interprets certain information listed on the instrument approach chart, Figure *17*, for New Orleans International (Moisant Field).

1—Decision Height for straight-in Localizer Approoach to RWY 10 is 360 feet.
2—RBN to Localizer Missed Approach is 6.6 NM.
3—RWY 10 has a displaced threshold.
4—Straight-in ILS Approach Minimum for RWY 10 is 1,800 yards.

60. As you descend from FL 310 through 10,000 feet MSL, your speed should be not more than 250 knots IAS.

1—True
2—False

61. Your clearance for an ILS approach to RWY 10 at MSY ensures that you will receive landing priority over other traffic.

1—True
2—False

62. New Orleans Approach Control is issuing you radar vectors to intercept the front ILS course west of Turtle Intersection. To complete the approach, you are expected to complete the procedure turn as designated on the procedure chart.

1—True
2—False

63. Assume that you miss the approach at MSY and are cleared to the alternate airport—MEM. What is/are your landing minimum/s for a RWY 9 ILS approach at MEM?

1—Standard alternate minimums of 600 feet, 2 miles.
2—Ceiling 700 feet, 2,400 feet RVR.
3—Published DH and visibility value for the approach.
4—Ceiling 800 feet and 1 mile.

64. Landing minimums are now predicated on various aircraft speed/weight combinations. Speeds are based on 1.3 V_{so} at

1—actual landing gross weight.
2—maximum certificated gross weight.
3—certificated operating weight.
4—maximum certificated landing weight.

65. The computed speed range of a particular airplane places it in Approach Category B, while the weight places it in Category C. Which Approach Category is appropriate for determining landing minimums for this airplane?

1—A
2—B
3—C
4—D

* * * * * *

Test items 66 through 70 are based on an international flight between JFK and LPPT. See Figures 26 through 29 in the Appendix.

* * * * * *

66. At FL 300, the flight may encounter cirroform cloud layers between 45° W. and 40° W.

1—True
2—False

67. On the 300 MB Prog Chart, the wind over Ocean Weather Station "DELTA" (44° N.; 41° W.) is approximately

1—200°/80 knots.
2—220°/95 knots.
3—230°/105 knots.

68. Refer to the Tropopause-Vertical Wind Shear Chart, Figure *29*. At FL 300, the aircraft will be above the tropopause at 60° W. on the indicated route of flight.

1—True
2—False

69. What is the flight time enroute based on the following data?

Total distance	2,960 NM
Time and distance for climb	25 min./160 NM
Time and distance for descent	16 min./100 NM
Cruise	.82 Mach
Average temperature (true)	−47° C.
Average wind factor	+40 kts.

1—5 hours, 30 minutes
2—5 hours, 36 minutes
3—5 hours, 44 minutes
4—5 hours, 53 minutes

70. What is the required fuel for this trip based on the enroute time computed in the previous test item and the additional data below?

Time to alternate	25 minutes
Average fuel flow for climb, cruise, and descent	12,900 lbs./hr.
Holding fuel flow	8,400 lbs./hr.
Fuel for approach and missed approach	1,500 lbs.

1—89,000 pounds
2—93,000 pounds
3—94,500 pounds
4—96,700 pounds

ANSWERS AND ANALYSES TO SAMPLE TEST ITEMS

Item	Answer	Analysis
1	2	FAR 121.533(e). The PIC does have complete control and authority over other crewmembers while in flight whether he possesses the pertinent airman certificate or not.
2	3	FAR 121.432
3	2	FAR 121.432
4	4	FAR 121.439
5	2	FAR 61.41(d)
6	1	FAR 91.25
7	2	FAR 91.75
8	2	FAR 91.77
9	4	FAR 91.81
10	3	FAR 91.83
11	3	Area Forecast, Figure *20*
12	3	FT1 Forecasts, Figure *20*
13	4	You will need to contrast the 1600Z and 1700Z SA reports to arrive at the correct response.
14	3	Weather depiction charts show areas of low cloud cover and heights of cloud bases; radar summary charts show precipitation areas and approximate heights of echo tops. Both charts are based on reported or observed conditions.
15	2	A well-defined jet stream is evident, however, at the 300-millibar level (30,000 feet). It is oriented in a northeasterly direction from the east Texas area.
16	2	See referenced chart. Range in percent of MAC is 24% at the stated gross weight.
17	1	Range in percent (24%) times MAC of 180.7" yields the total c.g. linear movement of 43.4".
18	3	Total moment is 127,641.3; divide this value by weight/1000 (143.250) which yields the total arm of the c.g. (891.3"). Since the LEMAC is known (860.2"), we can determine the relative position of the c.g. on the MAC—in this case, 31.1" aft of the LEMAC. Dividing this value by the MAC (180.7") and multiplying by 100, yields the c.g. location in percent of MAC—17.2%.
19	3	The desired 20% c.g. location is at 36.1" aft of the LEMAC, which reprents a 5" aft movement from the 31.1" location computed in the previous test item. Use the proportion as follows: $\frac{\text{Weight moved}}{\text{Gross weight}} :: \frac{\text{C.G. movement}}{\text{Distance moved}}$ The actual computed weight to be shifted is 1,477 pounds.
20	1	The pertinent portions of the flight time analysis form are reproduced below:

	GS	*Dist.*	*Time*	*Total Time*
Climb	455	114	0:15	
TOC/TXO	530	85	0:09.6	24.6
TXO/SPS	540	213	0:23.6	48.2
SPS/GSW	495	105	0:12.7	1:00.9
GSW/AEX	545	250	0:27.5	1:28.4
AEX/TOD	500	78	0:09.4	1:37.8
TOD/A'PT	—	—	0:13.5	1:51.3

Flight time for final answer is rounded off to nearest minute.

Item	Answer	Analysis
21	2	The enroute fuel is computed as follows:

ABQ/TOC	5,400 pounds
TOC/TOD	11,900 pounds
TOD/AIRPORT	900 pounds
Total	18,200 pounds

An alternative procedure is to enter the 31,000-ft. cruise planning chart in the bracket containing the gross weight at top of climb in the appropriate temperature column and cal-

Item	Answer	Analysis
		culate the fuel burn down through the weight brackets for the total enroute time at cruising altitude.
22	4	The fuel summary is shown below: Enroute fuel 18,200 pounds Alt. fuel 5,160 pounds Res. fuel (45 min.) 6,450 pounds Total 29,810 pounds The remaining fuel is rounded off to 6,200 pounds.
23	3	The basic operating weight of 88,350 pounds plus the actual payload of cargo and passengers (18,900 pounds), yields the actual ZFW of 107,250 pounds.
24	1	In this situation, the maximum taxi weight is limited to 158,000 pounds (maximum landing weight plus fuel to destination). Reducing this value by the total fuel load (42,000 pounds) yields a zero fuel weight for this flight of 116,000 pounds. Difference between this ZFW and BOW of 88,350 pounds is the maximum allowable payload for this flight (27,650 pounds).
25	3	The "best" PA is located in the altitude web at the intersection of the vertical distance/wind line and the horizontal fuel line.
26	1	The increased wind component can only be tolerated by raising the cruise pressure altitude—assuming no change in trip fuel.
27	2	At a constant indicated Mach, the TAS varies directly with temperature which acts to *decrease* trip time.
28	1	Refer to the lower-left corner of the subject chart for the graphical treatment of wind and slope. For example, a 20-knot headwind increases the "effective" length of an 8,000-foot runway to 8,750 feet. This additional effective length is almost exactly counterbalanced by the effect of the 1.3% upslope, as shown on the chart.
29	4	Follow the plotted example on the referenced chart. The runway limit value is limiting under these conditions.
30	3	Both the runway limit and the climb limit values must be investigated. In this case, the climb limit value is the limiting weight since it is less than the runway limit value.
31	3	The field elevation is 5,352 feet, therefore, the altimeter setting must be reduced by 5.35" to determine field pressure. The tabular value of 2.05 is increased by .03 since A/C is OFF.
32	2	Note that $V_1 = V_R$.
33	1	It is important to read and evaluate all notes on a chart or table. A note at the bottom of the V speed table (Fig. 5) indicates that 1 knot must be added (to all V speeds) if the c.g. is located forward of 14%.
34	4	The inset table in Figure 5 prescribes a speed of at least V_2+10 at the takeoff flap setting.
35	1	See the appropriate inset table in Figure 5.
36	3	The reference is FAR 121.189. The length of any clearway included must not be greater than one-half of the length of the runway.
37	2	FAR 121.189.
38	1	This chart illustrates the drastic penalty in weight loss produced by the adverse conditions specified. The field length limit gross weight of 102,000 pounds meets the FAR 121.195 destination airport landing limitation requirement. It is saying that at this limit weight of 102,000 pounds, the airplane will be able to land within 60% of the effective runway length.
39	3	See AIM, Part 1, Chapter 5.
40	1	The direction of takeoff is 080° magnetic and wind directions are listed as magnetic. The wind of 320°/25 knots is the only one listed which will cause the limitation to be exceeded.
41	3	FAR 121.617.

Item	Answer	Analysis
42	2	Cargo may be carried aft of the foremost seated passengers if it is carried in approved type cargo bins. It may also be carried forward of the foremost seated passengers. See FAR 121.285 for details.
43	2	The reference is FAR 121.359. The voice recorder must be operated continuously from the start of the use of the checklist (before starting engines for the purpose of flight) to completion of the final checklist at the termination of the flight.
44	2	(1) Vertical extent of PCA is normally FL 240 to FL 600; however, the floor of PCA has been lowered in certain parts of the U.S. to FL 180. (3) ATC will specify the Flight Level regardless of direction of flight. (4) ATC may authorize deviations from the requirements for operation in PCA. In case of in-flight failure of a transponder, ATC will immediately approve operation in PCA. Requests for planned deviations must be submitted in writing, 4 days prior to the operation, to the traffic control center having jurisdiction over the PCA in question. See AIM, Part 1, Chapter 3.
45	2	The transponder is operated only as specified by ATC. Mode C capability is currently available on some transponders. This system converts altitude in hundreds of feet to coded digital information which is transmitted to the interrogating facility. See AIM, Part 1, Chapter 4.
46	1	See AIM, Part 1, Chapter 4.
47	2	The reference is FAR 121.357. If current weather reports indicate that no thunderstorms or other hazardous weather conditions exist along the route, the flight can be dispatched without operable weather radar equipment.
48	4	Fuel from brake release to climb speed at gross weight 151,000 pounds and field elevation at ABQ of approximately 5,000 feet is 973 pounds. Time for this phase is 3 minutes. Climb time is 13½ minutes (16′ less 5 x ½′) and fuel burn is 4,167 pounds less 750 pounds (150 pounds for each 1,000 feet the departure airport is above sea level) or 3,417 pounds. Gross weight at top-of-climb is, therefore, 151,000 pounds less the total fuel burn of 4,390 pounds or 146,610 pounds. Clock time at top-of-climb is 1822 GMT (to nearest minute). Enter .82 Mach planning chart for cruising level 31,000 feet in the 150,000 pound bracket under the standard temperature column of −45° C. Proceed as follows:

Time	*Fuel Flow*	*Weight*
1822 G.M.T.		146,610 pounds
+11 min.	FF 8889	−1,610 pounds
1833 G.M.T.		145,000 pounds
+12 min.	FF 8691	−1,740 pounds
1845 G.M.T.		143,260 pounds

Item	Answer	Analysis
49	1	Enroute climb 13.5′/TAS 430 kts. = 97 NAM Cruise 23.5′/TAS 480 kts. = 188 NAM Total = 285 NAM
50	1	As the gross weight decreases with the fuel burn-off, speed will increase. This requires periodic reduction of thrust to average out the desired constant Mach indication.
51	1	The speed of sound is Mach 1.0. Depending on your type of computer, set Mach Index opposite true air temperature; opposite the "10" read speed of sound.
52	3	TAS in this situation is 492 knots Divide this value by 8.68 (thousands of pounds of fuel) to determine the NAM/1,000 pounds.
53	2	On the calculation side of the computer, set the "60" index opposite 4° on the outer scale (R090°–086X). Opposite 90 miles on the inner scale, read 6 miles off-course on the outer scale.

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Item	Answer	Analysis
54	3	Set distance off-course on outer scale opposite distance to travel on inner scale (6 opposite 63). Read 5.7° opposite "60" index. You will need to turn left 4° to parallel course plus 6° additional to converge on the selected point.
55	3	For this computer solution, you may solve for the *magnetic* wind direction, then convert to true direction, or change heading and course values to true direction prior to solution. Variation is 9° E. in the area considered.
56	1	Your accumulated flight plan time to GSW was 1 hour and 01 minute. Takeoff time was 1805 GMT, so your actual time over GSW of 1906 GMT agrees with the planned time.
57	3	The lowest DME mileage readout will approximate the vertical distance over the station in miles.
58	1	The 250 NM distance between GSW and AEX must be flown in 29 minutes at GS 516 knots. With the wind factor of +70 knots, the TAS must, therefore, be 446 knots. Set Mach Index opposite true temperature of −32° C. and opposite TAS 446 knots on the outer scale, read Mach .74 on inner scale.
59	2	(1) DH is not relevant to a Localizer Approach—only ILS or PAR. (3) RWY 28 has a displaced threshold as indicated by the open-looped symbol. (4) Visibility minimum for ILS approach to RWY 10 is 1,800 feet.
60	1	The reference is FAR 91.70.
61	2	See AIM, Chapter 4. Traffic control towers handle all aircraft, regardless of type of flight plan, on a "first-come, first-served" basis.
62	2	See AIM, Chapter 4. This is one of the situations in which you are *not* expected to make a procedure turn.
63	3	As noted in AC 90–1A, when the pilot proceeds to an alternate airport, the alternate ceiling and visibility values are no longer applicable. The published minimums for the new destination are now applicable, based on the procedure to be used.
64	4	The speed symbol V_{so} refers to the stalling speed in the landing configuration. For this purpose, the reference weight has been selected as the maximum certificated landing weight.
65	3	An airplane can fit into only one category, that being the highest category in which it meets either specification. Also, if a Category C airplane is circling to land at a speed above the upper "C" speed limit, the Category D minimums should be used. See Advisory Circular 90–1A.
66	2	The SIG PROG Chart for the vertical layer between 400 and 150 millibars is relevant to this test item. Clouds between the longitudes given are expected to be isolated "CBS" which, of course, are cumuliform.
67	2	Wind flows parallel to the contours which are heavy, black lines. Measure the angle which the contour passing through "D" makes with the closest meridian. Wind speed is related to the dashed lines which are called isotachs.
68	1	At the given position, the tropopause is somewhat below the 350-millibar level which corresponds to a height of 26,600 feet under standard conditions. 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 chart also shows: a. 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. b. Mean vertical wind shear for the layer from 300 to 150 millibars at intervals of 2 knots/1,000 feet,

Item	Answer	Analysis
		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. c. Tropopause and 150-millibar level temperatures are enclosed in rectangles and circles, respectively.
69	4	TAS for cruise is 480 knots and GS is, therefore, 520 knots. Time for cruise portion (2,700 NM) is 5 hours, 12 minutes. Climb and descent times increase total time to 5 hours, 53 minutes.
70	3	Time enroute 5:53 +10% :35 +Alternate :25 Total time 6:53 **Fuel Summary** 6:53 @ 12,900 lbs. = 88,800 lbs. 30 min. @ 8,400 lbs. = 4,200 lbs. App. and missed app. = 1,500 lbs. Total fuel 94,500 lbs.

APPENDIX

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

PHYSIOLOGICAL TRAINING

The following articles concerning Hypoxia and Hyperventilation are excerpted from the Physiological Training Manual of the Civil Aeromedical Institute (CAMI). If further information is desired, write the Chief, Physiological Operations and Training Section, AC-143, Civil Aeromedical Institute, FAA Aeronautical Center, P.O. Box 25082, Oklahoma City, Oklahoma 73125.

Hypoxia

Hypoxia is probably our most important physiological problem. It can be the most dangerous physical flying problem due to its insidious onset. Hypoxia, therefore, is one of the basic and most vital problems to the aviator. He must completely understand its causes, effects, prevention, and treatment.

Hypoxia can be defined as a lack of sufficient oxygen available to the body cells. The degree of hypoxia depends upon the reduction of the partial pressure of oxygen in the air sacs. This reduction of oxygen pressure becomes apparent in the Physiological Deficient Zone which extends from about 12,000 feet to 50,000 feet. Interference with the supply of oxygen to the cells of the body affects normal processes. The amount of oxygen in the cells may become inadequate due to various conditions.

The most important single characteristic of hypoxia at altitude is that if the aircrew member is engrossed in his duties, he may not notice the effect that hypoxia is having on his body. Each person will experience his individual symptoms of hypoxia; therefore, in order to detect hypoxia, you must know your reactions. Some of the common symptoms to look for are:

1. An increased breathing rate.
2. Light-headed or dizzy sensations.
3. Tingling or warm sensations.
4. Sweating.
5. Loss of vision or reduced vision; sleepiness.
6. Cyanosis (blue coloring of skin, fingernails, and lips).
7. Behavior changes.

Time of Useful Consciousness (T.U.C) is the time from the onset of hypoxia until deterioration of the individual's effective performance. At altitudes below 30,000 feet this time may differ considerably from the time of total consciousness (the time it takes to "pass out"). Above 35,000 feet the times become closer and eventually coincide for all practical purposes. Various factors will determine T.U.C., some of which are:

1. Altitude. T.U.C. decreases with increasing altitude.
2. Rate of Ascent. In general, the faster the rate, the shorter the T.U.C.
3. Physical Activity. Exercise decreases T.U.C. considerably.
4. Day-to-Day Factors. Physical fitness or ability to tolerate hypoxia will change from day to day; therefore, changing your T.U.C.

The following T.U.C.'s given for various altitudes represent *average* times without supplemental oxygen:

15–18,000 feet	30 minutes or more
22,000 feet	5 to 10 minutes
25,000 feet	3 to 5 minutes
28,000 feet	2½ to 3 minutes
30,000 feet	1 to 2 minutes
35,000 feet	30 to 60 seconds

An immediate realization of your hypoxia symptoms and the obtaining of a proper amount of supplemental oxygen by emergency oxygen equipment procedures are necessary to combat hypoxia.

If oxygen is administered within a matter of 3 to 5 minutes to a person who is unconscious from hypoxia, recovery is usually rapid and complete. However, a hypoxic reaction may be followed by a state of shock during which there is a weak pulse, sweating, low blood pressure, and pooling of blood in dilated capillaries. This condition will require the usual treatment for shock.

Hyperventilation

The respiratory center of the brain reacts to the amount of carbon dioxide found in the blood stream. When you are in a physically relaxed state, the amount of carbon dioxide in your blood stimulates the respiratory center and your breathing rate is stabilized at about 12 to 16 breaths a minute. When physical activity occurs, the body cells use more oxygen and more carbon dioxide is produced. Excessive carbon dioxide enters the blood and consequently the respiratory center responds to this excess. Breathing increases in depth and rate to remove the excess carbon dioxide. When the excess is removed, the respiratory center changes the breathing back to normal.

The same process is involved when a maximum effort is made to hold the breath. While the breath is being held, the body cells continue to manufacture carbon dioxide which enters the blood. The amount in the blood finally becomes so great that in spite of conscious efforts, the respiratory center overrides it and breathing is resumed.

Hyperventilation, or overbreathing, is a disturbance of respiration that may occur in individuals as a result of physical exertion, emotional tension, or anxiety. It is a condition in which the respiratory rate and depth are abnormally increased. This results in an excessive loss of carbon dioxide from the lungs, lowering the normal carbon dioxide tension of 40 mm. Hg. The most common symptoms are dizziness, hot and cold sensations, tingling of the hands, legs, and feet, tetany, nausea, sleepiness, and, finally, unconsciousness. After becoming unconscious, the breathing rate will be exceedingly low until enough carbon dioxide is produced to stimulate the respiratory center. Hyperventilation is a normal response to hypoxia. However, the excessive breathing does little good. Hyperventilation combined with hypoxia is very serious.

Should symptoms occur which you cannot definitely identify as either hypoxia or hyperventilation, the following steps should be taken:

Check your oxygen equipment immediately and put the regulator on 100% oxygen.

After three or four deep breaths of oxygen, the symptoms should improve markedly, if the condition experienced was hypoxia. (Recovery from hypoxia is extremely rapid.)

If the symptoms persist, you should consciously slow your breathing rate to an abnormally slow rate for 30 to 45 seconds, and then resume your breathing at a normal rate.

FIRE PROTECTION

Types of fires

Class A fires—Fires in ordinary combustible materials where the quenching and cooling effects of quantities of water, or solutions containing large percentages of water, are of first importance.

Class B fires—Fires in flammable liquids, greases, etc., where a blanketing effect is essential.

Class C fires—Fires in electrical equipment, where the use of a nonconducting extinguishing agent is of first importance.

Airworthiness Standards: Transport Category Airplanes

Airplanes certificated as Transport Category Airplanes must comply with the following requirements for hand fire extinguishers:

Flight deck—at least 1.

Passenger compartment—determined by passenger capacity.

Passenger capacity	*Minimum number extinguishers*
7 through 30	1
31 through 60	2
61 or more	3

DEFINITIONS

Speed of sound—the speed at which sound waves travel through a medium which is solely a function of temperature.

Mach number—the ratio of the true airspeed to the speed of sound.

$$\text{Mach No. (M)} = \frac{\text{True Airspeed (TAS)}}{\text{Speed of Sound}}$$

Speed of Sound = Mach 1.00

Subsonic—less than the speed of sound.

Transonic—airflow on aircraft components may be partly subsonic and partly supersonic. . Mach numbers from 0.75 to 1.20.

Supersonic—definite supersonic airflow on all parts of the aircraft. Mach numbers from 1.20 to 5.00.

Hypersonic—Mach numbers above 5.00.

Critical Mach number—the highest flight speed possible without supersonic flow over any part of the aircraft.

Mean Aerodynamic Chord (MAC)—is the mean chord of the wing which is established by the manufacturer for engineering design and weight and balance purposes.

Specific range—is the nautical miles of flying distance per pound of fuel. The specific range can be defined by the following relationships:

$$\text{specific range} = \frac{\text{nautical miles}}{\text{lbs. of fuel}} \quad \text{or} \quad \frac{\text{nautical miles/hr.}}{\text{lbs. of fuel/hr.}}$$

$$\text{thus, specific range} = \frac{\text{velocity, knots}}{\text{fuel flow, lbs./hr.}}$$

Because of high fuel flow in jet aircraft, specific range is usually expressed as nautical *air* miles per 1,000 lbs. of fuel. (NAM/1,000 lbs.)

Clearway—expressed in terms of a clearway plane, extending from the end of the runway with an upward slope not exceeding 1.25 percent, above which no object nor any terrain protrudes.

Stopway—an area beyond the runway, not less in width than the runway, for use in decelerating the airplane during an aborted takeoff. A stopway can be used for increasing the accelerate-stop distance.

Takeoff Distance—The greater of:

1. The horizontal distance from the point of brake release to a point where the airplane attains a height of 35 feet above the takeoff surface, assuming an engine failure at the V_1 speed, or

2. 1.15 times the horizontal distance from the point of brake release to the point where the airplane attains a height of 35 feet above the takeoff surface with all engines operating.

The takeoff distance available, used in entering the chart, is the sum of the runway length plus the actual or maximum allowable clearway length. The length of the clearway used must not be greater than one-half the length of the runway.

Takeoff Run—The greater of:

1. The horizontal distance from the point of brake release to a point equidistant between the lift-off point and the point where the airplane attains a height of 35 feet above the takeoff surface, assuming an engine failure at V_1 speed, or

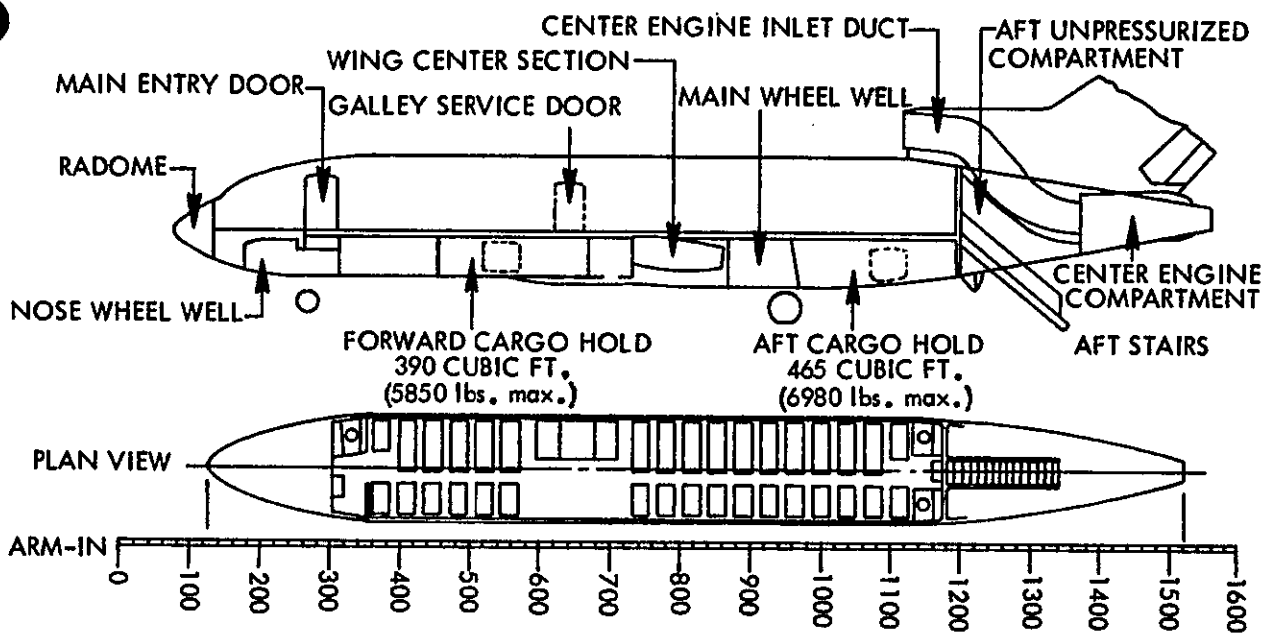
2. 1.15 times the horizontal distance from the point of brake release to a point equidistant between the lift-off point and the point where the airplane attains a height of 35 feet above the takeoff surface with all engines operating.

The takeoff run, used in entering the chart, must not exceed the length of the runway.

Accelerate-Stop Distance—The horizontal distance to accelerate from a standing start to the V_1 speed and thereafter, assuming an engine failure at this speed, to bring the airplane to a full stop. The accelerate-stop distance, used in entering the chart, must not exceed the length of the runway plus the length of the stopway.

Balanced Field Length—The condition where the takeoff distance is equal to the accelerate-stop distance. This distance must not exceed the length of the runway.

Unbalanced Field Length—The condition where the takeoff distance and accelerate-stop distance are not equal.



WEIGHT LIMITATIONS

Basic operating weight..... 88,350 pounds
Maximum taxi weight.....161,000 pounds
Maximum takeoff weight.....160,000 pounds
Maximum landing weight.....142,500 pounds
Maximum zero fuel weight.....118,000 pounds

FUEL LOADING TABLE

Weight	*Tank 1 and 3*		*Tank 2 (3 Cell)*		*Weight*
Lb.	*Arm*	*Moment 1000*	*Arm*	*Moment 1000*	*Lb.*
8,500	892.1	7,583	817.5	6,949	8,500
9,000	893.0	8,037	817.2	7,355	9,000
9,500	893.9	8,492	817.0	7,762	9,500
10,000	894.7	8,947	816.8	8,168	10,000
10,500	895.4	9,402	816.6	8,574	10,500
11,000	896.1	9,857	816.5	8,982	11,000
11,500	896.8	10,313	816.3	9,387	11,500
12,000	897.5	10,770	816.1	9,793	12,000
18,500	906.8	16,776	815.1	15,079	18,500
19,000	907.8	17,248	815.0	15,485	19,000
19,500	908.9	17,724	814.9	15,891	19,500
20,000	910.1	18,202	814.9	16,298	20,000
20,500	911.7	18,690	814.8	16,703	20,500
21,000	913.4	19,181	814.7	17,109	21,000
21,500	915.5	19,683	814.6	17,514	21,500

AIRPLANE DATUM CONSTANTS

Mean Aerodynamic Chord applicable to this airplane:

MAC = 180.7 inches

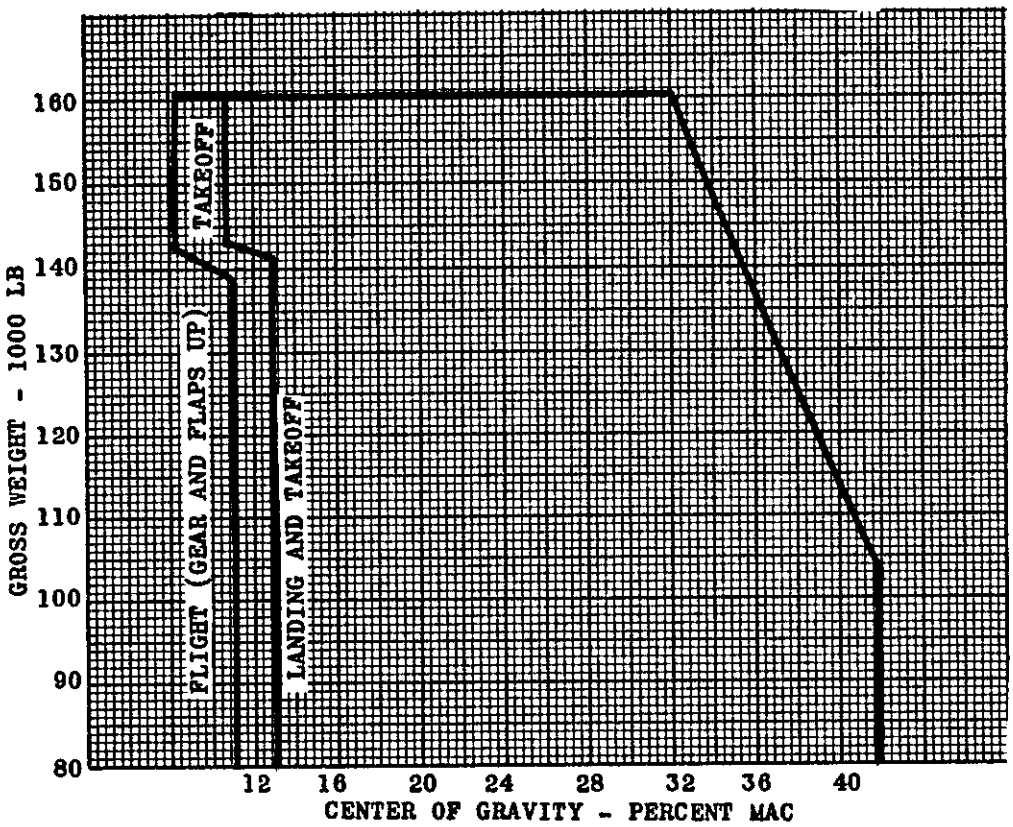
Leading edge of MAC = 860.2 inches

FUEL DUMPING

Fuel dumping rates with all boost pumps on, all dump valves open, and both nozzle valves open are:

Tank # 1..... 600 lbs/min
Tank # 2.....1100 lbs/min
Tank # 3..... 600 lbs/min

FIGURE 1. Airplane data.



CARGO LOADING TABLE		
	Moment 1000	
Weight Lb.	*Forward Hold Arm 581*	*Aft Hold Arm 1066*
6,000		6,396
5,000	2,905	5,330
4,000	2,324	4,264
3,000	1,743	3,198
2,000	1,162	2,132
1,000	581	1,066
900	523	959
800	465	853
700	407	746
600	349	640
500	290	533
400	232	426
300	174	320
200	116	213
100	58	107

PASSENGER LOADING TABLE		
Number of Pass.	*Weight Lb.*	*Moment 1000*
FWD. COMP. CENTROID 486.3		
5	850	418
10	1,700	827
15	2,550	1,240
20	3,400	1,653
25	4,250	2,067
29	4,930	2,397
AFT. COMP. CENTROID 928.8		
5	850	789
10	1,700	1,579
15	2,550	2,368
20	3,400	3,158
25	4,250	3,947
30	5,100	4,736
35	5,950	5,526
40	6,800	6,315
45	7,650	7,105
50	8,500	7,894
54	9,180	8,526

FIGURE 2. C.G. chart and loading tables.

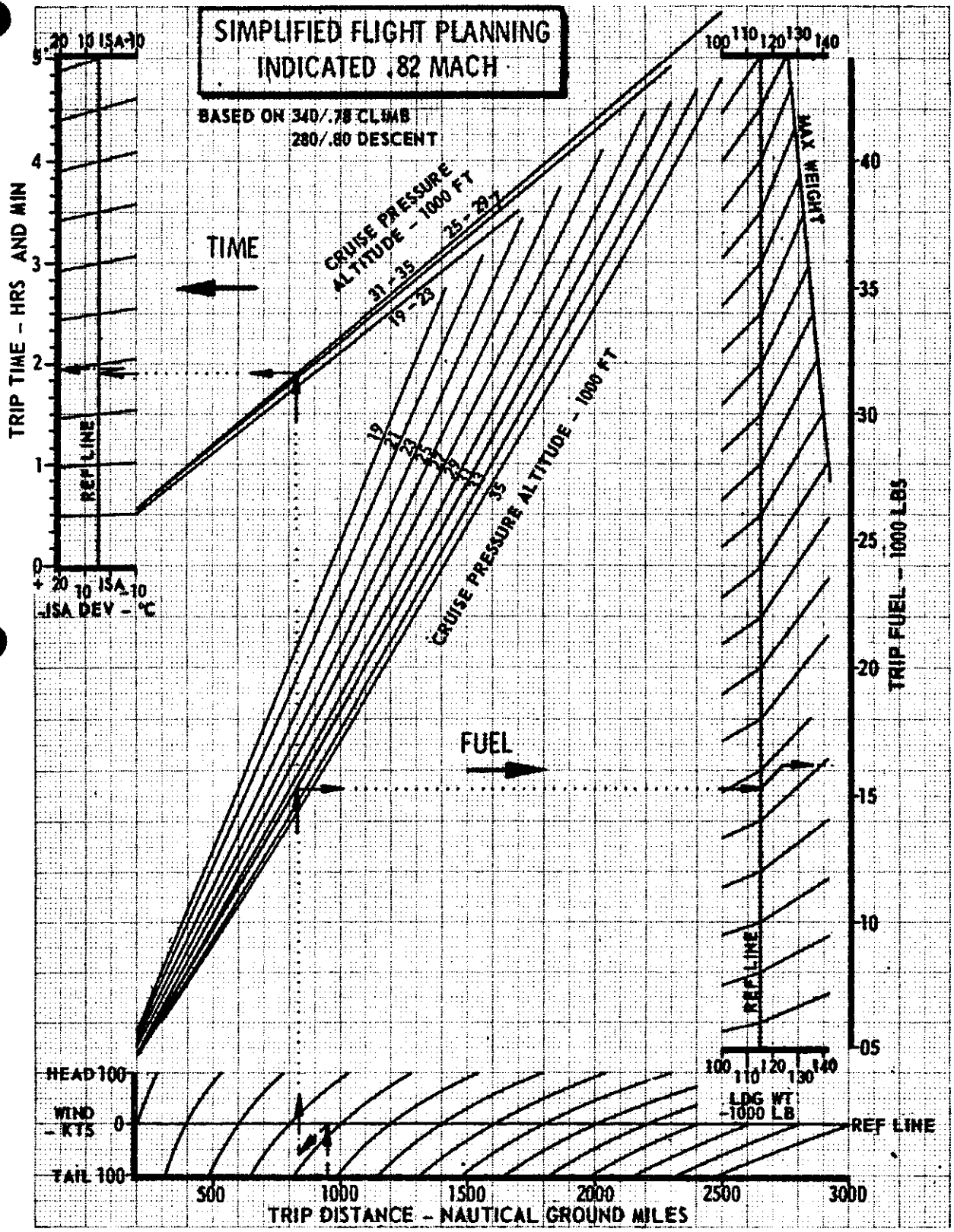


FIGURE 3. Simplified flight planning chart.

Explanation of Figure 4

Given Factors:

Runway length available	8,150 feet
Tailwind component	4 knots
Slope	1% UP
Airport pressure altitude	4,000 feet
Outside air temperature	+88° F.
Average takeoff EPR	1.88

For runway limit: start at runway length available line and follow dotted line and arrows. Answer is 132,000 pounds.

For climb limit: start where EPR 1.88 intersects climb limit base line and follow dotted line and arrows. Answer is 143,500 pounds.

Use of Chart

Gross Weight at Brake Release for this aircraft under the conditions specified on the chart is seen to be influenced by either *Runway* or *Climb* limitations. The following explanation of these limits is offered.

Runway Limit: Based on the runway length available, the operating variables (wind, runway slope, pressure altitude, and temperature) together with average takeoff EPR directly influence the Gross Weight at Brake Release. In the plotted example, this value is seen to be 132,000 pounds.

Climb Limit: Regulations specify that certain climb gradients or profiles must be met during the takeoff and climb phases. (See FAR 25.121.) This chart, therefore, shows the weights for various combinations of power (EPR) and pressure altitude at which the aircraft is able to equal the prescribed climb gradients. In the plotted example, the Gross Weight at Brake Release is 143,500 pounds. This value far exceeds the runway limit of 132,000 pounds. Of these two weights, the *smaller value* is *always* used and in *most* cases, this is the *runway limit.* Structural weight limitations, of course, must not be exceeded.

NOTE.—Under certain conditions, the Climb Limit Gross Weight at Brake Release will be *less than* the Runway Limit value and thus it becomes the limiting value. Plot the example below which shows this relationship:

Given Factors:

Runway length available	9,250 feet
Wind	calm
Slope	0
Airport pressure altitude	3,000 feet
Outside air temperature	+59° F.
Average takeoff EPR	1.90

Solution:

Runway Limit Gross Weight at Brake Release	156,000 pounds
Climb Limit Gross Weight at Brake Release	153,000 pounds

(The Climb Limit value is the limiting weight in this case.)

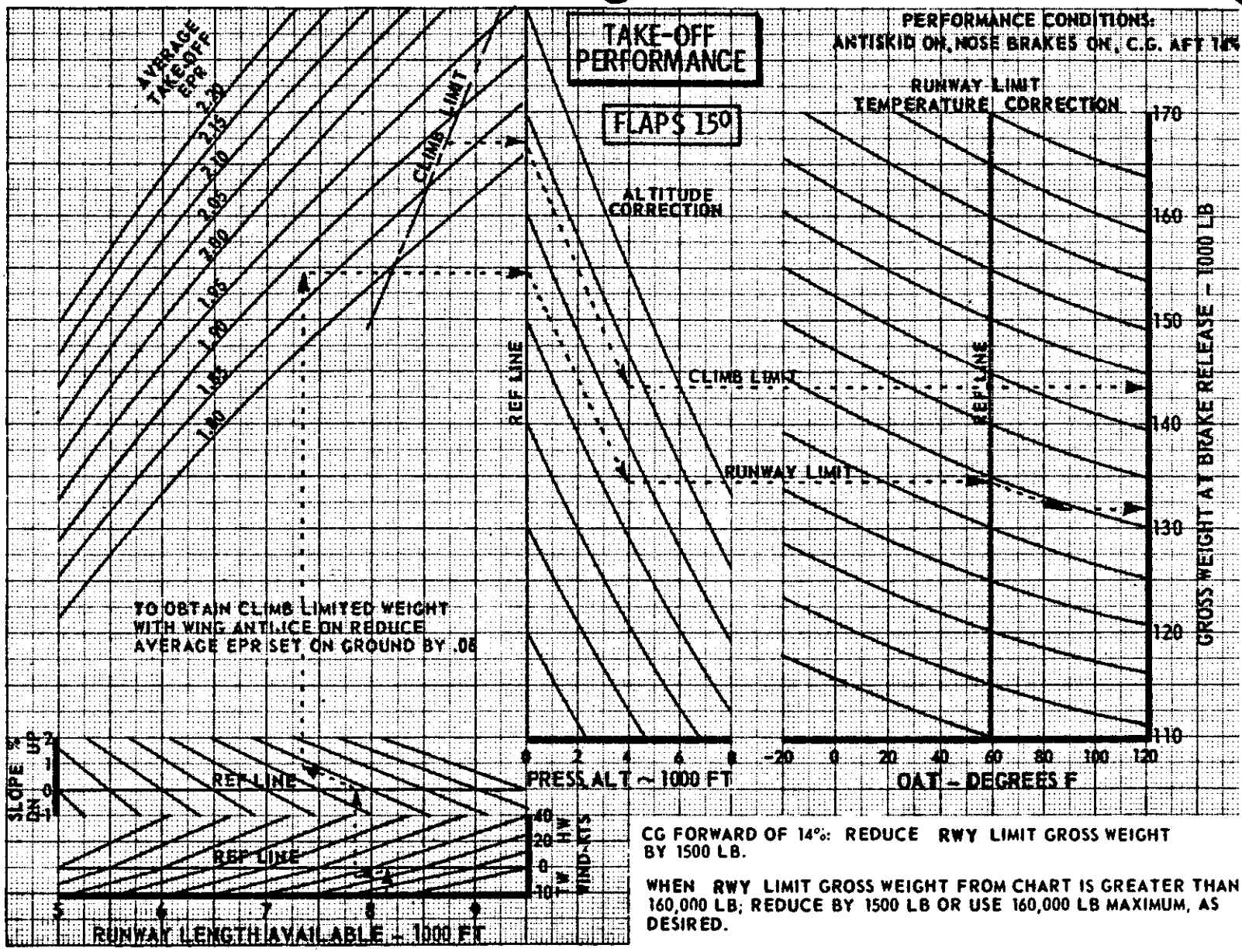


FIGURE 4. Takeoff performance chart.

TAKEOFF

EPR

ENG 1 & 3 - A/C ON
ENG 2 - NO BLEED

EPR BLEED CORRECTIONS	ENG 1 & 3	ENG 2
AIR CONDITIONING	OFF: +.03	ON: +.03
ENGINE ANTI-ICE ON		+.03

O.A.T. DEG F.	FIELD PRESSURE - INCHES Hg											O.A.T. DEG F.
	22	23	24	25	26	27	28	29	30	31	32	
70	1.97	1.96	1.96	1.96	1.95	1.94	1.93	1.93	1.93	1.92	1.89	70
60	1.97	1.96	1.96	1.96	1.95	1.95	1.95	1.95	1.95	1.92	1.89	60
50	1.98	1.98	1.98	1.98	1.98	1.98	1.98	1.98	1.95	1.92	1.89	50
40	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.00	1.95	1.92	1.89	40
30	2.05	2.05	2.05	2.05	2.05	2.05	2.04	2.00	1.95	1.92	1.89	30

$V_1 = V_R$ | V_2

ANTI-SKID AND NOSE BRAKES OPERATIVE.

PRESSURE ALTITUDE -1000 FT		OAT			
9 TO 10	°F		-60 TO -25	-24 TO 20	21 TO 88
	°C		-51 TO -32	-31 TO -7	-6 TO 29
7 TO 9	°F	-60 TO -31	-30 TO 10	11 TO 49	50 TO 100
	°C	-51 TO -35	-34 TO -12	-11 TO 9	10 TO 38
5 TO 7	°F	-60 TO 5	6 TO 40	41 TO 75	76 TO 108
	°C	-51 TO -15	-14 TO 4	5 TO 24	25 TO 42
3 TO 5	°F	-60 TO 35	36 TO 65	66 TO 102	103 TO 115
	°C	-51 TO 2	3 TO 18	19 TO 39	40 TO 46
1 TO 3	°F	-60 TO 60	61 TO 95	96 TO 120	
	°C	-51 TO 16	17 TO 35	36 TO 49	
-1 TO 1	°F	-60 TO 90	91 TO 120		
	°C	-51 TO 32	33 TO 49		

FLAPS	WEIGHT - 1000 LBS	$V_1=V_R$	V_2	$V_1=V_R$	V_2	$V_1=V_R$	V_2	$V_1=V_R$	V_2
5°	170	144	160	145	160	147	159		
	160	139	156	140	155	142	155		
	150	134	151	136	151	137	150	138	149
	140	128	147	130	146	132	146	134	145
	130	122	142	124	141	126	141	128	140
	120	116	137	118	136	120	136	122	135
	110	109	132	111	131	113	131	116	130
15°	170	136	150	137	149				
	160	131	147	133	146	134	145		
	150	127	142	128	142	129	141		
	140	121	139	123	138	124	137	125	136
	130	116	134	117	133	119	132	120	131
	120	110	130	112	129	113	128	115	127
	110	104	126	106	125	107	123	109	122
25°	160	123	138	124	137	125	136		
	150	118	135	119	133	121	133		
	140	113	131	115	130	116	129	117	128
	130	108	127	110	126	111	125	112	124
	120	103	122	104	122	106	121	107	120
	110	98	118	99	117	100	116	102	115

ADD 1 KNOT FOR CG FWD OF 14% OR GROSS WEIGHT IN EXCESS OF 160,000 LBS

AFTER TAKEOFF NORMAL MANEUVERING SPEEDS

- KTS IAS

FLAPS	BELOW MAX LANDING WT	ABOVE MAX LANDING WT
0	200	210
2	190	200
5	160	170
15	150	160
25	140	150

FOR MANEUVERS IMMEDIATELY AFTER TAKE-OFF EXCEEDING 15° BANK, MAINTAIN AT LEAST V_2 + 10 AT TAKE-OFF FLAPS

ENGINE LIMITS

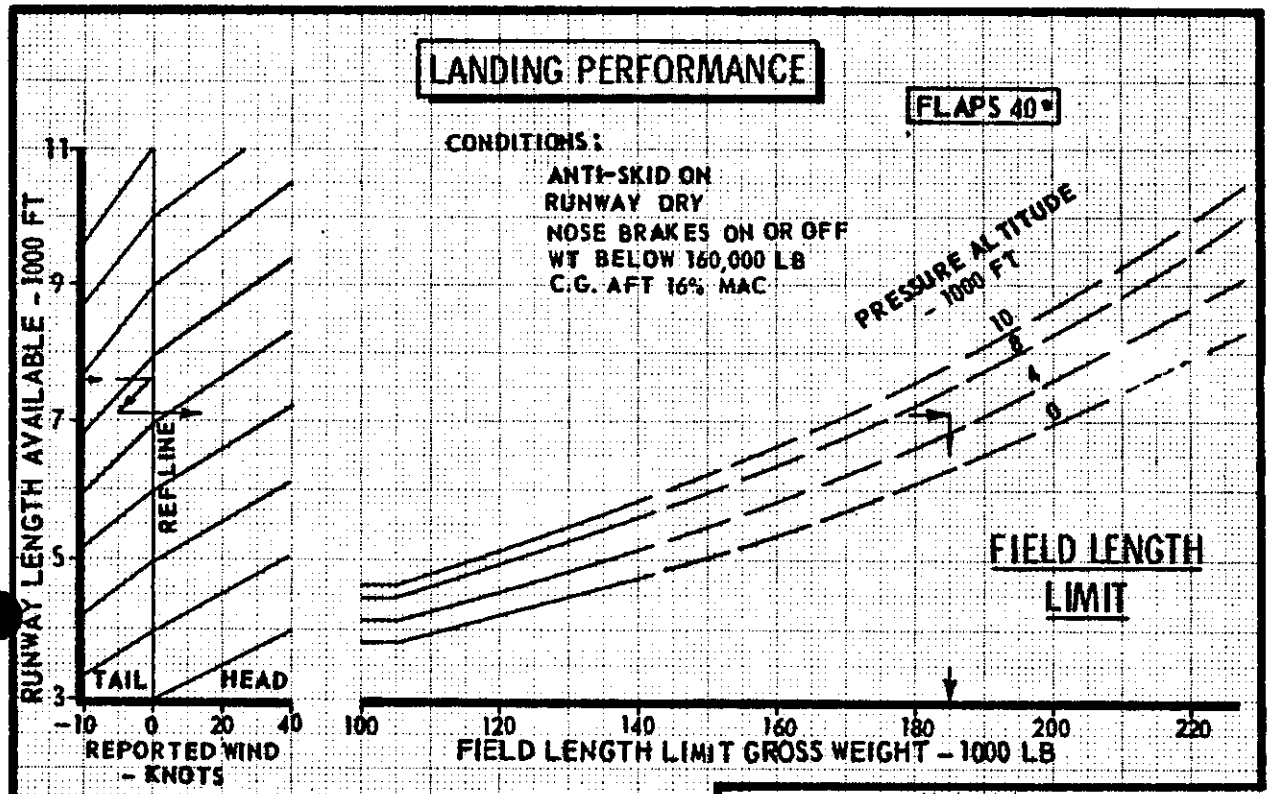
N_1 RPM - 100.1%
N_2 RPM - 100.0%
STARTING EGT
420°C ABOVE 15°C OAT
350°C BELOW 15°C OAT
MAX CONT EGT - 535°C
TAKE-OFF EGT - 570°C

STAB. TRIM SETTING - UNITS AIRPLANE NOSE UP

FLAPS	CG 10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
5°	9¼	8	7½	7	6½	6	5½	5	4½	4¼	3¾	3¼	2¾	2¼	2	1½	1
15°	9	8½	8	7½	7	6½	6	5½	5	4½	4	3½	3	2¼	2	1½	1
25°	9¼	9	8½*	8	7½	7	6½	5¾	5¼	4¾	4½	3¾	3	2½	2	1½	1

* USE 8 UNITS ON AIRPLANES WITHOUT EXTENDED GREEN BAND

FIGURE 5. Takeoff data.



FIELD LENGTH WEIGHT CORRECTIONS

DISPATCH CONDITION	ANTI-SKID	RUNWAY	NOSE BRAKES	WEIGHT CORRECTION
C.G. AFT 16% MAC AND WT BELOW 160,000 LB	ON	DRY	ON	0 LB
			OFF	0 LB
		WET	ON	-14000 LB
			OFF	-22000 LB
	OFF	DRY	OFF	-54000 LB
		WET	OFF	-75000 LB
C.G. FORWARD 16% MAC OR WT ABOVE 160,000 LB	ON	DRY	ON	- 4000 LB
			OFF	- 12000 LB
		WET	ON	- 14000 LB
			OFF	- 28000 LB
	OFF	DRY	OFF	- 61000 LB
		WET	OFF	- 83000 LB

FIGURE 6. Landing performance chart.

GROSS WT -1000 LB	FIELD ELEVATION			
	S.L. FUEL LB	2000 FT FUEL LB	4000 FT FUEL LB	6000 FT FUEL LB
170	1030	1090	1150	1210
165	970	1020	1080	1140
160	920	980	1030	1090
155	880	930	980	1030
150	840	890	940	990
145	800	840	890	940
140	770	810	850	900
135	740	780	820	870
130	710	750	790	830

TIME AND FUEL FROM BRAKE RELEASE TO CLIMB SPEED

TIME = APPROX 3 MIN

PRESS ALT - 1000 FT	TIME-MIN	FUEL-LBS	DIST-NAM
39	20	850	124
37	19	800	112
35	18	700	101
33	17	650	92
31	16	600	86
29	15	600	80
27	14	550	74
25	13	550	68
23	12	500	63
21	11	500	58
19	10	450	52
17	10	450	46
15	9	400	41
10	6	300	26
5	3	150	13

DESCENT PLANNING

FIGURE 7. Climb and descent planning.

PRESS. ALT-FT	CLIMB DATA	DEVIATION FROM ISA - DEGREE(C)								
		-15	-10	-5	-0	5	10	15	20	25
40000	TIME MIN									
	FUEL LBS									
	DIST NAM									
	AVTAS KTS									
39000	TIME MIN	25	31							
	FUEL LBS	5367	6157							
	DIST NAM	177	218							
	AVTAS KTS	423	429							
38000	TIME MIN	21	23	27	33					
	FUEL LBS	4749	5194	5787	6661					
	DIST NAM	145	167	197	243					
	AVTAS KTS	422	427	433	438					
37000	TIME MIN	18	20	23	26	31	39			
	FUEL LBS	4357	4752	5190	5748	6506	7663			
	DIST NAM	128	144	165	193	231	292			
	AVTAS KTS	421	426	431	437	442	448			
36000	TIME MIN	17	18	21	23	27	32	39	52	
	FUEL LBS	4145	4456	4830	5289	5871	6647	7775	9742	
	DIST NAM	116	130	147	169	197	236	294	401	
	AVTAS KTS	420	425	430	436	441	447	453	459	
35000	TIME MIN	15	17	19	21	24	28	34	42	
	FUEL LBS	3952	4236	4574	4983	5491	6144	7031	8354	
	DIST NAM	107	120	135	154	178	209	253	321	
	AVTAS KTS	420	425	430	435	440	446	451	458	
34000	TIME MIN	14	16	18	20	22	26	30	37	47
	FUEL LBS	3788	4053	4366	4740	5199	5777	6536	7592	9217
	DIST NAM	100	112	125	142	163	190	226	279	362
	AVTAS KTS	419	424	429	434	439	445	450	456	463
33000	TIME MIN	13	15	16	18	21	24	28	33	41
	FUEL LBS	3640	3889	4181	4529	4952	5478	6153	7059	8360
	DIST NAM	94	104	117	132	151	175	207	250	314
	AVTAS KTS	418	423	428	433	438	443	449	455	461
32000	TIME MIN	13	14	15	17	19	22	26	30	37
	FUEL LBS	3503	3739	4014	4340	4734	5220	5834	6639	7754
	DIST NAM	88	98	110	124	141	163	190	228	281
	AVTAS KTS	417	422	426	432	437	442	448	453	460
31000	TIME MIN	12	13	15	16	18	21	24	28	34
	FUEL LBS	3375	3598	3859	4167	4537	4989	5555	6285	7274
	DIST NAM	83	92	103	116	132	152	177	210	256
	AVTAS KTS	415	420	425	430	435	441	446	452	458
30000	TIME MIN	11	12	14	15	17	19	22	26	31
	FUEL LBS	3253	3466	3713	4005	4354	4778	5304	5976	6873
	DIST NAM	79	87	97	109	124	142	165	195	236
	AVTAS KTS	414	419	424	429	434	439	444	450	456
29000	TIME MIN	11	12	13	14	16	18	21	24	29
	FUEL LBS	3137	3340	3576	3853	4184	4583	5075	5700	6527
	DIST NAM	74	82	92	103	117	134	155	182	219
	AVTAS KTS	413	417	422	427	432	437	443	448	454
28000	TIME MIN	10	11	12	14	15	17	20	23	27
	FUEL LBS	3025	3219	3444	3708	4021	4397	4858	5441	6207
	DIST NAM	70	78	87	97	110	126	145	170	203
	AVTAS KTS	411	416	420	425	430	435	441	446	452

ENROUTE CLIMB
START CLIMB WT
150,000 LB

NOTE: 1. Enter chart at cruise flight level.
2. Subtract 150 lbs. fuel and $\frac{1}{2}$ min. of time for each 1000 feet that departure airport is above sea level.

FIGURE 8. Enroute climb chart.

IND. MACH .82 CRUISE
PLANNING
3 ENGINES 2 AIRBLEEDS

31,000 FT

ISA=-46.4 DEG C

GROSS WT	OAT-DEG C	-65	-60	-55	-50	-45	-40	-35	-30	-25
165000 LB	MACH/TAS TOTAL FF	.820/458 9015	.820/464 9147	.820/469 9279	.820/474 9411	.820/480 9540	.815/482 9558			
160000 LB	MACH/TAS TOTAL FF	.820/458 8802	.820/464 8931	.820/469 9060	.820/474 9189	.820/480 9315	.820/485 9441	.806/481 9225		
155000 LB	MACH/TAS TOTAL FF	.820/458 8595	.820/464 8721	.820/469 8847	.820/474 8973	.820/480 9096	.820/485 9222	.816/488 9267		
150000 LB	MACH/TAS TOTAL FF	.820/458 8400	.820/464 8523	.820/469 8646	.820/474 8769	.820/480 8889	.820/485 9012	.820/490 9132	.804/486 8904	
145000 LB	MACH/TAS TOTAL FF	.820/458 8214	.820/464 8334	.820/469 8454	.820/474 8574	.820/480 8691	.820/485 8811	.820/490 8928	.815/492 8937	
140000 LB	MACH/TAS TOTAL FF	.820/458 8034	.820/464 8154	.820/469 8271	.820/474 8388	.820/480 8505	.820/485 8615	.820/490 8736	.820/495 8850	
135000 LB	MACH/TAS TOTAL FF	.820/458 7875	.820/464 7992	.820/469 8106	.820/474 8220	.820/480 8334	.820/485 8448	.820/490 8562	.820/495 8673	.811/495 8595
130000 LB	MACH/TAS TOTAL FF	.820/458 7719	.820/464 7833	.820/469 7944	.820/474 8056	.820/480 8169	.820/485 8280	.820/490 8391	.820/495 8502	.820/500 8610
125000 LB	MACH/TAS TOTAL FF	.820/458 7575	.820/464 7686	.820/469 7797	.820/474 7908	.820/480 8016	.820/485 8127	.820/490 8235	.820/495 8343	.820/500 8451
120000 LB	MACH/TAS TOTAL FF	.820/458 7434	.820/464 7542	.820/469 7650	.820/474 7758	.820/480 7866	.820/485 7974	.820/490 8079	.820/495 8187	.820/500 8292
115000 LB	MACH/TAS TOTAL FF	.820/458 7302	.820/464 7410	.820/469 7515	.820/474 7623	.820/480 7728	.820/485 7833	.820/490 7938	.820/495 8043	.820/500 8145
110000 LB	MACH/TAS TOTAL FF	.820/458 7173	.820/464 7281	.820/469 7383	.820/474 7486	.820/480 7593	.820/485 7695	.820/490 7800	.820/495 7902	.820/500 8004
105000 LB	MACH/TAS TOTAL FF	.820/458 7062	.820/464 7167	.820/469 7269	.820/474 7371	.820/480 7473	.820/485 7575	.820/490 7677	.820/495 7776	.820/500 7878
100000 LB	MACH/TAS TOTAL FF	.820/458 6954	.820/464 7056	.820/469 7158	.820/474 7257	.820/480 7359	.820/485 7458	.820/490 7557	.820/495 7656	.820/500 7755

FIGURE 9. Cruise planning chart.

ENROUTE HIGH ALTITUDE - U.S.

For use at and above 18,000' MSL

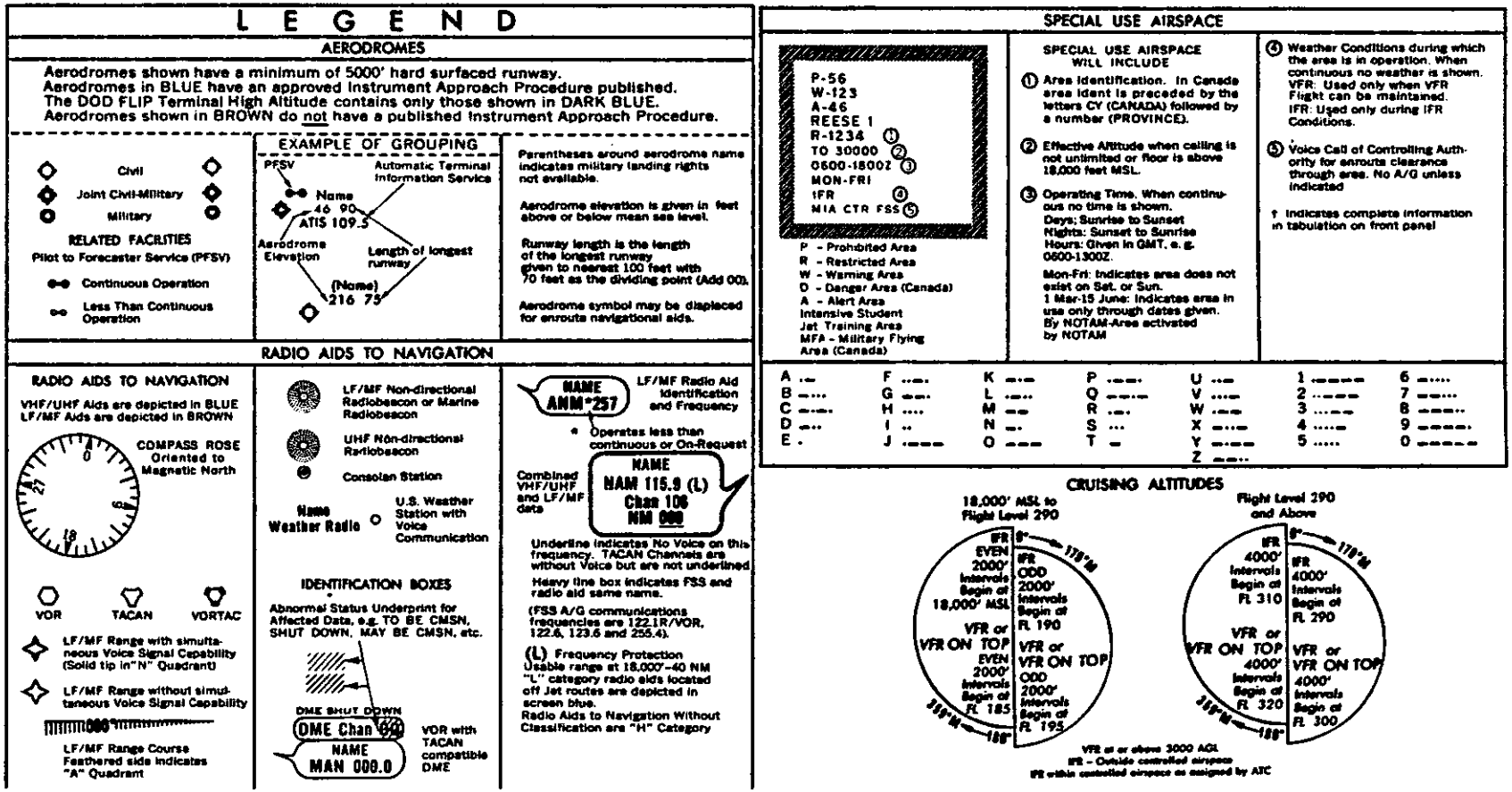


FIGURE 10. Enroute chart legend.

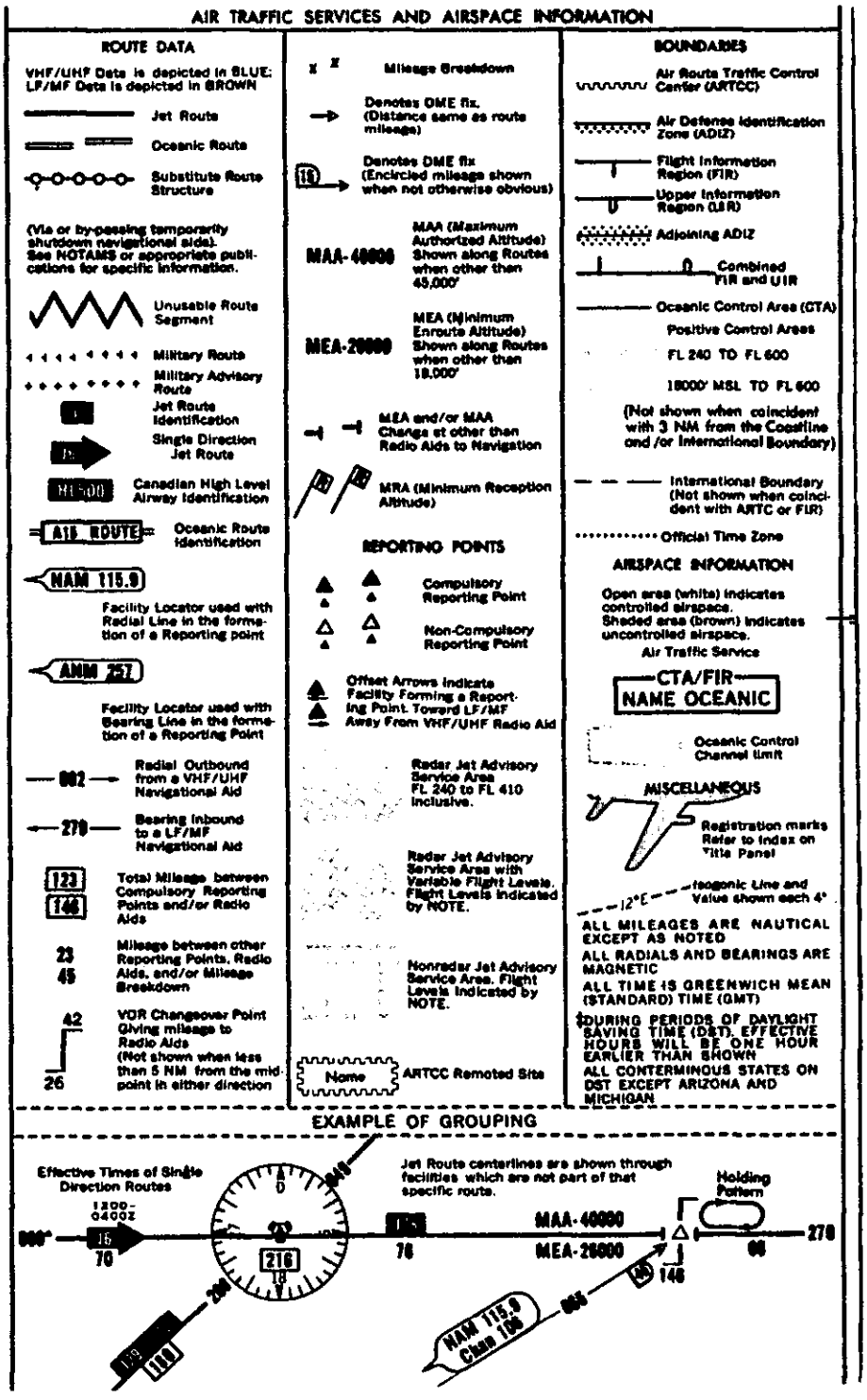


FIGURE 11. Enroute chart legend.

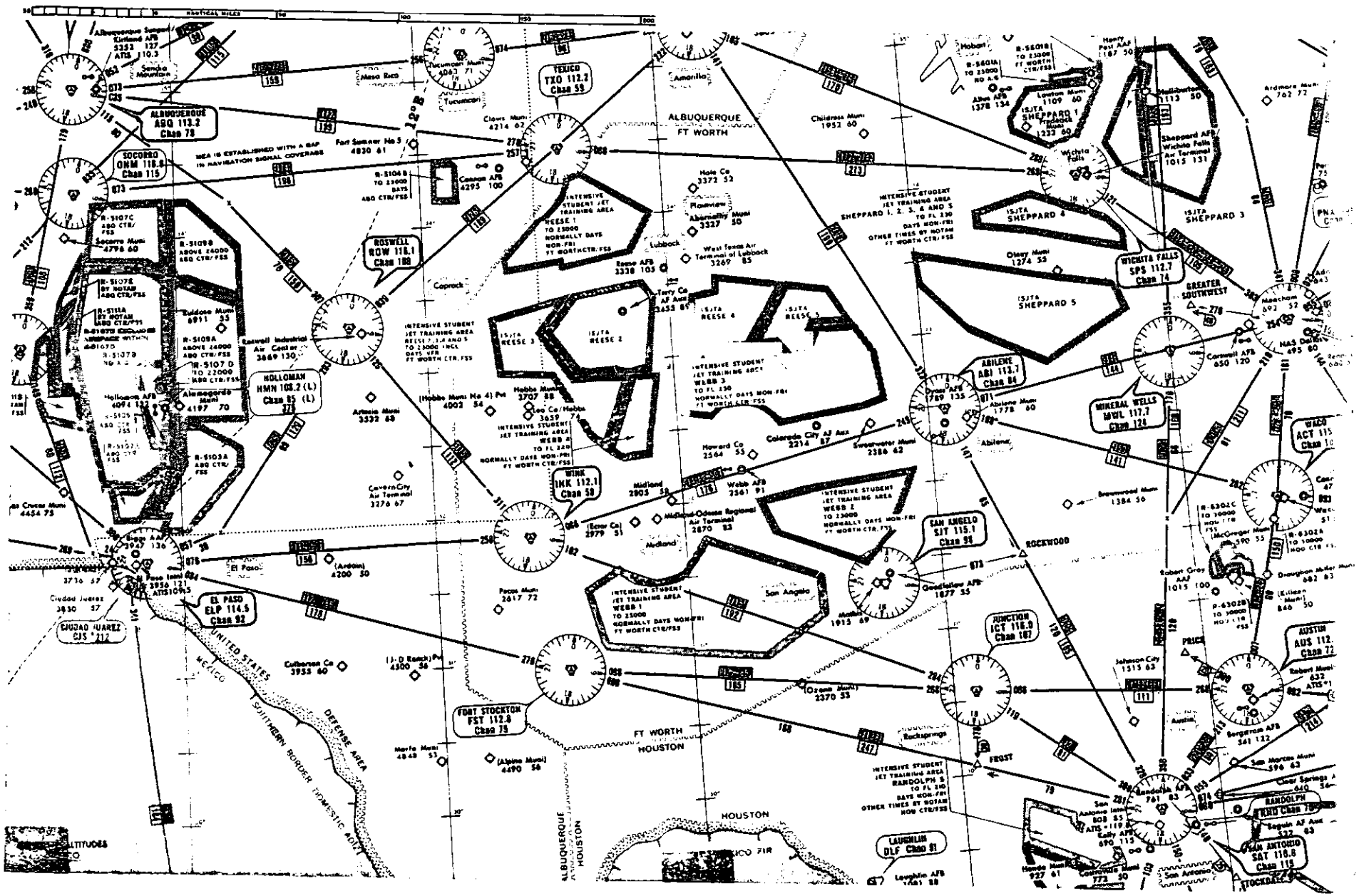


FIGURE 12. Segment—Enroute high altitude chart.

443-470 O - 71 (Face p. 421 No. 1

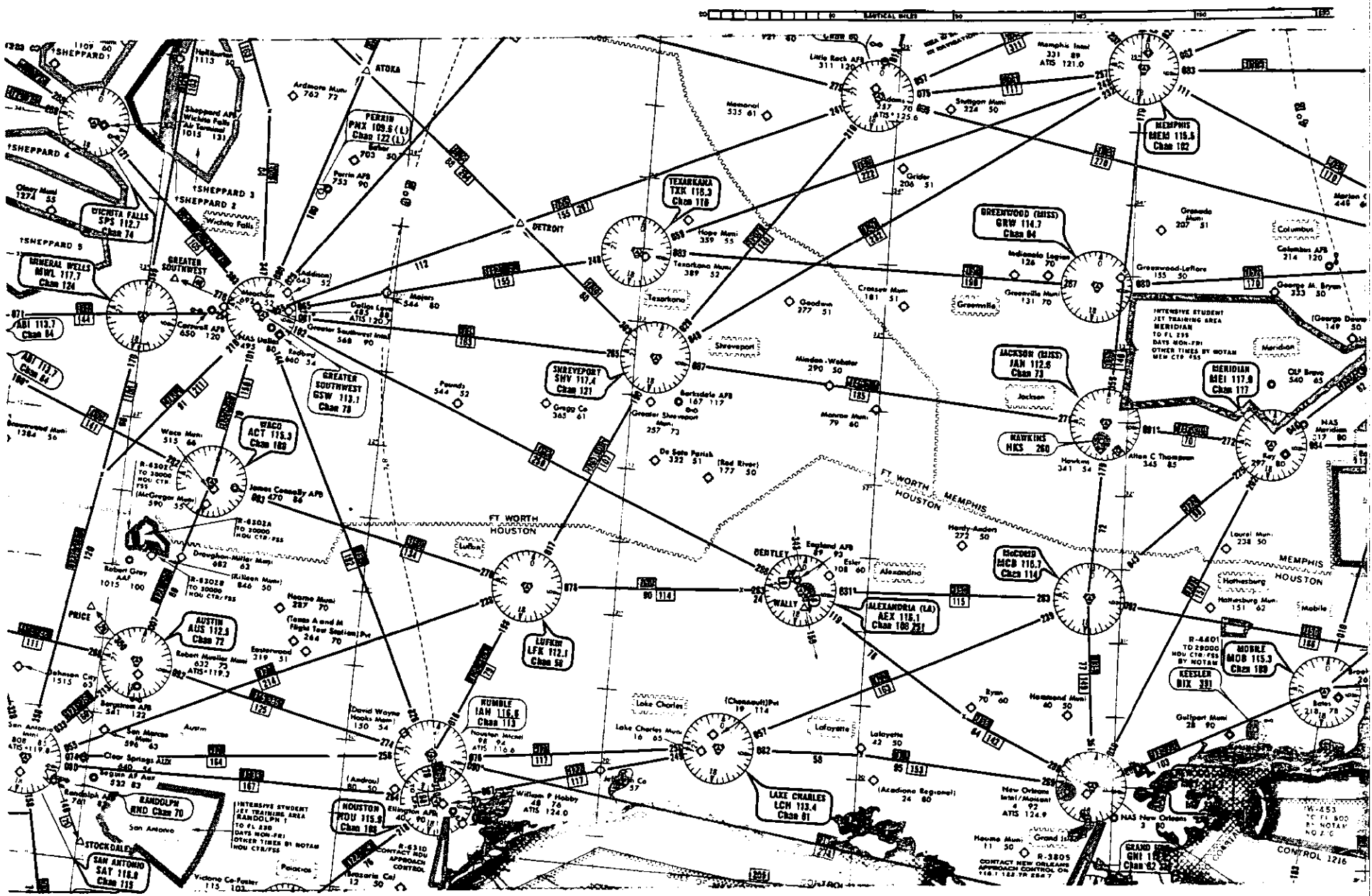


FIGURE 13. Segment—Enroute high altitude chart.

443-6fu O - 71 (Face p. 42) No. 2

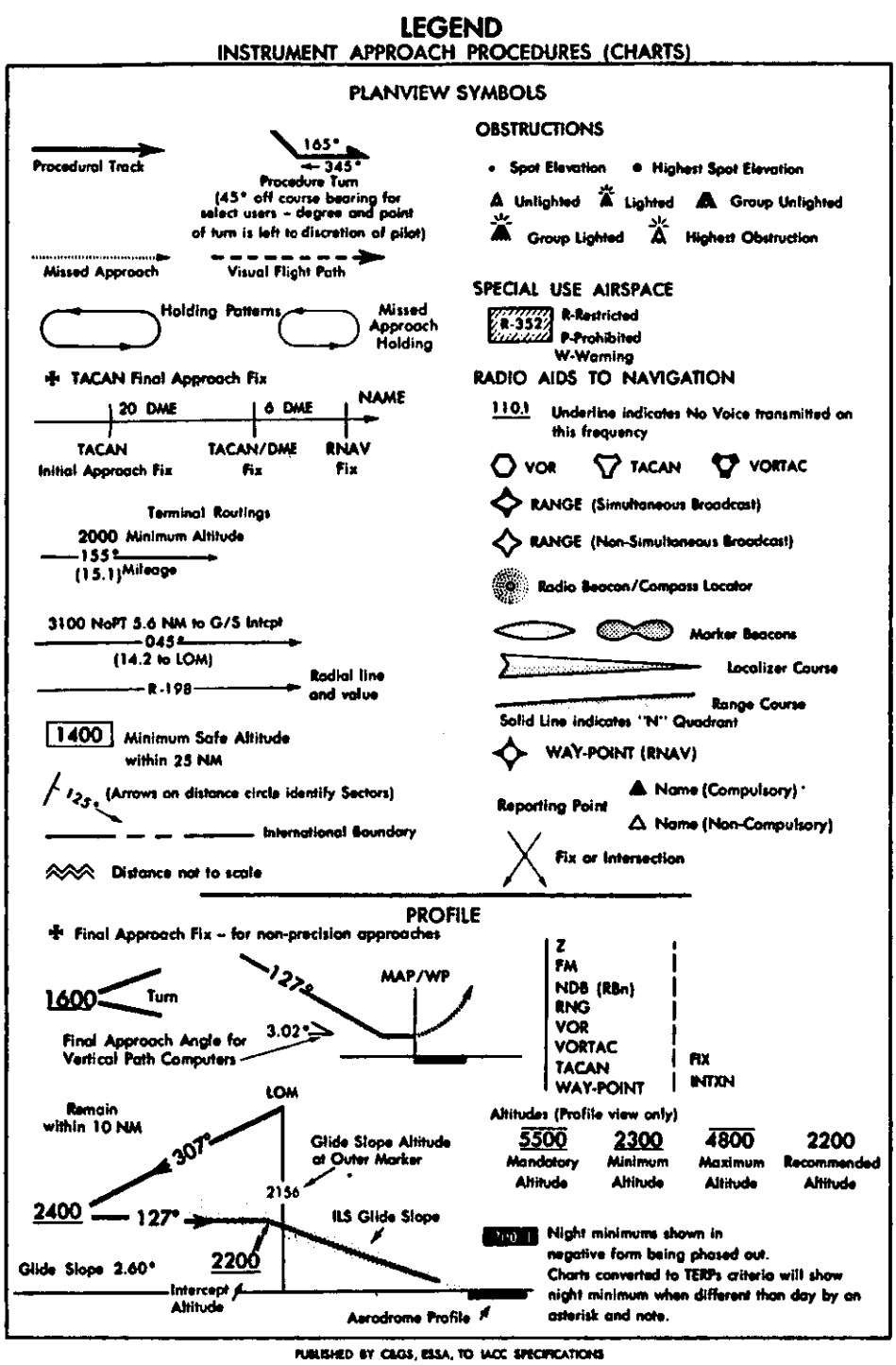


FIGURE 14. Legend—approach charts.

LEGEND

INSTRUMENT APPROACH PROCEDURES (CHARTS)

AERODROME SKETCH

Runways

Hard Surface — Other Than Hard Surface — Hardstands/Taxiways

Closed Runways and Taxiways — Under Construction — Metal Surface

Over-run — Displaced Threshold

Arresting Gear

uni-directional — bi-directional — Jet Barrier

- Control Tower
  When Control Tower and Rotating Beacon are co-located, Beacon symbol will be used and further identified as TWR.
- Rotating Aerodrome Beacon.
- U.S. Navy Optical Landing System (OLS) "OLS" location is shown because of its height of approximately 7 feet and proximity to edge of runway may create an obstruction for some types of aircraft.

Ⓗ Helicopter Alighting Area (the prop type symbol is being phased out).

Approach light symbols are shown on a separate legend.

0.8% → UP Total Runway Gradient (shown when runway gradient exceeds 0.3%)

0.8% → DOWN Take-Off Gradient (shown when runway gradient for first 5000' exceeds 0.5%). This take-off gradient being phased out.

▲ Indicates other than standard Alternate Minimums apply for U.S. Army and Civil, refer to tabulation.

▼ Indicates other than standard Take-off Minimums or departures procedures apply for Civil users. Civil users refer to tabulation. DOD users refer to Service Directives and DOD produced civil SID publication.

S/S Sliding Scale applicable to U.S. Army

GENERAL INFORMATION & ABBREVIATIONS

All distances in nautical miles (except Visibility Data which is in statute miles and Runway Visual Range which is in hundreds of feet)

Runway dimensions in feet.

Elevations in feet Mean Sea Level.

All radials/bearings are Magnetic.

ADF . . . . . Automatic Direction Finder
ALS . . . . . Approach Light System.
BC . . . . . Back Course.
CHAN . . . . . Channel.
DH . . . . . Decision Height.
DME . . . . . Distance Measuring Equipment.
HAA . . . . . Height Above Aerodrome.
HAT . . . . . Height Above Touchdown.
HIRL . . . . . High Intensity Runway Lights.
INTXN . . . . . Intersection.
LDA . . . . . Localizer Type Directional Aid
LDIN . . . . . Lead in Light System
LOC . . . . . Localizer
MALS . . . . . Medium Intensity Approach Light System.
MDA . . . . . Minimum Descent Altitude.
NDB . . . . . Non-directional Radio Beacon.
NoPT . . . . . No Procedure Turn Required Unless ATC advised.
PAR/ASR . . . . . Published Radar Minimums at this Aerodrome.
Radar Required . . . . . Radar vectoring required for this approach.
Radar Vectoring . . . . . May be expected through any portion of the Nav Aid Approach, except final.
RAIL . . . . . Runway Alignment Indicator Lights
RBn . . . . . Radio Beacon.
REIL . . . . . Runway End Identifier Lights.
RCLS . . . . . Runway Centerline Light System
Runway Touchdown Zone . . First 3000' of Runway.
RVR . . . . . Runway Visual Range.
SALS . . . . . Short Approach Light System.
(S) SALS . . . . . (Simplified) Short Approach Light System.
TAC . . . . . TACAN
TDZ . . . . . Touchdown Zone
TDZL . . . . . Touchdown Zone Lights

PUBLISHED BY: C&GS, ESSA, TO IACC SPECIFICATIONS

FIGURE 15. Legend—approach charts.

INSTRUMENT APPROACH PROCEDURES (CHARTS)
APPROACH LIGHTING SYSTEMS—UNITED STATES

Actual length will be shown on Airport Diagram for any system, or portion thereof, not conforming to standard lengths listed on this page.

Each approach lighting system indicated on Airport Diagrams will bear system identification letter (A, B, etc.) indicated in legend.

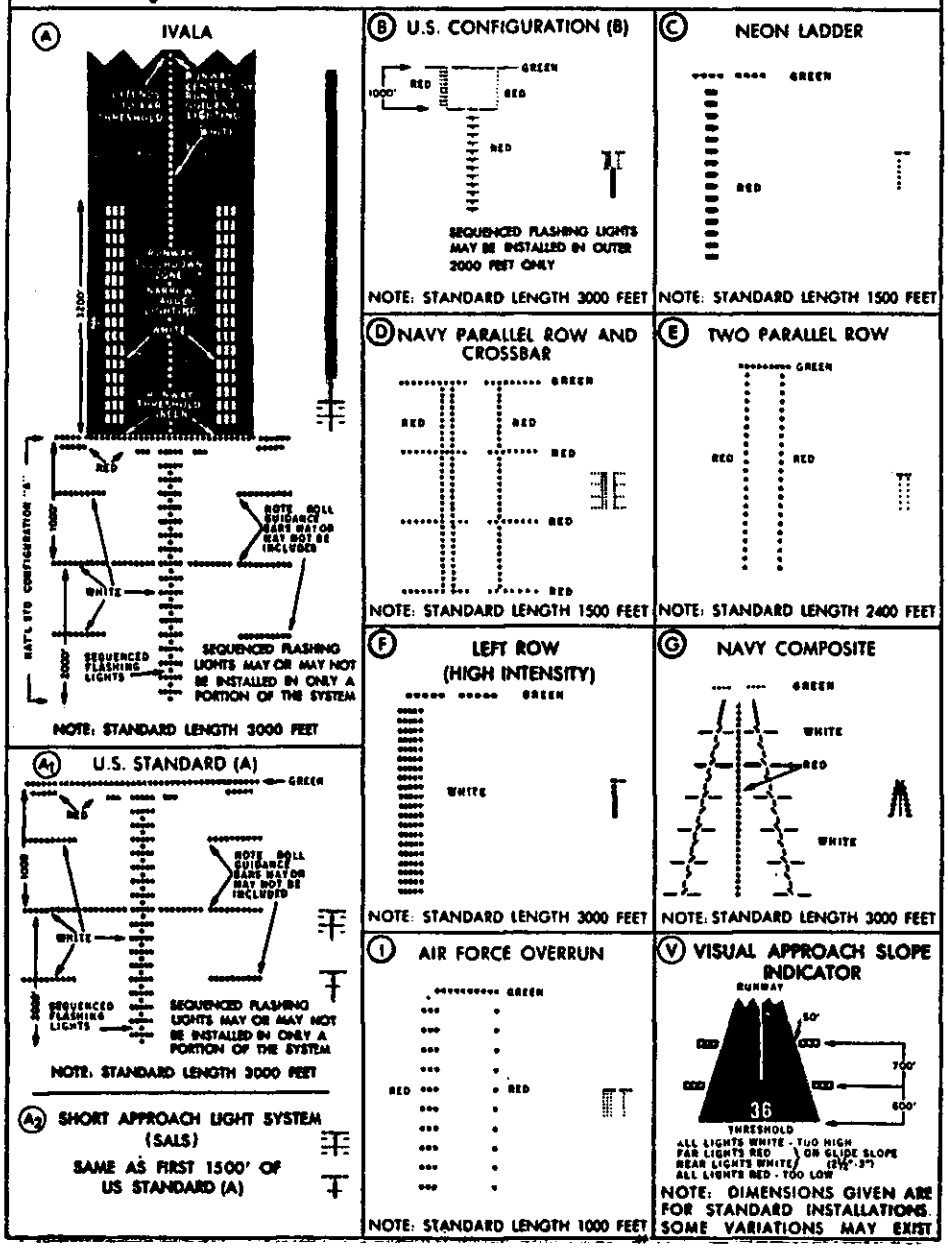


FIGURE 16. Approach light systems.

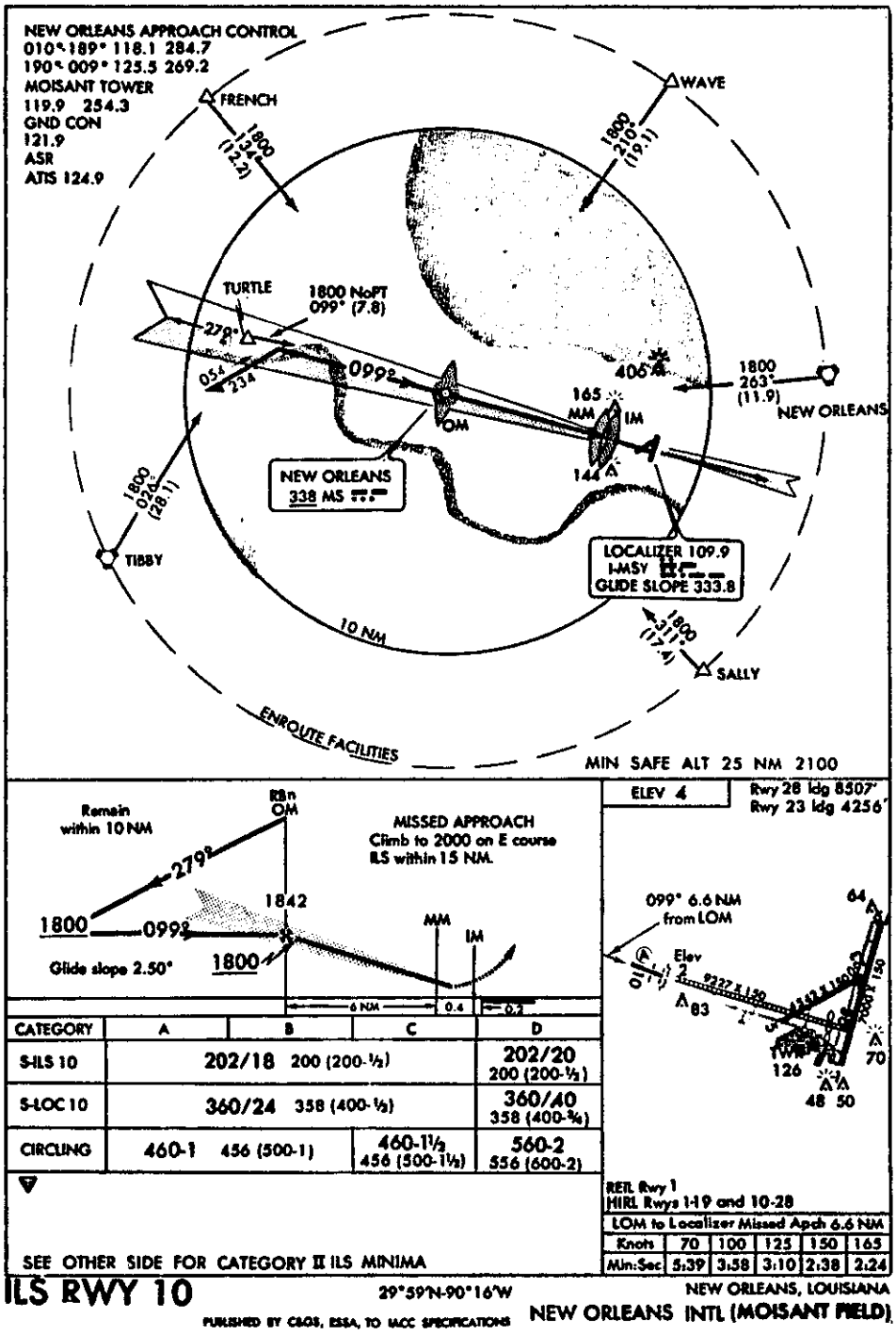


FIGURE 17. Approach chart—MSY.

KEY TO AVIATION WEATHER REPORTS.....

LOCATION IDENTIFIER AND TYPE OF REPORT*	SKY AND CEILING	VISIBILITY WEATHER AND OBSTRUCTION TO VISION	SEA-LEVEL PRESSURE	TEMPERATURE AND DEW POINT	WIND	ALTIMETER SETTING	RUNWAY VISUAL RANGE	CODED PIREPS
MKC	150M250⊕	1R-K	132	/58/56	/18Ø7	/993/	RØ4LVR2ØV4Ø	/⊕55

SKY AND CEILING

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

Sky cover symbols are

○ Clear: Less than 0.1 sky cover.

◑ Scattered: 0.1 to less than 0.6 sky cover.

● Broken: 0.6 to 0.9 sky cover.

⊕ Overcast: More than 0.9 sky cover.

– Thin (When prefixed to the above symbols.)

–X Partial obscuration: 0.1 to less than 1.0 sky hidden by precipitation or obstruction to vision (bases at surface.)

X Obscuration: 1.0 sky hidden by precipitation or obstruction to vision (bases at surface.)

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

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

VISIBILITY

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

WEATHER AND OBSTRUCTION TO VISION SYMBOLS

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

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

WIND

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

EXAMPLES: 3627 360 Degrees, 27 Knots;

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

ALTIMETER SETTING

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

RUNWAY VISUAL RANGE (RVR)

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

CODED PIREPS

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

DECODED REPORT

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

*TYPE OF REPORT

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

FIGURE 18. Key to aviation weather reports.

KEY TO AVIATION WEATHER FORECASTS.....

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

CEILING: Identified by the letter "C"
CLOUD HEIGHTS: In hundreds of feet above the station (ground)
CLOUD LAYERS: Stated in ascending order of height
VISIBILITY: In statute miles, but omitted if over 6 miles
SURFACE WIND: In tens of degrees and knots; omitted when less than 10.

EXAMPLE OF TERMINAL FORECASTS

CI5●	Ceiling 1500', broken clouds	O11/2GF	Clear, visibility one and one-half miles, ground fog.
20@C70@6K 3230G	Scattered clouds at 2000', ceiling 7000' overcast, visibility 6 miles, smoke, surface wind 320 degrees 30 knots, gusty.	CSX1/4S+	Sky obscured, vertical visibility 500 ft. visibility one-fourth mile, heavy snow.

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

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

WINDS AND TEMPERATURES ALOFT (FD) FORECASTS are computer prepared forecasts of wind direction (nearest 10° true N) and speed (knots) for selected flight levels. Temperatures aloft (°C) are included for all levels (±2500 ft. above station elevation) except the 3000-foot level.

EXAMPLES OF WINDS AND TEMPERATURES ALOFT (FD) FORECASTS:

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

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
BOS	3127	3425-07	3420-11	3421-16	3516-27	3512-38	311649	292451	283451
JFK	3026	3327-08	3324-12	3322-16	3120-27	2923-38	284248	285150	285749

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

PILOTS report in-flight weather to nearest FSS

FIGURE 19. Key to aviation weather forecasts.

STATION IDENTIFIERS

ELP	El Paso, Texas	SAT	San Antonio, Texas
INK	Wink, Texas	ACT	Waco, Texas
ABI	Abilene, Texas	HOU	Houston, Texas
MWL	Mineral Wells, Texas	SHV	Sherveport, Louisiana
GSW	Fort Worth, Texas	MLU	Monroe, Louisiana
ABQ	Albuquerque, New Mexico	MSY	New Orleans, Louisiana
TCC	Tucumcari, New Mexico	FSM	Fort Smith, Arkansas
AMA	Amarillo, Texas	LIT	Little Rock, Arkansas
SPS	Wichita Falls, Texas	MEM	Memphis, Tennessee

FA MSY Ø51245
13Z MON-Ø1Z TUE

LA S HLF MISS MOBILE AREA OF ALA FLA W OF 85 DEG CSTL WTRS

HGTS ASL UNLESS NOTED

SYNS. RDG OVR AREA MOVG EWD AS FRONT ENTRS NW LA BY Ø1Z. LOW MOVG ACRS NRN GLFMEX THRU MON.

CLDS AND WX. OVR WRN LA AND ADJT CSTL WTRS C2Ø-4Ø⊕ LYRD TO 35Ø. OCNL C1Ø⊕2R SPRDG EWD THRU DAY. FEW TSTMS AHD FRONT NWRN LA TOPS 4ØØ.

ELSW C6Ø-1ØØ⊕35Ø WITH OCNL R-. CONDS LWRG FM W AND S TO C2Ø-4Ø⊕35Ø AND R- BY Ø1Z.

ICG. OCNL MDT MXD ICGICIP ABV FRZG LVL 5Ø INTR LND SLPG TO 11Ø CSTL WTRS.

TURBC. MDT TO SVR IN BLDUPS.

OTLK Ø1Z-19Z TUE. GENLY C8-1Ø⊕2-4R- SPRDG OVR ALL AREA WITH C6⊕4Ø BHND FRONT. TRW CONTG ALG AND AHD FRONT. CLRG WRN LA AFT 18Z.

FT1 Ø517ØØ

17ØØZ MON-Ø5Z TUE

ABQ O Ø915G OCNL 5ØⒹ. 19Z 5ØⒹ 1Ø2ØG. Ø1Z 5ØⒹ1ØØⒹ 1215..
MSY C2ØⒹ6Ø⊕3R-F Ø612. 2ØZ C16Ⓓ4Ø⊕3R- Ø612. ØØZ C6⊕3R- Ø612 CHC TRW..
SHV C8Ⓓ3Ø⊕4R- 121Ø ⒹVⒹ. 19Z C6⊕3R- 121Ø. Ø4Z CFP C8⊕4R- Ø215..
HOU 2ⒹC5⊕2R-F Ø712 VRBL C2⊕1R-F. 23Z CFP C5⊕5R- 3617G ISOLD TRA+. Ø2Z C8⊕5R- 3617G..
MLU C2ØⒹ8Ø⊕7 OCNL R-. 2ØZ C15⊕3R- 121Ø. 23Z C6⊕3R- 121Ø..
MEM C8Ø⊕7 1812. 2ØZ C3Ø⊕7 1812 SCTD RW-. ØØZ C15⊕5R--F 2Ø12. Ø3Z CFP C15⊕5H 3612G OCNL RW-..
LIT C6Ø⊕7 Ø91Ø OCNL RW-. 2ØZ C2Ø⊕5R--F 1412 VRBL C12⊕2R-F. ØØZ CFP C12⊕5F 3612G VRBL C1Ø⊕3SW-F..
ELP O. 2ØZ 5ØⒹ1ØØⒹ 2715G. ØØZ 35Ⓓ1ØØⒹ Ø715G..
SAT 1ØⒹC18⊕7 351Ø OCNL C1Ø⊕2R-F. 2ØZ CFP 8ⒹC15⊕5R- 3617G VRBL C8⊕2R- ISOLD TRW. 23Z C12⊕ Ø215G OCNL C8⊕5R-E-..

FIGURE 20. Area and terminal forecasts.

SA 05 1600Z

```
ELP O4Ø 172/39/28/23Ø5/ØØ7
INK /-Ø15 215/29/22/Ø115G25/Ø13
ABI M11Ø2ØØ2Ø 194/43/37/321Ø/ØØ9
MWL E1Ø11/2R-F 2ØØ/43/42/Ø9Ø4/Ø12
GSW S M3VØ11/2R-F 2Ø7/42/42/35Ø6/Ø13/ R13VRNO CIG 2V4
ABQ O6Ø 214/19/9/36Ø5/ØØ6
TCC S W12X2S-F 28Ø/15/7/Ø615/Ø24/ PRESRR
AMA -XM8Ø/Ø1S-BSF 251/12/7/Ø22ØG28/Ø17/RØ3VR24V6Ø S1
SPS M13Ø8 214/28/25/3623G28/Ø14
SAT 6ØM12Ø25Ø8 174/48/46/Ø1Ø9/ØØ4/RE38→SAT↘12/29 UR
ACT M3VØ11/2RF 196/43/43/34Ø4/ØØ9/R18VV11/4 CIG 2V4→ACT↘12/2 CNW UR
HOU M3Ø21/2R-F 168/50/50/0815G22/CO2
SHV 25ØE8ØØ5R-K 226/4Ø/36/12Ø9/Ø19/ FEW SCUD 6 HND
MLU 12ØØUØ15 239/42/35/15Ø9/Ø23
MSY M5ØØ8ØØ3R-F 241/48/45/Ø71Ø/Ø23→MSY↘1/5 XX
FSM M18Ø15R- 24Ø/38/34/Ø8Ø5/Ø22
LIT E8ØØ7 257/4Ø/29/Ø4Ø4/Ø28
MEM M8ØØ13ØØ12 265/45/26/17Ø8/Ø3Ø/BINOVC
```

SA 05 1700Z

```
ELP O2Ø 18Ø/48/38/281Ø/Ø11 VIS LWR E-S
INK /Ø15+ 217/32/23/3613G25/Ø14
ABI M13Ø15 2Ø4/32/22/3616G28/Ø11
MWL S E3Ø2R--F 196/44/42/Ø7Ø5/Ø1Ø
GSW S M4VØ11/2R-F 2Ø5/42/42/Ø3Ø7/Ø12/R13VRNO CIG 3V5
ABQ O6Ø 223/24/1Ø/36Ø8/Ø1Ø
TCC -XE12Ø2S-F 283/16/7/Ø419/Ø25/ S4 F2
AMA S 8ØUØ2S-BS 264/11/5/Ø22ØG3Ø/Ø2Ø
SPS M15Ø8 23Ø/26/23/Ø121G26/Ø18
SAT S M7Ø2ØØ12 168/5Ø/47/Ø2Ø8/ØØ2→SAT↘12/29 UR
ACT M3VØ11/2RF 187/44/43/36Ø7/ØØ7/R18VV11/2PLUS CIG 2V4→ACT↘
    12/2CNW UR
HOU S M3Ø21/2R-F 5Ø/5Ø/Ø815G2Ø/ØØØ
SHV M6Ø25Ø3R-FK 215/41/39/12Ø9/Ø15
MLU E11ØØ/Ø15 233/43/37/1512/Ø21
MSY S M7Ø19Ø3R-F 231/47/44/Ø711/Ø2Ø→MSY↘1/5 XX
FSM S 3Ø9ØM18Ø6R- 234/39/36/Ø8Ø6/Ø21
LIT E6ØØ1Ø 251/41/28/Ø6Ø4/Ø26
MEM M75Ø12ØØ12 258/48/25/1712/Ø28/BINOVC
```

FIGURE 21. Surface weather reports.

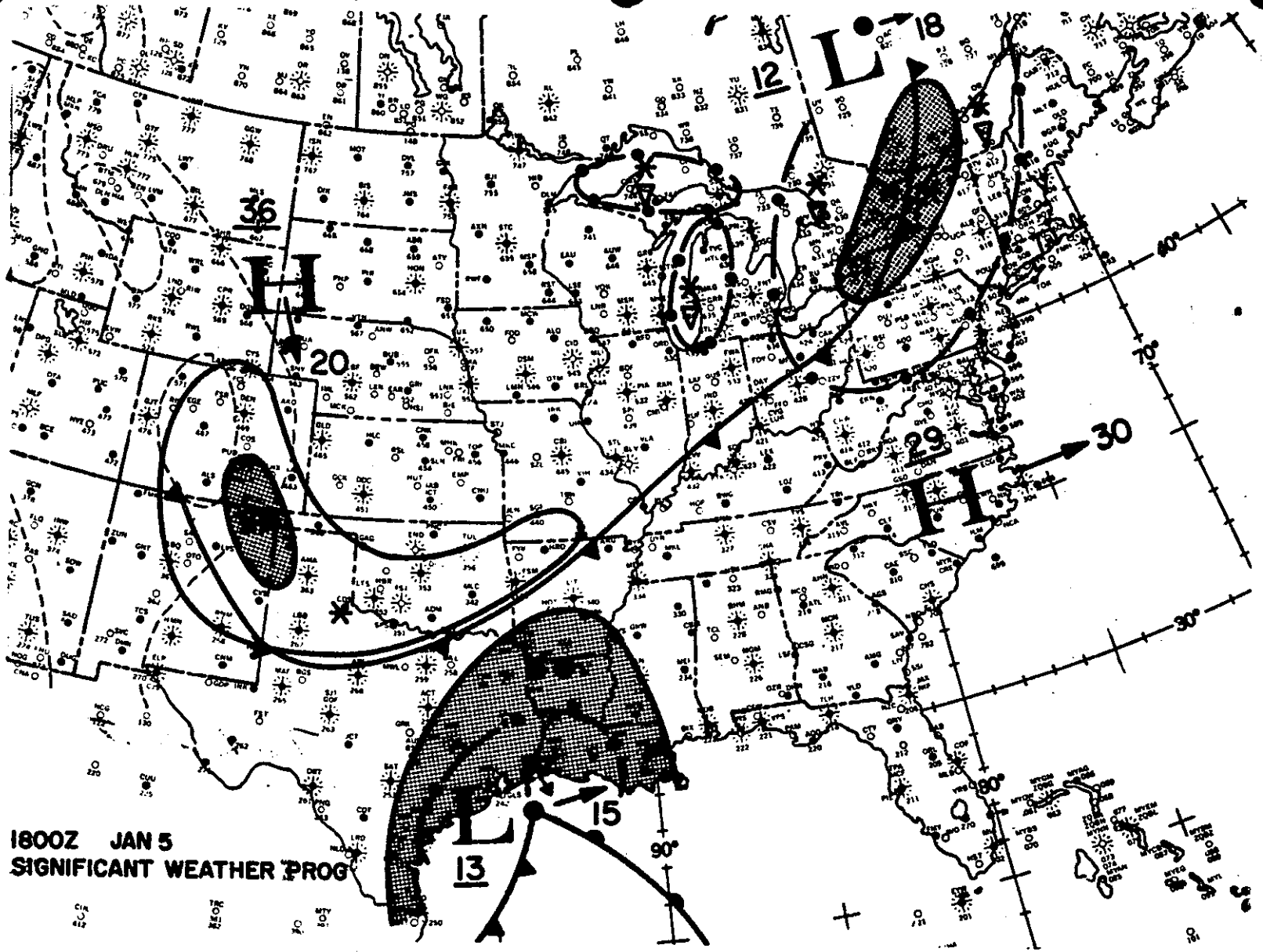


FIGURE 22. Significant weather prog chart, U.S.

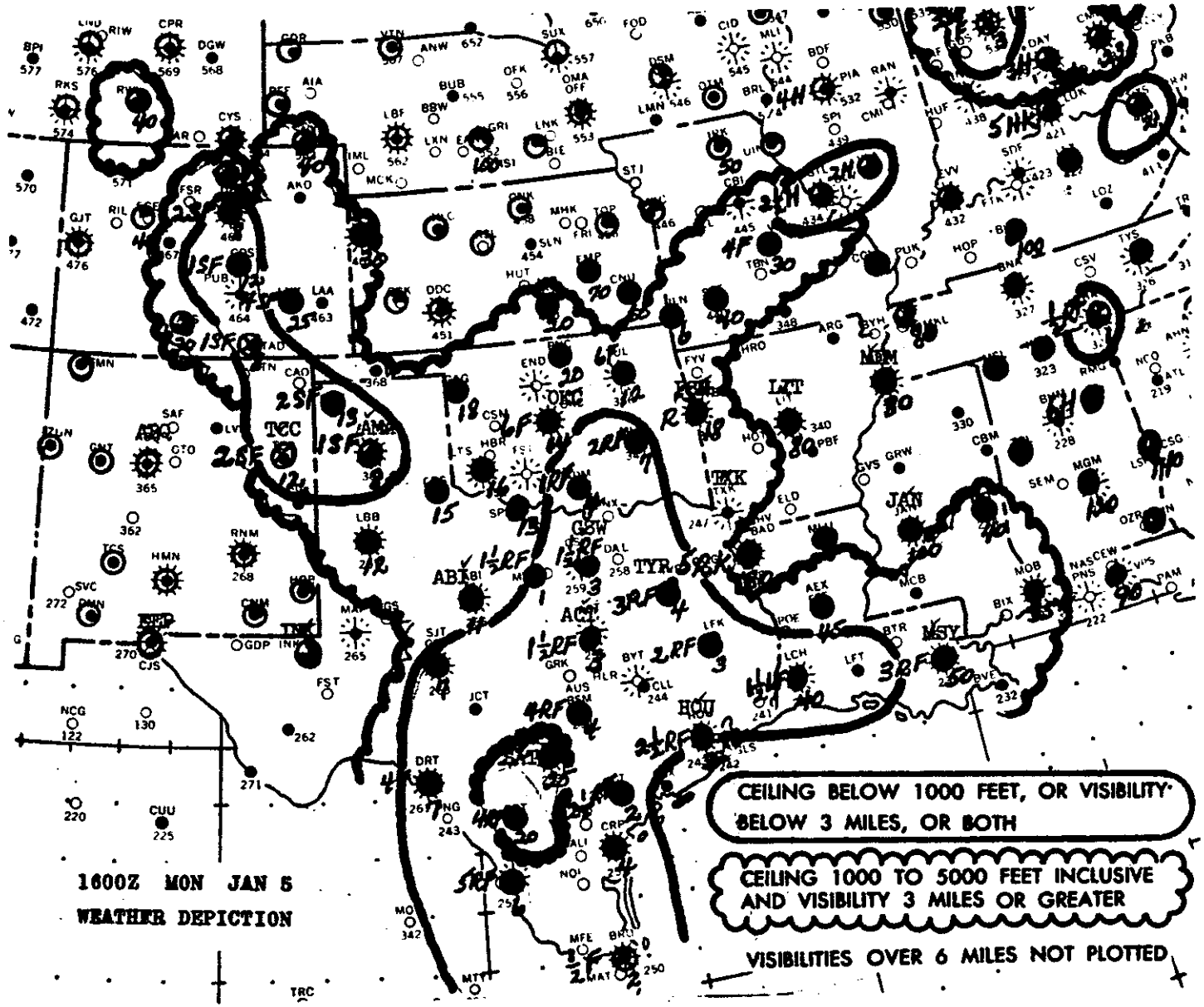


FIGURE 23. Weather depiction chart.

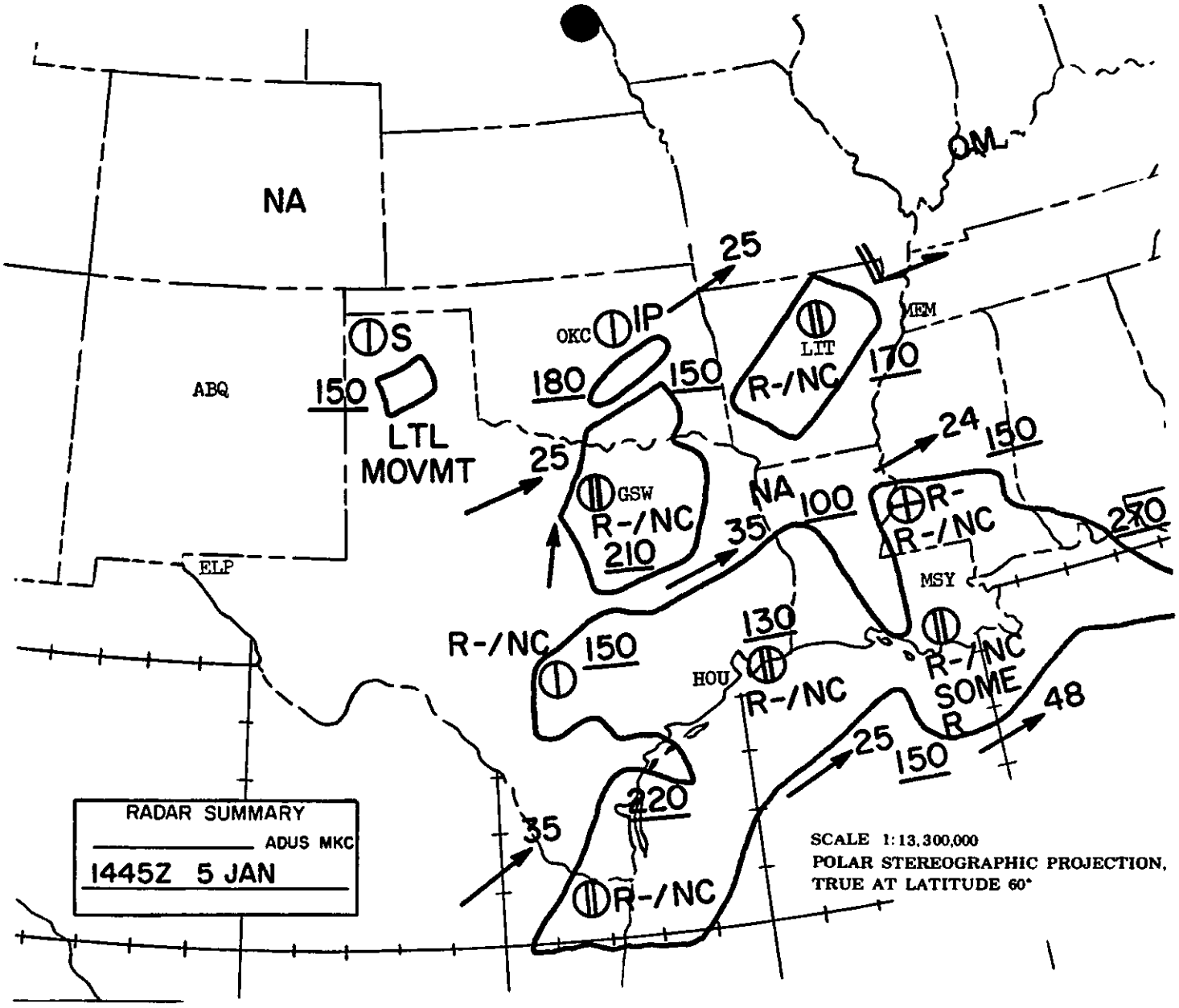


FIGURE 24. Radar summary chart.

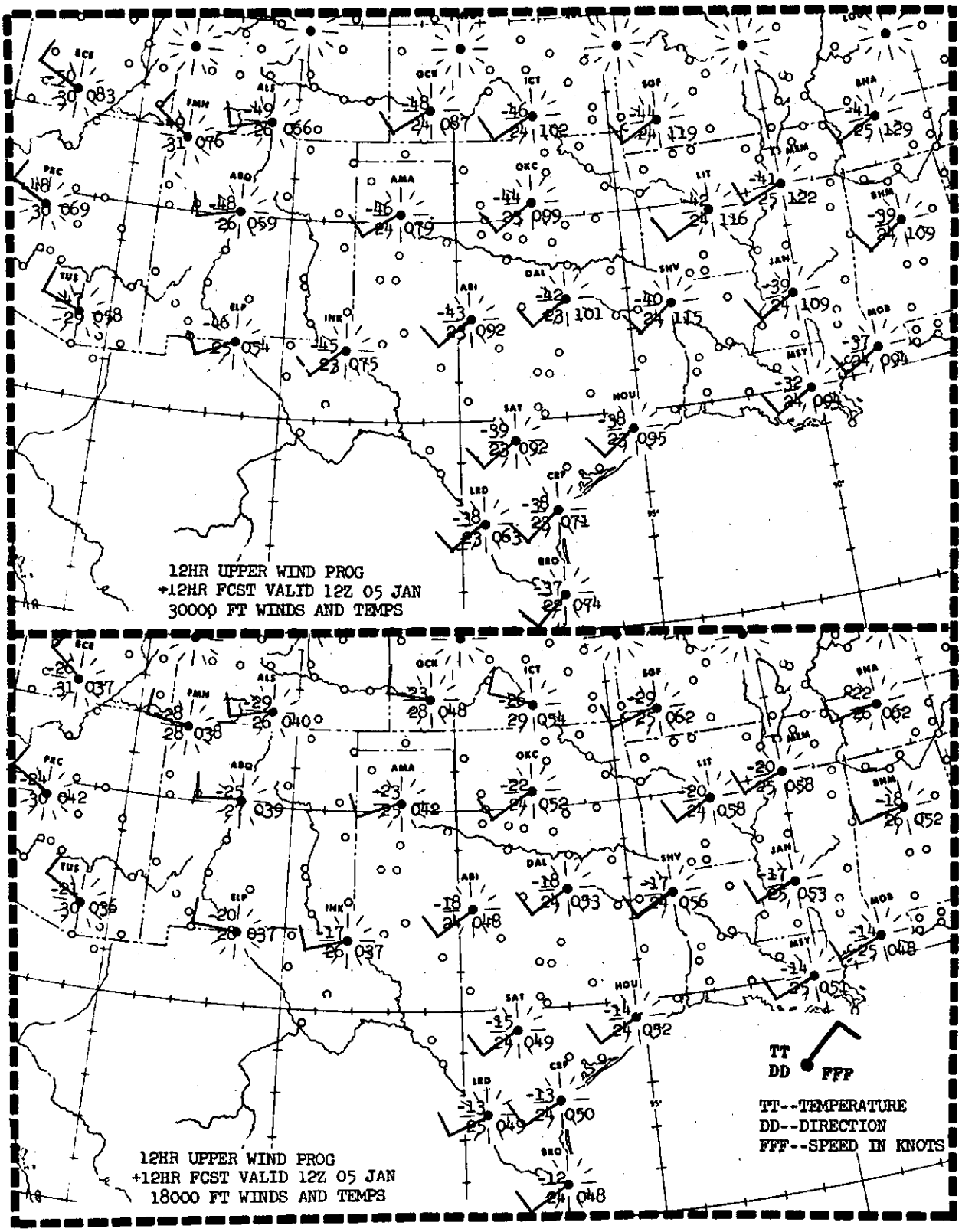


FIGURE 25. Upper wind progs.

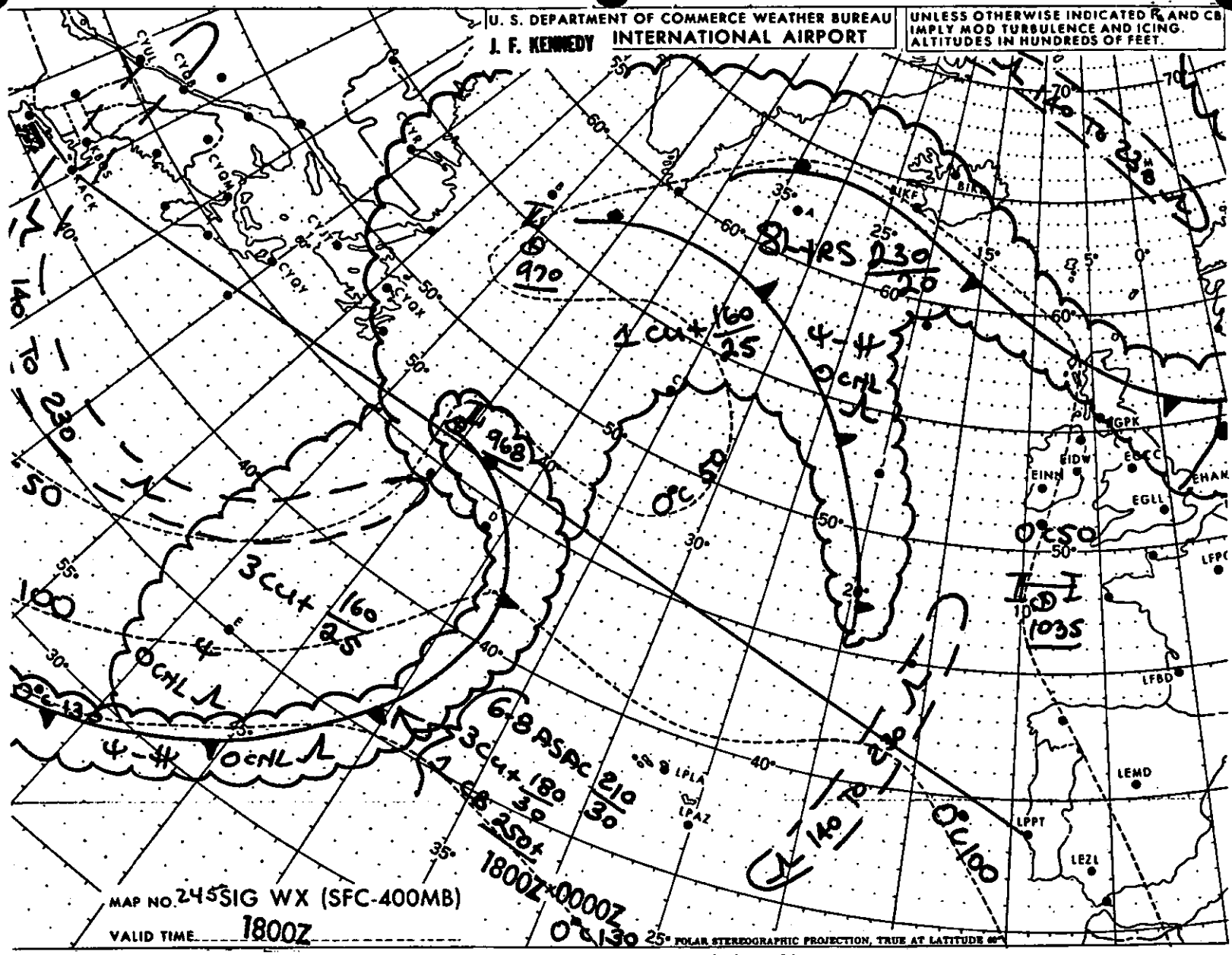


FIGURE 26. Significant weather prog (SFC-400 MB).

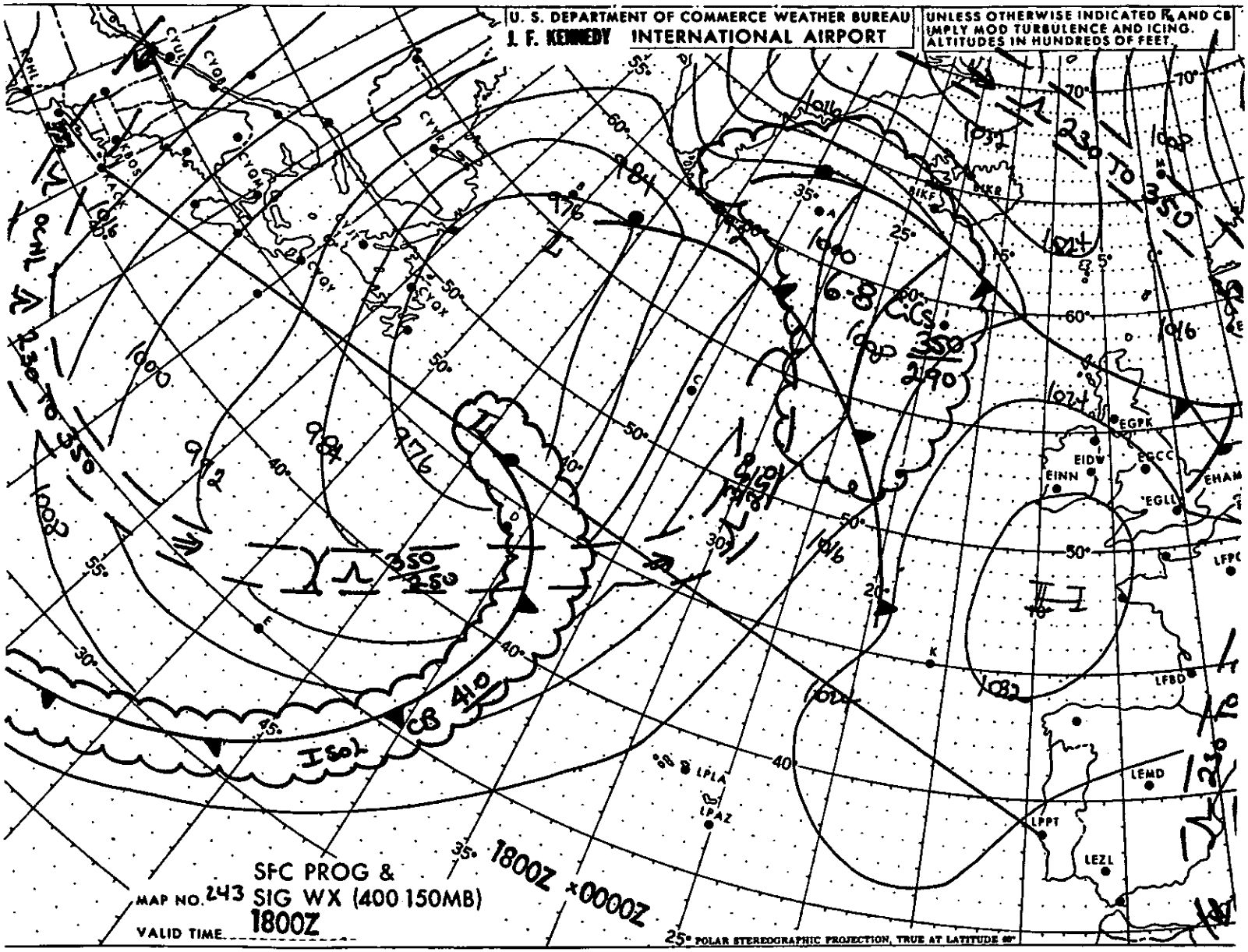


FIGURE 27. Significant weather prog (400–150 MB).

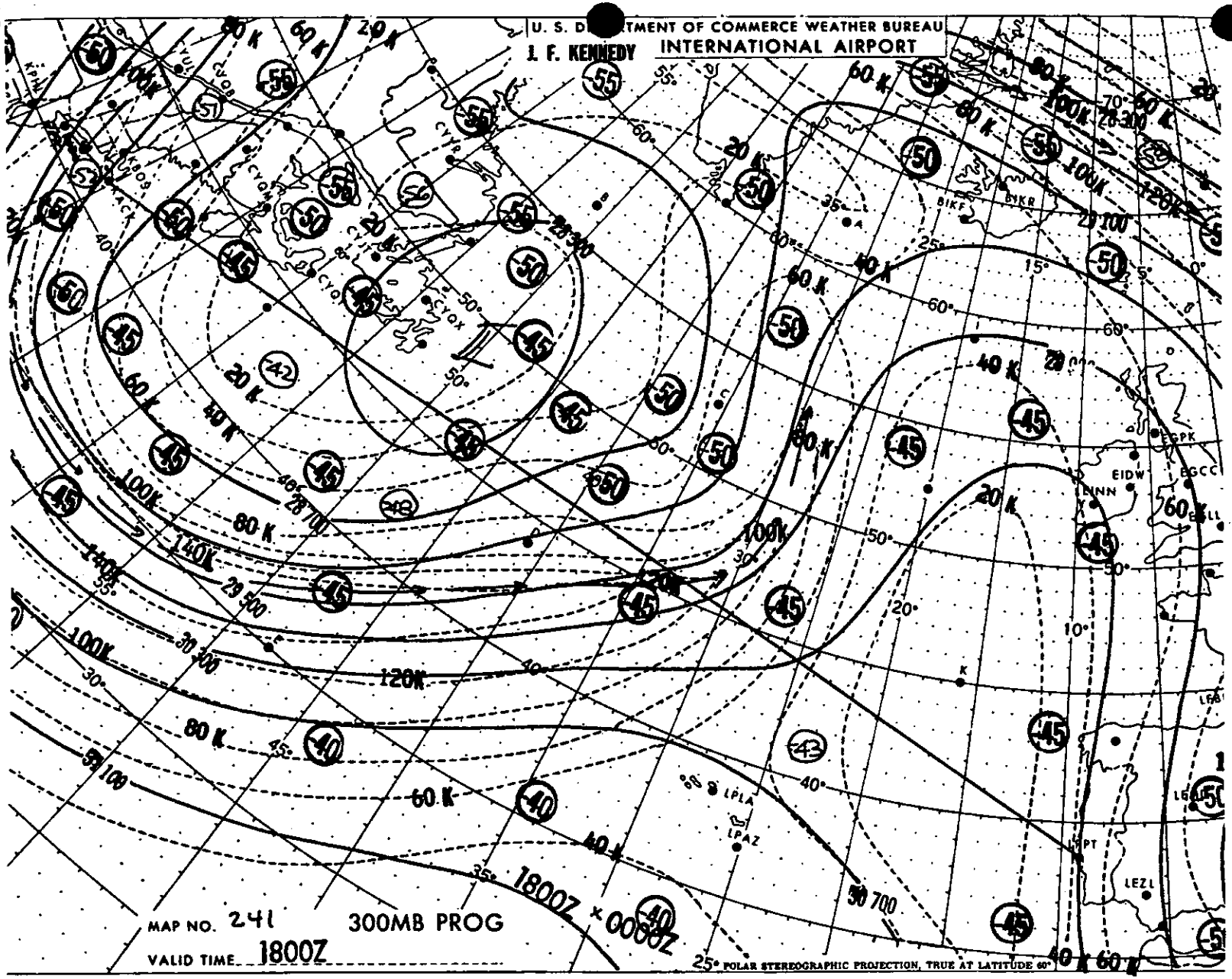


FIGURE 28. 300-millibar prog chart.

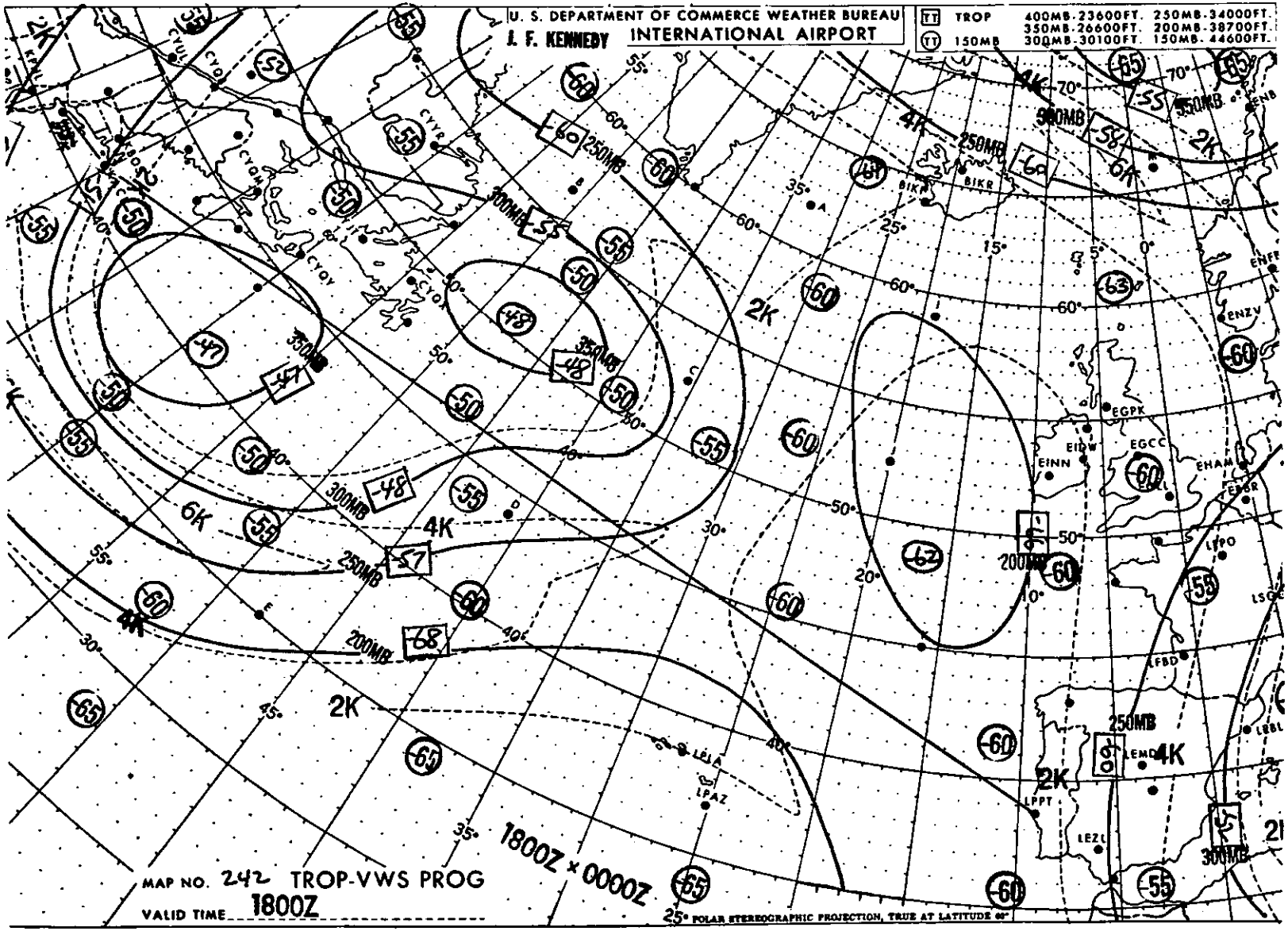


FIGURE 29. Tropopause-vertical wind shear chart.

FLIGHT TIME ANALYSIS

CHECK POINTS		ROUTE CRUISE ALT./FLT. LEVEL	TRUE COURSE	AIRSPEED-KTS.		WINDS ALOFT DIRECTION VELOCITY TEMPERATURE	DRIFT CORR ANGLE	GROUND SPEED	DISTANCE N.M.	TIME		FUEL CONSUMPTION LBS./GALS.		MISC.
FROM	TO			EAS OR MACH NO.	TAS					LEG	TOTAL	LEG	TOTAL	
ABQ Sunport	Top of Climb	J72/Climb	---	---	415	+40 kts.	---		---	0:15		*5,400		*Includes taxi fuel
TOC	TXO	J72/FL 310	---	.80		+60 kts. -45°C.	---		85					
TXO	SPS	" "	---	.80		+70 kts. -45°C.	---							
SPS	GSW	" "	---	.80		+20 kts. -40°C.	---							
GSW	AEX	J58/FL 310	---	.80		+70 kts. -40°C.	---							
AEX	Top of Descent	" "	---	.80		+20 kts. -35°C.	---		78					
Top of Descent	Turtle Intersec.	Radar Vector 2000	---	---	320	+30	---		44			600		
Turtle Intersec.	Airport	ILS	---	---	---	-------	---		---	0:06		300		

ALTERNATE DATA

MSY	MEM	J35/FL 220	---	---	---	-------	---	---	---	---	0:36

FUEL SUMMARY

	TIME	LBS./GALS.
ENROUTE		
ALTERNATE		
RESERVE		
EXTRA		
TOTAL		

*Includes taxi fuel

INSTRUCTIONS:
1. Use information listed above in your flight plan computations.
2. For cruise and reserve fuel computations, use 8,600 pounds per hour.
3. Round off total fuel to the nearest 100 pounds.
4. Round off total time to nearest minute.

FAA AC 71-2860

FIGURE 30. Flight time analysis.

U. S. GOVERNMENT PRINTING OFFICE: 1971 O - 443-470