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ABSTRACT

This question book was developed by the Federal Aviation Administration (FAA) for testing applicants who are preparing for certification as airline transport pilots, aircraft dispatchers, or flight navigators. The publication contains several innovative features that are a departure from previous FAA publications related to air carrier personnel certification written tests: (1) testing materials related to the pilot who seeks to advance to the airline transport pilot level are contained in this book, rather than in the previous two separate books; and (2) the test questions are multiple choice, but have three, rather than four, alternative answers, to allow the use of new scoring techniques. The book has been developed to test applicants in the following knowledge areas: air transport pilot-airplane (in two parts), added rating--airplane, helicopter, added rating--helicopter; aircraft dispatcher; and flight navigator. Extensive appendixes provide statistical and background materials needed to answer the questions, including 157 figures. (Answers to the questions are not included, nor are they published by the FAA.) (KC)

AIRLINE TRANSPORT PILOT, AIRCRAFT DISPATCHER, AND FLIGHT NAVIGATOR

QUESTION BOOK

U.S. Department of Transportation

Federal Aviation Administration

Expires September 1, 1991

AIRLINE TRANSPORT PILOT, AIRCRAFT DISPATCHER, AND FLIGHT NAVIGATOR

1989

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Aviation Standards National Field Office

PREFACE

This question book has been developed by the Federal Aviation Administration (FAA) for testing applicants who are preparing for certification as airline transport pilots, aircraft dispatchers, or flight navigators.

The publication contains several innovative features which are a departure from previous FAA issuances related to air carrier airman certification written tests. These new features are:

1. Testing materials related to the pilot who seeks to advance to the airline transport pilot level are contained in this book. These testing materials are appropriate for testing pilots who have had training or actual experience in flight operations conducted under either FAR Part 121 or FAR Part 135. This feature eliminates the publication of two separate books which contained a significant amount of redundant materials. The combined question book contains test items covering all the written test variations formerly covered in the two books. The airline transport pilot applicant may still request a test related to his or her particular training or experience as related to operations conducted under FAR Part 121 or FAR Part 135.

2. The test questions contained in this publication are all multiple-choice type, a standard practice for all FAA certification written tests. However, the test questions contained in this book have been developed to offer the applicant three alternative answers, rather than the four-answer format used on other FAA written tests. This change has been adopted to allow the use of new scoring analysis techniques.

This question book has been developed to test applicants in the following knowledge areas:

Airline Transport Pilot (FAR Part 121) Airplane
Airline Transport Pilot (FAR Part 135) Airplane
Airline Transport Pilot (FAR Part 135) Added Rating-Airplane
Airline Transport Pilot (FAR Part 135) Helicopter
Airline Transport Pilot (FAR Part 135) Added Rating-Helicopter
Aircraft Dispatcher
Flight Navigator

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or from U.S. Government Printing Office bookstores located in major cities throughout the United States.

The questions included in this publication are predicated on regulations, principles, and practices that were valid at the time of publication. The question selection sheets prepared for use with this question book are security items and are revised at frequent intervals.

The FAA does NOT publish, supply, or make available the correct answers to questions included in this book. Students should determine the answers by research and study, by working with instructors, or by attending ground schools. The FAA is NOT responsible for either the content of commercial reprints of this book or the accuracy of the answers they may list.

Comments regarding this publication should be directed to:

U.S. Department of Transportation
Federal Aviation Administration
Aviation Standards National Field Office
Examinations Standards Branch
Operations Standards Section, AVN-131
P.O. Box 25082
Oklahoma City, OK 73125

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GENERAL INSTRUCTIONS

MAXIMUM TIME ALLOWED FOR TEST: 6 HOURS

TEST MATERIALS

Materials to be used with this question book when used for airman testing:

1. AC Form 8080-3, Airman Written Test Application, which includes the answer sheet.
2. Question selection sheet which identifies the questions to be answered.
3. Plastic overlay sheet which can be placed over performance charts for plotting purposes.

TAKING THE TEST

1. Read the instructions on page 1 of AC Form 8080-3, and complete page 4 of the form.
2. The question numbers in the question book are numbered consecutively beginning with number 5001. Refer to the question selection sheet to determine which questions to answer.
3. For each item on the answer sheet, find the appropriate question in the question book.
4. Mark your answer in the space provided for that item on the answer sheet.
5. Miscellaneous reference materials are in appendix 2.
6. The supplementary material required to answer the questions will be found in appendix 3.
7. Read each question carefully and avoid hasty assumptions. Do not answer until you understand the question. Do not spend too much time on any one question. Answer all the questions that you readily know and then reconsider those you find difficult. Be careful to make necessary conversions when working with temperatures, speeds, and distances.

If a regulation, chart, or operations procedure is changed after this question book is printed, you will receive credit for the affected question until the next question book revision.

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THE MINIMUM PASSING GRADE IS 70

WARNING

§ 61.37 Written tests: Cheating or other unauthorized conduct.

(a) Except as authorized by the Administrator, no person may—

(1) Copy, or intentionally remove, a written test under this part;

(2) Give to another, or receive from another, any part or copy of that test;

(3) Give help on that test to, or receive help on that test from, any person during the period that test is being given;

(4) Take any part of that test in behalf of another person;

(5) Use any material or aid during the period that test is being given; or

(6) Intentionally cause, assist, or participate in any act prohibited by this paragraph.

(b) No person whom the Administrator finds to have committed an act prohibited by paragraph (a) of this section is eligible for any airman or ground instructor certificate or rating, or to take any test therefore, under this chapter for a period of 1 year after the date of that act. In addition, the commission of that act is a basis for suspending or revoking any airman or ground instructor certificate or rating held by that person.

INTRODUCTION TO THE AIRLINE TRANSPORT PILOT, AIRCRAFT DISPATCHER, AND FLIGHT NAVIGATOR QUESTION BOOK

This question book presents the FAA written tests to the applicants. The book consists of questions on subject areas pertaining to the airline transport pilot, aircraft dispatcher, and flight navigator certificates. This question book is scheduled for revision each 24 months, and associated question selection sheets will be revised periodically as required.

At an FAA testing center or an FAA designated written test examiner's facility, the applicant is issued a "clean copy" of this question book, an appropriate question selection sheet which indicates the specific questions to be answered, and AC Form 8080-3, Airman Written Test Application, which contains the answer sheet. The question book contains all the supplementary material required to answer the questions. This material will be found in appendix 2 and appendix 3.

Questions and Scoring

Answers to questions listed on the question selection sheet should be marked on the answer sheet of AC Form 8080-3. Directions should be read carefully before beginning the test. Incomplete or erroneous personal information entered on this form delays the scoring process. The answer sheet is sent to the Mike Monroney Aeronautical Center in Oklahoma City where it is scored by computer. The applicant will then be issued an AC Form 8080-2, Airman Written Test Report. This report must be presented for a flight test or for retesting in the event of written test failure. The applicant's AC Form 8080-2 will list the subject matter knowledge codes for the knowledge areas in which the applicant is found to be deficient. The written test subject matter knowledge codes, which list these knowledge areas by code, are located in apppendix 1 of this question book.

Taking the Test

The test may be taken at FAA testing centers, FAA written test examiners' facilities, or other designated places. After completing the test, the applicant must surrender the issued question book, question selection sheet, answer sheet, and any papers used for computations or notations, to the monitor before leaving the test room.

When taking the test, the applicant should keep the following points in mind:

1. Answer each question in accordance with the latest regulations and procedures.
2. Read each question carefully before looking at the possible answers. You should clearly understand the problem before attempting to solve it.
3. After formulating an answer, determine which of the alternatives most nearly corresponds with that answer. The answer chosen should completely resolve the problem.
4. From the answers given, it may appear that there is more than one possible answer; however, there is only one answer that is correct and complete. The other answers are either incomplete or are derived from popular misconceptions.
5. If a certain question is difficult for you, it is best to proceed to other questions. After the less difficult questions have been answered, return to those which gave you difficulty. Be sure to indicate on the question selection sheet the questions to which you wish to return.
6. When solving a computer problem, select the answer nearest your solution. The problem has been checked with various types of computers; therefore, if you have solved it correctly, your answer will be closer to the correct answer than to any of the other choices.
7. To aid in scoring, enter personal data in the appropriate spaces on the test answer sheet in a complete and legible manner. Enter the test number printed on the question selection sheet.

Retesting—FAR Section 61.49

Applicants who receive a failing grade may apply for retesting

1. after 30 days from the date the applicant failed the test; or
2. in case of the first failure, the applicant may apply for retesting before the 30 days have expired upon presenting a written statement from an authorized instructor certifying that the instructor has given ground instruction to the applicant and finds the applicant competent to pass the test.

The AC Form 8080-2, Airman Written Test Report, must be presented for the practical test, or for retesting in the event of written test failure.

QUESTIONS

5001. What is an area identified by the term stopway?

1—An area, at least the same width as the runway, capable of supporting an airplane during a normal takeoff.
2—An area designated for use in decelerating an aborted takeoff.
3—An area, not as wide as the runway, capable of supporting an airplane during a normal takeoff.

5002. Regulations concerning the operational control of a flight refer to

1—the specific duties of any required crewmember.
2—exercising authority over initiating, conducting, or terminating a flight.
3—exercising the privileges of pilot in command of an aircraft.

5003. What is a definition of the term crewmember?

1—Only a pilot, flight engineer, or flight navigator assigned to duty in an aircraft during flight time.
2—A person assigned to perform duty in an aircraft during flight time.
3—Any person assigned to duty in an aircraft during flight except a pilot or flight engineer.

5004. What is the name of a plane beyond the end of a runway which does not contain obstructions and can be considered when calculating takeoff performance of turbine-powered aircraft?

1—Clearway.
2—Stopway.
3—Obstruction clearance plane.

5005. The minimum steady flight speed or stalling speed in the landing configuration is represented by the symbol

1—V_S.
2—V_{S1}.
3—V_{SO}.

5006. Which is the correct symbol for the stalling speed or the minimum steady flight speed at which the airplane is controllable?

1—V_{SO}.
2—V_S.
3—V_{S1}.

5007. Which is the correct symbol for design cruising speed?

1—V_C.
2—V_S.
3—V_{MA}.

5008. Which speed symbol indicates the maximum operating limit speed for an airplane?

1—V_{LE}.
2—V_{MO}/M_{MO}.
3—V_{LO}/M_{LO}.

5009. What is the correct symbol for minimum unstick speed?

1—V_{MU}.
2—V_{MD}.
3—V_{FC}.

5010. Which is a definition of V_2 speed?

1—Takeoff decision speed.
2—Takeoff safety speed.
3—Minimum takeoff speed.

5011. When a temporary replacement is received for an airman's medical certificate, for what maximum time is this document valid?

1—30 days.
2—60 days.
3—90 days.

5012. Unless otherwise authorized, the pilot in command is required to hold a type rating when operating any

1—aircraft that is certificated for more than one pilot.
2—aircraft having a gross weight of more than 12,500 pounds.
3—multiengine aircraft having a gross weight of more than 6,000 pounds.

5013. The pilot in command is normally required to hold a type rating when operating which of the following?

1—Any turbojet-powered airplane.
2—Any airplane which has a gross weight of 6,000 pounds or more.
3—Any multiengine airplane which is operated under interstate commerce.

5014. What is the lowest HAT for which a Category II applicant can be certified during the first 6 months of Category II operations?

1—100 feet AGL.
2—150 feet AGL.
3—200 feet AGL.

5015. A Category II ILS pilot authorization, when originally issued, is normally limited to

1—Category II operations not less than 1600 RVR and a 150-foot DH.
2—pilots who have completed an FAA-approved Category II training program.
3—Category II operations not less than 1200 RVR and a 100-foot DH.

5016. When may a Category II ILS limitation be removed?

1—When three ILS approaches have been completed to a 150-foot decision height.
2—When six ILS approaches to Category II minimums have been completed in the past 6 months.
3—120 days after issue or renewal.

5017. What minimum instrument time in the past 6 months meets the second-in-command requirement to maintain IFR currency in a helicopter?

1—3 hours of actual or simulated time in the same type helicopter.
2—3 hours of actual or simulated IFR in a helicopter.
3—3 hours of actual or simulated IFR in a helicopter and 3 hours in an approved simulator.

5018. What minimum conditions are necessary for the instrument approaches required for second in command IFR currency in a helicopter?

1—Three must be made in a helicopter.
2—Three must be made in a rotorcraft category.
3—All may be made in an airplane, helicopter, or approved simulator.

5019. Within the past 6 months a pilot has accomplished:

One approach in a helicopter
Two approaches in an airplane
Two approaches in an approved simulator

What additional approaches, if any, must the pilot perform to act as second in command on an IFR helicopter flight?

1—None.
2—One approach in an airplane, helicopter, or approved simulator.
3—Two approaches in a helicopter and one approach in an approved simulator.

5020. A pilot, acting as second in command, successfully completes the instrument competency check specified in FAR Part 61. How long does this pilot remain current if no further IFR flights are made?

1—12 months.
2—90 days.
3—6 months.

5021. Within the past 6 months a pilot has accomplished:

1 hour actual IFR and 1 hour simulated IFR in a helicopter
2 hours actual IFR in an airplane
1 hour in an approved simulator

What additional instrument time, if any, must that pilot acquire to act as second in command on an IFR helicopter flight?

1—None.
2—1 hour actual or simulated IFR in a helicopter.
3—1 hour actual or simulated IFR in an aircraft.

5022. Within the past 6 months a pilot has accomplished:

Two approaches in a helicopter
Two approaches in an airplane
Two approaches in a simulator

What additional approaches, if any, must that pilot perform to act as second in command on an IFR helicopter flight?

1—None.
2—One in a helicopter.
3—One in either a helicopter or an airplane.

5023. What instrument flight time may be logged by a second in command of an aircraft requiring two pilots?

1—All of the time the second in command is controlling the airplane solely by reference to flight instruments.
2—One-half the time the flight is on an IFR flight plan.
3—One-half the time the airplane is in actual IFR conditions.

5024. What instrument flight time may be logged by the second in command of a two-pilot air taxi flight?

1—All of the time the second in command is controlling the airplane solely by reference to flight instruments.
2—One-half the time the flight is on an IFR flight plan.
3—All of the time the airplane is in actual IFR conditions.

5025. To satisfy the minimum required instrument experience for IFR operations, a pilot must accomplish during the past 6 months at least

1—six instrument approaches and 6 hours of instrument time, 3 of the 6 hours in flight in the category of aircraft to be flown.
2—six instrument approaches, three of which must be in the same category and class of aircraft to be flown, and 6 hours of instrument time in any aircraft.
3—six instrument approaches and 6 hours of instrument time in any aircraft.

5026. To be eligible for the practical test for the renewal of a Category II authorization, what recent instrument approach experience is required?

1—Within the previous 6 months, six ILS approaches, three of which may be flown to the Category I DH by use of an approach coupler.
2—Within the previous 6 months, six ILS approaches flown by use of an approach coupler to the Category I DH.
3—Within the previous 12 calendar months, three ILS approaches flown by use of an approach coupler to the Category II DH.

5027. A flight requiring two pilots is scheduled on August 1. Both the pilot in command and the second in command have First-Class Medical Certificates dated February 28. Prior to the scheduled flight, the pilot in command

1—and second in command must hold certificates appropriate for the flight.
2—must obtain a new First-Class Medical Certificate; the second in command must have a new medical certificate, but a Second-Class Medical Certificate is adequate.
3—must obtain a new First-Class Medical Certificate; the second in command's certificate is adequate.

5028. To be eligible for the practical test for the original issue of a Category II authorization, what recent experience is required?

1—Within the previous 6 months, six ILS approaches flown manually to the Category I DH.
2—Within the previous 12 calendar months, six ILS approaches flown by use of an approach coupler to the Category I or Category II DH.
3—Within the previous 6 months, six ILS approaches, three of which may be flown to the Category I DH by use of an approach coupler.

5029. What is the minimum number of instrument approaches required to act as pilot in command under IFR conditions?

1—Six in any approved instrument ground trainer or aircraft within the past 6 months.
2—Six, at least three of which must be in an aircraft, within the past 6 months.
3—Six in an aircraft, at least three of which must be in the same category, within the past 6 months.

5030. When an airline transport pilot is instructing other pilots in air transportation service, instruction is restricted to

1—those aircraft in which the pilot holds a category, class, and type rating.
2—a maximum of 30 hours in any 7-day period.
3—a school conducted by a certificated air carrier.

5031. What restriction is imposed regarding flight instruction of other pilots in air transportation service by an airline transport pilot?

1—30 hours in any 7-day period
2—7 hours in any 1-day period.
3—36 hours in any 7-day period.

5032. What maximum hours a day may an airline transport pilot instruct other pilots in air transportation service?

1—6 hours.
2—8 hours.
3—10 hours.

5033. A commercial pilot has DC-3 and DC-9 type ratings. A flight test is completed for an Airline Transport Pilot Certificate in a B-727. What pilot privileges may be exercised?

1—ATP—B-727 and DC-3; Commercial—DC-9.
2—ATP—B-727 only; Commercial—DC-9 and DC-3.
3—ATP—B-727 and DC-9; Commercial—DC-3.

5034. A commercial pilot has a type rating in a B-727 and B-737. A flight test is completed in a B-747 for the Airline Transport Pilot Certificate. What pilot privileges may be exercised regarding these airplanes?

1—Commercial—B-737; ATP—B-727 and B-747.
2—ATP—B-747; Commercial—B-727 and B-737.
3—ATP—B-747, B-727, and B-737.

5035. To serve as flight navigator, a person must possess

1—a current Flight Navigator Certificate only.
2—a current Flight Navigator Certificate and at least a Second-Class Medical Certificate.
3—a current Third-Class Medical Certificate and Airline Transport Pilot Certificate.

5036. A Flight Navigator Certificate remains in effect

1—for 2 years.
2—for 12 calendar months.
3—until surrendered, suspended, or revoked.

5037. How many hours of satisfactory flight navigation experience must an applicant have logged to apply for a Flight Navigator Certificate if the applicant has no pilot time?

1—100 hours.
2—200 hours.
3—500 hours.

5038. How many hours of satisfactory flight navigation experience must an applicant have logged to apply for a Flight Navigator Certificate if the applicant has 500 hours of cross-country flight time as pilot, of which at least 100 hours were at night?

1—100 hours.
2—200 hours.
3—500 hours.

5039. If an applicant for a Flight Navigator Certificate fails the flight portion of the practical test, when may the applicant be retested?

1—At the end of a 30-day period or after receiving additional in-flight instruction.
2—After 10 hours of flight instruction.
3—After 5 hours of ground instruction in navigation.

5040. What document(s) must be in a person's possession for that person to act as a flight navigator?

1—Current Flight Navigator Certificate and a current Second-Class (or higher) Medical Certificate.
2—Current Flight Navigator Certificate and a valid passport.
3—Third-Class Medical Certificate and current Flight Navigator Certificate.

5041. A turbine-engine-powered or large airplane is required to enter an Airport Traffic Area at an altitude of at least

1—1,500 feet AGL.
2—2,000 feet AGL.
3—3,000 feet AGL.

5042. What is the maximum indicated airspeed a reciprocating-engine-powered airplane may be operated within a TCA?

1—180 knots.
2—230 knots.
3—250 knots.

5043. At what maximum indicated airspeed can a B-727 operate within a TCA without special ATC authorization?

1—230 knots.
2—250 knots.
3—275 knots.

5044. At what maximum indicated airspeed may a reciprocating-engine-powered airplane be operated within an Airport Traffic Area?

1—156 knots.
2—180 knots.
3—200 knots.

5045. What is the maximum indicated airspeed a turbine-powered aircraft may be operated below 10,000 feet MSL?

1—288 knots.
2—250 knots.
3—230 knots.

5046. At what maximum indicated airspeed can a reciprocating-engine airplane operate in the airspace underlying a Terminal Control Area?

1—180 knots.
2—200 knots.
3—230 knots.

5047. A pilot of a turbine-powered airplane should climb as rapidly as practicable after taking off to what altitude?

1—1,000 feet AGL.
2—1,500 feet AGL.
3—5,000 feet AGL.

5048. What action should a pilot take when a clearance is received from ATC that appears to be contrary to a regulation?

1—Read the clearance back in its entirety.
2—Request a clarification from ATC.
3—Do not accept the clearance.

5049. Which facility may be substituted for the middle marker during a Category I ILS approach?

1—VOR/DME FIX.
2—Surveillance radar.
3—Compass locator.

5050. When proceeding to the alternate airport, which minimums apply?

1—The IFR alternate minimums section in front of the NOAA IAP book.
2—2000-3 for at least 1 hour before until 1 hour after the ETA.
3—The actual minimums shown on the IAP chart for the airport.

5051. The visibility criteria for a particular instrument approach procedure is RVR 40. What minimum ground visibility may be substituted for the RVR value?

1—5/8 SM.
2—3/4 SM.
3—7/8 SM.

5052. The prescribed visibility criteria of RVR 32 for the runway of intended operation is not reported. What minimum ground visibility may be used instead of the RVR value?

1—3/8 SM.
2—5/8 SM.
3—3/4 SM.

5053. What minimum ground visibility may be used instead of a prescribed visibility criteria of RVR 16 when that RVR value is not reported?

1—1/4 SM.
2—3/4 SM.
3—3/8 SM.

5054. While in IFR conditions a pilot experiences two-way radio communications failure, which route should be flown in the absence of an ATC assigned route or a route ATC has advised to expect in a further clearance?

1—The most direct route to the filed alternate airport.
2—An off-airway route to the point of departure.
3—The route filed in the flight plan.

5055. What altitude and route should be used if the pilot is flying in IFR weather conditions and has two-way radio communications failure?

1—Continue on the route specified in the clearance and fly the highest of the following: the last assigned altitude, altitude ATC has informed the pilot to expect, or to the MEA.
2—Descend to MEA and, if clear of clouds, proceed to the nearest appropriate airport. If not clear of clouds, maintain the highest of the MEA's along the clearance route.
3—Fly the most direct route to the destination, maintaining the last assigned altitude or MEA, whichever is higher.

5056. After experiencing two-way radio communications failure en route, when should a pilot begin the descent for the instrument approach?

1—Upon arrival at any initial approach fix for the instrument approach procedure but not before the flight plan ETA as amended by ATC.
2—Upon arrival at the holding fix depicted on the instrument approach procedure at the corrected ETA, plus or minus 3 minutes.
3—At the primary initial approach fix for the instrument approach procedure at the ETA shown on the flight plan or the EFC time, whichever is later.

5057. If a pilot is being radar vectored in IFR conditions and loses radio communications with ATC, what action should be taken?

1—Fly directly to the next point shown on the IFR flight plan and continue the flight.
2—Squawk 7700 and climb to VFR On Top.
3—Fly direct to a fix, route, or airway specified in the vector clearance.

5058. A pilot is flying in IFR weather conditions and has two-way radio communications failure. What altitude should be used?

1—Last assigned altitude, altitude ATC has advised to expect, or the MEA, whichever is highest.
2—An altitude that is at least 1,000 feet above the highest obstacle along the route.
3—A VFR altitude that is above the MEA for each leg.

5059. A pilot is holding at an initial approach fix after having experienced two-way radio communications failure. When should that pilot begin descent for the instrument approach?

1—At the EFC time, if this is within plus or minus 3 minutes of the flight plan ETA as amended by ATC.
2—At flight plan ETA as amended by ATC.
3—At the EFC time as amended by ATC.

5060. Unless otherwise prescribed, what is the rule regarding altitude and course to be maintained by a helicopter during an off-airways IFR flight over non-mountainous terrain?

1—1,000 feet above the highest obstacle within 5 statute miles of course.
2—2,000 feet above the highest obstacle within 5 statute miles of course.
3—1,500 feet above the highest obstacle within a horizontal distance of 3 statute miles of course.

5061. Unless otherwise prescribed, what is the rule regarding altitude and course to be maintained by a helicopter during an IFR off-airways flight over mountainous terrain?

1—1,000 feet above the highest obstacle within a horizontal distance of 5 statute miles of course.
2—2,500 feet above the highest obstacle within a horizontal distance of 3 nautical miles of course.
3—2,000 feet above the highest obstacle within 5 statute miles of course.

5062. A pilot is operating outside of controlled airspace. If existing weather conditions are below those for VFR flight, an IFR flight plan must be filed and an ATC clearance received prior to

1—takeoff if weather conditions are below IFR minimums.
2—entering controlled airspace.
3—entering IFR weather conditions.

5063. What minimum altitude should a helicopter maintain while en route?

1—Over congested areas such as towns, no lower than 1,000 feet over the highest obstacle within a horizontal radius of 2,000 feet of the helicopter.
2—That specifically prescribed by the air carrier for the operation.
3—That prescribed by the Administrator.

5064. According to FAR Part 91, when takeoff minimums are not prescribed for a civil airport, what are the takeoff minimums under IFR for a single-engine helicopter?

1—1/2 SM visibility.
2—1 SM visibility.
3—1200 RVR.

5065. According to FAR Part 91, when takeoff minimums are not prescribed for a civil airport, what are the takeoff minimums under IFR for a multiengine helicopter?

1—1 SM visibility
2—1/2 SM visibility.
3—1200 RVR.

5066. When takeoff minimums are not prescribed for a civil airport, what are the takeoff minimums under IFR for a three-engine airplane?

1—1 SM.
2—1/2 SM.
3—300 feet and 1/2 SM.

5067. If being radar vectored to the final approach course of a published instrument approach that specifies "NO PT," the pilot should

1—advise ATC that a procedure turn will not be executed.
2—not execute the procedure turn unless specifically cleared to do so by ATC.
3—execute a holding pattern type procedure turn.

5068. When must the pilot initiate a missed approach procedure from an ILS approach?

1—At the DH when the runway is not clearly visible.
2—When the time has expired after reaching the DH and the runway environment is not clearly visible.
3—At the DH, if the visual references for the intended runway are not distinctly visible or anytime thereafter that visual reference is lost.

5069. Assuming that all ILS components are operating and the required visual references are not established, the missed approach should be initiated upon

1—arrival at the DH on the glide slope.
2—arrival at the visual descent point.
3—expiration of the time listed on the approach chart for missed approach.

5070. What action should be taken when a pilot is "cleared for approach" while being radar vectored on an unpublished route?

1—Descend to minimum vector altitude.
2—Remain at last assigned altitude until established on a published route segment.
3—Descend to initial approach fix altitude.

5071. Under which condition may a pilot descend below DH or MDA when using the ALSF-1 approach light system as the necessary visual reference for the intended runway?

1—Under no condition can the approach light system serve as a necessary visual reference for descent below DH or MDA.
2—Descent to the intended runway is authorized as long as any portion of the approach light system can be seen.
3—The approach light system can be used as a visual reference, except that descent below 100 feet above TDZE requires that the red light bars be visible and identifiable.

5072. What altitude is a pilot authorized to fly when cleared for an ILS approach? The pilot

1—may begin a descent to the procedure turn altitude.
2—must maintain the last assigned altitude until established on a published route or segment of the approach with published altitudes.
3—may descend from the assigned altitude only when established on the final approach course.

5073. While flying IFR in controlled airspace, if one of the two VOR receivers fails, which course of action should the pilot in command follow?

1—No call is required if one of the two VOR receivers is operating properly.
2—Advise ATC immediately.
3—Notify the dispatcher via company frequency.

5074. While flying in controlled airspace, the ADF fails. What action is required?

1—Descend below positive control airspace.
2—Advise dispatch via company frequency.
3—Notify ATC immediately.

5075. When may ATC request a detailed report on an emergency even though a rule has not been violated?

1—When priority has been given.
2—Anytime an emergency occurs.
3—When the emergency occurs in controlled airspace.

5076. What action should be taken if one of the two VHF radios fail while IFR in controlled airspace?

1—Notify ATC immediately.
2—Squawk 7600.
3—Monitor the VOR receiver.

5077. What action is necessary when a partial loss of ILS receiver capability occurs while operating in controlled airspace under IFR?

1—Continue as cleared and file a written report to the Administrator if requested.
2—If the aircraft is equipped with other radios suitable for executing an instrument approach, no further action is necessary.
3—Report the malfunction immediately to ATC.

5078. During an emergency, a pilot in command does not deviate from a FAR rule but is given priority by ATC. To whom or under what condition is the pilot required to submit a written report?

1—To the manager of the General Aviation District Office.
2—To the manager of the facility in control at the time of the deviation.
3—Upon request by ATC, submit a written report to the ATC manager.

5079. A pilot approaching to land a turbine-powered aircraft on a runway served by a VASI shall

1—not use the VASI unless a clearance for a VASI approach is received.
2—use the VASI only when weather conditions are below basic VFR.
3—maintain an altitude at or above the glide slope until a lower altitude is necessary for a safe landing.

5080. Which checks and inspections of flight instruments or instrument systems must be accomplished before an aircraft can be flown under IFR?

1—VOR within 30 days and altimeter systems and transponder within 24 calendar months.
2—ELT test within 30 days, altimeter systems within 12 calendar months, and transponder within 24 calendar months.
3—Airspeed indicator within 24 calendar months, altimeter system within 24 calendar months, and transponder within 12 calendar months.

5081. Which entry shall be recorded by the person performing a VOR operational check?

1—Frequency, radial and facility used, and bearing error.
2—Flight hours and number of days since last check, and bearing error.
3—Date, place, bearing error, and signature.

5082. What is the maximum permissible variation between the two bearing indicators on a dual VOR system when checking one VOR against the other?

1—4° on the ground and in flight.
2—6° on the ground and in flight.
3—6° in flight and 4° on the ground.

5083. What record shall be made by the pilot performing a VOR operational check?

1—The date, frequency of VOR or VOT, number of hours flown since last check, and signature in the aircraft log.
2—The date, place, bearing error, and signature in the aircraft log or other record.
3—The date, approval or disapproval, tach reading, and signature in the aircraft log or other permanent record.

5084. During a VOT check of the VOR equipment, the course deviation indicator centers on 356° with the TO/FROM reading FROM. This VOR equipment may

1—be used if 4° is entered on a correction card and subtracted from all VOR courses.
2—be used during IFR flights, since the error is within limits.
3—not be used during IFR flights, since the TO/FROM should read TO.

5085. If an airborne checkpoint is used to check the VOR system for IFR operations, the maximum bearing error permissible is

1—plus or minus 6°.
2—plus 6° or minus 4°.
3—plus or minus 4°.

5086. A function of the minimum equipment list is to indicate required items which

1—are required to be operative for overwater passenger air carrier flights.
2—may be inoperative for a one-time ferry flight of a large airplane to a maintenance base.
3—may be inoperative prior to beginning a flight in a multiengine airplane.

5087. When is DME required for an instrument flight?

1—At or above 24,000 feet MSL if VOR navigational equipment is required.
2—In terminal radar service areas.
3—Above 12,500 feet MSL.

5088. In what altitude structure is a transponder required when operating in controlled airspace?

1—Above 12,500 feet AGL, excluding the airspace at and below 2,500 feet AGL.
2—Above 12,500 feet MSL, excluding the airspace at and below 2,500 feet AGL.
3—Above 14,500 feet MSL, excluding the airspace at and below 2,500 feet AGL.

5089. Which of the following is a transponder requirement for helicopter operations?

1—Helicopters with a certified gross weight of more than 12,500 pounds that are engaged in commercial operations are required to be equipped with operable ATC transponders.
2—Under the terms of a letter of agreement, helicopters may be operated at or below 1,000 feet AGL within TCA's without an operable ATC transponder.
3—Operable ATC transponders are required when operating helicopters within control zones at night under special VFR.

5090. In addition to a two-way radio capable of communicating with ATC on appropriate frequencies, which equipment is the helicopter required to have to operate within a Terminal Control Area? (Letter of agreement not applicable.)

1—A VOR or TACAN receiver.
2—DME, a VOR or TACAN receiver, and an appropriate transponder beacon.
3—An appropriate radar beacon transponder.

5091. In addition to the localizer, glide slope, marker beacons, approach lighting, and HIRL, which ground components are required to be operative for a Category II instrument approach to a DH below 150 feet AGL?

1—RCLS and REIL.
2—Radar and RVR.
3—TDZL, RCLS, and RVR.

5092. When may a pilot descend below 100 feet above the touchdown zone elevation during a Category II ILS instrument approach when only the approach lights are visible?

1—After passing the visual descent point (VDP).
2—When the RVR is 1,600 feet or more.
3—When the red terminal bar of the approach light systems are in sight.

5093. Which ground components are required to be operative for a Category II approach in addition to LOC, glide slope, marker beacons, and approach lights?

1—Radar and RVR.
2—RCLS and REIL.
3—HIRL, TDZL, RCLS, and RVR.

5094. Information obtained from flight data and cockpit voice recorders shall be used only for

1—determining who was responsible for any accident or incident.
2—determining evidence for use in civil penalty or certificate action.
3—determining possible causes of accidents or incidents.

5095. For what purpose may cockpit voice recorders and flight data recorders not be used?

1—Determining causes of accidents and occurrences under investigation by the NTSB.
2—Determining any certificate action, or civil penalty, arising out of an accident or occurrence.
3—Identifying procedures that may have been conducive to any accident, or occurrence resulting in investigation under NTSB Part 830.

5096. How long is cockpit voice recorder and flight recorder data kept, in the event of an accident or occurrence resulting in terminating the flight?

1—60 days.
2—90 days.
3—30 days.

5097. A commercial operator plans to ferry a large, four-engine, reciprocating-engine-powered airplane from one facility to another to repair an inoperative engine. Which is an operational requirement for the three-engine flight?

1—The gross weight at takeoff may not exceed 75 percent of the maximum certificated gross weight.
2—Weather conditions at the takeoff and destination airports must be VFR.
3—The computed takeoff distance to reach V_1 must not exceed 70 percent of the effective runway length.

5098. Which operational requirement must be observed when ferrying an air carrier airplane when one of its three turbine engines is inoperative?

1—The weather conditions at takeoff and destination must be VFR.
2—The flight cannot be conducted between official sunset and official sunrise.
3—Weather conditions must exceed the basic VFR minimums for the entire route, including takeoff and landing.

5099. Which operational requirement must be observed when ferrying a large, turbine-engine-powered airplane when one of its engines is inoperative?

1—The weather conditions at takeoff and destination must be VFR.
2—Weather conditions must exceed the basic VFR minimums for the entire route, including takeoff and landing.
3—The flight cannot be conducted between official sunset and sunrise.

5100. When a turbine-engine-powered airplane is to be ferried to another base for repair of an inoperative engine, which operational requirement must be observed.

1—Only the required flight crewmembers may be on board the airplane.
2—The existing and forecast weather for departure, en route, and approach must be VFR.
3—No passengers except authorized maintenance personnel can be carried.

5101. Which operational requirement must be observed by a commercial operator when ferrying a large, three-engine, turbojet-powered airplane from one facility to another to repair an inoperative engine?

1—The computed takeoff distance to reach V_1 must not exceed 70 percent of the effective runway length.
2—The existing and forecast weather for departure, en route, and approach must be VFR.
3—No passengers can be carried.

5102. A person may not act as a crewmember of a civil aircraft if alcoholic beverages have been consumed by that person within the preceding

1—8 hours.
2—12 hours.
3—24 hours.

5103. How may an aircraft operate in North Atlantic (NAT) Minimum Navigation Performance Specifications Airspace with less than the minimum navigation capability required by FAR Part 91, appendix C? By

1—operating under VFR conditions only.
2—requesting a deviation from the Administrator.
3—operating only between 2400Z and 0600Z.

5104. Which publication includes information on operations in the North Atlantic (NAT) Minimum Navigation Performance Specifications Airspace?

1—FAR Part 121.
2—ICAO Annex 1, Chapter 2.
3—FAR Part 91.

5105. When a certificate holder is notified that a person specifically authorized to carry a deadly weapon is to be aboard an aircraft (except in an emergency), how long before loading that flight should the air carrier be notified?

1—5 hours.
2—2 hours.
3—1 hour.

5106. When a person, in the custody of law enforcement personnel, is scheduled on a flight, what procedures are required regarding boarding of this person and the escort?

1—They shall enplane and depart before all other passengers.
2—They shall be boarded after all other passengers enplane, and deplaned before all other passengers deplane.
3—They shall be boarded before all other passengers enplane, and deplaned after all passengers have left the aircraft.

5107. When a passenger notifies the certificate holder prior to checking baggage that an unloaded weapon is in the baggage, what action is required by regulation regarding this baggage?

1—The baggage may be carried in the flightcrew compartment, provided the baggage remains locked.
2—The baggage must remain locked and only the passenger retains the key.
3—The baggage must remain locked and custody of the key shall remain with a designated person other than the owner of the weapon.

5108. Which applies to the carriage of a person in the custody of law enforcement personnel?

1—The air carrier is not allowed to serve a meal to the person in custody.
2—No more than one person in custody may be carried on a flight if the person is considered to be in a maximum risk category.
3—The person in custody and the escort must remain seated for the entire flight.

5109. With whom must the crew of a domestic and flag air carrier airplane be able to communicate, under normal conditions, along the entire route of flight.

1—Any FSS.
2—ARINC
3—Company dispatch office.

5110. With whom must the crew of a domestic and flag air carrier airplane be able to communicate, under normal conditions, along the entire route of flight?

1—Any FSS.
2—ARINC
3—Air Traffic Control.

5111. For which of these aircraft is the "clearway" for a particular runway considered in computing takeoff weight limitations?

1—Passenger-carrying transport aircraft.
2—U.S. certified air carrier airplanes.
3—Turbine-engine-powered transport airplanes.

5112. What effective runway length is required for a turbojet-powered airplane at the destination airport if the runways are forecast to be wet or slippery at the ETA?

1—70 percent of the actual runway available.
2—150 percent of the runway length required for a dry runway.
3—115 percent of the runway length required for a dry runway.

5113. What restrictions must be observed regarding the carrying of cargo in the passenger compartment of an airplane operated under FAR Part 121?

1—All cargo must be separated from all seated passengers by a partition capable of withstanding certain load stresses.
2—Cargo may be carried aft of a divider if properly secured by a safety belt.
3—All cargo must be carried in a suitable bin and secured to the floor structure of the airplane.

5114. What requirement must be met regarding cargo that is carried anywhere in the passenger compartment of an air carrier airplane.

1—The bin in which the cargo is carried may not be installed in a position that restricts access to, or use of, any emergency exit.
2—Cargo may not be carried anywhere in the rear of the passenger compartment.
3—The container or bin in which the cargo is carried must be made of material which is at least flash resistant.

5115. Information recorded during normal operation by a required cockpit voice recorder in a passenger-carrying airplane

1—must be retained for 30 minutes after landing.
2—may be erased only once each flight.
3—may all be erased except the last 30 minutes.

5116. Which rule applies to the use of the cockpit voice recorder erasure feature?

1—All recorded information may be erased at the end of a flight.
2—Any information more than 30 minutes old may be erased.
3—Any ground operation that was recorded may be erased.

5117. For the purpose of testing the flight recorder system,

1—a maximum of 45 minutes of the oldest prerecorded data may be erased.
2—a total of 1 hour of the oldest recorded data accumulated at the time of testing may be erased.
3—a total of no more than 1 hour of recorded data may be erased.

5118. When must a cockpit voice recorder be operated?

1—From the start of the before starting engine checklist to completion of checklist prior to engine shutdown.
2—From the start of the before starting engine checklist to completion of final checklist upon termination of flight.
3—When starting to taxi for takeoff to engine shutdown after termination of flight.

5119. If there is a required emergency exit located in the flightcrew compartment, the door which separates the compartment from the passenger cabin must

1—be locked at all times, except during emergencies, while landing.
2—be locked at all times, except during any emergency declared by the pilot in command.
3—be latched open during takeoff and landing.

5120. If a passenger-carrying landplane is required to have an automatic deploying escape slide system, when must this system be armed?

1—During taxi, takeoff, and landing.
2—Only for takeoff and landing.
3—Only for taxi and takeoff.

5121. If a turbine-engine-powered, pressurized airplane is not equipped with quick-donning oxygen masks, what is the maximum flight altitude authorized without one pilot wearing and using an oxygen mask?

1—FL300.
2—FL250.
3—FL200.

5122. If either pilot of an air carrier airplane leaves the duty station while flying at FL310, the other pilot

1—shall put on and use an oxygen mask.
2—must have a quick-donning type oxygen mask available.
3—and the flight engineer shall put on and use their oxygen mask.

5123. Which airplanes are required to be equipped with a ground proximity warning glide slope deviation alerting system?

1—All turbojet-powered airplanes.
2—Passenger-carrying airplanes only.
3—Large turbine-powered airplanes only.

5124. When may two persons share one seatbelt in a lounge seat?

1—When one is an adult and one is a child under 3 years of age.
2—Only during the en route portion of a flight
3—During all operations except the landing portion of a flight.

5125. While on an IFR flight in controlled airspace, the failure of which unit will precipitate an immediate report to ATC?

1—Secondary or backup attitude indicator.
2—Airborne radar altimeter.
3—DME.

5126. An air carrier airplane's airborne radar must be in satisfactory operating condition prior to dispatch, if the flight will be

1—conducted under IFR conditions and thunderstorms are reported en route.
2—carrying passengers, but not if it is "all cargo."
3—conducted over water more than 50 miles from shore.

5127. If an air carrier airplane's airborne radar is inoperative and thunderstorms are forecast along the proposed route of flight, an airplane may be dispatched only

1—when two alternate airports are filed.
2—if the flight is filed IFR.
3—in day VFR conditions.

5128. If an air carrier airplane is flying IFR using a single ADF navigation receiver and the ADF equipment fails, the flight must be able to

1—proceed safely to a suitable airport using VOR aids and complete an instrument approach.
2—continue to the destination airport by means of dead reckoning navigation.
3—proceed to and land at a filed en route alternate airport.

5129. What action should be taken by the pilot in command of a transport category airplane if the airborne weather radar becomes inoperative en route on an IFR flight for which weather reports indicate possible thunderstorms?

1—Request radar vectors from ATC to the nearest airport suitable for large aircraft landings.
2—Proceed in accordance with the approved instructions in the operations manual.
3—Return to the departure airport if closer than the destination airport.

5130. When a pilot plans a flight using NDB NAVAIDS, which rule applies?

1—An alternate airport must be filed that has a radar approach available.
2—The pilot must be able to return to the departure airport using other navigation radios.
3—The airplane must have sufficient fuel to proceed, by means of VOR NAVAIDS, to a suitable airport and land.

5131. When must an air carrier airplane be DME equipped?

1—Whenever VOR navigational receivers are required.
2—For flights at or above 18,000 feet MSL.
3—In the Continental Control Area for all IFR or VFR On Top operations.

5132. When an air carrier flight is operated under IFR or over-the-top on "victor airways," which navigation equipment is required to be installed in duplicate?

1—ADF.
2—VOR.
3—Marker beacon receiver.

5133. The emergency lights on a passenger-carrying airplane must be armed or turned on during

1—preflight prior to night operations.
2—taxiing, takeoff, and landing.
3—preflight prior to every flight.

5134. Federal Aviation Regulations require that interior emergency lights must

1—operate automatically when subjected to a negative G load.
2—be operable manually from the flightcrew station and the passenger compartment.
3—be armed or turned on during ground operation and all flight operations.

5135. Where should the portable battery-powered megaphone be located if only one is required on a passenger-carrying airplane?

1—The most rearward location in the passenger cabin.
2—The most forward location in the passenger cabin.
3—In the passenger cabin near the overwing emergency exit.

5136. How many portable battery-powered megaphones are required on an air carrier airplane with a seating capacity of 100 passengers on a trip segment when 45 passengers are carried?

1—Two; one at the forward end and the other at the most rearward location in the passenger cabin.
2—One; at the most rearward location in the passenger cabin.
3—Two; one located near or accessible to the flightcrew and one located near the center of the passenger cabin.

5137. How many portable battery-powered megaphones are required on an air carrier airplane with a seating capacity of 150 passengers on a trip segment when 75 passengers are carried?

1—Two; one located near or accessible to the flightcrew, and one located near the center of the passenger cabin.
2—One; at the most rearward location in the passenger cabin.
3—Two; one at the forward end, and the other at the most rearward location of the passenger cabin.

5138. In the event of an engine emergency, the use of a cockpit check procedure by the flightcrew is

1—discouraged because of possible failure of the cockpit lighting system.
2—required by regulations to prevent reliance upon memorized procedures.
3—recommended by the FAA as a doublecheck after the memorized procedure has been followed.

5139. Which emergency equipment is required for a flag air carrier flight between John F. Kennedy International Airport and London, England?

1—A life preserver or other flotation device for the full seating capacity of the airplane.
2—An appropriately equipped survival kit attached to each required liferaft.
3—A self-buoyant, water resistant, portable radio for each required liferaft.

5140. What emergency equipment is required for extended overwater operations?

1—A portable emergency radio transmitter for each crewmember.
2—A survival kit for each life preserver.
3—A life preserver equipped with a survivor locator light, for each occupant.

5141. Each large aircraft operating over water must have a life preserver for each

1—seat on the aircraft.
2—occupant.
3—seat, plus 10 percent

5142. For a flight over uninhabited terrain, an airplane operated by a flag or supplemental air carrier must carry enough appropriately equipped survival kits for

1—50 percent of the passengers.
2—all occupants of the airplane.
3—all paying passengers.

5143. When a supplemental air carrier is operating over an uninhabited area, how many appropriately equipped survival kits are required aboard the airplane?

1—One for each passenger seat.
2—One for each four passengers.
3—Enough for the number of occupants of the airplane.

5144. Life preservers required for overwater operations are stored

1—adjacent to every emergency exit.
2—behind the cockpit bulkhead.
3—within easy access in the event of ditching.

5145. An airplane operated by a supplemental air carrier flying over uninhabited terrain must carry which emergency equipment?

1—Survival saw.
2—Pyrotechnic signaling device.
3—Colored smoke flares.

5146. An airplane operated by a commercial operator flying over uninhabited terrain must carry which emergency equipment?

1—Colored smoke flares.
2—Pyrotechnic signaling device.
3—Survival saw.

5147. An airplane operated by a flag air carrier operator flying over uninhabited terrain must carry which emergency equipment?

1—Pyrotechnic signaling device.
2—Colored smoke flares.
3—Survival saw.

5148. An air carrier airplane must have an operating public address system if it

1—has 15 or more passengers aboard.
2—has a seating capacity for more than 19 passengers.
3—weighs more than 12,500 pounds.

5149. A crewmember interphone system is required on which airplane?

1—A large airplane.
2—An airplane with more than 19 passenger seats.
3—A turbojet airplane.

5150. Which requirement applies to emergency equipment (fire extinguishers, megaphones, first aid kits, and crash ax) installed in an air carrier airplane?

1—Cannot be located on the flight deck, all must be located in the passenger compartment.
2—Cannot be located in a compartment or area where it is not immediately visible to a flight attendant in the passenger compartment.
3—Must be clearly marked to indicate its method of operation.

5151. Which factor determines the minimum number of hand fire extinguishers required for flight under FAR Part 121?

1—Number of passengers aboard.
2—Number of required crewmembers.
3—Number of passenger seats in the airplane.

5152. Which restriction applies to a cargo bin in a passenger compartment? The bin

1—may have an open top if the cargo is secured by a cargo net.
2—must withstand the load factor required of passenger seats, multiplied by 1.15.
3—must be equipped with an approved fire-extinguishing system and constructed of flame retardant material.

5153. What is the passenger oxygen supply requirement for a flight with a cabin pressure altitude in excess of 15,000 feet? Enough oxygen for

1—all passengers for the entire flight duration above 15,000 feet cabin altitude.
2—50 percent of the actual passenger load for 30 minutes.
3—10 percent of the seating capacity at those altitudes.

5154. How much supplemental oxygen must pressurized air transport airplanes carry for each flight crewmember on flight deck duty when operating at flight altitudes of 10,000 feet?

1—A minimum of 2-hours' supply.
2—Sufficient for the duration of the flight above 8,000 feet cabin pressure altitude.
3—Sufficient for the duration of the flight above 10,000 feet flight altitude.

5155. What is the highest flight level that operations may be conducted without the pilot at the controls wearing and using an oxygen mask while the other pilot is away from the duty station?

1—FL410.
2—FL310.
3—FL250.

5156. Above which cabin altitude must oxygen be provided for all passengers during the entire flight?

1—15,000 feet.
2—12,000 feet.
3—14,000 feet.

5157. For a 2-hour flight in a turbine-engine-powered airplane at a cabin pressure altitude of 12,000 feet, how much supplemental oxygen for sustenance must be provided? Enough oxygen for

1—10 percent of the passengers for 1.5 hours.
2—each passenger during the entire flight.
3—each passenger for 30 minutes.

5158. A flight crewmember must be able to don and use a quick-donning oxygen mask within

1—5 seconds.
2—15 seconds.
3—20 seconds.

5159. Each air carrier flight deck crewmember on flight deck duty must be provided with an oxygen mask that can be rapidly placed on his face when operating at flight altitudes above

1—FL200.
2—FL250.
3—FL120.

5160. The supplemental oxygen requirements for passengers when a flight is operated at or below FL250 is dependent upon the airplane's ability to make an emergency descent to a flight altitude of

1—10,000 feet within 4 minutes.
2—12,000 feet within 4 minutes or at a minimum rate of 2,500 feet per minute, whichever is quicker.
3—14,000 feet within 4 minutes.

5161. A passenger briefing by a crewmember shall be given, instructing passengers on the necessity and use of oxygen in the event of cabin depressurization prior to flights conducted above

1—FL250.
2—FL240.
3—FL200.

5162. What is the minimum number of acceptable oxygen-dispensing units for first aid treatment of occupants who might require undiluted oxygen for physiological reasons?

1—Four.
2—Three.
3—Two.

5163. Routes that require a flight navigator are listed in the

1—Airplane Flight Manual.
2—International Flight Information Manual.
3—Air Carrier's Operations Specifications.

5164. Where is a list maintained for routes that require special navigation equipment?

1—Air Carrier's Operations Specifications.
2—International Flight Information Manual.
3—Airplane Flight Manual.

5165. Which document includes descriptions of required crewmember functions to be performed in the event of an emergency?

1—Airplane Flight Manual.
2—Certificate holder's manual.
3—Emergency Procedures Handbook.

5166. A flight navigator or a specialized means of navigation is required aboard an air carrier airplane operated outside the 48 contiguous states and District of Columbia when

1—the airplane's position cannot be reliably fixed for a period of more than 1 hour.
2—operations are conducted IFR or VFR On Top.
3—operations are conducted over water more than 50 miles from shore.

5167. Required crewmember functions to be performed in the event of an emergency shall be assigned by the

1—pilot in command.
2—air carrier's chief pilot.
3—certificate holder.

5168. What is the minimum number of flight attendants required for an airplane having a seating capacity of 176 passengers with only 113 passengers aboard.

1—Five.
2—Four.
3—Three.

5169. What is the minimum number of flight attendants required for an air carrier airplane with a seating capacity for 335 passengers when 299 passengers are aboard?

1—Seven.
2—Six.
3—Five.

5170. An air carrier that elects to use an Inertial Navigational System (INS) must meet which equipment requirement prior to takeoff on a proposed flight?

1—One INS with a dual VORTAC/ILS system may be used as a backup.
2—Dual ILS systems with an operative Flight Director System may be used as a backup for one inoperative INS.
3—One INS may be inoperative, but an operational Doppler Radar unit may be substituted in its stead.

5171. If a turbojet air carrier flight is to be operated in VFR over-the-top conditions, which radio navigation equipment is required to be a dual installation?

1—VOR and ILS.
2—VOR.
3—VOR and DME.

5172. Which equipment requirement must be met by an air carrier that uses an Inertial Navigation System (INS) on a proposed flight?

1—Dual ILS systems with an operative Flight Director System can be substituted for one inoperative INS.
2—A dual VORTAC/ILS system may be substituted for an inoperative INS.
3—Only one INS is required if an operative Doppler Radar can be substituted for the other INS.

5173. When an air carrier airplane with a seating capacity of 187 has 151 passengers on board, what is the minimum number of flight attendants required?

1—Five.
2—Four.
3—Three.

5174. An airplane has a seating capacity of 149 passengers. What is the minimum number of flight attendants required with 97 passengers aboard

1—Four.
2—Three.
3—Two.

5175. The "age 60 rule" of FAR Part 121 applies to

1—any required pilot crewmember.
2—any pilot or flight engineer.
3—the pilot in command only.

5176. When the need for a flight engineer is determined by aircraft weight, what is the takeoff weight above which a flight engineer is required?

1—80,000 pounds.
2—12,500 pounds.
3—300,000 pounds.

5177. Under which condition is a flight engineer required as a flight crewmember in FAR Part 121 operations?

1—If the airplane has a seating capacity for 30 passengers or more.
2—If the airplane is powered by more than two engines.
3—If required by the airplane's type certificate.

5178. If a flight engineer becomes incapacitated during flight, who may perform the flight engineer's duties?

1—The second in command only.
2—Any crewmember designated by the pilot in command.
3—Either pilot, if qualified to perform flight engineer functions.

5179. On an air carrier airplane that is certified for operation with a flightcrew of two pilots and one flight engineer, in case of emergency,

1—at least one pilot must be qualified to perform flight engineer duties.
2—the flight engineer must be qualified to perform duties at one pilot position.
3—each pilot must be qualified to perform flight engineer duties.

5180. When a flight engineer is a required crewmember on a flight, it is necessary for

1—at least one pilot to hold a Flight Engineer Certificate.
2—the flight engineer to be properly certificated and qualified, but there is no requirement for any other crewmember to be qualified or certified to perform flight engineer duties.
3—at least one pilot to be qualified to perform flight engineer duties, but a certificate is not required.

5181. If a flight crewmember completes a required annual flight check in December 1987 and the required annual recurrent flight check in January 1989, the latter check is considered to have been taken in

1—December.
2—January
3—November.

5182. What is the term for the training required for flight crewmembers who have not qualified and served in the same capacity on another airplane of the same group (e.g., turbojet powered)?

1—Upgrade training.
2—Primary training.
3—Initial training.

5183. A crewmember who has served as second in command on a particular type airplane (e.g., B-727-100), may serve as pilot in command upon completing which training program?

1—Upgrade training.
2—Recurrent training.
3—Initial training.

5184. What is the term for the training required for crewmembers or dispatchers who have qualified and served in the same capacity on other airplanes of the same group?

1—Difference training.
2—Transition training.
3—Upgrade training.

5185. How often must a crewmember actually operate the airplane emergency equipment? Once every

1—6 calendar months.
2—12 calendar months.
3—24 calendar months.

5186. The air carrier must give instruction on such subjects as respiration, hypoxia, and decompression to each crewmember serving on pressurized airplanes operated above

1—20,000 feet.
2—12,000 feet.
3—25,000 feet.

5187. A pilot in command must complete either a proficiency check or simulator training within the preceding

1—6 months.
2—12 months.
3—24 months.

5188. Any person whose duties include the handling or carriage of dangerous articles and magnetized materials must have satisfactorily completed an established and approved training program within the preceding

1—24 calendar months.
2—12 calendar months.
3—6 calendar months.

5189. A pilot flight crewmember, other than pilot in command, must have received either a proficiency check or line-oriented simulator training within the preceding

1—6 months.
2—12 months.
3—24 months.

5190. Which is one of the requirements that must be met by a required pilot flight crewmember in re-establishing recency of experience?

1—At least one landing must be made to a full stop with a simulated failure of the most critical engine.
2—At least one landing must be made from an ILS approach to the lowest ILS minimums authorized for the certificate holder.
3—At least two landings must be made to a complete stop.

5191. What is one of the requirements that must be met by an airline pilot to re-establish recency of experience?

1—At least one landing approach must be made from a circling instrument approach.
2—At least one landing must be made to a full stop.
3—At least one nonprecision approach must be made to the lowest minimums authorized for the certificate holder.

5192. What are the line check requirements for the pilot in command for a domestic air carrier?

1—The line check is required only when the pilot is scheduled to fly a new route.
2—The line check is required each 12 calendar months in one of the types of airplanes to be flown.
3—The line check is required each 12 months in each type aircraft in which the pilot may serve.

5193. Normally, a dispatcher should be scheduled for no more than

1—6 consecutive hours of service in any 24 hours.
2—8 hours of service in any 24 consecutive hours.
3—10 hours of service in any 24 consecutive hours.

5194. An aircraft dispatcher shall receive at least 24 consecutive hours of rest during each

1—120 consecutive hours.
2—7 consecutive days.
3—10 consecutive days.

5195. To remain current as an aircraft dispatcher, a person must, in addition to other requirements,

1—make a trip over one of the air carrier's routes within the preceding 6 calendar months.
2—spend 5 hours observing flight deck operations within the preceding 12 calendar months.
3—make a trip in one of the types of airplanes to be dispatched, every 3 calendar months.

5196. If a domestic or flag air carrier schedules a dispatcher for 13 hours of duty in a 24-consecutive-hour period, what action is required?

1—The dispatcher should report a violation of FAR Part 121 to the air carrier's director of operations.
2—Within 72 hours, the dispatcher should report a violation of FAR Part 121 to the supervising air carrier district office.
3—The dispatcher should be given a rest period of at least 8 hour at or before the completion of 10 hours of duty.

5197. Duty and rest period rules for domestic air carrier operations require that a flight crewmember

1—not be assigned to any duty with the air carrier during a required rest period.
2—not be on duty aloft for more than 90 hours in any calendar month.
3—be relieved of all duty for at least 48 hours during any 7 consecutive days.

5198. When a flag air carrier airplane requires more than one flight engineer or flight navigator, which flight time limitation applies during any 12 calendar months?

1—1,000 hours.
2—1,100 hours.
2—1,200 hours.

5199. What is the maximum number of hours that a pilot may fly as a crewmember in domestic air carrier service?

1—120 hours in any 30 consecutive days and 1,200 hours in any 12 consecutive months.
2—120 hours in any calendar month and 1,000 hours in any calendar year.
3—100 hours in any calendar month and 1,000 hours in any calendar year.

5200. How does deadhead transportation affect the computation of flight time limits for air carrier flight crewmembers? It is

1—considered part of the rest period if the flightcrew includes more than two pilots.
2—not considered part of the rest period.
3—considered part of the rest period for flight engineers and navigators.

5201. A flag air carrier may schedule a pilot of any airplane, having two pilots and one additional crewmember, for no more than

1—8 hours during any 12 consecutive hours.
2—10 hours during any 12 consecutive hours.
3—12 hours during any 24 consecutive hours.

5202. What is the maximum flight time in 24 consecutive hours that a flag air carrier may schedule a pilot in a two-pilot crew without a rest period?

1—8 hours.
2—10 hours.
3—12 hours.

5203. What is the maximum number of hours a pilot may fly in 7 consecutive days as a pilot in a two-pilot crew for a flag air carrier?

1—35 hours.
2—32 hours.
3—30 hours.

5204. What is the maximum number of hours that a supplemental air carrier pilot may fly in 30 consecutive days?

1—100 hours.
2—120 hours.
3—300 hours.

5205. How many hours may a supplemental air carrier pilot on a three-pilot crew be scheduled for flight deck duty during any 24-hour period?

1—6 hours.
2—8 hours.
3—10 hours.

5206. The flight time limitations established for flight crewmembers include

1—all commercial flying in any flight crewmember position.
2—only commercial flying in any flight crewmember position in which FAR Part 121 operations are conducted.
3—all flight time in any flight crewmember position.

5207. Which passenger announcement must be made after each takeoff?

1—The location and use of emergency exits.
2—Keep seatbelts fastened while seated.
3—How to use the passenger oxygen system in an emergency.

5208. What information must the pilot in command of a domestic air carrier flight carry to the destination airport?

1—Cargo and passenger distribution information.
2—Copy of the flight plan.
3—Names of all crewmembers and designated pilot in command.

5209. How long may a domestic air carrier flight remain on the ground at an intermediate airport before a ...dispatch release is required?

1—1 hour.
2—2 hours.
3—6 hours.

5210. When an intoxicated person creates a disturbance aboard an air carrier aircraft, within what period of time must the certificate holder submit a written report, concerning the incident, to the Administrator?

1—7 days.
2—5 days.
3—48 hours.

5211. Which applies when carrying a passenger aboard an all-cargo aircraft?

1—The passenger must have a seat reserved on the flight deck.
2—The pilot in command may authorize the passenger to be admitted to the crew compartment.
3—Crew-type oxygen must be provided for the passenger.

5212. Each crewmember shall have available for individual use on each flight a

1—pyrotechnic signaling device.
2—hand fire extinguisher suitable for combating Class A, B, and C fires.
3—flashlight in good working order.

5213. Following the stoppage of an engine's rotation in flight, the pilot in command must, as soon as practicable, first report the occurrence to the

1—appropriate ground radio station.
2—nearest air carrier district office.
3—operations manager (or director of operations).

5214. Should it become necessary to shut one engine down on a domestic air carrier three-engine turbojet airplane, the pilot in command

1—may continue to the planned destination if approved by the company aircraft dispatcher.
2—may continue to the planned destination if this is considered as safe as landing at a closer airport.
3—must land at the nearest airport that a landing can be made.

5215. What is the maximum number of continuous hours of duty that an aircraft dispatcher may be scheduled?

1—8 hours.
2—10 hours.
3—12 hours.

5216. When an aircraft dispatcher declares an emergency for a flight and a deviation results, a written report shall be sent to the

1—ATC facility chief within 48 hours.
2—nearest FAA district office within 48 hours.
3—FAA Administrator within 10 days.

5217. When the pilot in command is responsible for a deviation during an emergency, the pilot should submit a written report within

1—48 hours after the deviation.
2—24 hours after returning to home base.
3—10 days after returning to home base.

5218. What action should the pilot in command follow if it is necessary to shut down one of the two engines on an air carrier airplane?

1—Land at any airport the pilot considers as safe as the nearest suitable airport in point of time.
2—Proceed to the airport specified by the company dispatcher.
3—Land at the nearest suitable airport in point of time at which a safe landing can be made.

5219. Assuring that appropriate aeronautical charts are aboard an aircraft is the responsibility of the

1—aircraft dispatcher.
2—flight navigator.
3—pilot in command.

5220. Which persons are jointly responsible for the initiation, continuation, diversion, and termination of a supplemental air carrier or commercial operator flight?

1—Pilot in command and aircraft dispatcher.
2—Director of operations and chief pilot.
3—Pilot in command and director of operations.

5221. The pilot in command has emergency authority to exclude any and all persons from admittance to the flight deck

1—with the exception of any certified FAA inspector.
2—as an emergency action in the interest of safety.
3—except those persons who have specific authorization of the certificate holder and the FAA.

5222. If an aircraft dispatcher cannot communicate with an air carrier flight during an emergency the aircraft dispatcher should

1—take any action considered necessary under the circumstances.
2—comply with the company's lost aircraft plan.
3—notify transit alert.

5223. Who is required to submit a written report on a deviation that occurs during an emergency?

1—Pilot in command.
2—Dispatcher.
3—Person who declares the emergency.

5224. When a departure alternate is required for a three-engine air carrier flight, it must be located at a distance not greater than

1—2 hours from the departure airport at normal cruising speed in still air with one engine inoperative.
2—1 hour from the departure airport at normal cruising speed in still air with one engine inoperative.
3—2 hours from the departure airport at normal cruising speed in still air.

5225. When is a supplemental air carrier, operating under IFR, required to list an alternate airport for each destination airport within the 48 contiguous United States?

1—When the forecast weather indicates the ceiling will be less than 2,000 feet and visibility less than 3 miles at the estimated time of arrival.
2—An alternate airport is required regardless of existing or forecast weather conditions.
3—When the flight is scheduled for more than 6 hours en route.

5226. If a four-engine air carrier airplane is dispatched from an airport that is below landing minimums, what is the maximum distance that a departure alternate airport may be located from the departure airport?

1—Not more than 1 hour of normal cruise speed in still air with one engine inoperative.
2—Not more than 2 hours at slow cruise speed in still air with one engine inoperative.
3—Not more than 2 hours at normal cruise speed in still air with one engine inoperative.

5227. What is the maximum distance required for a departure alternate airport for two-engine airplanes?

1—1 hour at normal cruise speed in still air with one engine operating.
2—1 hour at normal cruise speed in still air with both engines operating.
3—2 hours at normal cruise speed in still air with one engine operating.

5228. An alternate airport for the airport of takeoff is required

1—if weather conditions are below authorized landing minimums.
2—when no destination alternate airport is available.
3—when destination weather is marginal VFR (ceiling less than 3,000 feet and visibility less than 5 SM).

5229. When the forecast weather conditions for a destination and alternate airport are considered marginal for a domestic air carrier's operation, what specific action should the pilot in command take?

1—Delay the flight, not to exceed 1 hour, for possible weather improvement.
2—Add 1 additional hour of fuel based on cruise power settings for the airplane in use.
3—List at least one additional alternate airport.

5230. Which inflight conditions are required by a supplemental air carrier to conduct a day, over-the-top flight below the specified IFR minimum en route altitude?

1—The flight must remain clear of clouds by at least 500 feet vertically and 1,000 feet horizontally and have at least 3 miles flight visibility.
2—The flight must be conducted at least 1,000 feet above an overcast or broken cloud layer and have at least 5 miles flight visibility.
3—The height of any higher overcast or broken layer must be at least 500 feet above the IFR MEA.

5231. Prior to listing an airport as an alternate airport in the dispatch or flight release, weather reports and forecasts must indicate that weather conditions at that airport will be at or above authorized minimums

1—for a period 2 hours before and 2 hours after the ETA.
2—during the entire flight.
3—when the flight arrives.

5232. What minimum weather conditions must exist for an airport to be listed as an alternate in the dispatch release for a domestic air carrier flight? Those

1—listed on the NOAA IAP chart for the alternate airport, at the time the flight is expected to arrive.
2—specified in the certificate holder's operations specifications for that airport, when the flight arrives.
3—listed on the NOAA IAP chart for the alternate airport, from 2 hours before to 2 hours after the ETA for that flight.

5233. Which dispatch requirement applies to a flag air carrier scheduled for a 7-hour IFR flight?

1—No alternate airport is required if the forecast weather at the ETA at the destination airport is at least 1,500 feet and 3 miles.
2—An alternate airport is required.
3—An alternate airport is required only if it is specified in the International Flight Information Manual.

5234. An airport is not listed in a domestic air carrier's operations specifications and does not have prescribed takeoff weather minimums. What are the minimum weather conditions for takeoff?

1—1000-3.
2—900-2.
3—800-2.

5235. The pilot in command of an airplane en route determines that icing conditions can be expected that might adversely affect safety of the flight. Which action is appropriate?

1—The pilot in command and the company dispatcher must jointly decide whether or not the flight may continue to the original destination airport.
2—The pilot in command shall not continue flight into the icing conditions.
3—The flight may continue to the original destination airport, provided all anti-icing and deicing equipment is operational and is used.

5236. What action is required prior to takeoff if snow is adhering to the wings of an air carrier airplane?

1—Turn on wing deice prior to takeoff.
2—Assure that the snow is removed.
3—Add 15 knots to the normal V_R speed.

5237. When an alternate airport outside the United States has no prescribed takeoff minimums and is not listed in a flag air carrier's operations specifications, what minimum weather conditions will meet the requirements for takeoff?

1—800-2-1/2.
2—600-3.
3—900-1-1/2.

5238. What minimum weather conditions must exist for a domestic air carrier flight to take off from an airport within the United States which is not listed in the air carrier's operations specifications? (Takeoff minimums are not prescribed for that airport.)

1—800-2, 100-1/2, or 1500-1.
2—800-2, 900-1-1/2, or 1000-1.
3—600-3, 1000-2, or 1200-1.

5239. An alternate airport is not required to dispatch a flag air carrier airplane for a flight less than 6 hours when the visibility for at least 1 hour before and 1 hour after the ETA at the destination airport is forecast to be

1—2 miles or greater.
2—at least 3 miles, or 2 miles more than the lowest applicable minimum.
3—at least 5 miles.

5240. Which weather conditions meet the minimum requirements for a flag air carrier to take off from an alternate airport that is not listed in the operation specifications?

1—800-1/2, 900-1, 1000-2.
2—800-1, 900-2, 1000-3.
3—800-2, 900-1-1/2, 1000-1.

5241. When a domestic air carrier airplane lands at an intermediate airport at 1815Z, what is the latest time it may depart that airport without a specific authorization from an aircraft dispatcher?

1—1945Z.
2—1915Z.
3—1845Z.

5242. When a flag air carrier flight lands at an intermediate airport at 1805Z, what is the latest time it may depart without being redispatched?

1—0005Z.
2—2005Z.
3—1905Z.

5243. When a flag air carrier airplane lands at an intermediate airport at 1322Z, what is the latest time it may continue a flight without receiving a redispatch authorization?

1—1922Z.
2—1622Z.
3—1422Z.

5244. When a flag air carrier flight lands at an intermediate airport at 1345Z and experiences a delay, what is the latest time it may depart for the next airport without a redispatch release?

1—1945Z.
2—1545Z
3—1445Z.

5245. The reserve fuel supply for a domestic air carrier flight is

1—30 minutes of holding fuel consumption 1,500 feet above the destination or alternate airport.
2—45 minutes at normal fuel consumption in addition to the fuel required to the most distant alternate airport.
3—45 minutes of holding fuel consumption 1,500 feet above the destination or alternate airport.

5246. What is the minimum fuel required by a flag air carrier turbojet airplane on a flight within the 48 contiguous United States, after reaching the most distant alternate airport?

1—45 minutes at normal cruising fuel consumption.
2—2 hours at normal cruising fuel consumption.
3—Enough fuel to return to the destination airport.

5247. What is the fuel reserve requirement for a commercially operated reciprocating-engine-powered airplane flying within the contiguous United States upon arrival at the most distant alternate airport specified in the flight release? Enough fuel to fly

1—30 minutes plus 15 percent of total time required to fly at normal cruising consumption to the alternate.
2—45 minutes at normal cruising fuel consumption.
3—15 minutes plus 30 percent of the total time required to fly to the alternate at normal cruising fuel consumption.

5248. For a flag air carrier flight to be released to an island airport for which an alternate airport is not available, a turbojet-powered airplane must have enough fuel to fly to that airport and thereafter to fly

1—for 2 hours at normal cruising fuel consumption.
2—for 2 hours at a fuel consumption computed for 10,000 feet MSL at a specific weight and holding airspeed.
3—back to the departure airport.

5249. An alternate airport is not required for a supplemental or commercial air carrier, turbojet-powered airplane on an IFR flight outside the 48 contiguous states, if

1—a fuel reserve for 30 minutes, plus 15 percent of the total flight time, is carried aboard the airplane.
2—enough fuel is aboard the airplane to fly to the destination and thereafter to fly for at least 2 hours at normal cruising fuel consumption.
3—enough fuel to fly for 30 minutes at holding airspeed at 1,500 feet AGL is carried aboard the airplane.

5250. What is the fuel reserve required for a turbine-engine-powered (other than turbopropeller) supplemental air carrier airplane upon arrival over the most distant alternate airport outside the contiguous United States?

1—30 minutes at holding speed.
2—45 minutes at normal cruising speed.
3—2 hours at normal cruise fuel consumption.

5251. Upon arriving at the most distant airport, what is the fuel reserve requirement for a turbopropeller flag air carrier airplane.

1—30 minutes at the most economical altitude for fuel consumption at holding speed.
2—45 minutes at holding altitude.
3—30 minutes plus 15 percent of the total time required, or 90 minutes at normal cruise, whichever is less.

5252. What is the fuel reserve required for a turbopropeller supplemental air carrier airplane upon the arrival at a destination airport for which an alternate airport is not specified

1—30 minutes at holding airspeed.
2—2 hours at normal cruising fuel consumption.
3—3 hours at normal cruising fuel consumption.

5253. When a turbine-engine-powered flag air carrier airplane is released to an airport which has no available alternate, what is the required fuel reserve?

1—1 hour 30 minutes at maximum range airspeed.
2—2 hours at normal cruise fuel consumption.
3—30 minutes plus 10 percent of the total flight time.

5254. What is the fuel reserve required for a reciprocating-engine-powered supplemental air carrier airplane upon arrival at the most distant alternate airport during a flight within the contiguous United States?

1—45 minutes at normal cruising fuel consumption.
2—2 hours at normal cruising fuel consumption.
3—3 hours at normal cruising fuel consumption.

5255. If an instrument on a multiengine airplane is inoperative, which document dictates whether the flight may continue en route?

1—Amended flight/dispatch release.
2—Original dispatch release.
3—Certificate holder's manual.

5256. Under what conditions may an air carrier pilot continue an instrument approach to the DH or MDA, after receiving a weather report indicating that less than minimum published landing conditions exist at the airport?

1—If the instrument approach is conducted in a radar environment.
2—When the weather report is received after the pilot has been cleared for an instrument approach.
3—When the weather report is received after the pilot has begun the final approach segment of an instrument approach.

5257. By regulation, who shall provide the pilot in command of a domestic or flag air carrier airplane, information concerning irregularities of facilities and services?

1—Air route traffic control center.
2—Director of operations.
3—Aircraft dispatcher.

5258. Who is responsible for obtaining information on all current airport conditions and irregularities of navigation facilities for a supplemental air carrier flight?

1—Aircraft dispatcher.
2—Director of operations.
3—Pilot in command.

5259. During a supplemental air carrier flight, who is responsible for obtaining information on meteorological conditions?

1—Aircraft dispatcher.
2—Pilot in command.
3—Director of operations.

5260. Where can the pilot of a flag air carrier airplane find the latest FDC NOTAM's?

1—Any company dispatch facility.
2—In the standard instrument approach procedures book.
3—Airport/Facility Directory.

5261. Who is responsible, by regulation, for briefing a domestic or flag air carrier pilot in command on all available weather information?

1—FSS.
2—Aircraft dispatcher.
3—Director of operations.

5262. Category II ILS operations below 1600 RVR and a 150-foot DH may be approved after the pilot has

1—successfully completed an FAA-approved Category II training program.
2—made at least six Category II approaches in actual IFR conditions with 100-foot DH within the preceding 12 calendar months.
3—logged 100 hours' flight time in make and model airplane and three Category II ILS approaches in actual or simulated IFR conditions with 150-foot DH since the beginning of the sixth preceding month.

5263. When a pilot's flight time consists of 80 hours' pilot in command in a particular type airplane, how does this affect the MDA, DH, or minimum visibility for the destination airport?

1—Has no effect.
2—MDA or DH and visibility minimums are decreased by 100 feet and 1/2 mile.
3—MDA or DH and visibility minimums are increased by 100 feet and 1/2 mile.

5264. Which information must be contained in, or attached to, the dispatch release for a flag air carrier flight?

1—Type of operation (e.g., IFR, VFR).
2—Total fuel supply on board the airplane.
3—Passenger manifest and cargo weight.

5265. Which certificated air carrier operators must attach to, or include on, the flight release form the name of each flight crewmember, flight attendant, and designated pilot in command?

1—Supplemental and commercial.
2—Supplemental and domestic.
3—Flag and commercial.

5266. What information must be contained in, or attached to, the dispatch release for a domestic air carrier flight?

1—Departure airport, immediate stops, destinations, and alternate airports.
2—Names of all passengers on board.
3—Cargo load and weight and balance data.

5267. What information must be included on a domestic air carrier dispatch release?

1—Evidence that the airplane is loaded according to schedule.
2—Minimum fuel supply.
3—Company or organization name.

5268. A dispatch release for a flag or domestic air carrier must contain or have attached to it

1—weather information for the complete flight.
2—weight and balance data.
3—a crew list.

5269. What information is required in the flight release for supplemental air carriers and commercial operators that is not required in the dispatch release for flag and domestic air carriers?

1—Weather reports and forecasts.
2—Names of all crewmembers.
3—Minimum fuel supply.

5270. Which documents are required to be carried aboard each flag air carrier flight?

1—Dispatch release and weight and balance release.
2—Load manifest and flight release.
3—Dispatch release, load manifest, and flight plan.

5271. Which documents are required to be carried aboard each domestic air carrier flight?

1—Dispatch release, load manifest, and flight plan.
2—Dispatch release and weight and balance release.
3—Load manifest and flight release.

5272. How long shall a supplemental air carrier or commercial operator retain a record of the load manifest, flight release, and flight plan?

1—1 month.
2—3 months.
3—12 months.

5273. A domestic or flag air carrier shall keep copies of the flight plans, dispatch releases, and load manifests for at least

1—6 months.
2—3 months.
3—30 days.

5274. A flag air carrier flight which requires three pilots is scheduled to operate on August 5. Each of the pilots has a First-Class Medical Certificate dated January 28 of the same year. For this scheduled flight

1—all three pilots must have new medical certificates prior to departure.
2—only the pilots serving as pilot in command and second in command must have new medical certificates prior to departure.
3—these medical certificates are adequate for each of the pilot positions.

5275. A certificate holder must have "exclusive use" of

1—at lease one aircraft for each operation authorized in the certificate holder's manual.
2—at least one aircraft that meets the requirements of the specific operations authorized in the certificate holder's operations specifications.
3—at least one aircraft that meets the requirements of at least one kind of operation authorized in the certificate holder's operations specifications.

5276. Which document specifically authorizes a person to operate an aircraft in a particular geographic area?

1—Certificate of designation.
2—Air taxi operating certificate.
3—Operations specifications.

5277. If previous arrangements have not been made by the operator, where can the procedures for servicing the aircraft be found?

1—Certificate holder's director of maintenance.
2—Certificate holder's manual.
3—Part E of the certificate holder's operations specifications.

5278. What document contains procedures that explain how the required return-to-service conditions have been met?

1—Certificate holder's manual.
2—Mechanical Interruption Summary Report.
3—Operations Inspections and Surveillance Procedures Handbook.

5279. Who is responsible for keeping copies of the certificate holder's manual up to date with approved changes or additions?

1—Each employee of the certificate holder who is furnished a manual.
2—Air Taxi/Commercial Technical Service.
3—A representative of the Administrator assigned to the certificate holder.

5280. An aircraft may be operated in a foreign country bv a FAR Part 135 operator only if authorized to do so by

1—an FAA International Field Office.
2—the ICAO (International Civil Aviation Organization).
3—the foreign country.

5281. Who is responsible for the preparation of a required load manifest?

1—Dispatcher.
2—Air carrier certificate holder.
3—Company official specifically designated by the Administrator.

5282. Which is not a required item on the load manifest?

1—Aircraft registration or flight number.
2—List of passenger names.
3—Identification of crewmembers.

5283. A certificate holder must keep copies of completed load manifests for at least

1—30 days.
2—90 days.
3—60 days.

5284. Before each flight, who is directly responsible for determining the airworthiness status of a mechanical irregularity previously entered in the aircraft maintenance log?

1—Aircraft dispatcher.
2—Line maintenance supervisor.
3—Pilot in command of next flight.

5285. Where is the certificate holder required to list the name and title of each person authorized to exercise operational control for a particular flight?

1—Part B of the certificate holder's Operations Specifications.
2—Attached to the load manifest for that flight.
3—Certificate holder's manual.

5286. Procedures for keeping copies of the aircraft maintenance log in the aircraft and available to appropriate personnel shall be set forth in

1—the certificate holder's manual.
2—the aircraft maintenance procedures handbook.
3—Part D of the operations specifications.

5287. Which person, other than the second in command, may the pilot in command permit to manipulate the flight controls?

1—When authorized by the certificate holder, a passenger who holds a pilot certificate appropriate for the aircraft.
2—An authorized FAA safety representative who is qualified in the aircraft, and is checking flight operations.
3—A pilot employed by an engineering firm who is authorized by the certificate holder to conduct flight tests.

5288. The maximum altitude loss for a malfunctioning autopilot without an approach coupler is 45 feet. If the MDA is 1,620 feet MSL and the touchdown zone elevation is 1,294 feet, to which minimum altitude may you use the autopilot?

1—1,510 feet MSL.
2—1,339 feet MSL.
3—1,570 feet MSL.

5289. The maximum altitude loss for a malfunctioning autopilot with an approach coupler is 40 feet. To which minimum altitude may the autopilot be used during an ILS approach in less than basic VFR conditions?

1—40 feet AGL.
2—50 feet AGL.
3—80 feet AGL.

5290. The maximum altitude loss for a particular malfunctioning autopilot under approach conditions is 55 feet. If the touchdown zone elevation is 571 feet and the MDA is 1,100 feet, to which minimum altitude may you use this autopilot?

1—626 feet MSL.
2—990 feet MSL.
3—1,050 feet MSL.

5291. The maximum altitude loss specified for malfunction of a certain autopilot under cruise conditions is 50 feet. What is the lowest altitude this autopilot may be used en route?

1—550 feet AGL.
2—600 feet AGL.
3—500 feet AGL.

5292. What is the lowest altitude above the terrain that an autopilot may be used during en route operations, if the airplane flight manual specifies a malfunction under cruise conditions?

1—100 feet.
2—500 feet.
3—1,000 feet.

5293. The altitude loss for a particular malfunctioning autopilot with an approach coupler is 60 feet. If the reported weather is below basic VFR minimums and an ILS approach using the approach coupler is to be used, what minimum altitude may be used?

1—50 feet AGL.
2—60 feet AGL.
3—100 feet AGL.

5294. An autopilot may be used in place of a second in command in any aircraft

1—being operated in commuter air carrier service.
2—having a passenger seating configuration, excluding any pilot's seat, of 10 seats or more.
3—having a total seating capacity of more than eight seats and being operated in commuter air service.

5295. Which is a condition that must be met by a commuter air carrier certificate holder to have an aircraft approved for operation with an autopilot system and no second in command?

1—The passenger seating configuration is 12 or less, excluding any pilot seat.
2—The autopilot system is capable of operating the controls to maintain flight and to maneuver the aircraft about the three axes.
3—The operation is restricted to VFR or VFR over-the-top.

5296. A commuter air carrier certificate holder plans to assign a pilot as pilot in command of an aircraft having eight passenger seats to be used in passenger-carrying operations. Which experience requirement must that pilot meet if the aircraft is to be flown with an autopilot and no second in command?

1—100 hours as pilot in command in the make and model.
2—100 hours in the category, class, and type.
3—50 hours and 10 landings as pilot in command in the make and model.

5297. Who may be allowed to carry a deadly weapon on board an aircraft operated under FAR Part 135?

1—Official bodyguards attached to foreign legations.
2—Security officers employed by corporate executives.
3—Employees of a municipality or state authorized to carry arms.

5298. Which restriction must be observed regarding the carrying of cargo in the passenger compartment?

1—Cargo must be properly secured by a safety belt or other approved tiedown.
2—All cargo must be carried in a suitable bin and secured to a passenger seat or the floor structure of the aircraft.
3—Cargo carried in passenger seats must be forward of all passengers.

5299. Which person may be carried aboard an aircraft without complying with the passenger-carrying requirements of FAR Part 135?

1—An authorized technical representative of an aircraft or engine company.
2—A member of the United States diplomatic corps on an official courier mission.
3—An individual who is necessary for the safe handling of animals on the aircraft.

5300. In a cargo-only operation, cargo must be loaded

1—so that it does not obstruct the aisle between the crew and cargo compartments.
2—in such a manner that at least one emergency or regular exit is available to all occupants.
3—so that all required flight crewmembers have ready access to all regular and emergency exits.

5301. Which is a requirement governing the carriage of cargo?

1—Cargo must be carried in an approved rack, bin, or compartment.
2—Cargo not stowed in an approved bin must be secured by a safety belt or approved tiedown device.
3—All cargo carried in the passenger compartment must be packaged and stowed ahead of the foremost seated passenger.

5302. Which is a requirement governing the carriage of carry-on baggage?

1—All carry-on baggage must be restrained so that its movement is prevented during turbulence.
2—Carry-on baggage must be stowed ahead of all seated occupants.
3—Pieces of carry-on baggage weighing more than 10 pounds must be carried in an approved rack or bin.

5303. If carry-on baggage or cargo is carried in the passenger compartment, it must be

1—stowed ahead of the foremost seated passengers.
2—placed in an approved rack, bin, or compartment installed in the aircraft.
3—so located that it does not obstruct the aisle between the crew and passenger compartments.

5304. The load manifest must be prepared prior to each takeoff for

1—any aircraft with a passenger seating capacity of 10 seats or more.
2—multiengine aircraft only.
3—all helicopters and large aircraft operated by a commuter air carrier.

5305. Which minimum passenger seating configuration requires a second in command?

1—10 seats.
2—12 seats.
3—15 seats.

5306. A flight attendant crewmember is required on aircraft having a passenger seating configuration, excluding any pilot seat, of

1—15 or more.
2—20 or more.
3—19 or more.

5307. Before each takeoff, the pilot in command of an aircraft carrying passengers shall ensure that all passengers have been orally briefed on the

1—location of normal and emergency exits, oxygen masks, and life preservers.
2—use of seatbelts, oxygen, and liferafts.
3—use of seatbelts, smoking, and location of survival equipment.

5308. Before takeoff, the pilot in command of an aircraft carrying passengers shall ensure that all passengers have been orally briefed on the normal and emergency use of oxygen

1—regardless of the altitude at which the flight will operate.
2—if the flight involves operations above 12,000 feet MSL.
3—if the flight involves operations at or above 10,000 feet MSL for more than 1 hour.

5309. The oral preflight briefing required on passenger-carrying aircraft shall be

1—supplemented by an actual demonstration of emergency exit door operation by a crewmember.
2—presented in person by the pilot in command while another flight crewmember demonstrates the operation of emergency equipment.
3—conducted by the pilot in command or a crewmember and supplemented by printed cards for the use of each passenger.

5310. Which is a requirement regarding the carriage and operation of oxygen equipment for medical use by passengers?

1—No person may smoke within 10 feet of oxygen storage and dispensing equipment.
2—When oxygen equipment is used for the medical treatment of a patient, the rules pertaining to emergency exit access are waived.
3—No person may connect oxygen bottles or any other ancillary equipment until all passengers are aboard the aircraft and seated.

5311. If a certificate holder deviates from the provisions of regulations which pertain to medical use of oxygen by passengers, a complete report of the incident shall be sent to the FAA within

1—48 hours.
2—7 working days.
3—10 working days.

5312. Which is a condition that must be met when a person is administered medical oxygen in flight?

1—The distance between a person using medical oxygen and any electrical unit must not be less than 5 feet.
2—A person using oxygen equipment must be seated to avoid restricting access to, or use of, any required exit.
3—A person being administered oxygen must be monitored by equipment that displays and records pulse and respiration.

5313. Which requirement applies when oxygen is stored in liquid form?

1—Liquified oxygen is a hazardous material and must be kept in an isolated storage facility.
2—The equipment used to store liquid oxygen must be included in the certificate holder's approved maintenance program.
3—Smoking is not permitted within 50 feet of stored liquid oxygen.

5314. Which is a pilot requirement for oxygen?

1—Each pilot of a pressurized aircraft operating at 18,000 feet MSL and above shall have an approved quick-donning type oxygen mask.
2—On pressurized aircraft requiring a flightcrew of two pilots, both shall continuously wear oxygen masks whenever the cabin pressure altitude exceeds 12,000 feet MSL.
3—On unpressurized aircraft, flying above 12,000 feet MSL, pilots shall use oxygen continuously.

5315. Which is a requirement for pilot use of oxygen in a pressurized airplane?

1—At altitudes of 18,000 feet MSL and above, each pilot shall have an approved quick-donning oxygen mask.
2—The pilot at the controls shall use oxygen continuously any time the cabin pressure altitude is more than 12,000 feet
3—At altitudes above 20,000 feet MSL, the pilot at the controls must use an approved oxygen mask any time the other pilot is away from the duty station.

5316. Above which altitude must at least one pilot at the controls of a pressurized aircraft wear a secured and sealed oxygen mask?

1—30,000 feet MSL.
2—35,000 feet MSL.
3—41,000 feet MSL.

5317. Which is a requirement for flightcrew use of oxygen masks in a pressurized cabin airplane?

1—At altitudes above FL250, one of the two pilots at the controls shall use an oxygen mask continuously.
2—Both pilots at the controls shall use oxygen masks above FL300.
3—At altitudes above 25,000 feet MSL, if one pilot leaves the pilot duty station, the remaining pilot at the controls shall use an oxygen mask.

5318. At altitudes above 10,000 feet through 12,000 feet MSL, each pilot of an unpressurized airplane must use supplemental oxygen for that part of the flight that is of a duration of more than

1—20 minutes.
2—30 minutes.
3—45 minutes.

5319. The two pilot stations of a pressurized aircraft are equipped with approved quick-donning oxygen masks. What is the maximum altitude authorized without one pilot wearing and using an oxygen mask?

1—25,000 feet MSL.
2—35,000 feet MSL.
3—41,000 feet MSL.

5320. In airplanes where a third gyroscopic bank-and-pitch indicator is required, that instrument must

1—continue reliable operation for at least 45 minutes after the output of the airplane's electrical generating system falls below an optimum level.
2—be operable by a selector switch which may be actuated from either pilot station.
3—continue reliable operation for a minimum of 30 minutes after total failure of the aircraft's electrical generating system.

5321. In which aircraft operating under FAR Part 135 is a third gyroscopic bank-and-pitch indicator required?

1—All turbojet airplanes.
2—All airplanes where the flightcrew of pilot in command and second in command are required.
3—All airplanes having a passenger seating capacity of 30 seats or more.

5322. To operate a multiengine aircraft with certain equipment inoperative under the provisions of a minimum equipment list, what document must be carried within the aircraft?

1—Letter from the Regional Airworthiness Office authorizing such operation.
2—Letter from the certificate holder's director of maintenance authorizing the operation.
3—Letter of Authorization issued by the FAA district office having certification responsibility.

5323. What performance is required of a multiengine airplane with the critical engine inoperative, while carrying passengers for hire in IFR weather conditions?

1—Climb at least 100 feet a minute at the highest MEA of the route to be flown or 3,000 feet MSL, whichever is higher.
2—Climb at least 50 feet a minute at the MEA's of the route to be flown or 5,000 feet MSL, whichever is higher.
3—Maintain altitude at the highest MEA of the route to be flown or 5,000 feet MSL, whichever is higher.

5324. Which performance requirement applies to passenger-carrying land airplanes being operated over water?

1—Multiengine airplanes must be able to climb, with the critical engine inoperative, at least 100 feet a minute at 1,500 feet above the surface.
2—Single-engine airplanes must be operated at an altitude that will allow them to reach land in case of engine failure.
3—Both single-engine and multiengine airplanes must have integral flotation devices that will keep them afloat in event of ditching.

5325. The weight and CG of an aircraft used in air taxi service must have been calculated from those values established by actual weighing of the aircraft within what period of time?

1—Multiengine aircraft, 24 calendar months; single-engine, 36 calendar months.
2—Multiengine aircraft, 36 calendar months.
3—Multiengine and single-engine aircraft, 36 calendar months.

5326. Which aircraft must be equipped with an approved public address and crewmember interphone system?

1—All turbine-engine-powered aircraft in passenger-carrying operations.
2—Aircraft having a passenger seating configuration, excluding any pilot seat, of more than 19 seats.
3—Multiengine aircraft having a passenger seating configuration of 10 seats or more.

5327. Information recorded during normal operations by a required cockpit voice recorder

1—must be retained for at least 12 hours.
2—may be erased only once each flight.
3—may be erased, except the last 30 minutes.

5328. An approved cockpit voice recorder is required equipment in

1—large airplanes having a maximum passenger capacity of more than 19 seats.
2—turbojet-powered airplanes having a passenger seating configuration, excluding any pilot seat, of 10 seats or more.
3—all aircraft operated in commuter air carrier service having a passenger seating configuration of 19 seats or more.

5329. During which time period must a required voice recorder of a passenger-carrying airplane be continuously operated?

1—From the beginning of taxi to the end of the landing roll.
2—From engine start at departure airport to engine shutdown at landing airport.
3—From the use of the checklist before the flight to completion of the final check at the end of the flight.

5330. In which airplanes is a ground proximity warning system required?

1—All airplanes having a passenger seating configuration, excluding any pilot seat, of 10 seats or more.
2—Airplanes having a passenger seating configuration of 19 seats or more, being operated in commuter air service.
3—Turbojet-powered airplanes having a passenger seating configuration, excluding any pilot seat, of 10 seats or more.

5331. When a ground proximity warning system is required under FAR Part 135, it must

1—convey warnings for excessive closure rates with the terrain but not for deviation from an ILS glide slope.
2—alert the pilot by an audible warning signal when deviation above or below glide slope occurs.
3—convey warnings of any deviation below glide slope and of excessive closure rate with the terrain.

5332. When a ground proximity warning system is required, it must

1—incorporate a means of alerting the pilot when a malfunction occurs.
2—apply corrective control pressure when deviation below glide slope occurs.
3—incorporate a backup feature that activates automatically upon total failure of the aircraft's electrical generating system.

5333. A pressurized airplane being operated at FL300 can descend safely to 15,000 feet MSL in 4 minutes. What oxygen supply must be carried for all occupants other than the pilots?

1—30 minutes.
2—45 minutes.
3—1 hour.

5334. Above what altitude in an unpressurized airplane, must all passengers be supplied oxygen?

1—12,000 feet MSL.
2—14,000 feet MSL.
3—15,000 feet MSL.

5335. Between what altitudes in an unpressurized airplane must oxygen be available to at least 10 percent of the occupants, other than the pilots?

1—Above 10,000 feet through 15,000 feet MSL, if flight at those altitudes is of more than a 30-minute duration.
2—Above 12,000 feet through 16,000 feet MSL, for any time period.
3—Above 12,000 feet through 15,000 feet MSL, if flight at those altitudes is of more than a 15-minute duration.

5336. An unpressurized aircraft with 10 occupants other than the pilots, will be cruising at 11,000 feet MSL for 20 minutes. For how many, if any, of these occupants must there be an oxygen supply?

1—Five.
2—One.
3—None.

5337. The oxygen requirements for occupants of a pressurized airplane operated at altitudes above 24,000 feet MSL is dependent upon the airplane's ability to descend safely to an altitude of

1—10,000 feet MSL in 4 minutes.
2—15,000 feet MSL in 4 minutes.
3—12,000 feet MSL at a minimum rate of 2,500 ft/min.

5338. In addition to fully-equipped liferafts and life preservers, what emergency equipment must be provided during extended overwater operations?

1—One water resistant, self-buoyant, portable emergency radio transmitter for each 10 occupants.
2—One survival-type emergency locator transmitter.
3—One pyrotechnic signaling device for each 10 occupants.

5339. Which is a requirement for life preservers during extended overwater operations? Each life preserver must be equipped with

1—an approved survivor locator light.
2—a dye marker.
3—one flashlight having at least two size "D" cells or equivalent.

5340. Which aircraft must have a shoulder harness installed at each flight crewmember station?

1—Aircraft having a passenger seating configuration, excluding any pilot seat, of 10 seats or more.
2—All passenger-carrying aircraft operating under FAR Part 135.
3—Large aircraft being operated in commuter air service.

5341. Under which condition is a pilot not required to keep the shoulder harness fastened during takeoff and landing while at a pilot station?

1—When operating an aircraft having a passenger seating configuration, excluding any pilot seat, of 10 seats or less.
2—When the pilot cannot perform the required duties with the shoulder harness fastened.
3—When serving as pilot in command or second in command of an aircraft having a total seating capacity of eight seats or less.

5342. Which airplanes must have a shoulder harness installed at each flight crewmember station?

1—All airplanes operating under FAR Part 135.
2—All turbojet-powered airplanes.
3—All airplanes used in commuter air service.

5343. In which aircraft, or under what conditions, is airborne thunderstorm detection equipment required?

1—Multiengine turbine-powerd aircraft having a passenger seating configuration of 19 seats or more being operated by a commuter air carrier.
2—Any aircraft having a passenger seating configuration of 19 seats or more that is engaged in passenger-carrying operations under IFR or at night.
3—Small multiengine aircraft having a passenger seating configuration of 10 seats or more, excluding any pilot seat, that are engaged in passenger-carrying operations.

5344. Airborne weather radar equipment must be installed in large transport category aircraft in the conterminous 48 United States

1—and be fully operational, although weather forecasts indicate no hazardous conditions.
2—engaged in passenger-carrying operations.
3—engaged in either cargo or passenger-carrying operations.

5345. An aircraft has a passenger seating configuration of 16 seats, excluding any pilot seats. How many, if any, approved first aid kits are required?

1—One.
2—Two.
3—None.

5346. How many, if any, approved first aid kits are required on an aircraft having a passenger seating configuration of 20 seats and a passenger load of 14?

1—None.
2—One.
3—Two.

5347. When a crash ax is required equipment on an aircraft, where should it be located?

1—As close as practicable to an emergency exit.
2—At a location where it is inaccessible to the passengers during normal operations.
3—At a location where it is accessible to both the crew and passengers during normal operations.

5348. A pilot may make an IFR departure from an airport that does not have an approved standard instrument approach procedure if the

1—certificate holder holds a waiver from ATC approving the procedure.
2—certificate holder has been issued operations specifications by the Administrator approving the procedure.
3—departure airport is within 30 minutes or less flying time of another airport that has an approved standard instrument approach procedure.

5349. Which condition must be met to conduct IFR operations from an airport that is not at the location where weather observations are made?

1—The Administrator must issue operations specifications that permit the procedure.
2—A "Letter of Waiver" authorizing the procedure must be issued by the U.S. National Weather Service.
3—An "Authorization Letter" permitting the procedure must be issued to the operator by the supervising FAA district office.

5350. What are the empty weight and balance currency requirements for aircraft used in air taxi service?

1—The empty weight and CG of multiengine and single-engine aircraft must have been calculated from an actual weighing within the previous 24 calendar months.
2—The empty weight and CG of multiengine aircraft must have been calculated from an actual weighing within the previous 36 calendar months.
3—The empty weight and CG must have been calculated from an actual weighing within the previous 24 calendar months unless the original Airworthiness Certificate was issued within the previous 36 calendar months.

5351. A pilot may not begin an IFR operation unless the next airport of intended landing is forecast to be at or above authorized IFR landing minimums at

1—the estimated time of arrival.
2—the estimated time of arrival, plus or minus 1 hour.
3—30 minutes before, until 30 minutes after, the estimated time of arrival.

5352. A takeoff may not be made from an airport that is below the authorized IFR landing minimums unless

1—there is an alternate airport with the required IFR landing minimums within 45 minutes' flying time.
2—the departure airport is forecast to have the required IFR landing minimums within 1 hour.
3—there is an alternate airport with the required IFR landing minimums within 1-hour's flying time.

5353. A pilot may not designate an airport as an alternate unless it is forecast to be at or above alternate minimums at

1—the time of departure.
2—the estimated time of arrival, plus or minus 1 hour.
3—the estimated time of arrival.

5354. Assuming the required ceiling exists, an alternate for the destination airport is not required if, for at least 1 hour before and after the ETA, the forecast visibility is at least

1—5 miles, or 3 miles more than the lowest applicable visibility minimums for the instrument approach procedure to be used, whichever is greater.
2—3 miles, or 2 miles more than the lowest applicable visibility minimums for the instrument approach procedure to be used, whichever is greater.
3—5 miles, or 3 miles more than the lowest applicable circling minimums.

5355. The required visibility exists and circling is not authorized. An alternate for the destination airport is not required if, for at least 1 hour before and after the ETA, the forecast ceiling is at least

1—1,500 feet above the lowest published minimum, or 2,000 feet above the airport elevation, whichever is higher.
2—1,000 feet above the lowest MEA, MOCA, or altitude prescribed for the initial approach procedure for the airport.
3—1,000 feet above the lowest published minimum, or 1,500 feet above the airport elevation, whichever is higher.

5356. If the weather forecasts do not require the listing of an alternate airport on an IFR flight, the airplane must carry sufficient fuel to fly to the destination airport and

1—fly thereafter for 45 minutes at normal cruising speed.
2—fly thereafter for 30 minutes at normal cruising speed.
3—make one missed approach and thereafter have a 45-minute reserve at normal cruising speed.

5357. If the weather forecasts require the listing of an alternate airport on an IFR flight, the airplane must carry enough fuel to fly to the first airport of intended landing, then to the alternate, and fly thereafter for a minimum of

1—30 minutes.
2—20 minutes.
3—45 minutes.

5358. At a foreign airport, a pilot may not take off under IFR unless the reported weather conditions indicate that the

1—visibility is 1 mile or more.
2—ceiling is at least 500 feet and the visibility is 1 mile or more.
3—visibility is 1/2 mile or more.

5359. A pilot may not take off under IFR at a military airport unless the visibility is

1—at least 1 mile.
2—1/2 mile or more.
3—3/4 mile or more.

5360. A pilot may not make an instrument approach at a military or foreign airport unless the minimum visibility is at least

1—1/2 mile.
2—RVR 32.
3—RVR 40.

5361. An instrument approach procedure to an airport may not be initiated unless the latest weather report issued by an authorized weather reporting facility indicates that weather conditions

1—are at or above the circling minimums for the runway the pilot intends to use.
2—exceed the straight-in minimums for all nonprecision approaches.
3—are at or above the authorized IFR landing minimums for that procedure.

5362. After passing the final approach fix on a VOR approach, a weather report is received indicating the visibility is below prescribed minimums. In this situation, the pilot

1—may continue the approach and land, if at the MDA the visibility is at least equal to the required minimums.
2—should continue the approach to the MDA, and regardless of the visibility, execute a missed approach.
3—continue the approach and land regardless of the visibility you observe at the MDA, if prior to beginning the approach, the visibility was reported at or above minimums.

5363. Which is one required condition for a pilot to take off under IFR with less-than-standard takeoff minimums at an airport where a straight-in instrument approach procedure is authorized and there is an approved weather reporting source?

1—The pilot must have at least 100 hours as pilot in command in the type airplane to be flown.
2—Visibility at time of takeoff must be at least RVR 16.
3—Wind direction and velocity must be such that a straight-in approach can be made to the runway served by the procedure.

5364. Which is an operational requirement concerning ice, snow, or frost on structural surfaces?

1—A takeoff may not be made if ice or snow is adhering to the wings or stabilizing or control surfaces.
2—A takeoff may be made with ice, snow, or frost adhering to the wings or stabilizing or control surfaces if anti-icing and deicing equipment is operating.
3—If snow, ice, or frost is adhering to the airplane's lift or control surfaces, but polished smooth, a takeoff may be made.

5365. What are the minimum certificate and rating requirements for the pilot in command of a multiengine airplane in commuter air carrier service under IFR?

1—Airline transport pilot of any category; multiengine class rating.
2—Airline transport pilot; airplane category; multiengine class rating; airplane type rating, if required.
3—Commercial pilot; airplane category; multiengine class and instrument rating.

5366. A multiengine airplane is being operated by a commuter air carrier. What are the minimum certificate and rating requirements for the pilot in command?

1—Airline transport pilot; airplane category; multiengine class; airplane type rating, if required.
2—Commercial pilot; airplane category; multiengine class; instrument rating; airplane type rating, if required.
3—Airline transport pilot; airplane category; multiengine class.

5367. What are the minimum certificate and rating requirements for the pilot in command of a turbojet airplane with two engines?

1—Airline transport pilot of any category; multiengine class rating; airplane type rating.
2—Airline transport pilot; airplane category; multiengine class rating; airplane type rating, if required.
3—Commercial pilot; airplane category; multiengine class rating; instrument rating; airplane type rating.

5368. A person is designated pilot in command of a multiengine, reciprocating-engine-powered airplane operated in passenger-carrying service by a commuter air carrier. If five takeoffs and landings are accomplished in that make and basic model, which additional pilot-in-command experience meets the requirement for designation?

1—Two takeoffs and landings, and 8 hours.
2—Five takeoffs and landings, and 5 hours.
3—Three takeoffs and landings, and 6 hours.

5369. A person is designated as pilot in command of a turbojet-powered airplane operated in passenger-carrying service by a commuter air carrier. If 10 takeoffs and landings are accomplished in that make and basic model, which additional pilot-in-command experience meets the requirement for designation?

1—10 hours.
2—10 hours, and five takeoffs and landings.
3—15 hours.

5370. A pilot's experience includes 8 hours in a particular make and basic model multiengine, turboprop airplane. Which additional pilot-in-command experience meets the requirements for designation as pilot in command of that airplane when operated by a commuter air carrier in passenger-carrying service?

1—Five takeoffs and landings, and 2 hours.
2—Ten takeoffs and landings, and 2 hours.
3—Twelve takeoffs and landings.

5371. A person is designated pilot in command of a single-engine airplane operated in passenger-carrying service by a commuter air carrier. If seven takeoffs and landings are accomplished in that make and basic model, which additional pilot-in-command experience meets the requirement for designation?

1—5 hours.
2—6 hours.
3—10 hours.

5372. A person is designated pilot in command of a multiengine, turboprop-powered airplane operated in passenger-carrying service by a commuter air carrier. If eight takeoffs and landings are accomplished in that make and basic model, which additional pilot-in-command experience meets the requirement for designation?

1—7 hours.
2—5 hours, and two takeoffs and landings.
3—10 hours, and two takeoffs and landings.

5373. What instrument time experience must a pilot have had to act as second in command of an airplane for an IFR air taxi flight?

1—6 hours of actual or simulated instrument flight time within the preceding 6 months.
2—3 hours of instrument flight time under actual or simulated instrument flight conditions within the preceding 6 months.
3—3 hours of actual or simulated instrument flight time within the preceding 90 days.

5374. To satisfy the instrument approach recency experience requirement, a second in command must have made at least

1—six approaches within the past 6 months; three must have been in the category aircraft to be flown.
2—six approaches within the past 6 months in any airplane, helicopter, approved instrument ground trainer, or simulator.
3—three approaches within the past 90 days in an airplane, helicopter, approved instrument ground trainer, or simulator.

5375. Pilot flight time limitations under FAR Part 135 are based

1—on the flight time accumulated under FAR Part 135 and in any other commercial flying.
2—solely on flight time accumulated in air taxi operations.
3—solely on flight time accumulated under FAR Part 135 and FAR Part 121.

5376. A person may not serve as pilot in any operation unless that person has passed

1—a competency check within 180 days prior to the date to serve.
2—an aircraft proficiency check since the beginning of the 6th calendar month prior to the date to serve.
3—a competency check since the beginning of the 12th calendar month prior to the date to serve.

5377. A pilot in command who is authorized to use an autopilot system in place of a second in command, may take the autopilot check

1—concurrently with the instrument proficiency check, but at 1-month intervals.
2—in any aircraft appropriately equipped, providing the check is taken at 3-month intervals.
3—concurrently with the competency check, providing the check is taken at 6-month intervals.

5378. A person may not serve as pilot in command in an IFR operation unless that person has passed an

1—aircraft competency and an instrument proficiency check within the previous 18 calendar months.
2—instrument proficiency check in the airplane in which to serve, or in an approved aircraft simulator, within the previous 12 calendar months.
3—instrument proficiency check under actual or simulated IFR conditions, since the beginning of the 6th calendar month prior to the date to serve.

5379. A person is assigned as pilot in command to fly both single-engine and multiengine airplanes and has passed the initial instrument proficiency check in a multiengine airplane. Which requirement applies regarding each succeeding instrument check?

1—The instrument check must be taken each 6 calendar months in both a single-engine and a multiengine airplane.
2—The instrument check must be taken alternately in single-engine and multiengine airplanes.
3—The instrument check may be taken in either a single-engine or multiengine airplane if taken at intervals of 3 calendar months.

5380. A pilot in command is authorized to use an autopilot system in place of a second in command. During the instrument proficiency check, that person is required to demonstrate the ability to

1—properly conduct instrument operations competently both with, and without, the autopilot.
2—properly conduct air-ground communications with, but not without, the autopilot.
3—comply with complex air traffic control instructions with, but not without, the autopilot.

5381. A person may act as pilot in command of both type A and type B aircraft under IFR if an instrument proficiency check has been passed in

1—type A since the beginning of the 12th month, and in type B since the beginning of the 6th month before time to serve.
2—either type A or B since the beginning of the 24th month before time to serve.
3—type A since the beginning of the 12th month, and in type B since the beginning of the 24th month before time to serve.

5382. No certificate holder may use a person as pilot in command unless that person has passed a line check

1—within the past 180 days.
2—since the beginning of the 6th month before serving as pilot in command.
3—since the beginning of the 12th month before serving as pilot in command.

5383. What are the minimum requirements for the line check required of each pilot in command authorized for IFR air taxi operations? The line check shall be given over

1—one route segment in each type of airplane the pilot is to fly and includes takeoffs and landings at each airport on the route.
2—a civil airway or an approved off-airway route in one type of airplane the pilot is to fly and includes takeoffs and landings at one or more representative airports.
3—a civil airway or an approved off-airway route in each make and model airplane the pilot is to fly and includes instrument approaches at each designated airport on the route.

5384. To serve as pilot in command in an IFR operation, a person must have passed a line check

1—since the beginning of the 12th month before that service, which included at least one flight over a civil airway, or approved off-airway route, or any portion of either.
2—consisting of a flight over the route to be flown, with at least three instrument approaches at representative airports, within the past 12 calendar months.
3—within the past 12 months, which include a portion of a civil airway and one instrument approach at one representative airport.

5385. Which takeoff computation must not exceed the length of the runway plus the length of the stopway for a turbine-engine-powered small transport category airplane?

1—Takeoff distance.
2—Acceleration-stop distance.
3—Takeoff run.

5386. The effective length of the most favorable runway at a certain airport is 8,600 feet. The maximum landing distance permitted for a large transport category turbopropeller-powered airplane to list this airport as an alternate is

1—6,020 feet.
2—6,880 feet.
3—7,740 feet.

5387. What is the maximum landing distance for a turbojet small transport category airplane if the effective length of the most favorable runway of the airport to be used as an alternate is 8,000 feet?

1—6,400 feet.
2—5,600 feet.
3—4,800 feet.

5388. What is the maximum landing distance for a turbine-engine-powered small transport category airplane if the effective length of the most favorable runway of the destination airport is 7,000 feet?

1—4,200 feet.
2—4,900 feet.
3—5,600 feet.

5389. If a certificate holder makes arrangements for another person to perform aircraft maintenance, that maintenance shall be performed in accordance with the

1—certificate holder's manual and FAR Parts 43, 91, and 135.
2—provisions of a contract prepared by a certificate holder and approved by the supervising FAA district office.
3—provisions and standards outlined in the certificate holder's aircraft maintenance handbook.

5390. Who is responsible for submitting a Mechanical Reliability Report?

1—Air carrier and commercial operator certificate holders.
2—Maintenance facility that discovers a reportable condition.
3—Aircraft maintenance inspector at district office that exercises surveillance.

5391. If not excepted, what label, if any, must be placed on a package containing acetone? (See appendix 2.)

1—No label is required.
2—POISON.
3—FLAMMABLE LIQUID.

5392. What is the maximum, if any, net quantity of acetyl bromide in one package, that may be carried in a cargo-only aircraft? (See appendix 2.)

1—1 quart.
2—1 gallon.
3—No limit is specified.

5393. What is the maximum, if any, net quantity of acetylene in one package, that may be carried in a passenger-carrying aircraft? (See appendix 2.)

1—Any amount is forbidden.
2—300 pounds.
3—No limit is specified.

5394. If not excepted, what label, if any, must be placed on a package containing allethrin? (See appendix 2.)

1—ORM-A.
2—None.
3—CORROSIVE.

5395. What is the maximum, if any, net quantity of aluminum hydride in one package, that may be carried in a passenger-carrying aircraft? (See appendix 2.)

1—No limit is specified.
2—25 pounds.
3—Any amount is forbidden.

5396. Hazardous material shipped in an aircraft operated under FAR Part 135 must be described and certified on a shipping paper. For what period of time must the originating aircraft operator retain one copy of this document? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—30 days.
2—60 days.
3—90 days.

5397. Certain classes of hazardous material may be shipped by air but are not permitted aboard passenger-carrying aircraft. How must such material be labeled? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—DANGEROUS.
2—HAZARDOUS/CLASS X.
3—CARGO AIRCRAFT ONLY.

5398. The aircraft operator discovers that the label on a container of hazardous material is missing. How should the appropriate replacement label be determined? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—Shipping papers.
2—Hazardous material index.
3—Hazardous materials table of CFR 49.

5399. An operator makes a telephone report of an incident involving fire during the loading of hazardous materials. Within what period of time must a written report be submitted? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—48 hours.
2—10 days.
3—15 days.

5400. Which procedure must be followed if an operator, when loading magnetized material, cannot avoid placing it in a position where it affects the accuracy of the magnetic compass? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—Placard the compass "unreliable."
2—Rely solely on electronic navigation.
3—Make a special compass swing and calibration.

5401. Which class of hazardous material must be loaded aboard an aircraft in a position that allows no contact with containers of corrosive materials? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—Organic chemicals.
2—Oxidizing materials.
3—Catalytic agents.

5402. What is the maximum weight of hazardous material (other than nonflammable compressed gas) that may be carried in an accessible cargo compartment of a passenger-carrying aircraft? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—50 pounds, unless otherwise specifically permitted.
2—10 pounds, if classified as corrosive.
3—25 pounds, if classified as ORM-D.

5403. What is the maximum, if any, number of packages of ORM material that may be transported in a passenger-carrying aircraft? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—No limit applies
2—A number whose combined transportation indices total 50.
3—A number whose combined transportation indices total 100.

5404. If transported in a passenger-carrying aircraft, what is the maximum combined transportation indices of packages containing radioactive materials? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—100.
2—50.
3—25.

5405. What is the maximum quantity of flammable liquid fuel that may be carried in the cabin of a small, nonscheduled, passenger-carrying aircraft being operated in a remote area of the United States? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—10 gallons.
2—15 gallons.
3—20 gallons.

5406. What is the minimum distance that a package of radioactive materials bearing the label "RADIOACTIVE YELLOW II," and having a transport index of 15, may be placed from a space continuously occupied by people? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—3 feet.
2—4 feet.
3—5 feet.

5407. Who should be notified if there is a suspected radioactive contamination involving a radioactive materials shipment and it is determined that radiological advice is needed? (See appendix 2, Excerpt from CFR 49, Part 175.)

1—Office of Hazardous Materials Regulation.
2—U.S. Energy Research and Development Administration.
3—Nuclear Regulatory Commission.

5408. What precaution, if any, should be taken if dry ice is carried aboard an aircraft?

1—This material does not require special precautions.
2—A waiver to carry this material should be requested from the certificating FAA district office.
3—Proper ventilation of the aircraft should be assured.

5409. How can turbulent air cause an increase in stalling speed of an airfoil?

1—An abrupt change in relative wind.
2—A decrease in angle of attack.
3—Sudden decrease in load factor.

5410. What effect does an increase in airspeed have on a coordinated turn while maintaining a constant angle of bank and altitude?

1—The rate of turn will decrease resulting in a decreased load factor.
2—The rate of turn will increase resulting in an increased load factor.
3—The rate of turn will decrease resulting in no changes in load factor.

5411. What is the effect on total drag of an aircraft if the airspeed decreases in level flight below that speed for maximum L/D?

1—Drag increases because of increased induced drag.
2—Drag increases because of increased parasite drag.
3—Drag decreases because of lower induced drag.

5412. What is load factor?

1—Lift multiplied by the total weight.
2—Lift subtracted from the total weight.
3—Lift divided by the total weight.

5413. For a given angle of bank, the load factor imposed on both the aircraft and pilot in a coordinated constant altitude turn

1—is directly related to the airplane's gross weight.
2—varies with the rate of turn.
3—is constant.

5414. What is the ratio between the total air load imposed on the rotor disc and the gross weight of a helicopter in flight?

1—Power loading.
2—Load factor.
3—Aspect ratio.

5415. If an aircraft with a gross weight of 2,000 pounds were subjected to a total load of 6,000 pounds in flight, the load factor would be

1—2 G's.
2—3 G's.
3—9 G's.

5416. What does wing loading during a level coordinated turn in smooth air depend upon?

1—Rate of turn.
2—Angle of bank.
3—True airspeed.

5417. What is the relationship of the rate of turn with the radius of turn with a constant angle of bank but increasing airspeed?

1—Rate will decrease and radius will increase.
2—Rate will increase and radius will decrease.
3—Rate and radius will increase.

5418. How can the pilot increase the rate of turn and decrease the radius at the same time?

1—Steepen the bank and increase airspeed.
2—Steepen the bank and decrease airspeed.
3—Shallow the bank and increase airspeed.

5419. Why must the angle of attack be increased during a turn to maintain altitude?

1—Compensate for loss of vertical component of lift.
2—Increase the horizontal component of lift equal to the vertical component.
3—Compensate for increase in drag.

5420. If no corrective action is taken by the pilot as angle of bank is increased, how is the vertical component of lift and sink rate affected?

1—Lift increases and the sink rate increases.
2—Lift decreases and the sink rate decreases.
3—Lift decreases and the sink rate increases.

5421. What affects indicated stall speed?

1—Weight, load factor, and power.
2—Load factor, angle of attack, and power.
3—Angle of attack, weight, and air density.

5422. In a light twin-engine airplane with one engine inoperative, when is it acceptable to allow the ball of a slip-skid indicator to be deflected outside the reference lines?

1—While maneuvering at minimum controllable airspeed to avoid overbanking.
2—When operating at any airspeed greater than V_{MC}.
3—When practicing imminent stalls in a banked attitude.

5423. What is the safest and most efficient takeoff and initial climb procedure in a light twin-engine airplane? Accelerate to

1—best engine-out, rate-of-climb airspeed while on the ground, then lift off and climb at that speed.
2—V_{MC}, then lift off at that speed and climb at maximum angle-of-climb airspeed.
3—an airspeed slightly above V_{MC}, then lift off and climb at the best rate-of-climb airspeed.

5424. What procedure is recommended for an engine-out approach and landing?

1—The flightpath and procedures should be almost identical to a normal approach and landing.
2—The altitude and airspeed should be considerably higher than normal throughout the approach.
3—A normal approach, except do not extend the landing gear or flaps until over the runway threshold.

5425. What performance should a pilot of a light twin-engine airplane be able to maintain at V_{MC}?

1—Heading.
2—Heading and altitude.
3—Heading, altitude, and ability to climb 50 ft/min.

5426. What criteria determines which engine is the "critical" engine of a twin-engine airplane?

1—The one with the center of thrust closest to the centerline of the fuselage.
2—The one designated by the manufacturer which develops most usable thrust.
3—The one with the center of thrust farthest from the centerline of the fuselage.

5427. What effect, if any, does altitude have on V_{MC} for an airplane with unsupercharged engines?

1—None.
2—Increases with altitude.
3—Decreases with altitude.

5428. Under what condition should stalls never be practiced in a twin-engine airplane?

1—With one engine inoperative.
2—With climb power on.
3—With full flaps and gear extended.

5429. The blue radial line on the airspeed indicator of a light twin-engine airplane represents

1—maximum single-engine rate of climb.
2—maximum single-engine angle of climb.
3—minimum controllable airspeed for single-engine operation.

5430. Under what condition is V_{MC} the highest?

1—Gross weight is at the maximum allowable value.
2—CG is at the most rearward allowable position.
3—CG is at the most forward allowable position.

5431. What action should be taken if one engine of a light twin-engine airplane becomes inoperative prior to lift-off during takeoff?

1—Accelerate to V_{YSE} before lift-off.
2—Accelerate to V_{XSE} before lift-off.
3—Close both throttles and abandon the takeoff.

5432. What is the resulting performance loss when one engine on a twin-engine fails?

1—Reduction of cruise airspeed by 50 percent.
2—Reduction of climb by 50 percent or more.
3—Reduction of all performance by 50 percent.

5433. When an engine fails after takeoff, what technique will provide the best climb performance? Wings banked approximately 5° toward the

1—inoperative engine and the ball centered.
2—operating engine and the ball centered.
3—operating engine and ball displaced one diameter toward the operating engine.

5434. If an engine failure occurs at an altitude above single-engine ceiling, what airspeed should be maintained?

1—V_{MC}.
2—V_{YSE}.
3—V_{XSE}.

5435. What is the reason for variations in geometric pitch (twisting) along a propeller or rotor blade?

1—It permits a relatively constant angle of attack along its length when in cruising flight.
2—It prevents the portion of the blade near the hub or root from stalling during cruising flight.
3—It permits a relatively constant angle of incidence along its length when in cruising flight.

5436. Describe dynamic longitudinal stability.

1—Motion about the longitudinal axis.
2—Motion about the lateral axis.
3—Motion about the vertical axis.

5437. What is a characteristic of longitudinal instability?

1—Pitch oscillations becoming progressively greater.
2—Bank oscillations becoming progressively greater.
3—craft constantly tries to pitch down.

5438. Identify the type stability if the aircraft attitude remains in the new position after the controls have been neutralized.

1—Negative longitudinal static stability.
2—Neutral longitudinal dynamic stability.
3—Neutral longitudinal static stability.

5439. Identify the type stability if the aircraft attitude tends to move farther from its original position after the controls have been neutralized.

1—Negative static stability.
2—Positive static stability.
3—Negative dynamic stability.

5440. Identify the type stability if the aircraft attitude tends to return to its original position after the controls have been neutralized.

1—Positive dynamic stability.
2—Positive static stability.
3—Neutral dynamic stability.

5441. What effect does landing at high elevation airports have on groundspeed with comparable conditions relative to temperature, wind, and airplane weight?

1—Higher than at low elevation.
2—Lower than at low elevation.
3—The same as at low elevation.

5442. What flight condition should be expected when an aircraft leaves ground effect?

1—An increase in induced drag requiring a higher angle of attack.
2—A decrease in parasite drag permitting a lower angle of attack.
3—An increase in dynamic stability.

5443. What characteristic should exist if an airplane is loaded to the rear of its CG range?

1—Sluggish in aileron control.
2—Sluggish in rudder control.
3—Unstable about the lateral axis.

5444. What will be the ratio between airspeed and lift if the angle of attack and other factors remain constant and airspeed is doubled? Lift will be

1—the same.
2—two times greater.
3—four times greater.

5445. What true airspeed and angle of attack should be used to generate the same amount of lift as altitude is increased?

1—The same true airspeed and angle of attack.
2—A higher true airspeed for any given angle of attack.
3—A lower true airspeed and higher angle of attack.

5446. How can an airplane produce the same lift in ground effect as when out of ground effect?

1—The same angle of attack.
2—A lower angle of attack.
3—A higher angle of attack.

5447. What performance is characteristic of flight at maximum L/D in a propeller-driven airplane?

1—Maximum range and distance glide.
2—Best angle of climb.
3—Maximum endurance.

5448. On an airfoil, the force of lift acts perpendicular to and the force of drag acts parallel to the

1—chord line.
2—flightpath.
3—longitudinal axis.

5449. By changing the angle of attack of a wing, the pilot can control the airplane's

1—lift, gross weight, and drag.
2—lift, airspeed, and drag.
3—lift and airspeed, but not drag.

5450. Which maximum range factor decreases as weight decreases?

1—Angle of attack.
2—Altitude.
3—Airspeed.

5451. What are some characteristics of an airplane loaded with the CG at the aft limit?

1—Lowest stall speed, highest cruise speed, and least stability.
2—Highest stall speed, highest cruise speed, and least stability.
3—Lowest stall speed, lowest cruise speed, and highest stability.

5452. The lift differential that exists between the advancing main rotor blade and the retreating main rotor blade is known as

1—Coriolis effect.
2—dissymmetry of lift.
3—translating tendency.

5453. During a hover, a helicopter tends to drift in the direction of tail rotor thrust. What is this movement called?

1—Translating tendency.
2—Transverse flow effect.
3—Gyroscopic precession.

5454. What is the purpose of the lead-lag (drag) hinge in a three-bladed, fully articulated helicopter rotor system?

1—Offset lateral instability during autorotation.
2—Compensate for Coriolis effect.
3—Provide geometric balance.

5455. During an autorotation (collective pitch full down), what is an increase in rotor RPM associated with?

1—An increase in airflow through the rotor system.
2—A decrease in airflow through the rotor system.
3—A decrease in airspeed.

5456. What causes Coriolis effect?

1—Differential thrust of rotor blades.
2—Changing angle of attack of blades during rotation.
3—Shift in center of mass of flapping blade.

5457. Why are the rotor blades more efficient when operating in ground effect?

1—Induced drag is reduced.
2—Induced angle of attack is increased.
3—Downwash velocity is accelerated.

5458. What result does a level turn have on the total lift force and load factor?

1—Lift force remains constant and the load factor increases.
2—Lift force increases and the load factor decreases.
3—Both total lift force and load factor increase.

5459. What causes a helicopter to turn?

1—Centrifugal force.
2—Horizontal component of lift.
3—Greater angle of attack of rotor blades on upward side of the rotor disc.

5460. What is the primary purpose of the tail rotor system?

1—Maintain heading during forward flight.
2—Act as a rudder to assist in coordinated turns.
3—Counteract the torque effect of the main rotor.

5461. Under what condition would it be necessary to cause the tail rotor to direct thrust to the left on an American-made helicopter?

1—To maintain heading with a left crosswind.
2—To counteract the drag of the transmission during autorotation.
3—To execute hovering turns to the right.

5462. What is the primary purpose of the free-wheeling unit?

1—To provide speed reduction between the engine, main rotor system, and tail rotor system.
2—To provide disengagement of the engine from the rotor system for autorotation purposes.
3—To transmit engine power to the main rotor, tail rotor, generator/alternator, and other accessories.

5463. The main rotor blades of a fully articulated rotor system can

1—flap, drag, and feather collectively.
2—flap, drag, and feather independently of each other.
3—flap and drag individually, but can only feather collectively.

5464. The main rotor blades of a semi-rigid system can

1—flap and feather as a unit.
2—flap, drag, and feather independently.
3—flap and drag individually, but can only feather collectively.

5465. What is the result of loading a helicopter so that the CG is aft of the rearward limit?

1—Insufficient aft cyclic control to decelerate properly during an approach.
2—Inability of the pilot to recognize this dangerous condition when hovering in a strong headwind.
3—Insufficient forward cyclic control to fly in the upper allowable airspeed range.

5466. How is helicopter climb performance most adversely affected?

1—Higher-than-standard temperature and high relative humidity.
2—Lower-than-standard temperature and high relative humidity.
3—Higher-than-standard temperature and low relative humidity.

5467. How does high density altitude affect helicopter performance?

1—Engine and rotor efficiency is increased.
2—Engine and rotor efficiency is reduced.
3—Engine efficiency is reduced, but rotor efficiency is increased.

5468. What type frequency vibration is indicative of a defective tail rotor system?

1—Low frequency.
2—Medium frequency.
3—High frequency.

5469. What type frequency vibration is associated with the main rotor system?

1—Low frequency.
2—Medium frequency.
3—High frequency.

5470. What type frequency vibration is associated with a defective transmission?

1—Low frequency.
2—Medium frequency.
3—High frequency.

5471. Which is a major warning of approaching retreating blade stall?

1—High frequency vibration.
2—Tendency to roll opposite the stalled side of the rotor.
3—Pitchup of the nose.

5472. What corrective action can a pilot take to prevent a retreating blade stall at its onset?

1—Reduce collective pitch and increase rotor RPM.
2—Increase collective pitch and increase rotor RPM.
3—Reduce collective pitch and decrease rotor RPM.

5473. Which type rotor system is more susceptible to ground resonance?

1—Fully articulated rotor system.
2—Semi-rigid rotor system.
3—Rigid rotor system.

5474. What corrective action can a pilot take to recover from settling with power?

1—Increase forward speed and raise collective pitch.
2—Decrease forward speed and partially raise collective pitch.
3—Increase forward speed and partially lower collective pitch.

5475. What limits the high airspeed potential of a helicopter?

1—Harmonic resonance.
2—Retreating blade stall.
3—Rotor RPM limitations.

5476. How does V_{NE} speed vary with altitude?

1—Varies directly with altitude.
2—Remains the same at all altitudes.
3—Varies inversely with altitude.

5477. How should a quick stop be initiated?

1—Raise collective pitch.
2—Apply aft cyclic.
3—Decrease RPM while raising collective pitch.

5478. How should the pilot execute a pinnacle-type approach to a rooftop heliport in conditions of high wind and turbulence?

1—Steeper than normal approach, maintaining the desired angle of descent with collective.
2—Normal approach, maintaining a slower-than-normal rate of descent with cyclic.
3—Shallow approach, maintaining a constant line of descent with cyclic.

5479. The primary purpose of high-lift devices is to increase the

1—L/D_{max}
2—lift at low speeds.
3—drag and reduce airspeed.

5480. What is the primary function of the leading edge flaps in landing configuration during the flare before touchdown?

1—Prevent flow separation.
2—Decrease rate of sink.
3—Increase profile drag.

5481. What effect does the leading edge slot in the wing have on performance?

1—Decrease profile drag.
2—Changes the stalling angle of attack to a higher angle.
3—Decelerates the upper surface boundary layer air.

5482. Within what Mach range does transonic flight regimes usually occur?

1—.50 to .75 Mach.
2—.75 to 1.20 Mach.
3—1.20 to 2.50 Mach.

5483. What is the highest speed possible without supersonic flow over the wing?

1—Initial buffet speed.
2—Critical Mach number.
3—Transonic index.

5484. What is the free stream Mach number which produces first evidence of local sonic flow?

1—Supersonic Mach number.
2—Transonic Mach number.
3—Critical Mach number.

5485. At what Mach range does the subsonic flight range normally occur?

1—Below .75 Mach.
2—From .75 to 1.20 Mach.
3—From 1.20 to 2.50 Mach.

5486. What is the principal advantage of a sweepback design wing over a straightwing design?

1—The critical Mach number will increase significantly.
2—Sweepback will increase changes in the magnitude of force coefficients due to compressibility.
3—Sweepback will accelerate the onset of compressibility effect.

5487. What is the result of a shock-induced separation of airflow occurring symmetrically near the wing root of a sweptwing aircraft?

1—A high-speed stall and sudden pitchup.
2—A severe moment or "tuck under."
3—Severe porpoising.

5488. What is one disadvantage of a sweptwing design?

1—The wing root stalls prior to the wingtip section.
2—The wingtip section stalls prior to the wing root.
3—Severe pitch down moment when the center of pressure shifts forward.

5489. What is the condition known as when gusts cause a sweptwing-type airplane to roll in one direction while yawing in the other?

1—Porpoise.
2—Wingover.
3—Dutch roll.

5490. What is the movement of the center of pressure when the wingtips of a sweptwing airplane are shock-stalled first?

1—Inward and aft.
2—Inward and forward.
3—Outward and forward.

5491. What is critical Mach number?

1—The highest flight speed possible without supersonic flow.
2—The speed at which the forward shift of center of pressure causes a severe pitch down.
3—The speed at which the airflow over the wing first reaches the speed of sound.

5492. What equipment on a sweptwing airplane contributes to the control of a dutch roll?

1—Rudder lock.
2—Yaw damper.
3—Rudder trim.

5493. Aircraft equipped with both high-speed and low-speed ailerons will use the outboard ailerons only during

1—low-speed operations.
2—high-speed operations.
3—low-altitude operations.

5494. (Refer to figures 1, 2, and 5.) What is the ETE at .80 Mach?

1—43 minutes.
2—45 minutes.
3—47 minutes.

5495. (Refer to figures 1, 2, and 5.) What is the total fuel required at .80 Mach?

1—9,700 pounds.
2—15,550 pounds.
3—16,750 pounds.

5496. (Refer to figures 1, 2, and 5.) What approximate indicated Mach should be maintained to arrive over the BLH VORTAC 9 minutes after passing TRM VORTAC?

1—.73 Mach.
2—.74 Mach.
3—.75 Mach.

5497. (Refer to figures 1 and 5.) What approximate indicated Mach should be maintained to arrive over the SALOM Intersection 5 minutes after passing BLH VORTAC?

1—.85 Mach.
2—.86 Mach.
3—.87 Mach.

5498. (Refer to figures 1 and 5.) What is the specific range in nautical miles per 1,000 pounds of fuel from TRM VORTAC to the SALOM Intersection using .76 Mach?

1—42 NAM/1,000 pounds.
2—43 NAM/1,000 pounds.
3—44 NAM/1,000 pounds.

5499. (Refer to figures 1, 2, and 5.) What is the ETE at .78 Mach?

1—46 minutes.
2—48 minutes.
3—50 minutes.

5500. (Refer to figures 1, 2, and 5.) What is the total fuel required at .78 Mach?

1—15,620 pounds.
2—16,820 pounds.
3—17,250 pounds.

5501. (Refer to figures 1, 2, and 5.) What is the ETE at .82 Mach?

1—43 minutes.
2—45 minutes.
3—47 minutes.

5502. (Refer to figures 1, 2, and 5.) What is the total fuel required at .82 Mach?

1—15,434 pounds.
2—15,484 pounds.
3—16,750 pounds.

5503. (Refer to figures 1, 2, and 5.) What approximate indicated Mach should be maintained to arrive over the BLH VORTAC 8 minutes after passing TRM VORTAC?

1—.84 Mach.
2—.85 Mach.
3—.86 Mach.

5504. (Refer to figures 1, 2, and 5.) What is the specific range in nautical miles per 1,000 pounds of fuel from level-off to the SALOM Intersection using .78 Mach?

1—42 NAM/1,000 pounds.
2—43 NAM/1,000 pounds.
3—44 NAM/1,000 pounds.

5505. (Refer to figures 1 and 2.) Immediately after takeoff on Rwy 25, communications fail. What action should the pilot take?

1—Abort the departure and return to the airport.
2—Continue the flight according to the clearance.
3—Continue to the nearest suitable airport and land.

5506. (Refer to figures 1 and 2.) Define the departure route from a takeoff on Rwy 25 to the en route phase according to the flight plan.

1—Direct VTU VORTAC, then via VTU R-114 to FLIPR INT., via SLI R-220 to SLI, via SLI R-080 to CHANGEOVER PT., via V64 TRM.
2—Rwy heading to VTU VORTAC, then via VTU R-114 to FLIPR INT., via 066 BRN from MAAGG LMM to intercept and maintain V64 to TRM VORTAC.
3—Rwy heading to LAX VORTAC, turn left heading 220° to intercept VTU R-114 to FLIPR INT., via 066 BRN to MAAGG LMM, via 060 BRN from MAAGG LMM to intercept and maintain V64 to TRM VORTAC.

5507. (Refer to figures 1 and 2.) What frequency should be monitored during departure from LAX?

1—125.2 or 385.4 MHz.
2—120.95 or 379.1 MHz.
3—124.3 MHz.

5508. (Refer to figure 3.) During the arrival phase at Phoenix Sky Harbor Intl., what radio frequency will provide weather and airport conditions?

1—121.2 MHz.
2—122.0 MHz.
3—124.1 MHz.

5509. (Refer to figure 4.) The minimum weather condition to clear a flight for the POWER PLANT VISUAL RWY 26L approach is

1—1,000/3.
2—4,000/3.
3—4,000/8.

5510. (Refer to figure 4.) What are the minimum conditions for the base leg for the POWER PLANT VISUAL RWY 26L approach?

1—4,000 feet and remain on or east of the SRP R-170.
2—3,100 feet and remain on or west of the SRP R-170.
3—3,100 feet and remain on or east of the SRP R-170.

5511. (Refer to figure 4.) The POWER PLANT VISUAL RWY 26L approach normally begins

1—15 flying miles from the airport.
2—opposite South Mountain.
3—at ARLIN INT.

5512. (Refer to to figure 4.) ATC may clear the flight for the POWER PLANT VISUAL RWY 26L only in radar environment and only

1—if the pilot agrees to cancel the IFR flight plan and proceed VFR.
2—after the pilot reports citing a charted landmark or a preceding aircraft.
3—if the approach is requested by the pilot.

5513. (Refer to figure 4.) Why are charted visual flight procedures, such as the POWER PLANT VISUAL RWY 26L, established?

1—For noise abatement purposes at locations with jet operations.
2—To sequence landing aircraft and enable IFR approaches to have priority.
3—To allow pilots to request the VFR approaches in lieu of IFR approaches.

5514. (Refer to figure 3.) Straight in minimums for a Category B aircraft equipped with DME on the LOC BC RWY 26L approach are

1—1,800/1.
2—700/1.
3—1,540/1.

5515. (Refer to figure 3.) How is course reversal accomplished when outbound on the LOC BC RWY 26L approach at Phoenix Sky Harbor Intl.?

1—Radar vector only.
2—Procedure turn beyond 10 NM.
3—Holding pattern entry beyond 10 NM.

5516. (Refer to figure 3.) What instrument approach light system, if any, is available for the LOC BC RWY 26L approach at Phoenix Sky Harbor Intl.?

1—None.
2—HIRL.
3—REIL.

5517. (Refer to figure 3.) Identify the final approach fix on the LOC BC RWY 26L approach at Phoenix Sky Harbor Intl.

1—Upon intercepting the glide slope beyond I-PHX 5 DME.
2—When crossing I-PHX 5 DME at 3,000 feet.
3—When crossing the SRP VORTAC on the glide slope.

5518. (Refer to figure 3.) The touchdown zone elevation of the LOC BC RWY 26L approach at Phoenix Sky Harbor Intl. is

1—1,132 feet.
2—1,122 feet.
3—1,121 feet.

5519. (Refer to figure 3.) When should the pilot expect radar vectors to the final approach course of the LOC BC RWY 26L approach at Phoenix Sky Harbor Intl.?

1—SALOM INT.
2—ARLIN INT.
3—Approximately 25 NM from SRP VORTAC.

5520. (Refer to figure 3.) Determine the FAR Part 121 landing minimums for the LOC BC RWY 26L approach at Phoenix Sky Harbor Intl.

PIC time....................94 hours
Airplane V_{SO} maximum
certificated weight....................105 knots
V_{REF} approach speed....................140 knots
DME NOTAMed OTS

1—1,800/2.
2—1,900/2-1/4.
3—1,900/2-1/2.

5521. (Refer to figure 3.) Determine the FAR Part 135 landing minimums for turbine powered aircraft on the LOC BC RWY 26L approach at Phoenix Sky Harbor Intl.

PIC time....................98 hours
Airplane V_{SO} maximum
certificated weight....................103 knots
V_{REF} approach speed....................126 knots
DME NOTAMed OTS

1—1,800/2.
2—1,900/2-1/4.
3—1,900/2-1/2.

5522. (Refer to figure 3.) What is the HAT a Category B aircraft may descend to if the pilot has identified HADEN INT on the LOC BC RWY 26L approach at Phoenix Sky Harbor Intl.?

1—418 feet.
2—500 feet.
3—670 feet.

5523. (Refer to figures 6 and 7.) If communications are lost soon after takeoff on Rwy 11R at Tucson Intl., what altitude restrictions apply?

1—Maintain 17,000 feet to GBN, then climb to assigned altitude.
2—Climb in holding pattern (NW, right turn, 128 inbound) to 9,000, then on course to 17,000 feet or lower assigned altitude.
3—Remain at or below 9,000 feet to ROSKR INT, then climb to and maintain 17,000 feet to GBN.

5524. (Refer to figure 7.) What are the takeoff minimums for Rwy 11R at Tucson Intl.?

1—1 SM.
2—800/1.
3—4,000/3.

5525. (Refer to figure 7.) Determine the DEP CON frequency for the TUS2.GBN SID after takeoff from Rwy 11R at Tucson Intl.

1—125.1 MHz.
2—118.5 MHz.
3—119.0 MHz.

5526. (Refer to figures 6 and 7.) Using an average groundspeed of 140 knots, what minimum indicated rate of climb must be maintained to meet the required climb rate (feet per NM) to 9,000 as specified on the SID?

1—349 ft/min.
2—560 ft/min.
3—584 ft/min.

5527. (Refer to figure 6.) What CAS should be used to maintain the fixed TAS at the proposed altitude?

1—157 knots.
2—167 knots.
3—172 knots.

5528. (Refer to figure 7.) How can the pilot receive the latest NOTAM's for the TUS-LAX flight?

1—Monitor ATIS on 123.8 MHz.
2—Contact the FSS on 122.2 MHz.
3—Request ADCUS on any FSS or Tower frequency.

5529. (Refer to figure 7.) What distance is available for takeoff on Rwy 11R at Tucson Intl.?

1—7,000 feet.
2—9,129 feet.
3—10,994 feet.

5530. (Refer to figure 7.) What effect on the takeoff run can be expected on Rwy 11R at Tucson Intl.?

1—Takeoff length shortened to 6,986 feet by displaced threshold.
2—Takeoff run shortened by 0.6 percent runway slope to the SE.
3—Takeoff run will be lengthened by the 0.6 percent upslope of the runway.

5531. (Refer to figures 5, 6, 7, and 8.) Determine the ETE for the flight from Tucson Intl. to Los Angeles Intl.

1—2 hours 10 minutes.
2—2 hours 15 minutes.
3—2 hours 19 minutes.

5532. (Refer to figures 5, 6, 7, and 8.) Estimate the total fuel required (including missed approach) from Tucson Intl. to Los Angeles Intl.

1—2,048 pounds.
2—2,098 pounds.
3—2,218 pounds.

5533. (Refer to figures 5 and 6.) What TAS would be required to arrive at the start descent position 24 minutes after passing TNP?

1—248 knots.
2—251 knots.
3—254 knots.

5534. (Refer to figures 5 and 6.) What TAS would be required to arrive at the intersection of J104 20 minutes after passing GBN?

1—266 knots.
2—269 knots.
3—272 knots.

5535. (Refer to figures 2 and 8.) Which approach control frequency is indicated for the TPN.DOWNE2 Arrival with LAX as the destination?

1—128.5 MHz.
2—124.9 MHz.
3—124.5 MHz.

5536. (Refer to figure 9.) At what point does the flight enter the final approach phase of the ILS RWY 25L at LAX?

1—FUELR INT.
2—HUNDA INT.
3—Intercept of glide slope.

5537. (Refer to figure 9.) What is the DH for the ILS RWY 25L at LAX if the pilot has completed the initial Category II certification within the preceding 6 months?

1—201 feet.
2—251 feet.
3—301 feet.

5538. (Refer to figure 9.) The radio altimeter indication for the DH at the inner marker on the ILS RWY 25L approach at LAX is

1—101.
2—111.
3—201.

5539. (Refer to figure 9) The 7,000-foot marker at BASET INT on the ILS RWY 25L approach at LAX is the

1—maximum altitude at BASET INT.
2—minimum altitude at BASET INT.
3—minimum altitude at BASET INT for pilots approved for the 151 DH.

5540. (Refer to figure 9.) If the glide slope indication is lost upon passing HUNDA INT on the ILS RWY 25L approach at LAX, what action should the pilot take?

1—Continue the approach as an LOC and add 100 feet to the DH.
2—Immediately start the missed approach direct to INISH INT.
3—Continue to the MAP and execute the missed approach as indicated.

5541. (Refer to figure 9.) What approach lights are available for the ILS RWY 25L approach at LAX?

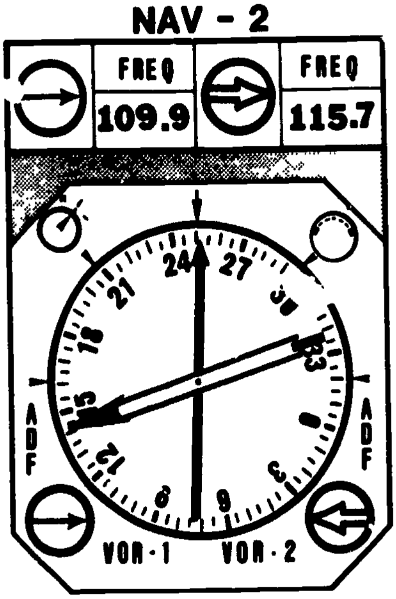
1—ALSF-2 with sequenced flashing lights.
2—MALSR with a displayed threshold.
3—HIRL and TDZ/CL.

5542. (Refer to figures 8 and 9.) What is the function of "LR-075 LAX" depicted below FUELR INT and BASET INT on the plan view of ILS RWY 25L at LAX?

1—Limits off-course on the left side of the LOC.
2—Replaces the edge of the LOC indication where it is unreliable.
3—Lead in radial for transition to the LOC course.

5543. (Refer to figure 9.) What is the position of the aircraft on the ILS RWY 25L approach at LAX?

NAV - 2



1—Right of course just past BASET INT inbound.
2—Left of course approaching DOWNE INT inbound.
3—Left of course just past DOWNE INT inbound.

5544. (Refer to figures 10 and 11.) What is the ETE for the IFR Helicopter flight from Baker Airport to LAX?

1—1 hour 33 minutes.
2—1 hour 36 minutes.
3—1 hour 39 minutes.

5545. (Refer to figures 10 and 11.) What is the total fuel required for the IFR Helicopter flight from Baker Airport to LAX?

1—3,038 pounds.
2—3,656 pounds.
3—3,703 pounds.

5546. (Refer to figures 10 and 11.) What TAS would be required to arrive at POM VORTAC 52 minutes after passing DAG VORTAC?

1—114 knots.
2—117 knots.
3—120 knots.

5547. (Refer to figures 10 and 11.) What TAS would be required to arrive at POM VORTAC 1 hour after passing DAG VORTAC?

1—102 knots.
2—105 knots.
3—108 knots.

5548. (Refer to figure 11.) The changeover point on V394 between DAG VORTAC and POM VORTAC is

1—halfway.
2—38 DME miles from DAG VORTAC.
3—64 DME miles from DAG VORTAC.

5549. (Refer to figure 11.) The minimum crossing altitude at APLES INT southwest bound on V394 is

1—7,500 feet.
2—9,100 feet.
3—11,500 feet.

5550. (Refer to figure 11.) What is the minimum crossing altitude at POM VORTAC when southwest bound on V210?

1—10,700 feet.
2—10,300 feet.
3—5,300 feet.

5551. (Refer to figure 9.) How can DOWNE INT be identified?

1—ILAX 15 DME.
2—LAX VORTAC 15 DME.
3—LAX VORTAC R-249 and SLI VORTAC R-327.

5552. (Refer to figure 2.) How should the IFR flight plan be closed upon landing at LAX?

1—Contact Hawthorne FSS on 123.6 MHz.
2—Phone Hawthorne FSS on 644-1020.
3—LAX tower will close it automatically.

5553. (Refer to figure 9.) What tower and ground control frequencies should a helicopter use when operating from the west to the heliport on the SE side of LAX?

TOWER	GROUND CONTROL
1—119.8 MHz	121.75 MHz.
2—120.35 MHz	121.75 MHz.
3—119.8 MHz	121.65 MHz.

5554. (Refer to figures 12, 13 and 14.) What is the ETE from Greater Buffalo Intl. to Chicago O'Hare Intl. using .80 Mach?

1—1 hour 11 minutes.
2—1 hour 15 minutes.
3—1 hour 17 minutes.

5555. (Refer to figures 12, 13, and 14.) Determine the total fuel required for the flight from Greater Buffalo Intl. to Chicago O'Hare Intl. using .80 Mach.

1—15,357 pounds.
2—15,995 pounds.
3—15,645 pounds.

5556. (Refer to figures 12 and 14.) What approximate indicated Mach should be maintained to arrive at the start of descent 28 minutes after passing ECK?

1—.85 Mach.
2—.86 Mach.
3—.83 Mach.

5557. (Refer to figures 12 and 14.) What is the specific range in nautical air miles per 1,000 pounds of fuel from ECK to start descent using .80 Mach?

1—55 NAM/1,000.
2—56 NAM/1,000.
3—57 NAM/1,000.

5558. (Refer to figures 12 and 14.) What is the ETE at .78 Mach?

1—1 hour 12 minutes.
2—1 hour 14 minutes.
3—1 hour 16 minutes.

5559. (Refer to figures 12 and 14.) What is the total fuel required at .78 Mach?

1—14,902 pounds.
2—15,537 pounds.
3—16,326 pounds.

5560. (Refer to figures 12 and 14.) What approximate indicated Mach should be maintained to arrive at the start of descent 32 minutes after passing ECK?

1—.72 Mach.
2—.73 Mach.
3—.74 Mach.

5561. (Refer to figures 12 and 14.) What is the specific range in nautical air miles per 1,000 pounds of fuel from ECK to start descent using .78 Mach?

1—53 NAM/1,000.
2—54 NAM/1,000.
3—55 NAM/1,000.

5562. (Refer to figures 12 and 14.) What is the ETE at .76 Mach?

1—1 hour 15 minutes.
2—1 hour 17 minutes.
3—1 hour 19 minutes.

5563. (Refer to figures 12 and 14.) What is the total fuel required at .76 Mach?

1—14,702 pounds.
2—15,036 pounds.
3—15,729 pounds.

5564. (Refer to figures 12 and 14.) What approximate indicated Mach should be maintained to arrive at the start of descent 34 minutes after passing ECK?

1—.67 Mach.
2—.68 Mach.
3—.69 Mach.

5565. (Refer to figures 12 and 14.) What is the specific range in nautical air miles per 1,000 pounds of fuel from ECK to start descent using .76 Mach?

1—51.9 NAM/1.000.
2—52.9 NAM/1,000.
3—53.8 NAM/1,000.

5566. (Refer to figures 12 and 14.) What is the lowest MEA for the en route portion from BUF to OBK?

1—10,000 feet.
2—12,000 feet.
3—FL180.

5567. (Refer to figure 14 and chart legend.) Identify the ARTCC three letter idents and HA-EFAS frequency for Chicago.

1—ZAU, 135.525 MHz.
2—ORD, 269.9 MHz.
3—OBK, 122.0 MHz.

5568. (Refer to figure 14 and chart legend.) For that portion of the flight on HL547, night time begins at

1—sunset.
2—1/2 hour after sunset.
3—1 hour after sunset.

5569. (Refer to figures 14 and 17.) Identify the LORAN-C coordinates for Greater Buffalo Intl.

1—116.4 BUF 286.9°, 3.5 NM.
2—42°55'44"N - 78°38'48"W.
3—42°56'26"N - 78°43'57"W.

5570. (Refer to figures 14 and 17.) Identify the RNAV coordinates for Greater Buffalo Intl.

1—116.4 BUF 286.9°, 3.5 NM
2—42°56'44"N - 78°38'48"W.
3—42°56'26"N - 78°43'57"W.

5571. (Refer to figures 14, 15, and 16.) What is the ETE from Chicago Midway Airport to Greater Buffalo Intl.?

1—2 hours 21 minutes.
2—2 hours 25 minutes.
3—2 hours 28 minutes.

5572. (Refer to figures 14, 15, and 16.) What are the fuel requirements from Chicago Midway Airport to Greater Buffalo Intl.?

1—483 pounds.
2—532 pounds.
3—569 pounds.

5573. (Refer to figures 14 and 15.) What TAS should be maintained to arrive over CRL VORTAC 50 minutes after level off?

1—163 knots.
2—165 knots.
3—167 knots.

5574. (Refer to figures 14, 15, and 16.) If communications are lost after takeoff on Rwy 13L at Chicago Midway, what action should the pilot take?

1—Circle and land at Chicago Midway.
2—Climb on runway heading to 2,000 feet until 6 DME miles from Midway, then maintain 3,000 to 25 DME from Midway. Climb to FL180 and intercept J146.
3—Climb on runway heading to 1,300 feet, at 4 DME turn east then climb to 2,000 feet until 6 DME miles from Midway. Climb to and maintain 3,000 feet to 25 DME from Midway, then turn and climb to FL180 direct to SBN VORTAC.

5575. (Refer to figure 14.) What type airway is HL547 used on the flight from Chicago Midway Airport to Greater Buffalo Intl.?

1—Non-jet High Level Route.
2—Helicopter Preferred Route.
3—Canadian High Level Airway.

5576. (Refer to figure 14.) The VOR changeover point between SBN VORTAC and CRL VORTAC on J554 should be

1—BENJO INT.
2—Halfway.
3—ARTCC boundary.

5577. (Refer to figure 17.) How can the FAF on the RNAV RWY 32 approach at BUF be identified?

1—The RNAV receiver will indicate 175.1° and 2.5 DME miles from BUF VORTAC.
2—The RNAV receiver will indicate a change from TO to FROM and 0 deflection of the course needle.
3—Two flashes/second on the OM beacon light.

5578. (Refer to figure 17.) Which waypoint should be setup on the RNAV receiver after identifying the final approach fix?

1—CYUGA.
2—MAP.
3—GANIS.

5579. (Refer to figure 17.) What is the procedure for initiating the missed approach on the RNAV RWY 32 approach at BUF?

1—Select GANIS Waypoint and establish a direct course, climbing to 2,700 feet.
2—Select and maintain R-302 of BUF VORTAC climbing to 2,700 feet.
3—Establish and maintain R-286.9 of BUF VORTAC climbing to 2,700 feet.

5580. (Refer to figure 17.) What type entry is appropriate for the missed approach holding pattern on the RNAV RWY 32 approach at BUF?

1—Parallel.
2—Direct.
3—Tear drop.

5581. (Refer to figure 18.) A VFR helicopter flight originates at the Pan Am Metroport near the United Nations Complex and is scheduled to JFK Intl. List the appropriate route.

1—West bank of East River to E 34th St. via RESERVOIR ROUTE to JFK Intl.
2—East bank of East River to E 34th St. via RESERVOIR ROUTE to JFK Intl.
3—East bank of East River to Williamsburg Bridge via WILLIAMSBURG and RESERVOIR ROUTES to JFK Intl.

5582. (Refer to figure 18.) What is the vertical extent of the TCA along the route from Pan Am Metroport to JFK Intl.?

1—1,500 to 7,000 feet.
2—1,700 to 7,000 feet.
3—Surface to 7,000 feet.

5583. (Refer to figure 18.) What is the requested minimum altitude on the CONEY ISLAND ROUTE from Flatbush Ave. to the boundary of JFK Intl.?

1—1,700 feet MSL.
2—2,000 feet AGL.
3—300 feet AGL.

5584. (Refer to figure 18.) Under what condition, if any, may a helicopter flight depart JFK Intl. on a Special VFR Clearance?

1—None.
2—Both pilot and helicopter are IFR certificated.
3—Clearance from JFK Intl.

5585. (Refer to figure 18.) Helicopters en route to LaGuardia below 1,400 feet should contact the tower on

1—118.7 MHz.
2—122.95 MHz.
3—126.05 MHz.

5586. (Refer to figure 18.) What frequency should helicopters monitor when maintaining the HUDSON RIVER ROUTE outside the TCA?

1—123.05 MHz.
2—123.75 MHz.
3—122.9 MHz.

5587. (Refer to figures 19, 20, 21, and 23.) What is the ETE from DFW Intl. to landing at IAH?

1—54 minutes.
2—56 minutes.
3—58 minutes.

5588. (Refer to figures 19, 20, 21, and 23.) What is the total fuel required from DFW Intl. to landing at IAH?

1—1,205 pounds.
2—1,264 pounds.
3—1,393 pounds.

5589. (Refer to figure 19.) Determine the TAS required to arrive at CUGAR, 31 minutes after level-off.

1—242 knots.
2—246 knots.
3—249 knots.

5590. (Refer to figure 19.) Determine the TAS required to arrive at CUGAR, 29 minutes after level-off.

1—281 knots.
2—286 knots.
3—291 knots.

5591. (Refer to figures 20 and 22.) Which frequency should be selected to check airport conditions and weather prior to departure at DFW Intl.?

1—117.0 MHz.
2—134.9 MHz.
3—135.5 MHz.

5592. (Refer to figures 20, 21, and 22.) The frequency change from departure control to ARTCC after departing DFW Intl. for IAH is

1—135.5 to 126.0 MHz.
2—118.55 to 127.95 MHz.
3—127.75 to 127.95 MHz.

5593. (Refer to figure 21.) Where is the VOR changeover point on V369 between DFW Intl. and TNV?

1—Ft. Worth/Houston ARTCC boundary.
2—81 NM from DFW Intl.
3—TORNN Intl.

5594. (Refer to figure 21 or 22.) What is the magnetic variation at both DFW Intl. and IAH?

1—08 E.
2—0.
3—08 W.

5595. (Refer to figures 21 and 23.) How should the pilot identify the position to leave V369 for the BILEE CUGAR4 ARRIVAL?

1—Intercept R-305 of IAH.
2—21 DME miles from TNV.
3—141 DME miles from DFW.

5596. (Refer to figure 22 and 23.) In addition to VOR and DME, what electronic equipment is required for the VOR/DME RWY 32R approach at IAH?

1—Altitude alerting system.
2—Standby VOR and DME receivers.
3—VHF communications and transponder equipment.

5597. (Refer to figure 23.) The BILEE.CUGAR4 arrival ends

1—at BANTY INT.
2—at IAH VORTAC.
3—when cleared to land.

5598. (Refer to figure 23.) What action should the pilot take if communications were lost during the BILEE.CUGAR4 arrival?

1—Proceed direct to IAH VORTAC, then outbound on the IAH R-125 for a procedure turn for final approach.
2—From BANTY INT, proceed to the IAF on the IAH R-290, then continue on the IAH 10 DME Arc to final approach.
3—Proceed direct to IAH VORTAC, then to either IAF or the IAH 10 DME Arc to final approach.

5599. (Refer to figure 23.) Which approach lighting is available for Rwy 32R?

1—MALSR with RAIL.
2—HIRL.
3—TDZ and CL.

5600. (Refer to figure 23.) What effect on approach minimums, if any, does an inoperative MALSR for an aircraft with an approach speed of 120 knots at IAH?

1—None.
2—Increases RVR to 5,000 feet.
3—Increases RVR to 6,000 feet.

5601. (Refer to figure 23.) Under what condition may a pilot make a procedure turn while executing the VOR/DME RWY 32R approach at IAH?

1—Only when cleared by ATC.
2—If not DME equipped.
3—When approaching IAH from GOMER INT.

5602. (Refer to figure 23.) While arcing left on the IAH 10 DME Arc, the pilot experiences a left crosswind component. Where should the bearing pointer be referenced relative to the wingtip position to maintain the 10 DME range?

1—On the left wingtip reference.
2—Behind the left wingtip reference.
3—Ahead of the left wingtip reference.

5603. Where should the RMI bearing pointer be located relative to the wingtip reference to maintain a constant DME distance in a left-hand arc with a right crosswind component?

1—On the left wingtip reference.
2—Behind the left wingtip reference.
3—Ahead of the left wingtip reference.

5604. (Refer to figure 23.) When is the earliest time the pilot may initiate a descent from 460 feet MSL to land at IAH?

1—Anytime after GALES INT if the runway environment is visible.
2—Only after the IAH 1.3 DME if the runway environment is visible.
3—Only after the IAH 1 DME if the runway environment is visible.

5605. (Refer to figure 23.) How should the pilot identify the MAP on the IAH VOR/DME RWY 32R?

1—After time has elapsed from FAF.
2—IAH 1.3 DME.
3—IAH 1 DME.

5606. (Refer to figure 23.) At what point may the missed approach be initiated on the VOR/DME RWY 32R approach at IAF?

1—Anytime after the FAF.
2—IAH 1.3 DME.
3—IAH 1 DME.

5607. (Refer to figures 20, 21, 23, and 24.) What is the ETE from DFW to landing at IAH?

1—2 hours 05 minutes.
2—2 hours 19 minutes.
3—2 hours 22 minutes.

5608. (Refer to figures 20, 21, 23, and 24.) What is the total fuel required for the flight from DFW to IAH?

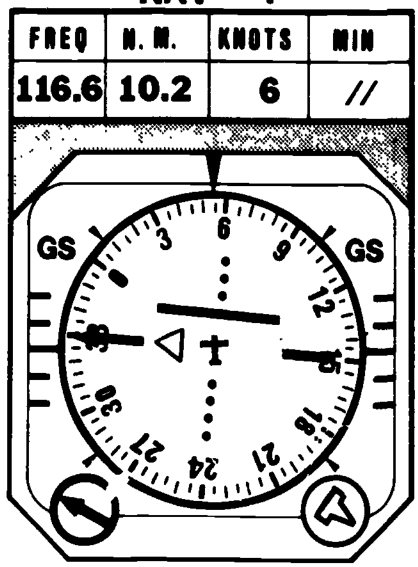
1—140 pounds.
2—270 pounds.
3—206 pounds.

5609. (Refer to figures 20, 21, 23, and 24.) What TAS should be maintained to arrive at BILEE.CUGAR4 initial point 1 hour 5 minutes after level-off?

1—138 knots.
2—143 knots.
3—146 knots.

5610. (Refer to figure 23.) What is the position of this flight on the VOR/DME RWY 32R approach at Houston?

NAV - 1



1—On missed approach 14.8 NM from GOMER INT.
2—Outside the 10 DME arc approaching R-125.
3—At the IAF on R-061.

5611. (Refer to figure 25.) What is the maximum approach speed for the COPTER VOR/DME 117° approach?

1—60 knots.
2—90 knots.
3—91 knots.

5612 (Refer to figure 25.) What type approach lights are available for the COPTER VOR/DME 117° approach?

1—REIL and MIRL only.
2—Nonstandard REIL only.
3—REIL and nonstandard VASI only.

5613. (Refer to figure 25.) What NOTAM's are available at Houma-Terrebonne Airport?

1—NOTAM D and L.
2—NOTAM L only.
3—NOTAM D only.

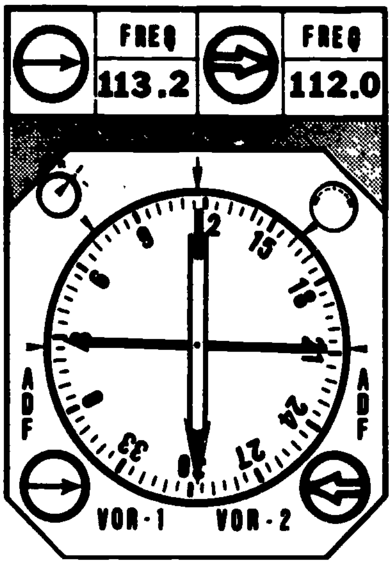
5614. (Refer to figure 25.) If the COPTER VOR/DME 117° approach is executed at 0630 local standard time, what minimums must be observed?

1—440/1/2.
2—580/1/2.
3—580/3/4.

5615. (Refer to figure 25.) What is the VASI approach slope angle for Rwy 12 at Houma-Terrebonne?

1—2.5°.
2—3.0°.
3—3.5°.

5616. (Refer to figure 25.) Determine the position of this flight on the COPTER VOR/DME 117° approach.



1—Approaching IAF TIBBY.
2—Starting to turn from the 5 DME arc to final approach.
3—Approaching BOURG INT during the missed approach procedure.

5617. (Refer to figure 25.) What type entry is appropriate for the missed approach holding pattern at Houma-Terrebonne?

1—Direct only.
2—Parallel or teardrop.
3—Teardrop only.

5618. (Refer to figure 25.) At what point may the missed approach be initiated?

1—TBD 10.2 DME.
2—Upon expiration of time from FAF.
3—Anytime after FAF.

5619. (Refer to figure 26.) What is the distance from the IAF to KINGS INT for the LDA/DME-2 RWY 18 approach?

1—19 DME miles.
2—20.4 DME miles.
3—21.3 DME miles.

5620. (Refer to figure 26.) Why is the localizer . South Lake Tahoe designated as LDA/DME?

1—DME is substituted for an outer marker.
2—The localizer is not aligned with the runway and all fixes are DME.
3—The localizer is wider than the standard ILS LOC and all fixes are DME.

5621. (Refer to figure 26.) What approach lighting is available for the LDA/DME-2 RWY 18 approach?

1—MIRL.
2—MIRL and 2-light VASI.
3—MALSF with sequenced flashing lights and 2-box VASI.

5622. (Refer to figure 26.) What is the minimum altitude for Category D aircraft at the FAF for the S-18 LDA/DME-21 RWY 18 approach?

1—8,120 feet.
2—8,480 feet.
3—8,900 feet.

5623. (Refer to figure 26.) On which IFR Low Altitude Charts can Lake Tahoe be found?

1—L panel 2G and Helicopter 5A.
2—2 panel G and 5 panel A.
3—H-2G, L-2G, and 5A.

5624. The threshold crossing height listed in figure 26 for the VASI on Rwy 18 is

1—6,254 feet MSL.
2—6,367 feet MSL.
3—47 feet AGL.

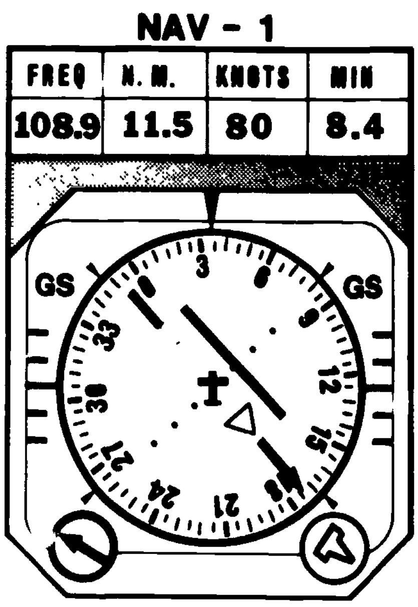
5625. (Refer to figure 26.) Approximately what rate of descent at 120 knots is necessary for the LDA/DME-2 RWY 18 approach at Lake Tahoe?

1—250 ft/min.
2—500 ft/min.
3—600 ft/min.

5626. (Refer to figure 26.) How can a pilot activate the approach lights to medium intensity at Lake Tahoe when the tower is closed?

1—Contact the FSS on CTAF frequency.
2—Key the mike three times on Unicom frequency.
3—Key the mike five times on CTAF frequency.

5627. (Refer to figure 26.) What is the position of this flight on the missed approach holding pattern at Lake Tahoe?



1—Turning from outbound leg.
2—Off course to the right inbound.
3—Turning on to the outbound leg.

5628. (Refer to figure 27.) From whom can a pilot request a DF steer in the Salisbury area?

1—Salisbury FSS.
2—Leesburg FSS.
3—Patuxent Approach Control.

5629. (Refer to figure 27.) Why is there an apparent difference in course direction on the plan view of the LOC BC RWY 14 approach?

1—The localizer bends.
2—To adjust for the nearby obstacles.
3—136° is the LOC course and 134° is a radial of SBY.

5630. (Refer to figure 27.) When may the missed approach at SBY be initiated if the aircraft is equipped with DME?

1—Anytime after SBY 3 DME.
2—When time has expired from the FAF.
3—Anytime after reaching the MDA.

5631. (Refer to figure 27.) What type VASI is installed for Rwy 14 at SBY?

1—4-light VASI.
2—4-box VASI – 2 each side of runway.
3—4-box VASI – all on left side of runway.

5632. (Refer to figure 27.) What is the purpose of the holding pattern at HEBRO INT on the LOC BC RWY 14 approach at SBY?

1—Timed approaches and course reversals.
2—En route and approach delays.
3—Climb or descent corridor and approach delays.

5633. (Refer to figure 27.) What type facility is WATERLOO as depicted on the plan view of the LOC BC RWY 14 approach at SBY?

1—VOR.
2—VOR/DME.
3—TACAN.

5634. (Refer to figure 27.) This flight is destined for the LOC BC RWY 14 approach at SBY. What minimum weather conditions must be forecast to avoid listing an alternate airport on the flight plan?

1—800/2-1/4.
2—1,000/3.
3—1,940/3-1/2.

5635. (Refer to figure 27.) What approach control facility, if any, is available when the tower is closed at SBY?

1—None.
2—Patuxent Approach Control.
3—Washington Center Approach Control.

5636. (Refer to figure 28.) Determine the minimum weather conditions for a Category D aircraft on the MLS RWY 19L approach that must be forecast to avoid listing an alternate on an IFR flight plan.

3.
4.

5637. What are the azimuth limits on the MLS such as the one depicted in figure 28?

1—5° each side of the centerline.
2—10° each side of the centerline.
3—40° each side of the centerline.

5638. (Refer to figure 28.) What is the threshold crossing height established by the VASI on Rwy 19L at ICT?

1—47 feet.
2—52-1/2 feet.
3—55 feet.

5639. (Refer to figure 28.) Of what use is the back azimuth of the MLS at ICT?

1—Lateral guidance for the missed approach.
2—Backup system to replace front course failure.
3—Support for the DME/P system.

5640. (Refer to figure 28.) If 120 knots is maintained on the final approach of MLS RWY 19L, what rate of descent will maintain the glide slope?

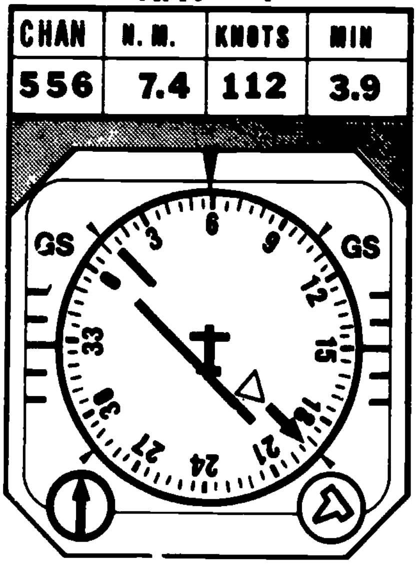
1—600 ft/min.
2—635 ft/min.
3—675 ft/min.

5641. (Refer to figure 28.) Identify the FAF on the MLS RWY 19L approach at ICT.

1—M-JOZ 7.1 DME at 3,207 feet.
2—Interception of glidepath at 3,300 feet.
3—Interception of glidepath at any point.

5642. (Refer to figure 28.) What is the position of this flight on the MLS RWY 19L approach at ICT?

NAV - 1



1—Turning inbound on the missed approach holding pattern.
2—On entry to the missed approach holding pattern.
3—Outbound on procedure turn.

5643. (Refer to figure 29.) This flight is destined for the NDB RWY 15 approach at CHS. What minimum weather conditions must be forecast to avoid listing an alternate airport on an IFR flight plan?

1—1,000/3.
2—1,980/3.
3—2,040/3.

5644. (Refer to figure 29.) What minimum navigation equipment is necessary for the NDB RWY 15 approach at CHS?

1—ADF.
2—ADF and VOR.
3—ADF, VOR, and DME.

5645. (Refer to figure 29.) When may the pilot initiate a missed approach on the NDB RWY 15 approach at CHS?

1—Anytime after the FAF.
2—At the CHS 2.5 DME.
3—At expiration of time after FAF.

5646. (Refer to figure 29.) At what point on the NDB RWY 15 approach at CHS may the pilot descend below the MDA if the runway environment is in sight?

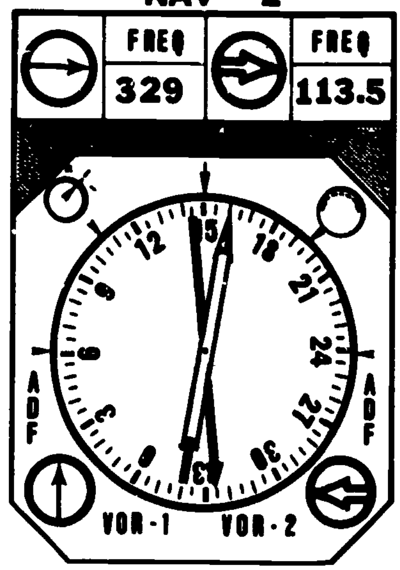
1—Only after the CHS 2.5 DME.
2—Only after the time to MDA has expired.
3—Anytime after the FAF.

5647. (Refer to figure 29.) What are the landing minimums for a Category C aircraft on a straight-in NDB RWY 15 approach at CHS if the touchdown zone lights and centerline lighting are inoperative?

1—480/40.
2—480/50.
3—530/60.

5648. (Refer to figure 29.) Determine the position of this flight on the NDB RWY 15 approach according to the indications of the RMI.

NAV - 2



1—Inbound on the procedure turn.
2—Left of course approaching the airport.
3—On missed approach turning to intercept CHS R-055.

5649. (Refer to figure 29.) If the aircraft approaches on final at 110 knots, what will be the time from FAF to MAP on the NDB RWY 15 approach at CHS?

1—2 hours 27 minutes.
2—2 hours 30 minutes.
3—2 hours 37.5 minutes.

5650. (Refer to figure 30.) Identify the IAF(s) for the SDF RWY 31 approach at Reidsville.

1—KLUTE INT.
2—Slammer NDB.
3—Greensboro VORTAC, Martinsville VOR/DME, and Danville VOR.

5651. (Refer to figure 30.) What minimum navigation equipment is necessary for the SDF RWY 31 approach at Reidsville?

1—VOR receiver.
2—ILS receiver.
3—ILS and ADF receivers.

5652. (Refer to figure 30.) What does the negative "L" on the plan view of the SDF RWY 31 represent?

1—The tower is on a UNICON frequency.
2—MIRL and VASI are activated by keying UNICOM frequency.
3—Approach lighting on Rwy 13 and Rwy 31 are nonstandard.

5653. (Refer to figure 30.) If the aircraft approaches on final at 115 knots, what will be the time from FAF to MAP on the SDF RWY 31 approach at Reidsville?

1—2 hours 34 minutes.
2—2 hours 37 minutes.
3—2 hours 40 minutes.

5654. (Refer to figure 30.) Why is the SDF RWY 31 approach classified as SDF rather than LOC RWY 31?

1—There is no outer marker.
2—The procedure turn is nonstandard.
3—The localizer course is wider than an ILS LOC course.

5655. (Refer to figure 31.) What is the landing minimum for a Category D aircraft for the ASR RWY 16 approach at Ashville Regional?

1—3,000-foot MDA.
2—2-3/4 miles visibility.
3—900-foot ceiling.

5656. (Refer to figure 31.) What are the Category C approach minimums for the ASR RWY S-8R approach at Atlanta/Fulton County Airport?

1—1,540/2.
2—1,590/2.
3—1,540/1-1/2.

5657. (Refer to figure 31.) What are the ASR RWY 20L approach minimums for Category A aircraft at Atlanta/Dekalb-Peachtree Airport with the MALSF inoperative and using the Fulton County-Brown Field altimeter setting?

1—1,560/3/4.
2—1,560/1-1/4.
3—1,610/1-1/4.

5658. (Refer to figure 31.) What are the ASR RWY 20L approach minimums for Category C aircraft at Atlanta/Dekalb-Peachtree with the MALSF inoperative and using the Fulton County-Brown Field altimeter setting?

1—1,520/1-1/2.
2—1,560/1-1/2.
3—1,560/2.

5659. (Refer to figure 31.) Determine ASR approach minimums for Category C aircraft on Rwy 8L at Atlanta/The William B. Hartsfield if the ALFS? is inoperative.

1—1,480/40.
2—1,530/60.
3—1,480/60.

5660. What information is provided by the MLS precision navigation system?

1—Azimuth, elevation, and distance information.
2—Azimuth, elevation, and three-letter identification.
3—Range, elevation, and ISMLS readouts.

5661. In addition to basic information, what expansion capabilities does the MLS have?

1—Back azimuth glide slope.
2—Back azimuth and data transmissions.
3—Variable front and back azimuth upon request.

5662. What azimuth coverage of the MLS can be expected?

1—Laterally 20° each side, vertically 15° to 20,000 feet, and range 50 NM.
2—Laterally 40° each side, vertically 15° to 20,000 feet, and range 20 NM.
3—Laterally 15° each side, vertically 6° to 20,000 feet, and range 20 NM.

5663. What is the difference, if any, between the front and back azimuth of the MLS?

1—None, except indicator reversal.
2—Transmissions are at a lower rate.
3—Back azimuth has no DME/P.

5664. In addition to navigation information, what data is transmitted on the MLS frequencies?

1—MLS status, missed approach procedure, and airport conditions.
2—ATC clearances, missed approach procedures, and airport conditions.
3—MLS status, airport conditions, and weather.

5665. What does operational flexibility of the MLS system include?

1—Selectable glidepath angles and boundaries providing obstruction clearance in the terminal area.
2—An azimuth of 40° in width providing obstacle clearance within 22 NM of the airport.
3—Curved and segmented approaches collocated with a fixed glidepath angle.

5666. LORAN-C is based upon measurements of the difference in time arrival of pulses generated by what type radio stations?

1—A group of stations operating on the 108-115 MHz frequency band.
2—Two stations operating on the 90-110 MHz frequency band.
3—A chain of stations operating on the 90-110 MHz frequency band.

5667. For what service has LORAN-C been approved?

1—IFR navigation in U.S. coastal areas and nonprecision approaches.
2—VFR navigation in the 48 contiguous states and District of Columbia.
3—IFR and VFR navigation in the 48 contiguous states and District of Columbia.

5668. What kind of network makes up the OMEGA Navigation System.

1—Four basic navigation facilities having worldwide signal coverage.
2—Eight stations transmitting on four basic navigation frequencies.
3—Four basic navigation facilities transmitting on four basic navigation frequencies.

5669. When is an OMEGA station said to be operating in full format?

1—The station is transmitting on the basic frequencies plus the unique frequency.
2—The station is transmitting on one of the four basic frequencies in the VLF range.
3—The station is transmitting on eight VHF frequencies, plus four discreet frequencies.

5670. What information does OMEGA provide?

1—Uninterrupted azimuth guidance and tracking.
2—Fixing information to an accuracy of plus or minus 2 NM.
3—Guidance, tracking, and fixing information.

5671. Under what condition may OMEGA navigation be used in the conterminous United States and Alaska?

1—The equipment is tested within the previous 30 days.
2—The equipment is used in conjunction with an inertial navigation system.
3—All navigation equipment otherwise required by the FAA be installed and operating.

5672. What type navigation system is Inertial Navigation System (INS)? A navigation computer which provides position

1—from information by compass, airspeed, and an input of wind and variation data.
2—from radar type sensors that measure ground speed and drift angles.
3—by signals from self-contained gyros and accelerometers.

5673. What is a Flight Management System (FMS)?

1—A computer system programmed to update position by reference to conventional navigation aids.
2—A transponder type navigation system which receives data for positions from satellites.
3—A doppler radar system, computerized to provide position from groundspeed and variations of direction.

5674. What functions are provided by ILS?

1—Azimuth, distance, and vertical angle.
2—Azimuth, range, and vertical angle.
3—Guidance, range, and visual information.

5675. Which component associated with the ILS is identified by the last two letters of the localizer group?

1—Inner marker.
2—Middle compass locator.
3—Outer compass locator.

5676. Which component associated with the ILS is identified by the first two letters of the localizer identification group?

1—Inner marker.
2—Middle compass locator.
3—Outer compass locator.

5677. What aural and visual indications should be observed over an ILS inner marker?

1—Continuous dots at the rate of six per second.
2—Continuous dashes at the rate of two per second.
3—Alternate dots and dashes at the rate of two per second.

5678. What aural and visual indications should be observed over an ILS middle marker?

1—Continuous dots at the rate of six per second.
2—Continuous dashes at the rate of two per second.
3—Alternate dots and dashes at the rate of two per second

5679. What aural and visual indications should be observed over an ILS outer marker?

1—Continuous dots at the rate of six per second.
2—Continuous dashes at the rate of two per second.
3—Alternate dots and dashes at the rate of two per second.

5680. What frequency range does the localizer transmitter of the ILS operate within?

1—108.10 to 118.10 MHz.
2—108.10 to 111.95 MHz.
3—108.10 to 117.95 MHz.

5681. What aural and visual indications should be observed over the ILS back course marker?

1—A series of two dot combinations.
2—Continuous dashes at the rate of one per second.
3—A series of two dash combinations.

5682. The lowest ILS Category II minimums are

1—DH 50 feet and RVR 1,200 feet.
2—DH 100 feet and RVR 1,200 feet.
3—DH 150 feet and RVR 1,500 feet.

5683. What is the lowest Category IIIA minimum?

1—DH 50 feet and RVR 1200 feet.
2—RVR 1,000 feet.
3—RVR 700 feet.

5684. How does the SDF differ from an ILS LOC?

1—SDF — 6° or 12° wide, ILS — 3° to 6°.
2—SDF — offset from runway plus 3°, ILS — aligned with runway.
3—SDF — 15° usable off course indications, ILS — 35°.

5685. How does the LDA differ from an ILS LOC?

1—LDA - 6° or 12° wide, ILS - 3° to 6°.
2—LDA - offset from runway plus 3°, ILS - aligned with runway.
3—LDA - 15° usable off course indications, ILS - 35°.

5686. What DME indications should a pilot observe when directly over a VORTAC site at 12,000 feet?

1—0 DME miles.
2—2 DME miles.
3—2.3 DME miles.

5687. Where does the DME indicator have the greatest error between the ground distance and displayed distance to the VORTAC?

1—High altitudes close to the VORTAC.
2—Low altitudes close to the VORTAC.
3—Low altitudes far from the VORTAC.

5688. What does the tri-color VASI consist of?

1—Three light bars; red, green, and amber.
2—One light projector with three colors; red, green, and amber.
3—Three glide slopes, each a different color; red green, and amber.

5689. Which color on a tri-color VASI is a "high" indication?

1—Red.
2—Amber.
3—Green.

5690. Which color on a tri-color VASI is an "on course" indication?

1—Red.
2—Amber.
3—Green.

5691. Which color on a tri-color VASI is a "low" indication?

1—Red.
2—Amber.
2—Green.

5692. What is the normal range of the tri-color VASI at night?

1—5 miles.
2—10 miles.
3—15 miles.

5693. What does the Precision Approach Path Indicator (PAPI) consist of?

1—Row of four lights parallel to the runway; red, white, and green.
2—Row of four lights perpendicular to the runway; red and white.
3—One light projector with two colors; red and white.

5694. What are the indications of PAPI?

1—High—white, on glidepath—red and white; low—red.
2—High—white, on glidepath—green; low—red.
3—High—white and green, on glidepath—green; low—red.

5695. What does the pulsating VASI consist of?

1—Three-light system, two pulsing and one steady.
2—Two-light projectors, one pulsing and one steady.
3—One-light projector, pulsing (some steady for on course).

5696. What are the indications of the pulsating VASI?

1—High—pulsing white, on glidepath—green; low—pulsing red.
2—High—pulsing white, on glidepath—pulsing red and white or steady white; low—pulsing red.
3—High—pulsing white, on course and on glidepath—steady white, off course but on glidepath—pulsing white and red; low—pulsing red.

5697. What is the advantage of a three-bar VASI?

1—Pilots have a choice of glide angles.
2—A normal glide angle is afforded both high and low cockpit aircraft.
3—The three-bar VASI is much more visible and can be used at a greater height.

5698. A pilot of a high-performance airplane should be aware that flying a steeper-than-normal VASI glide slope angle may result in

1—a hard landing.
2—increased landing rollout.
3—landing short of the runway threshold.

5699. The higher glide slope of the three-bar VASI is intended for use by

1—high performance aircraft.
2—helicopters.
3—high cockpit aircraft.

5700. What is the purpose of REIL?

1—Identification of a runway surrounded by a preponderance of other lighting.
2—Identification of the touchdown zone to prevent landing short.
3—Establish visual descent guidance information during an approach.

5701. Identify REIL.

1—Amber lights for the first 2,000 feet of runway.
2—Green lights at the threshold and red lights at far end of runway.
3—Synchronized flashing lights laterally at each side of the runway threshold.

5702. What is the advantage of HIRL or MIRL on an IFR runway as compared to a VFR runway?

1—Lights are closer together and easily distinguished from surrounding lights.
2—Amber lights replace white on the last 2,000 feet of runway for a caution zone.
3—Alternate red and white lights replace the white on the last 3,000 feet of runway for a caution zone.

5703. Identify touchdown zone lighting (TDZL).

1—Two rows of transverse light bars disposed symmetrically about the runway centerline.
2—Flush centerline lights spaced at 50-foot intervals extending through the touchdown zone.
3—Alternate white and green center line lights extending from 75 feet from the threshold through the touchdown zone.

5704. Identify runway remaining lighting on centerline lighting systems.

1—Amber lights from 3,000 feet to 1,000 feet, then alternate red and white lights to the end.
2—Alternate red and white lights from 3,000 feet to 1,000 feet, then red lights to the end.
3—Alternate red and white lights from 3,000 feet to the end of the runway.

5705. Identify taxi turnoff lights associated with the centerline lighting system.

1—Alternate blue and white lights curving from the centerline of the runway to the centerline of the taxiway.
2—White lights curving from the centerline of the runway to the centerline of the taxiway.
3—Blue lights curving from the centerline of the runway to the centerline of the taxiway.

5706. How can a pilot identify a military airport at night?

1—Green, yellow, and white beacon light.
2—White and red beacon light with dual flash of the white.
3—Green and white beacon light with dual flash of the white.

5707. How can a pilot identify a lighted heliport at night?

1—Green, yellow, and white beacon light.
2—White and red beacon light with dual flash of the white.
3—Green and white beacon light with dual flash of the white.

5708. Identify the runway distance remaining markers.

1—Signs with increments of 1,000 feet distance remaining.
2—Red markers laterally placed across the runway at 3,000 feet from the end.
3—Yellow marker laterally placed across the runway with signs on the side denoting distance to end.

5709. What restriction applies to a large, turbine-powered airplane operating to or from a primary airport in a TCA?

1—Must not exceed 200 knots within the TCA.
2—Must operate above the floor when within lateral limits of the TCA.
3—Must operate in accordance with IFR procedures regardless of weather conditions.

5710. What service is provided for aircraft operating within the outer area of an ARSA?

1—The same as within the ARSA when communications and radar contact is established.
2—Radar vectors to and from secondary airports within the outer area.
3—Basic radar service only when communications and radar contact is established.

5711. What services are provided for aircraft operating within the ARSA?

1—Sequencing of arriving aircraft, separation of aircraft (except between VFR aircraft), and traffic advisories.
2—Sequencing of arriving aircraft (except VFR aircraft), separation between all aircraft, and traffic advisories.
3—Sequencing of all arriving aircraft, separation between all aircraft, and traffic advisories.

5712. What pilot certification and aircraft equipment are required for operating in an ARSA?

1—No specific certification but a two-way radio.
2—At least a private pilot certificate and two-way radio.
3—At least a private pilot certificate, two-way radio, and a TSO-C74b transponder.

5713. What hazards to aircraft and its occupants may exist in restricted areas?

1—High speed military aircraft maneuvers.
2—Invisible hazards such as artillery firing or guided missiles.
3—Classified military operations of a hazardous nature.

5714. Why are certain areas classified as Warning Areas?

1—Any hazards within may be avoided easily with good vigilance.
2—Hazardous operations are rare but inquiries should be made prior to entering the area.
3—Invisible hazards exist in international airspace which cannot be controlled.

5715. What is the purpose of MOA's?

1—To protect military aircraft operations from civil aircraft.
2—To separate military training activities from IFR traffic.
3—To separate military training activities from both IFR and VFR traffic.

5716. Who is responsible for collision avoidance in an MOA?

1—Military controllers.
2—ATC controllers.
3—Each pilot.

5717. Which aeronautical chart depicts Military Training Routes (MTR) above 1,500 feet?

1—IFR Low Altitude En Route Chart.
2—IFR High Altitude En Route Chart.
3—IFR Planning Chart.

5718. Under what condition does ATC issue Safety Alerts?

1—When collision with another aircraft is imminent.
2—If the aircraft altitude is noted to be in close proximity to the surface or an obstacle.
3—When weather conditions are extreme and wind shear or large hail is in the vicinity.

5719. What is the hijack code?

1—7200.
2—7500.
3—7777.

5720. Which range of codes should a pilot avoid switching through when changing transponder codes.

1—0000 through 1000.
2—7200 and 7500 series.
3—7500, 7600, and 7700 series.

5721. To assure expeditious handling of a civilian air ambulance flight, the word "LIFEGUARD" should be entered in which section of the flight plan?

1—Aircraft type/special equipment block.
2—Pilot's name and address block.
3—Remarks block.

5722. What airport condition is reported by the tower when more than one wind condition at different positions on the airport is reported?

1—Light and variable.
2—Wind shear.
3—Frontal passage.

5723. How should a pilot describe braking action?

1—00 percent, 50 percent, 75 percent, or 100 percent.
2—Zero-zero, fifty-fifty, or normal.
3—Nil, poor, fair, or good.

5724. When "gate hold" procedures are in effect, what action should the pilot take?

1—Contact ground control prior to starting engines for sequencing.
2—Taxi into position and hold prior to requesting clearance.
3—Start engines, perform pretakeoff check, and request clearance prior to leaving the parking area.

5725. What special consideration is given for turbine-powered aircraft when "gate hold" procedures are in effect?

1—They are given preference for departure over other aircraft.
2—They are expected to be ready for takeoff when they reach the runway or warmup block.
3—They are expected to be ready for takeoff prior to taxi and will receive takeoff clearance prior to taxi.

5726. Under what situations are faster/larger helicopters integrated with fixed-wing aircraft?

1—IFR flights, noise avoidance routes, and use of runways or taxiways.
2—Use of taxiways, sequencing for takeoff and landing, and use of the same traffic patterns.
3—Use of taxiways, sequencing for takeoff and landing, and use of the same loading ramps.

5727. What is a helicopter pilot's responsibility when cleared to "air taxi" on the airport?

1—Taxi direct to destination as quickly as possible.
2—Taxi at hover altitude using taxiways.
3—Taxi below 100 feet AGL avoiding other aircraft and personnel.

5728. What action is expected of an aircraft upon landing at a controlled airport?

1—Continue taxiing in the landing direction until advised by the tower to switch to ground control frequency.
2—Exit the runway at the nearest suitable taxiway and remain on tower frequency until instructed otherwise.
3—Exit the runway at the nearest suitable taxiway and switch to ground control upon crossing the taxiway holding lines.

5729. What is the pilot's responsibility for clearance or instruction readback?

1—Except for SID's, read back altitude assignments, altitude restrictions, and vectors.
2—If the clearance or instruction is understood, an acknowledgment is sufficient.
3—Read back the entire clearance or instruction to confirm the message is understood.

5730. Under what conditions may a pilot on an IFR flight plan comply with authorization to maintain "VFR on Top"?

1—Maintain IFR flight plan but comply with visual flight rules while in VFR conditions.
2—Maintain VFR altitudes, cloud clearances, and comply with applicable instrument flight rules.
3—Maintain IFR altitudes, VFR cloud clearances, and comply with applicable instrument flight rules.

5731. What cloud clearance must be complied with when authorized to maintain "VFR On Top"?

1—May maintain VFR clearance above, below, or between layers.
2—Must maintain VFR clearance above or below.
3—May maintain VFR clearance above or below, but not between layers.

5732. In what areas will ATC not authorize "VFR On Top"?

1—ARSA's and TCA's.
2—Continental Control Area.
3—PCA's.

5733. What separation or service by ATC is afforded pilots authorized "VFR On Top"?

1—The same afforded all IFR flights.
2—3 miles horizontally instead of 5.
3—Traffic advisories only.

5734. When a speed adjustment is necessary to maintain separation, what minimum speed may ATC request of a turbine-powered aircraft operating below 10,000 feet?

1—200 knots.
2—210 knots.
3—250 knots.

5735. When a speed adjustment is necessary to maintain separation, what minimum speed may ATC request of a turbine-powered aircraft departing an airport?

1—188 knots.
2—210 knots.
3—230 knots.

5736. If ATC requests a speed adjustment that is not within the operating limits of the aircraft, what action must the pilot take?

1—Maintain an airspeed within the operating limitations as close to the requested speed as possible.
2—Attempt to use the requested speed as long as possible, then request a reasonable airspeed from ATC.
3—Advise ATC of the airspeed that will be used.

5737. What are FDC NOTAM's?

1—Conditions of facilities en route that may cause delays.
2—Time critical aeronautical information of a temporary nature from distant centers.
3—Regulatory amendments to published IAP's and charts not yet available in normally published charts.

5738. What type information is disseminated from NOTAM D's?

1—Status of navigation aids, ILS's, radar service available, and other information essential to planning.
2—Airport or primary runway closings, runway and taxiway conditions, and airport lighting aids outages.
3—Temporary flight restrictions, changes in status in navigational aids, and updates on equipment such as VASI.

5739. What type information is disseminated from NOTAM L's?

1—Conditions of facilities en route that may cause delays.
2—Airport or primary runway closings, runway and taxiway conditions, and airport lighting aids outages.
3—Time critical information of a permanent nature that is not yet available in normally published charts.

5740. How often are NOTAM's broadcast to pilots on a scheduled basis?

1—15 minutes before and 15 minutes after the hour.
2—Between weather broadcasts on the hour.
3—Hourly, appended to the weather broadcast.

5741. When a composite flight plan indicates IFR for the first portion of the flight, what is the procedure for the transition?

1—The IFR portion is automatically canceled and the VFR portion is automatically activated when the pilot reports VFR conditions.
2—The pilot should advise ATC to cancel the IFR portion and contact the nearest FSS to activate the VFR portion.
3—The pilot should advise ATC to cancel the IFR portion and activate the VFR portion.

5742. Which IFR fix(es) should be entered on a composite flight plan?

1—All compulsory reporting points en route.
2—The VOR's that define the IFR portion of the flight.
3—The fix where the IFR portion is to be terminated.

5743. When a composite flight plan indicates VFR for the first portion of the flight, what is the procedure for the transition?

1—The VFR portion is automatically canceled and the IFR portion is automatically activated when the pilot reports IFR conditions.
2—The pilot should advise ATC to cancel VFR and activate the IFR portion of the flight.
3—The pilot should close the VFR portion with the nearest FSS and request the IFR clearance at least 5 minutes prior to IFR.

5744. What is the suggested time interval for filing and requesting an IFR flight plan?

1—File at least 30 minutes prior to departure and request the clearance not more than 10 minutes prior to taxi.
2—File at least 30 minutes prior to departure and request the clearance at least 10 minutes prior to taxi.
3—File at least 1 hour prior to departure and request the clearance at least 10 minutes prior to taxi.

5745. How should the route of flight be defined on an IFR flight plan?

1—A simplified route via airways or jet routes with transitions.
2—A route via airways or jet routes with VOR's and fixes used.
3—A route via airways or jet routes with only the compulsory reporting points.

5746. How should an off-airway direct flight be defined on an IFR flight plan?

1—The initial fix, the true course, and the final fix.
2—All radio fixes over which the flight will pass.
3—The initial fix, all radio fixes which the pilot wishes to be compulsory reporting points, and the final fix.

5747. How are RNAV routes defined on the IFR flight plan?

1—Define each waypoint using degree-distance fixes based on appropriate navigational aids or by latitude/longitude.
2—List the initial and final fix with at least one waypoint each 200 NM.
3—The initial and final fix must be an established radio fix, then each waypoint in between is defined using degree-distance fixes based on appropriate navigational aids.

5748. What is one limitation when filing a random RNAV route on an IFR flight plan?

1—The waypoints must be located within 200 NM of each other.
2—The entire route must be within radar environment.
3—The waypoints may only be defined by degree-distance fixes based on appropriate navigational aids.

5749. Under what condition may a pilot cancel an IFR flight plan prior to completing the flight?

1—Anytime it appears the clearance will cause a deviation from FAR.
2—Anytime within controlled airspace by contacting ARTCC.
3—Only if in VFR conditions in other than a PCA.

5750. What minimum information does an abbreviated departure clearance "cleared as filed" include?

1—Clearance limit and en route altitude.
2—Clearance limit, en route altitude, and SID, if appropriate.
3—Destination airport, en route altitude, and SID, if appropriate.

5751. Under what condition does a pilot receive a "void time" specified in the clearance?

1—On an uncontrolled airport.
2—When "gate hold" procedures are in effect.
3—If the clearance is received prior to starting engines.

5752. What is the normal procedure for IFR departures at locations with pretaxi clearance programs?

1—Pilots request IFR clearance when ready to taxi. The pilot will receive taxi instruction with clearance.
2—Pilots request IFR clearance when ready to taxi. Pilots will receive taxi clearance, then receive IFR clearance while taxiing or on runup.
3—Pilots request IFR clearance 10 minutes or less prior to taxi, then request taxi clearance from ground control.

5753. What is the purpose of the term "hold for release" when included in an IFR clearance?

1—A procedure for delaying departure for traffic volume, weather, or need to issue further instructions.
2—When an IFR clearance is received by telephone, the pilot will have time to prepare for takeoff prior to being released.
3—Gate hold procedures are in effect and the pilot receives an estimate of the time the flight will be released.

5754. On what performance is obstacle clearance based for IFR departures, including SID's? Cross end of runway plus 35 feet AGL,

1—then minimum climb of 150 feet per NM after takeoff.
2—climb to 400 feet prior to turn at the end of the runway, and then climb at least 200 feet per NM.
3—climb to 400 feet prior to turn at the end of the runway, and then climb at least 150 feet per NM.

5755. In what way are SID's depicted in plan view?

1—"Vectors" provided for navigational guidance or "Pilot NAV" with courses the pilot is responsible to follow.
2—"Vectors" and "Pilot NAV" for pilots to use at their discretion.
3—Combined textual and graphic form which are mandatory routes and instructions.

5756. What action should a pilot take if asked by ARTCC to "VERIFY 9,000" and the flight is actually maintaining 8,000?

1—Immediately climb to 9,000.
2—Report climbing to 9,000.
3—Report maintaining 8,000.

5757. Where are position reports required on an IFR flight on airways or routes?

1—Over all designated compulsory reporting points.
2—Only where specifically requested by ARTCC.
3—When requested to change altitude or advise of weather conditions.

5758. Which reports are required when operating IFR in radar environment?

1—Position reports, vacating an altitude, unable to climb 500 feet per minute, and time and altitude reaching a holding fix or point to which cleared.
2—Position reports, vacating an altitude, unable to climb 500 feet per minute, time and altitude reaching a holding fix or point to which cleared, and a change in average true airspeed exceeding 5 percent or 10 knots.
3—Vacating an altitude, unable to climb 500 feet per minute, time and altitude reaching a holding fix or point to which cleared, a change in average true airspeed exceeding 5 percent or 10 knots, and leaving any assigned holding fix or point.

5759. Which reports are always required when on an IFR approach not in radar contact?

1—Leaving FAF inbound or outer marker inbound and missed approach.
2—Leaving FAF inbound, leaving outer marker inbound or outbound, and missed approach.
3—Leaving FAF inbound, leaving outer marker inbound or outbound, procedure turn outbound and inbound, and visual contact with the runway.

5760. What action should a pilot take if within 3 minutes of a clearance limit and further clearance has not been received?

1—Assume lost communications and continue as planned.
2—Plan to hold at cruising speed until further clearance is received.
3—Start a speed reduction to holding speed in preparation for holding.

5761. What report should the pilot make at a clearance limit?

1—Time and altitude/flight level arriving or leaving.
2—Time, altitude/flight level, and expected holding speed.
3—Time, altitude/flight level, expected holding speed, and inbound leg length.

5762. Maximum holding speed for a propeller-driven airplane is

1—156 knots.
2—175 knots.
3—210 knots.

5763. Maximum holding speed for a turbojet airplane above 14,000 feet is

1—210 knots.
2—230 knots.
3—265 knots.

5764. Maximum holding speed for a turbojet airplane between 6,000 and 14,000 feet is

1—175 knots.
2—200 knots.
3—210 knots.

5765. When using a flight director system, what rate of turn or bank angle should a pilot observe during turns in a holding pattern?

1—3° per second or 25° bank, whichever is less.
2—3° per second or 30° bank, whichever is less.
3—1-1/2° per second or 25° bank, whichever is less.

5766. When holding at an NDB, at what point should the timing begin for the second leg outbound?

1—Abeam the holding fix or when the wings are level after completing the turn to the outbound heading, whichever occurs first.
2—At the end of a 1-minute standard rate turn after station passage.
3—When abeam the holding fix.

5767. When entering a holding pattern above 14,000 feet, the initial outbound leg should not exceed

1—1 minute.
2—1-1/2 minutes.
3—1-1/2 minutes or 10 NM, whichever is less.

5768. What is the primary purpose of a STAR?

1—Provide separation between IFR and VFR traffic.
2—Simplify clearance delivery procedures.
3—Decrease traffic congestion at certain airports.

5769. When does ATC issue a STAR?

1—Only when ATC deems it appropriate.
2—Only to high priority flights.
3—Only upon request of the pilot.

5770. What action(s) should a pilot take if vectored across the final approach course during an IFR approach?

1—Continue on the last heading issued until otherwise instructed.
2—Contact approach control, and advise that the flight is crossing the final approach course.
3—Turn onto final, and broadcast in the blind that the flight has proceeded on final.

5771. While being vectored to the final approach course of an IFR approach, when may the pilot descend to published altitudes?

1—Anytime the flight is on a published leg of an approach chart.
2—When the flight is within the 10-mile ring of a published approach.
3—Only when Approach Control clears the flight for the approach.

5772. When is radar service terminated while vectored for an IFR approach at an uncontrolled airport?

1—Only upon landing or advised to change to advisory frequency.
2—When aligned on the final approach course.
3—When cleared for the approach.

5773. When cleared for an IFR approach to an uncontrolled airport with no FSS, what precaution should the pilot take after being advised to change to advisory frequency?

1—Monitor ATC for traffic advisories as well as UNICOM.
2—Broadcast intentions and continually update position reports on UNICOM.
3—Wait until visual contact is made with the airport and broadcast intentions to land.

5774. Under what condition may a pilot file an IFR flight plan containing a special or privately owned IAP?

1—Upon approval of ATC.
2—Upon approval of the owner.
3—Upon signing a waiver of responsibility.

5775. When may a pilot execute a missed approach during an ASR approach?

1—Anytime at the pilot's discretion.
2—Only at the MAP.
3—Only when advised by the controller.

5776. When simultaneous approaches are in progress, how does each pilot receive radar advisories?

1—On tower frequency.
2—On approach control frequency.
3—One pilot on tower frequency and the other on approach control frequency.

5777. When cleared to execute a published side-step maneuver, at what point is the pilot expected to commence this maneuver?

1—At the published DH.
2—At the MDA published or a circling approach.
3—As soon as possible after the runway environment is in sight.

5778. If visual reference is lost while circling to land from an instrument approach, what action(s) should the pilot take?

1—Make a climbing turn toward the landing runway until established on the missed approach course.
2—Turn toward the landing runway maintaining MDA, and if visual reference is not regained, perform missed approach.
3—Make a climbing turn toward the VOR/NDB, and request further instructions.

5779. What is the difference between a visual and a contact approach?

1—A visual approach is an IFR authorization while a contact approach is a VFR authorization.
2—A visual approach is initiated by ATC while a contact approach is initiated by the pilot.
3—Both are the same but classified according to the party initiating the approach.

5780. Except during an emergency, when can a pilot expect landing priority?

1—When cleared for an IFR approach.
2—When piloting a large heavy aircraft.
3—In turn, on a first come, first serve basis.

5781. Under what condition should a pilot on IFR advise ATC of minimum fuel status?

1—When the fuel supply becomes less than that required for IFR.
2—If the remaining fuel suggests a need for traffic or landing priority.
3—If the remaining fuel precludes any undue delay.

5782. What is the maximum acceptable tolerance for penetrating a domestic ADIZ?

1—Plus or minus 10 miles; plus or minus 10 minutes.
2—Plus or minus 20 miles; plus or minus 5 minutes.
3—Plus or minus 10 miles; plus or minus 5 minutes.

5783. What minimum condition is suggested for declaring an emergency?

1—Anytime the pilot is doubtful of a condition that could adversely affect flight safety.
2—When fuel endurance or weather will require an en route or landing priority.
3—When distress conditions such as fire, mechanical failure, or structural damage occurs.

5784. It is the responsibility of the pilot and crew to report a near midair collision as a result of proximity of at least

1—50 feet or less to another aircraft.
2—500 feet or less to another aircraft.
3—1,000 feet or less to another aircraft.

5785. When setting the altimeter, pilots should disregard

1—effects of nonstandard atmospheric temperatures and pressures.
2—corrections for static pressure systems.
3—corrections for instrument error.

5786. (Refer to figures 32, 35, and 36.) What is the CG in percent of MAC for Load Condition WT-1?

1—26.0 percent MAC.
2—27.1 percent MAC.
3—27.9 percent MAC.

5787. (Refer to figures 32, 35, and 36.) What is the CG in inches aft of datum for Load Condition WT-2?

1—908.8 inches.
2—909.6 inches.
3—910.7 inches.

5788. (Refer to figures 32, 35, and 36.) What is the CG in percent of MAC for Load Condition WT-3?

1—27.8 percent MAC.
2—28.9 percent MAC.
3—29.1 percent MAC.

5789. (Refer to figures 32, 35, and 36.) What is the CG in inches aft of datum for Load Condition WT-4?

1—908.4 inches.
2—909.0 inches.
3—909.5 inches.

5790. (Refer to figures 32, 35, and 36.) What is the CG in percent of MAC for Load Condition WT-5?

1—25.6 percent MAC.
2—26.7 percent MAC.
3—27.2 percent MAC.

5791. (Refer to figures 33, 35, and 36.) What is the gross weight index for Load Condition WT-6?

1—181,340.5 index.
2—156,545.0 index.
3—165,991.5 index.

5792. (Refer to figures 33, 35, and 36.) What is the CG in percent of MAC for Load Condition WT-7?

1—21.6 percent MAC.
2—22.9 percent MAC.
3—24.0 percent MAC.

5793. (Refer to figures 33, 35, and 36.) What is the CG in percent of MAC for Load Condition WT-8?

1—29.4 percent MAC.
2—30.0 percent MAC.
3—31.3 percent MAC.

5794. (Refer to figures 33, 35, and 36.) What is the gross weight index for Load Condition WT-9?

1—169,755.2 index.
2—158,797.9 index.
3—186,565.5 index.

5795. (Refer to figures 33, 35, and 36.) What is the CG in percent of MAC for Load Condition WT-10?

1—27.0 percent MAC.
2—27.8 percent MAC.
3—28.0 percent MAC.

5796. (Refer to figures 34, 35, and 36.) What is the CG in percent of MAC for Load Condition WT-11?

1—26.8 percent MAC.
2—27.5 percent MAC.
3—28.6 percent MAC.

5797. (Refer to figures 34, 35, and 36.) What is the CG in percent of MAC for Load Condition WT-12?

1—25.8 percent MAC.
2—26.3 percent MAC.
3—27.5 percent MAC.

5798. (Refer to figures 34, 35, and 36.) What is the CG in percent of MAC for Load Condition WT-13?

1—28.6 percent MAC.
2—29.4 percent MAC.
3—30.1 percent MAC.

5799. (Refer to figures 34, 35, and 36.) What is the CG in percent of MAC for Load Condition WT-14?

1—30.1 percent MAC.
2—29.5 percent MAC.
3—31.5 percent MAC.

5800. (Refer to figures 34, 35, and 36.) What is the CG in Percent of MAC for Load Condition WT-15?

1—32.8 percent MAC.
2—31.5 percent MAC.
3—29.5 percent MAC.

5801. What is the maximum allowable weight that may be carried on a pallet which has the dimensions of 76 X 76 inches?

Floor load limit - 186 lb/sq ft
Pallet weight - 93 lb
Tiedown devices - 39 lb

1—7,421.3 pounds.
2—7,250.3 pounds.
3—7,328.7 pounds.

5802. What is the maximum allowable weight that may be carried on a pallet which has the dimensions of 83 X 95 inches?

Floor load limit - 184 lb/sq ft
Pallet weight - 85 lb
Tiedown devices - 36 lb

1—10,075.3 pounds.
2—9,954.3 pounds.
3—10,028.6 pounds.

5803. What is the maximum allowable weight that may be carried on a pallet which has the dimensions of 81 X 84 inches?

Floor load limit - 169 lb/sq ft
Pallet weight - 88 lb
Tiedown devices - 37 lb

1—8,156.0 pounds.
2—8,281.0 pounds.
3—8,093.0 pounds.

5804. What is the maximum allowable weight that may be carried on a pallet which has the dimensions of 76 X 74 inches?

Floor load limit - 176 lb/sq ft
Pallet weight - 77 lb
Tiedown devices - 29 lb

1—6,767.8 pounds.
2—6,873.7 pounds.
3—6,796.8 pounds.

5805. What is the maximum allowable weight that may be carried on a pallet which has the dimensions of 81 X 83 inches?

Floor load limit — 180 lb/sq ft
Pallet weight — 82 lb
Tiedown devices — 31 lb

1—8,403.7 pounds.
2—8,321.8 pounds.
3—8,290.8 pounds.

5806. (Refer to figure 37.) What is the new CG if the weight is shifted from the forward to the aft compartment under Load Condition WS-1?

1—15.2 percent MAC.
2—28.9 percent MAC.
3—30.0 percent MAC.

5807. (Refer to figure 37.) What is the new CG if the weight is shifted from the aft to the forward compartment under Load Condition WS-2?

1—26.1 percent MAC.
2—20.5 percent MAC.
3—22.8 percent MAC.

5808. (Refer to figure 37.) What is the new CG if the weight is shifted from the forward to the aft compartment under Load Condition WS-3?

1—29.2 percent MAC.
2—33.0 percent MAC.
3—28.6 percent MAC.

5809. (Refer to figure 37.) What is the new CG if the weight is shifted from the aft to the forward compartment under Load Condition WS-4?

1—37.0 percent MAC.
2—23.5 percent MAC.
3—24.1 percent MAC.

5810. (Refer to figure 37.) Where is the new CG if the weight is shifted from the forward to the aft compartment under Load Condition WS-5?

1— +19.15 index arm.
2— +13.93 index arm.
3— -7.92 index arm.

5811. (Refer to figure 37.) What is the new CG if the weight is removed from the forward compartment under Load Condition WS-1?

1—27.1 percent MAC.
2—26.8 percent MAC.
3—30.0 percent MAC.

5812. (Refer to figure 37.) Where is the new CG if the weight is added to the aft compartment under Load Condition WS-2?

1— +17.06 index arm.
2— +14.82 index arm.
3— +12.13 index arm.

5813. (Refer to figure 37.) What is the new CG if the weight is added to the forward compartment under Load Condition WS-3?

1—11.4 percent MAC.
2—14.3 percent MAC.
3—14.5 percent MAC.

5814. (Refer to figure 37.) Where is the new CG if the weight is removed from the aft compartment under Load Condition WS-4?

1— +15.53 index arm.
2— +8.50 index arm.
3— -3.51 index arm.

5815. (Refer to figure 37.) What is the new CG if the weight is removed from the forward compartment under Load Condition WS-5?

1—31.9 percent MAC.
2—19.1 percent MAC.
3—35.2 percent MAC.

5816. (Refer to figures 38, 40, 42, 43, 44, and 45.) What is the CG in inches from datum under Loading Condition BE-1?

1—Station 290.3.
2—Station 285.8.
3—Station 291.8.

5817. (Refer to figures 38, 40, 42, 43, 44, and 45.) What is the CG in inches from datum under Loading Condition BE-2?

1—Station 295.2.
2—Station 292.9.
3—Station 293.0.

5818. (Refer to figures 38, 40, 42, 43, 44, and 45.) What is the CG in inches from datum under Loading Condition BE-3?

1—Station 288.2.
2—Station 285.8.
3—Station 290.4.

5819. (Refer to figures 38, 40, 42, 43, 44, and 45.) What is the CG in inches from datum under Loading Condition BE-4?

1—Station 297.4.
2—Station 299.6.
3—Station 297.7.

5820. (Refer to figures 38, 40, 42, 43, 44, and 45.) What is the CG in inches from datum under Loading Condition BE-5?

1—Station 288.9.
2—Station 290.5.
3—Station 289.1.

5821 (Refer to figures 38, 40, 42, 43, 44, and 45.) What is the CG shift if the passengers in row 1 are moved to seats in row 9 under Loading Condition BE-1?

1—1.5 inches aft.
2—5.6 inches aft.
3—6.2 inches aft.

5822. (Refer to figures 38, 40, 42, 43, 44, and 45.) What is the CG shift if the passengers in row 1 are moved to row 8, and the passengers in row 2 are moved to row 9 under Loading Condition BE-2?

1—9.2 inches aft.
2—5.7 inches aft.
3—7.8 inches aft.

5823. (Refer to figures 38, 40, 42, 43, 44, and 45.) What is the CG shift if four passengers weighing 170 pounds each are added; two to seats in row 6 and two to seats in row 7, under Loading Condition BE-3?

1—3.5 inches aft.
2—2.2 inches forward.
3—1.8 inches aft.

5824. (Refer to figures 38, 40, 42, 43, 44, and 45.) What is the CG shift if all passengers in rows 2 and 4 are deplaned under Loading Condition BE-4?

1—2.5 inches aft.
2—2.5 inches forward.
3—2.0 inches aft.

5825. (Refer to figures 38, 40, 42, 43, 44, and 45.) What is the CG shift if the passengers in row 8 are moved to row 2, and the passengers in row 7 are moved to row 1, under Loading Condition BE-5?

1—1.0 inches forward.
2—8.9 inches forward.
3—6.5 inches forward.

5826. (Refer to figures 39, 41, 43, 44, and 45.) What is the CG in inches from datum under Loading Condition BE-6?

1—Station 296.5.
2—Station 296.1.
3—Station 297.0.

5827. (Refer to figures 39, 41, 43, 44, and 45.) What is the CG in inches from datum under Loading Condition BE-7?

1—Station 295.4.
2—Station 300.2.
3—Station 296.0.

5828. (Refer to figures 39, 41, 43, 44, and 45.) What is the CG in inches from datum under Loading Condition BE-8?

1—Station 296.9.
2—Station 297.4.
3—Station 298.1.

5829. (Refer to figures 39, 41, 43, 44, and 45.) What is the CG in inches from datum under Loading Condition BE-9?

1—Station 296.7.
2—Station 297.2.
3—Station 297.1.

5830. (Refer to figures 39, 41, 43, 44, and 45.) What is the CG in inches from datum under Loading Condition BE-10?

1—Station 293.9.
2—Station 293.0.
3—Station 292.8.

5831. (Refer to figures 39, 41, 43, 44, and 45.) What is the CG shift if 300 pounds of cargo in section A is moved to section H under Loading Condition BE-6?

1—4.0 inches aft.
2—2.5 inches aft.
3—4.3 inches aft.

5832. (Refer to figures 39, 41, 43, 44, and 45.) What is the CG shift if the cargo in section F is moved to section A, and 200 pounds of the cargo in section G is added to the cargo in section B, under Loading Condition BE-7?

1—5.2 inches forward.
2—4.0 inches forward.
3—8.0 inches forward.

5833. (Refer to figures 39, 41, 43, 44, and 45.) What is the CG if all cargo in sections A, B, J, K, and L are off-loaded under Loading Condition BE-8?

1—Station 291.9.
2—Station 292.7.
3—Station 294.5.

5834. (Refer to figures 39, 41, 43, 44, and 45.) What is the CG if cargo is loaded to bring sections F, G, and H to maximum capacity under Loading Condition BE-9?

1—Station 303.5.
2—Station 301.6.
3—Station 305.4.

5835. (Refer to figures 39, 41, 43, 44, and 45.) What is the CG shift if the cargo in section G is moved to section J under Loading Condition BE-10?

1—2.0 inches forward.
2—2.3 inches aft.
3—3.2 inches aft.

5836. (Refer to figures 41, 43, 45, and 46.) What limit is exceeded under Loading Condition BE-11?

1—ZFW limit is exceeded.
2—Aft CG limit is exceeded at takeoff weight.
3—Aft CG limit is exceeded at landing weight.

5837. (Refer to figures 41, 43, 45, and 46.) What limit(s) is(are) exceeded under Loading Condition BE-12?

1—ZFW limit is exceeded.
2—Landing aft CG limit is exceeded.
3—ZFW and maximum takeoff weight limits are exceeded.

5838. (Refer to figures 41, 43, 45, and 46.) What limit, if any, is exceeded under Loading Condition BE-13?

1—Takeoff forward CG limit is exceeded.
2—No limit is exceeded.
3—Landing aft CG limit is exceeded.

5839. (Refer to figures 41, 43, 45, and 46.) What limit(s) is(are) exceeded under Loading Condition BE-14?

1—Maximum ZFW limit is exceeded.
2—Takeoff forward CG limit is exceeded.
3—Maximum landing weight and landing forward CG limits are exceeded.

5840. (Refer to figures 41, 43, 45, and 46.) What limit(s) is(are) exceeded under Loading Condition BE-15?

1—Maximum takeoff weight limit is exceeded.
2—Maximum ZFW and takeoff forward CG limits are exceeded.
3—Maximum takeoff weight and takeoff forward CG limits are exceeded.

5841. (Refer to figures 47, 49, 50 and 51.) Where is the longitudinal CG located under Loading Condition BL-1?

1—Station 214.3.
2—Station 235.6.
3—Station 237.8.

5842. (Refer to figures 47, 49, 50, and 51.) Where is the longitudinal CG located under Loading Condition BL-2?

1—Station 237.6.
2—Station 238.5.
3—Station 262.3.

5843. (Refer to figures 47, 49, 50, and 51.) Where is the longitudinal CG located under Loading Condition BL-3?

1—Station 223.4.
2—Station 239.0.
3—Station 240.3.

5844. (Refer to figures 47, 49, 50, and 51.) Where is the longitudinal CG located under Loading Condition BL-4?

1—Station 238.1.
2—Station 220.4.
3—Station 236.5.

5845. (Refer to figures 47, 49, 50, and 51.) Where is the longitudinal CG located under Loading Condition BL-5?

1—Station 232.0.
2—Station 235.4.
3—Station 234.9.

5846. (Refer to figures 47, 49, 50, and 51.) What is the CG shift if all passengers in row 1 are moved to row 4 under Loading Condition BL-1?

1—5.0 inches aft.
2—4.1 inches aft.
3—0.19 inch aft.

5847. (Refer to figures 47, 49, 50, and 51.) What is the CG shift if one passenger weighing 150 pounds in row 2 is moved to row 4 under Loading Condition BL-2?

1—0.1 inch aft.
2—0.6 inch aft.
3—1.1 inches aft.

5848. (Refer to figures 47, 49, 50, and 51.) What is the CG shift if all passengers in row 4 are moved to row 1 under Loading Condition BL-3?

1—3.7 inches forward.
2—0.4 inch forward.
3—3.9 inches forward.

5849. (Refer to figures 47, 49, 50, and 51.) What is the CG shift if the passengers in row 1 are moved to row 4 under Loading Condition BL-4?

1—1.1 inches aft.
2—1.6 inches aft.
3—0.2 inch aft.

5850. (Refer to figures 47, 49, 50, and 51.) What is the CG shift if one passenger, weighing 100 pounds seated in row 1 is moved to row 3, under Loading Condition BL-5?

1—1.0 inch aft.
2—0.4 inch aft.
3—1.3 inches aft.

5851. (Refer to figures 48, 50, 51, and 53.) What limits are exceeded under Loading Condition BL-6?

1—Aft CG limits are exceeded at takeoff and landing.
2—Takeoff aft CG and landing forward CG limits are exceeded.
3—Maximum takeoff weight and takeoff aft CG limits are exceeded.

5852. (Refer to figures 48, 50, 51, and 53.) What limit, if any, is exceeded under Loading Condition BL-7?

1—No limits are exceeded.
2—Forward CG limit is exceeded at landing only.
3—Forward CG limit is exceeded at takeoff and landing.

5853. (Refer to figures 48, 50, 51, and 53.) What limit, if any, is exceeded under Loading Condition BL-8?

1—No limits are exceeded.
2—Forward CG limit is exceeded at landing only.
3—Forward CG limit is exceeded at takeoff and landing.

5854. (Refer to figures 48, 50, 51, and 53.) What limit, if any, is exceeded under Loading Condition BL-9?

1—No limits are exceeded.
2—Aft CG limit is exceeded at takeoff only.
3—Aft CG limit is exceeded at takeoff and landing.

5855. (Refer to figures 48, 50, 51, and 53.) What limit, if any, is exceeded under Loading Condition BL-10?

1—No limits are exceeded.
2—Aft CG limit is exceeded at takeoff.
3—Forward CG limit is exceeded at landing.

5856. (Refer to figures 48, 49, 50, 51, and 52.) Given Loading Condition BL-6, what is the effect on lateral CG if the outside passengers from each row on the left side are deplaned? Deplaned passenger weights are 170 pounds each.

1—CG shifts 1.5 inches right, out of limits.
2—CG shifts 1.4 inches right, within limits.
3—CG shifts 1.6 inches left, out of limits.

5857. (Refer to figures 48, 49, 50, 51, and 52.) Given Loading Condition BL-7, what is the effect on lateral CG if additional passengers, each weighing 200 pounds, are seated, one in each outside right seat of rows 1, 2, 3, and 4?

1—CG shifts 1.5 inches left, out of limits.
2—CG shifts 0.2 inch right, within limits.
3—CG shifts 1.8 inches right, out of limits.

5858. (Refer to figures 48, 49, 50, 51, and 52.) Given Loading Condition BL-8, what is the effect on lateral CG if a passenger weighing 200 pounds is added to the outer left seat of row 1, and a passenger weighing 220 pounds is added to the outer left seat of row 4?

1—CG shifts 1.5 inches left, out of limits.
2—CG shifts 1.2 inches left, within limits.
3—CG shifts 1.0 inch left, within limits.

5859. (Refer to figures 48, 49, 50, 51, and 52.) Given Loading Condition BL-9, what is the effect on lateral CG if passengers, each weighing 160 pounds, are added to the outer left seats of rows 1 and 2; and passengers, each weighing 180 pounds are added to the outer right seats of rows 3 and 4?

1—CG shifts 0.14 inch left.
2—CG shifts 0.15 inch right.
3—CG does not shift.

5860. (Refer to figures 48, 49, 50, 51, and 52.) Given Loading Condition BL-10, what is the effect on lateral CG if a passenger, weighing 240 pounds, is shifted from the outer right seat of row 4 to the outer left seat of row 1?

1—CG shifts 1.1 inches left, within limits.
2—CG shifts 1.5 inches left, out of limits.
3—CG shifts 1.7 inches left, out of limits.

5861. (Refer to figures 54, 55, and 56.) What are V_1 and V_R speeds for Operating Conditions A-1?

1—V_1 123.1 knots; V_R 125.2 knots.
2—V_1 120.5 knots; V_R 123.5 knots.
3—V_1 122.3 knots; V_R 124.1 knots.

5862. (Refer to figures 54, 55, and 56.) What are V_1 and V_R speeds for Operating Condition A-2?

1—V_1 129.7 knots; V_R 134.0 knots.
2—V_1 127.2 knots; V_R 133.2 knots.
3—V_1 127.4 knots; V_R 133.6 knots.

5863. (Refer to figures 54, 55, and 56.) What are V_1 and V_R speeds for Operating Condition A-3?

1—V_1 136.8 knots; V_R 141.8 knots.
2—V_1 134.8 knots; V_R 139.0 knots.
3—V_1 133.5 knots; V_R 141.0 knots.

5864. (Refer to figures 54, 55, and 56.) What are V_1 and V_R speeds for Operating Condition A-4?

1—V_1 128.0 knots; V_R 130.5 knots.
2—V_1 129.9 knots; V_R 133.4 knots.
3—V_1 128.6 knots; V_R 131.1 knots.

5865. (Refer to figures 54, 55, and 56.) What are V_1 and V_R speeds for Operating Condition A-5?

1—V_1 110.4 knots; V_R 110.9 knots.
2—V_1 109.6 knots; V_R 112.7 knots.
3—V_1 106.4 knots; V_R 106.4 knots.

5866. (Refer to figure 55.) What is the STAB TRIM setting for Operating Condition A-1?

1—29 percent MAC.
2—32 percent MAC.
3—36 percent MAC.

5867. (Refer to figure 55.) What is the STAB TRIM setting for Operating Condition A-2?

1—26 percent MAC.
2—20 percent MAC.
3—22 percent MAC.

5868. (Refer to figure 55.) What is the STAB TRIM setting for Operating Condition A-3?

1—18 percent MAC.
2—20 percent MAC.
3—22 percent MAC.

5869. (Refer to figure 55.) What is the STAB TRIM setting for Operating Condition A-4?

1—26 percent MAC.
2—22 percent MAC.
3—18 percent MAC.

5870. (Refer to figure 55.) What is the STAB TRIM setting for Operating Condition A-5?

1—26 percent MAC.
2—30 percent MAC.
3—32 percent MAC.

5871. (Refer to figures 54, 57, and 58.) What is the max takeoff EPR for Operating Condition G-1?

1—Engines 1 and 3, 2.22; engine 2, 2.16.
2—Engines 1 and 3, 2.22; engine 2, 2.21.
3—Engines 1 and 3, 2.15; engine 2, 2.09.

5872. (Refer to figures 54, 57, and 58.) What is the max takeoff EPR for Operating Condition G-2?

1—Engines 1 and 3, 2.15; engine 2, 2.16.
2—Engines 1 and 3, 2.18; engine 2, 2.13.
3—Engines 1 and 3, 2.14; engine 2, 2.11.

5873. (Refer to figures 54, 57, and 58.) What is the max takeoff EPR for Operating Condition G-3?

1—Engines 1 and 3, 2.08; engine 2, 2.05.
2—Engines 1 and 3, 2.14; engine 2, 2.10.
3—Engines 1 and 3, 2.18; engine 2, 2.07.

5874. (Refer to figures 54, 57, and 58.) What is the max takeoff EPR for Operating Condition G-4?

1—Engines 1 and 3, 2.23; engine 2, 2.21.
2—Engines 1 and 3, 2.26; engine 2, 2.25.
3—Engines 1 and 3, 2.24; engine 2, 2.24.

5875. (Refer to figures 54, 57, and 58.) What is the max takeoff EPR for Operating Condition G-5?

1—Engines 1 and 3, 2.27; engine 2, 2.18.
2—Engines 1 and 3, 2.16; engine 2, 2.14.
3—Engines 1 and 3, 2.23; engine 2, 2.22.

5876. (Refer to figures 54, 57, and 58.) What is the takeoff safety speed for Operating Condition G-1?

1—122 knots.
2—137 knots.
3—133 knots.

5877. (Refer to figures 54, 57, and 58.) What is the rotation speed for Operating Condition G-2?

1—150 knots.
2—154 knots.
3—155 knots.

5878. (Refer to figures 54, 57, and 58.) What are V_1, V_R, and V_2 speeds for Operating Condition G-3?

1—134, 134, and 145 knots.
2—134, 139, and 145 knots.
3—132, 132, and 145 knots.

5879. (Refer to figures 54, 57, and 58.) What are V_1 and V_2 speeds for Operating Condition G-4?

1—133 and 145 knots.
2—127 and 141 knots.
3—132 and 146 knots.

5880. (Refer to figures 54, 57, and 58.) What are rotation and V_2 bug speeds for Operating Condition G-5?

1—120 and 134 knots.
2—119 and 135 knots.
3—135 and 135 knots.

5881. (Refer to figures 57 and 58.) What is the STAB TRIM setting for Operating Condition G-1?

1—4 ANU.
2—4-1/2 ANU.
3—4-3/4 ANU.

5882. (Refer to figures 57 and 58.) What is the STAB TRIM setting for Operating Condition G-2?

1—6-1/2 ANU.
2—7-1/4 ANU.
3—5-3/4 ANU.

5883. (Refer to figures 57 and 58.) What is the STAB TRIM setting for Operating Condition G-3?

1—3-3/4 ANU.
2—4 ANU.
3—4-1/4 ANU.

5884. (Refer to figures 57 and 58.) What is the STAB TRIM setting for Operating Condition G-4?

1—2-3/4 ANU.
2—4 ANU.
3—2-1/2 ANU.

5885. (Refer to figures 57 and 58.) What is the STAB TRIM setting for Operating Condition G-5?

1—3-1/4 ANU.
2—2-3/4 ANU.
3—2-1/2 ANU.

5886. (Refer to figures 54, 59, and 61.) What is the takeoff EPR for Operating Condition R-1?

1—2.04.
2—2.00.
3—2.01.

5887. (Refer to figures 54, 59, and 61.) What is the takeoff EPR for Operating Condition R-2?

1—2.16.
2—2.19.
3—2.18.

5888. (Refer to figures 54, 59, and 61.) What is the takeoff EPR for Operating Condition R-3?

1—2.01.
2—2.06.
3—2.04.

5889. (Refer to figures 54, 59, and 61.) What is the takeoff EPR for Operating Condition R-4?

1—2.08.
2—2.06.
3—2.11.

5890. (Refer to figures 54, 59, and 61.) What is the takeoff EPR for Operating Condition R-5?

1—1.98.
2—1.95.
3—1.96.

5891. (Refer to figures 54, 59, and 61.) What is the takeoff safety speed for Operating Condition R-1?

1—128 knots.
2—121 knots.
3—133 knots.

5892. (Refer to figures 54, 59, and 61.) What is the rotation speed for Operating Condition R-2?

1—147 knots.
2—152 knots.
3—146 knots.

5893. (Refer to figures 54, 59. and 61.) What are V_1, V_R, and V_2 speeds for Operating Condition R-3?

1—143, 143, and 147 knots.
2—138, 138, and 142 knots.
3—136, 138, and 143 knots.

5894. (Refer to figures 54, 59, and 61.) What are critical engine failure and takeoff safety speeds for Operating Condition R-4?

1—131 and 133 knots.
2—123 and 134 knots.
3—122 and 130 knots.

5895. (Refer to figures 54, 59, and 61.) What are rotation and V_2 bug speeds for Operating Condition R-5?

1—138 and 143 knots.
2—136 and 138 knots.
3—134 and 141 knots.

5896. (Refer to figures 59 and 61.) What is the STAB TRIM setting for Operating Condition R-1?

1—8 ANU.
2—7-5/8 ANU.
3—7-3/4 ANU.

5897. (Refer to figures 59 and 61.) What is the STAB TRIM setting for Operating Condition R-2?

1—5-3/4 ANU.
2—7 ANU.
3—6-3/4 ANU.

5898. (Refer to figures 59 and 61.) What is the STAB TRIM setting for Operating Condition R-3?

1—3 ANU.
2—4-1/2 ANU.
3—5 ANU.

5899. (Refer to figures 59 and 61.) What is the STAB TRIM setting for Operating Condition R-4?

1—4-1/4 ANU.
2—4-1/2 ANU.
3—5 ANU.

5900. (Refer to figures 59 and 61.) What is the STAB TRIM setting for Operating Condition R-5?

1—6-3/4 ANU.
2—8 ANU.
3—7-1/2 ANU.

5901. (Refer to figures 60, 62, and 63.) What is the ground distance covered during en route climb for Operating Condition V-1?

1—145 miles.
2—137 miles.
3—134 miles.

5902. (Refer to figures 60, 62, and 63.) What is the ground distance covered during en route climb for Operating Condition V-2?

1—84 miles.
2—65 miles.
3—69 miles.

5903. (Refer to figures 60, 62, and 63.) What is the ground distance covered during en route climb for Operating Condition V-3?

1—95 miles.
2—79 miles.
3—57 miles.

5904. (Refer to figures 60, 62, and 63.) What is the ground distance covered during en route climb for Operating Condition V-4?

1—63 miles.
2—53 miles.
3—65 miles.

5905. (Refer to figures 60, 62, and 63.) What is the ground distance covered during en route climb for Operating Condition V-5?

1—70 miles.
2—47 miles.
3—61 miles.

5906. (Refer to figures 60, 62, and 63.) How much fuel is burned during en route climb for Operating Condition V-1?

1—4,100 pounds.
2—3,600 pounds.
3—4,000 pounds.

5907. (Refer to figures 60, 62, and 63.) How much fuel is burned during en route climb for Operating Condition V-2?

1—2,250 pounds.
2—2,600 pounds.
3—2,400 pounds.

5908. (Refer to figures 60, 62, and 63.) What is the aircraft weight at the top of climb for Operating Condition V-3?

1—82,100 pounds.
2—82,500 pounds.
3—82,200 pounds.

5909. (Refer to figures 60, 62, and 63.) What is the aircraft weight at the top of climb for Operating Condition V-4?

1—102,900 pounds.
2—102,600 pounds.
3—103,100 pounds.

5910. (Refer to figures 60, 62, and 63.) What is the aircraft weight at the top of climb for Operating Condition V-5?

1—73,000 pounds.
2—72,900 pounds.
3—72,800 pounds.

5911. (Refer to figures 64 and 66.) What is the max climb EPR for Operating Conditions T-1?

1—1.96.
2—2.04.
3—1.90.

5912. (Refer to figures 64 and 66.) What is the max continuous EPR for Operating Condition T-2?

1—2.10.
2—1.99.
3—2.02.

5913. (Refer to figures 64 and 66.) What is the max cruise EPR for Operating Condition T-3?

1—2.11.
2—2.02.
3—1.90.

5914. (Refer to figures 64 and 66.) What is the max climb EPR for Operating Condition T-4?

1—2.20.
2—2.07.
3—2.06.

5915. (Refer to figures 64 and 66.) What is the max continuous EPR for Operating Condition T-5?

1—2.00.
2—2.04.
3—1.96.

5916. (Refer to figures 65, 67, and 68.) What is the ground distance covered during en route climb for Operating Condition W-1?

1—104.0 miles.
2—99.2 miles.
3—109.7 miles.

5917. (Refer to figures 65, 67, and 68.) What is the ground distance covered during en route climb for Operating Condition W-2?

1—85.8 miles.
2—87.8 miles.
3—79.4 miles.

5918. (Refer to figures 65, 67, and 68.) What is the ground distance covered during en route climb for Operating Condition W-3?

1—86.4 miles.
2—84.2 miles.
3—85.1 miles.

5919. (Refer to figures 65, 67, and 68.) What is the ground distance covered during en route climb for Operating Condition W-4?

1—58.4 miles.
2—61.4 miles.
3—60.3 miles.

5920. (Refer to figures 65, 67, and 68.) What is the ground distance covered during en route climb for Operating Condition W-5?

1—68.0 miles.
2—73.9 miles.
3—66.4 miles.

5921. (Refer to figures 65, 67, and 68.) What is the aircraft weight at the top of climb for Operating Condition W-1?

1—81,600 pounds.
2—81,400 pounds.
3—81,550 pounds.

5922. (Refer to figures 65, 67, and 68.) What is the aircraft weight at the top of climb for Operating Condition W-2?

1—82,775 pounds.
2—83,650 pounds.
3—83,800 pounds.

5923. (Refer to figures 65, 67, and 68.) What is the aircraft weight at the top of climb for Operating Condition W-3?

1—75,750 pounds.
2—75,900 pounds.
3—76,100 pounds.

5924. (Refer to figures 65, 67, and 68.) What is the aircraft weight at the top of climb for Operating Condition W-4?

1—86,150 pounds.
2—86,260 pounds.
3—86,450 pounds.

5925. (Refer to figures 65, 67, and 68.) What is the aircraft weight at the top of climb for Operating Condition W-5?

1—89,900 pounds.
2—90,000 pounds.
3—90,100 pounds.

5926. (Refer to figures 69 and 71.) What is the trip time for Operating Condition X-1?

1—4 hours 5 minutes.
2—4 hours 15 minutes.
3—4 hours.

5927. (Refer to figures 69 and 71.) What is the trip time for Operating Condition X-2?

1—5 hours 5 minutes.
2—6 hours 15 minutes.
3—5 hours 55 minutes.

5928. (Refer to figures 69 and 71.) What is the trip time for Operating Condition X-3?

1—4 hours 15 minutes.
2—3 hours 40 minutes.
3—4 hours.

5929. (Refer to figures 69 and 71.) What is the trip time for Operating Condition X-4?

1—6 hours 50 minutes.
2—5 hours 45 minutes.
3—5 hours 30 minutes

5930. (Refer to figures 69 and 71.) What is the trip time for Operating Condition X-5?

1—2 hours 55 minutes.
2—3 hours 10 minutes.
3—2 hours 50 minutes.

5931. (Refer to figures 69 and 71.) What is the trip fuel for Operating Condition X-1?

1—25,000 pounds.
2—26,000 pounds.
3—24,000 pounds.

5932. (Refer to figures 69 and 71.) What is the trip fuel for Operating Condition X-2?

1—33,000 pounds.
2—28,000 pounds.
3—35,000 pounds.

5933. (Refer to figures 69 and 71.) What is the trip fuel for Operating Condition X-3?

1—36,000 pounds.
2—34,500 pounds.
3—33,000 pounds.

5934. (Refer to figures 69 and 71.) What is the trip fuel for Operating Condition X-4?

1—33,000 pounds.
2—31,500 pounds.
3—34,000 pounds.

5935. (Refer to figures 69 and 71.) What is the trip fuel for Operating Condition X-5?

1—15,000 pounds.
2—20,000 pounds.
3—19,000 pounds.

5936. (Refer to figures 70 and 73.) What is the turbulent air penetration N_1 power setting for Operating Condition Q-1?

1—82.4 percent.
2—84.0 percent.
3—84.8 percent.

5937. (Refer to figures 70 and 73.) What is the turbulent air penetration N_1 power setting for Operating Condition Q-2?

1—78.2 percent.
2—75.2 percent.
3—78.7 percent.

5938. (Refer to figures 70 and 73.) What is the turbulent air penetration N_1 power setting for Operating Condition Q-3?

1—77.8 percent.
2—82.6 percent.
3—84.2 percent.

5939. (Refer to figures 70 and 73.) What is the turbulent air penetration N_1 power setting for Operating Condition Q-4?

1—76.8 percent.
2—75.4 percent.
3—74.0 percent.

5940. (Refer to figures 70 and 73.) What is the Turbulent air penetration N_1 power setting for Operating Condition Q-5?

1—70.9 percent.
2—72.9 percent.
3—71.6 percent.

5941. (Refer to figures 72 and 74.) What is the trip time corrected for wind under Operating Condition Z-1?

1—58.1 minutes.
2—51.9 minutes.
3—54.7 minutes.

5942. (Refer to figures 72 and 74.) What is the trip time corrected for wind under Operating Condition Z-2?

1—1 hour 35 minutes.
2—1 hour 52 minutes.
3—1 hour 46 minutes.

5943. (Refer to figures 72 and 74.) What is the trip time corrected for wind under Operating Condition Z-3?

1—2 hours 9 minutes.
2—1 hour 59 minutes.
3—1 hour 52 minutes.

5944. (Refer to figures 72 and 74.) What is the trip time corrected for wind under Operating Condition Z-4?

1—48.3 minutes.
2—50.7 minutes.
3—51.3 minutes.

5945. (Refer to figures 72 and 74.) What is the trip time corrected for wind under Operating Condition Z-5?

1—1 hour 11 minutes.
2—56 minutes.
3—62 minutes.

5946. (Refer to figures 72 and 74.) What is the estimated fuel consumption for Operating Condition Z-1?

1—5,230 pounds.
2—5,970 pounds.
3—5,550 pounds.

5947. (Refer to figures 72 and 74.) What is the estimated fuel consumption for Operating Condition Z-2?

1—10,270 pounds.
2—9,660 pounds.
3—10,165 pounds.

5948. (Refer to figures 72 and 74.) What is the estimated fuel consumption for Operating Condition Z-3?

1—12,300 pounds.
2—11,300 pounds.
3—13,990 pounds.

5949. (Refer to figures 72 and 74.) What is the estimated fuel consumption for Operating Condition Z-4?

1—4,950 pounds.
2—5,380 pounds.
3—5,230 pounds.

5950. (Refer to figures 72 and 74.) What is the estimated fuel consumption for Operating Condition Z-5?

1—6,250 pounds.
2—5,380 pounds.
3—7,120 pounds.

5951. (Refer to figures 75 and 78.) What is the total time from starting to the alternate through completing the approach for Operating Condition L-1?

1—30 minutes.
2—45 minutes.
3—29 minutes.

5952. (Refer to figures 75 and 78.) What is the total time from starting to the alternate through completing the approach for Operating Condition L-2?

1—36 minutes.
2—51 minutes.
3—40 minutes.

5953. (Refer to figures 75 and 78.) What is the total time from starting to the alternate through completing the approach for Operating Condition L-3?

1—1 hour.
2—1 hour 9 minutes.
3—1 hour 24 minutes.

5954. (Refer to figures 75 and 78.) What is the total time from starting to the alternate through completing the approach for Operating Condition L-4?

1—34 minutes.
2—19 minutes.
3—20 minutes.

5955. (Refer to figures 75 and 78.) What is the total time from starting to the alternate through completing the approach for Operating Condition L-5?

1—1 hour 10 minutes.
2—48 minutes.
3—55 minutes.

5956. (Refer to figures 75 and 78.) What is the approximate landing weight for Operating Condition L-1?

1—79,000 pounds.
2—83,500 pounds.
3—81,500 pounds.

5957. (Refer to figures 75 and 78.) What is the approximate landing weight for Operating Condition L-2?

1—65,200 pounds.
2—66,100 pounds.
3—69,600 pounds.

5958. (Refer to figures 75 and 78.) What is the approximate landing weight for Operating Condition L-3?

1—80,300 pounds.
2—85,400 pounds.
3—77,700 pounds.

5959. (Refer to figures 75 and 78.) What is the approximate landing weight for Operating Condition L-4?

1—73,300 pounds.
1—74,190 pounds.
3—73,500 pounds.

5960. (Refer to figures 75 and 78.) What is the approximate landing weight for Operating Condition L-5?

1—78,600 pounds.
2—77,000 pounds.
3—76,800 pounds.

5961. (Refer to figures 76 and 79.) What are the recommended IAS and EPR settings for holding under Operating Condition H-1?

1—264 knots and 1.80 EPR.
2—259 knots and 1.73 EPR.
3—261 knots and 1.81 EPR.

5962. (Refer to figures 76 and 79.) What are the recommended IAS and EPR settings for holding under Operating Condition H-2?

1—257 knots and 1.60 EPR.
2—258 knots and 1.66 EPR.
3—253 knots and 1.57 EPR.

5963. (Refer to figures 76 and 79.) What are the recommended IAS and EPR settings for holding under Operating Condition H-3?

1—226 knots and 1.30 EPR.
2—230 knots and 1.31 EPR.
3—234 knots and 1.32 EPR.

5964. (Refer to figures 76 and 79.) What are the recommended IAS and EPR settings for holding under Operating Condition H-4?

1—219 knots and 1.44 EPR.
2—216 knots and 1.42 EPR.
3—220 knots and I.63 EPR.

5965. (Refer to figures 76 and 79.) What are the recommended IAS and EPR settings for holding under Operating Condition H-5?

1—245 knots and 1.65 EPR.
2—237 knots and 1.61 EPR.
3—249 knots and 1.67 EPR.

5966. (Refer to figures 76 and 79.) What is the approximate fuel consumed when holding under Operating Condition H-1?

1—3,500 pounds.
2—4,680 pounds.
3—2,630 pounds.

5967. (Refer to figures 76 and 79.) What is the approximate fuel consumed when holding under Operating Condition H-2?

1—5,100 pounds.
2—3,400 pounds.
3—5,250 pounds.

5968. (Refer to figures 76 and 79.) What is the approximate fuel consumed when holding under Operating Condition H-3?

1—3,090 pounds.
2—6,950 pounds.
3—6,680 pounds.

5969. (Refer to figures 76 and 79.) What is the approximate fuel consumed when holding under Operating Condition H-4?

1—3,190 pounds.
2—3,050 pounds.
3—2,550 pounds.

5970. (Refer to figures 76 and 79.) What is the approximate fuel consumed when holding under Operating Condition H-5?

1—3,170 pounds.
2—7,380 pounds.
3—5,540 pounds.

5971. (Refer to figures 77 and 80.) What are the recommended IAS and EPR settings for holding under Operating Condition O-1?

1—221 knots and 1.83 EPR.
2—223 knots and 2.01 EPR.
3—217 knots and 1.81 EPR.

5972. (Refer to figures 77 and 80.) What are the recommended IAS and EPR settings for holding under Operating Condition O-2?

1—210 knots and 1.57 EPR.
2—210 knots and 1.51 EPR.
3—210 knots and 1.45 EPR.

5973. (Refer to figures 77 and 80.) What are the recommended IAS and EPR settings for holding under Operating Condition O-3?

1—217 knots and 1.50 EPR.
2—215 knots and 1.44 EPR.
3—216 knots and 1.40 EPR.

5974. (Refer to figures 77 and 80.) What are the recommended IAS and EPR settings for holding under Operating Condition O-4?

1—223 knots and 1.33 EPR.
2—225 knots and 1.33 EPR.
3—220 knots and 1.28 EPR.

5975. (Refer to figures 77 and 80.) What are the recommended IAS and EPR settings for holding under Operating Condition O-5?

1—219 knots and 1.28 EPR.
2—214 knots and 1.26 EPR.
3—218 knots and 1.27 EPR.

5976. (Refer to figures 77 and 80.) What is the approximate fuel consumed when holding under Operating Condition O-1?

1—1,625 pounds.
2—1,950 pounds.
3—2,440 pounds.

5977. (Refer to figures 77 and 80.) What is the approximate fuel consumed when holding under Operating Condition O-2?

1—2,250 pounds.
2—2,500 pounds.
3—3,000 pounds.

5978. (Refer to figures 77 and 80.) What is the approximate fuel consumed when holding under Operating Condition O-3?

1—2,940 pounds.
2—2,520 pounds.
3—3,250 pounds.

5979. (Refer to figures 77 and 80.) What is the approximate fuel consumed when holding under Operating Condition O-4?

1—2,870 pounds.
2—2,230 pounds.
3—1,440 pounds.

5980. (Refer to figures 77 and 80.) What is the approximate fuel consumed when holding under Operating Condition O-5?

1—2,950 pounds.
2—2,870 pounds.
3—2,400 pounds.

5981. (Refer to figure 81.) How many minutes of dump time is required to reach a weight of 144,500 pounds?

Initial Weight.. 180,500 lb
Zero Fuel Weight.. 125,500 lb

1—13 minutes.
2—15 minutes.
3—16 minutes.

5982. (Refer to figure 81.) How many minutes of dump time is required to reduce fuel load to 25,000 pounds?

Initial Weight.. 179,500 lb
Zero Fuel Weight.. 136,500 lb

1—10 minutes.
2—9 minutes.
3—8 minutes.

5983. (Refer to figure 81.) How many minutes of dump time is required to reach a weight of 151,500 pounds?

Initial Weight.. 181,500 lb
Zero Fuel Weight.. 126,000 lb

1—15 minutes.
2—14 minutes.
3—13 minutes.

5984. (Refer to figure 81.) How many minutes of dump time is required to reduce fuel load to 16,000 pounds?

Initial Weight.. 175,500 lb
Zero Fuel Weight.. 138,000 lb

1—9 minutes.
2—10 minutes.
3—8 minutes.

5985. (Refer to figure 81.) How many minutes of dump time is required to reach a weight of 144,000 pounds?

Initial Weight.. 178,000 lb
Zero Fuel Weight.. 121,000 lb

1—15 minutes.
2—14 minutes.
3—13 minutes.

5986. (Refer to figures 82 and 84.) What is the approximate level-off pressure altitude after drift-down under Operating Condition D-1?

1—19,400 feet.
2—18,000 feet.
3—20,200 feet.

5987. (Refer to figures 82 and 84.) What is the approximate level-off pressure altitude after drift-down under Operating Condition D-2?

1—14,700 feet.
2—17,500 feet.
3—18,300 feet.

5988. (Refer to figures 82 and 84.) What is the approximate level-off pressure altitude after drift-down under Operating Condition D-3?

1—22,200 feet.
2—19,800 feet.
3—21,600 feet.

5989. (Refer to figures 82 and 84.) What is the approximate level-off pressure altitude after drift-down under Operating Condition D-4?

1—27,900 feet.
2—22,200 feet.
3—24,400 feet.

5990. (Refer to figures 82 and 84.) What is the approximate level-off pressure altitude after drift-down under Operating Condition D-5?

1—8,800 feet.
2—9,600 feet.
3—13,000 feet.

5991. (Refer to figures 83 and 85.) What are descent time and distance under Operating Condition S-1?

1—24 minutes, 118 NAM.
2—26 minutes, 125 NAM.
3—25 minutes, 118 NAM.

5992. (Refer to figures 83 and 85.) What are descent fuel and distance under Operating Condition S-2?

1—1,440 pounds, 104 NAM.
2—1,500 pounds, 118 NAM.
3—1,400 pounds, 98 NAM.

5993. (Refer to figures 83 and 85.) What are descent fuel and distance under Operating Condition S-3?

1—1,490 pounds, 118 NAM.
2—1,440 pounds, 110 NAM.
3—1,550 pounds, 127 NAM.

5994. (Refer to figures 83 and 85.) What are descent time and distance under Operating Condition S-4?

1—22 minutes, 110 NAM.
2—21 minutes, 113 NAM.
3—24 minutes, 129 NAM.

5995. (Refer to figures 83 and 85.) What are descent fuel and distance under Operating Condition S-5?

1—1,420 pounds, 97 NAM.
2—1,440 pounds, 102 NAM.
3—1,390 pounds, 92 NAM.

5996. (Refer to figures 86 and 87.) What is the go-around EPR for Operating Condition L-1?

1—1.98 EPR.
2—2.01 EPR.
3—2.00 EPR.

5997. (Refer to figures 86 and 87.) What is the go-around EPR for Operating Condition L-2?

1—2.15 EPR.
2—2.03 EPR.
3—2.06 EPR.

5998. (Refer to figures 86 and 87.) What is the go-around EPR for Operating Condition L-3?

1—2.03 EPR.
2—2.07 EPR.
3—2.05 EPR.

5999. (Refer to figures 86 and 87.) What is the go-around EPR for Operating Condition L-4?

1—2.05 EPR.
2—2.12 EPR.
3—2.09 EPR.

6000. (Refer to figures 86 and 87.) What is the go-around EPR for Operating Condition L-5?

1—2.00 EPR.
2—2.07 EPR.
3—2.04 EPR.

6001. (Refer to figures 86, 87, and 118.) What is V_{REF} for Operating Condition L-1?

1—143 knots.
2—144 knots.
3—145 knots.

6002. (Refer to figures 86, 87, and 118.) What is reference speed For Operating Condition L-2?

1—140 knots.
2—145 knots.
3—148 knots.

6003. (Refer to figures 86, 87, and 118.) What is $V_{REF}+20$ for Operating Condition L-3?

1—151 knots.
2—169 knots.
3—149 knots.

6004. (Refer to figures 86, 87, and 118.) What is $V_{REF}+10$ for Operating Condition L-4?

1—152 knots.
2—138 knots.
3—148 knots.

6005. (Refer to figures 86, 87, and 118.) What is maneuvering speed for Operating Condition L-5?

1—124 knots.
2—137 knots.
3—130 knots.

6006. (Refer to figure 89.) Which of the following configurations will result in the shortest landing distance over a 50-foot obstacle to a wet runway?

1—Brakes and spoilers at 122,500 pounds gross weight.
2—Brakes and reversers at 124,000 pounds gross weight.
3—Brakes, spoilers and reversers at 131,000 pounds gross weight.

6007. (Refer to figures 88 and 89.) Which conditions will result in the shortest landing distance at a weight of 132,500 pounds?

1—Dry runway using brakes and reversers.
2—Dry runway using brakes and spoilers.
3—Wet runway using brakes, spoilers and reversers.

6008. (Refer to figure 90.) Which configuration will result in a landing distance of 5,900 feet over a 50-foot obstacle to an icy runway?

1—Use of three reversers at 131,000 pounds gross weight.
2—Use of brakes and spoilers at 125,000 pounds gross weight.
3—Use of three reversers at 133,000 pounds gross weight.

6009. (Refer to figure 88.) How much longer is the dry runway landing distance using brakes only compared to using brakes and reversers at 114,000 pounds gross weight?

1—1,150 feet.
2—500 feet.
3—300 feet.

6010. (Refer to figure 88.) How many feet will remain after landing on a 7,200-foot dry runway with spoilers inoperative at 118,000 pounds gross weight?

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

6011. (Refer to figure 90.) What is the transition distance when landing on an icy runway at a gross weight of 134,000 pounds?

1—400 feet.
2—950 feet.
3—1,350 feet.

6012. (Refer to figure 89.) How many feet will remain after landing on a 6,000-foot wet runway with reversers inoperative at 122,000 pounds gross weight?

1—2,200 feet.
2—2,750 feet.
3—3,150 feet.

6013. (Refer to figure 90.) What is the maximum landing weight which will permit stopping 500 feet short of the end of a 5,200-foot icy runway?

1—124,000 pounds.
2—137,000 pounds.
3—108,000 pounds.

6014. (Refer to figure 88.) What is the maximum landing weight which will permit stopping 2,000 feet short of the end of a 5,400-foot dry runway with reversers and spoilers inoperative?

1—117,500 pounds.
2—136,500 pounds.
3—139,500 pounds.

6015. (Refer to figure 90.) What is the landing distance on an icy runway with reversers inoperative at a landing weight of 125,000 pounds?

1—4,500 feet.
2—4,750 feet.
3—5,800 feet.

6016. (Refer to figure 91.) How much will landing distance be reduced by using 15° of flaps rather than 0° flaps at a landing weight of 119,000 pounds?

1—500 feet.
2—800 feet.
3—2,700 feet.

6017. (Refer to figure 91.) What is the ground roll when landing with 15° of flaps at a landing weight of 122,000 pounds?

1—1,750 feet.
2—2,200 feet.
3—2,750 feet.

6018. (Refer to figures 91 and 93.) What approach speed and ground roll will be needed when landing at a weight of 140,000 pounds if flaps are not used?

1—138 knots and 3,900 feet.
2—153 knots and 2,900 feet.
3—183 knots and 2,900 feet.

6019. (Refer to figure 91.) How much more runway will be used to land with 0° flaps rather than 15° of flaps at a landing weight of 126,000 pounds?

1—900 feet.
2—1,800 feet.
3—2,700 feet.

6020. (Refer to figures 91 and 93.) What approach speed and landing distance will be needed when landing at a weight of 140,000 pounds with 15° of flaps?

1—123 knots and 3,050 feet.
2—138 knots and 3,050 feet.
3—153 knots and 2,050 feet.

6021. (Refer to figure 92.) What is the maximum indicated airspeed available when maintaining a 3° glide slope at a weight of 110,000 pounds?

1—136 knots.
2—132 knots.
3—139 knots.

6022. (Refer to figure 93.) What is the maximum indicated airspeed available when maintaining a 3° glide slope at a weight of 140,000 pounds?

1—127 knots.
2—149 knots.
3—156 knots.

6023. (Refer to figure 93.) What is the thrust required to maintain a 3° glide slope at 140,000 pounds, with gear down, flaps 30°, and an airspeed of V_{REF} +30 knots?

1—13,300 pounds.
2—16,200 pounds.
3—17,700 pounds.

6024. (Refer to figure 92.) What is the thrust required to maintain a 3° glide slope at 110,000 pounds, with gear down, flaps 30°, and an airspeed of V_{REF} +20 knots?

1—9,800 pounds.
2—11,200 pounds.
3—17,000 pounds.

6025. (Refer to figure 92.) What thrust is required to maintain level flight at 110,000 pounds, with gear down, flaps 40°, and an airspeed of 118 knots.

1—17,000 pounds.
2—20,800 pounds.
3—22,300 pounds.

6026. (Refer to figure 93.) What thrust is required to maintain level flight at 140,000 pounds, with gear up, flaps 25°, and an airspeed of 172 knots?

1—13,700 pounds.
2—18,600 pounds.
3—22,000 pounds.

6027. (Refer to figure 92.) What thrust is required to maintain level flight at 110,000 pounds, with gear up, flaps 25°, and an airspeed of 152 knots?

1—14,500 pounds.
2—15,900 pounds.
3—16,700 pounds.

6028. (Refer to figure 93.) What thrust is required to maintain level flight at 140,000 pounds, with gear down, flaps 25°, and an airspeed of 162 knots?

1—17,400 pounds.
2—19,500 pounds.
3—22,200 pounds.

6029. (Refer to figure 93.) What thrust is required to maintain level flight at 140,000 pounds, with gear down, flaps 25°, and an airspeed of 145 knots?

1—16,500 pounds.
2—18,100 pounds.
3—18,500 pounds.

6030. (Refer to figure 93.) What is the change of total drag for a 140,000 pound airplane when configuration is changed from flaps 30°, gear down, to flaps 0°, gear up, at a constant airspeed of 160 knots?

1—13,500 pounds.
2—13,300 pounds.
3—15,300 pounds.

6031. (Refer to figure 94.) Given the following conditions, what is the minimum torque for takeoff?

Pressure altitude.. 9,000 ft
Temperature (OAT)... +3° C
Ice vanes..Extended

1—3,100 ft-lb.
2—3,040 ft-lb.
3—3,180 ft-lb.

6032. (Refer to figure 94.) Given the following conditions, what is the minimum torque for takeoff?

Pressure altitude.. 7,500 ft
Temperature (OAT)... +35° C
Ice vanes..Retracted

1—2,820 ft-lb.
2—2,880 ft-lb.
3—2,780 ft-lb.

6033. (Refer to figure 94.) Given the following conditions, what is the minimum torque for takeoff?

Pressure altitude	7,500 ft
Temperature (OAT)	+9° C
Ice vanes	Extended

1—3,200 ft-lb.
2—3,160 ft-lb.
3—3,300 ft-lb.

6034. (Refer to figure 94.) Given the following conditions, what is the minimum torque for takeoff?

Pressure altitude	3,500 ft
Temperature (OAT)	+43° C
Ice vanes	Retracted

1—3,000 ft-lb.
2—3,050 ft-lb.
3—3,110 ft-lb.

6035. (Refer to figure 94.) Given the following conditions, what is the minimum torque for takeoff?

Pressure altitude	5,500 ft
Temperature (OAT)	+29° C
Ice vanes	Retracted

1—2,950 ft-lb.
2—3,100 ft-lb.
3—3,200 ft-lb.

6036. (Refer to figure 95.) Given the following conditions, what is the takeoff distance over a 50-foot obstacle?

Pressure altitude	Sea Level
Temperature (OAT)	+12° C
Weight	16,000 lb
Wind component	16 kts HW
Ice vanes	Retracted

1—1,750 feet.
2—2,800 feet.
3—2,550 feet.

6037. (Refer to figure 95.) Given the following conditions, what is the takeoff ground roll and V_1 speed?

Pressure altitude	4,000 ft
Temperature (OAT)	0° C
Weight	15,500 lb
Wind component	10 kts TW
Ice vanes	Extended

1—2,900 feet, 106 knots.
2—4,250 feet, 102 knots.
3—2,700 feet, 107 knots.

6038. (Refer to figure 95.) Given the following conditions, what is the takeoff distance over a 50-foot obstacle?

Pressure altitude	2,000 ft
Temperature (OAT)	+15° C
Weight	16,600 lb
Wind component	Calm
Ice vanes	Retracted

1—3,400 feet.
2—3,700 feet.
3—4,200 feet.

6039. (Refer to figure 95.) Given the following conditions, what is the takeoff ground roll and V_1 speed?

Pressure altitude	3,000 ft
Temperature (OAT)	-10° C
Weight	15,000 lb
Wind component	8 kts TW
Ice vanes	Extended

1—2,200 feet, 105 knots.
2—2,000 feet, 113 knots.
3—1,900 feet, 103 knots.

6040. (Refer to figure 95.) Given the following conditions, what is the takeoff distance over a 50-foot obstacle?

Pressure altitude	6,000 ft
Temperature (OAT)	+35° C
Weight	14,500 lb
Wind component	10 kts HW
Ice vanes	Retracted

1—4,150 feet.
2—4,550 feet.
3—2,600 feet.

6041. (Refer to figure 96.) Given the following conditions, what is the accelerate-stop field length?

Pressure altitude	5,000 ft
Temperature (OAT)	+20° C
Weight	15,000 lb
Wind component	10 kts HW
Ice vanes	Retracted

1—6,300 feet.
2—4,700 feet.
3—4,300 feet.

6042. (Refer to figure 96.) Given the following conditions, what is the accelerate-stop field length?

Pressure altitude	2,000 ft
Temperature (OAT)	-15° C
Weight	16,000 lb
Wind component	5 kts TW
Ice vanes	Extended

1—3,750 feet.
2—4,600 feet.
3—4,250 feet.

6043. (Refer to figure 96.) Given the following conditions, what is the accelerate-stop field length?

Pressure altitude	6,000 ft
Temperature (OAT)	+10° C
Weight	16,600 lb
Wind component	15 kts HW
Ice vanes	Retracted

1—4,950 feet.
2—4,800 feet.
3—5,300 feet.

6044. (Refer to figure 96.) Given the following conditions, what is the accelerate-stop field length?

Pressure altitude	8,000 ft
Temperature (OAT)	-5° C
Weight	14,000 lb
Wind component	4 kts TW
Ice vanes	Extended

1—4,500 feet.
2—4,800 feet.
3—5,300 feet.

6[illegible]. (Refer to figure 96.) Given the following conditions, what is the accelerate-stop field length?

Pressure altitude	Sea Level
Temperature (OAT)	+30° C
Weight	13,500 lb
Wind component	14 kts HW
Ice vanes	Retracted

1—2,500 feet.
2—2,850 feet.
3—3,050 feet.

6046. (Refer to figures 97, 98, and 99.) What is the two-engine rate of climb after takeoff in climb configuration for Operating Condition B-21?

1—1,350 ft/min.
2—2,450 ft/min.
3—2,300 ft/min.

6047. (Refer to figures 97, 98, and 99.) What is the single-engine climb gradient after takeoff in climb configuration for Operating Condition B-22?

1—6.8 percent gradient.
2—7.5 percent gradient.
3—5.6 percent gradient.

6048. (Refer to figures 97, 98, and 99.) What is the two-engine rate of climb after takeoff in climb configuration for Operating Condition B-23?

1—1,500 ft/min.
2—2,600 ft/min.
3—2,490 ft/min.

6049. (Refer to figures 97, 98, and 99.) What is the two-engine rate of climb after takeoff in climb configuration for Operating Condition B-24?

1—2,100 ft/min.
2—2,400 ft/min.
3—1,500 ft/min.

6050. (Refer to figures 97, 98, and 99.) What is the single-engine rate of climb after takeoff in climb configuration for Operating Condition B-25?

1—385 ft/min.
2—780 ft/min.
3—665 ft/min.

6051. (Refer to figures 97 and 100.) What are the time, fuel, and distance from the start of climb to cruise altitude for Operating Condition B-21?

1—10.0 minutes; 290 pounds; 35 NAM.
2—10.0 minutes; 165 pounds; 30 NAM.
3—11.5 minutes; 165 pounds; 30 NAM.

6052. (Refer to figures 97 and 100.) What are the time, fuel, and distance from the start of climb to cruise altitude for Operating Condition B-22?

1—12.0 minutes; 220 pounds; 40 NAM.
2—11.0 minutes; 185 pounds; 37 NAM.
3—10.5 minutes; 175 pounds; 32 NAM.

6053. (Refer to figures 97 and 100.) What are the time, fuel, and distance from the start of climb to cruise altitude for Operating Condition B-23?

1—13.0 minutes; 180 pounds; 35 NAM.
2—14.0 minutes; 210 pounds; 40 NAM.
3—15.0 minutes; 240 pounds; 46 NAM.

6054. (Refer to figures 97 and 100.) What are the time, fuel, and distance from the start of climb to cruise altitude for Operating Condition B-24?

1—12.0 minutes; 220 pounds; 45 NAM.
2—9.0 minutes; 185 pounds; 38 NAM.
3—10.0 minutes; 170 pounds; 30 NAM.

6055. (Refer to figures 97 and 100.) What are the time, fuel, and distance from the start of climb to cruise altitude for Operating Condition B-25?

1—11.5 minutes; 170 pounds; 31 NAM.
2—8.0 minutes; 270 pounds; 28 NAM.
3—12.5 minutes; 195 pounds; 38 NAM.

6056. (Refer to figures 101 and 103.) At what altitude is the service ceiling with one engine inoperative for Operating Condition B-26?

1—13,000 feet.
2—14,200 feet.
3—13,600 feet.

6057. (Refer to figures 101 and 103.) Which statement is true regarding performance with one engine inoperative for Operating Condition B-27?

1—Climb rate at the MEA is more than 50 ft/min.
2—Service ceiling is below the MEA.
3—Bleed air OFF improves service ceiling by 3,000 feet.

6058. (Refer to figures 101 and 103.) At what altitude is the service ceiling with one engine inoperative for Operating Condition B-28?

1—1,500 feet above the MEA.
2—10,400 feet.
3—11,800 feet.

6059. (Refer to figures 101 and 103.) Which statement is true regarding performance with one engine inoperative for Operating Condition B-29?

1—Service ceiling is more than 100 feet above the MEA.
2—Bleed air must be off to obtain a rate of climb of 50 ft/min at the MEA.
3—Climb is not possible at the MEA.

6060. (Refer to figures 101 and 103.) At what altitude is the service ceiling with one engine inoperative for Operating Condition B-30?

1—9,600 feet.
2—13,200 feet.
3—2,100 feet above the MEA.

6061. (Refer to figures 102, 104, 105, 106, and 118.) What is the en route time of the cruise leg for Operating Condition B-31?

1—1 hour 11 minutes.
2—1 hour 17 minutes.
3—1 hour 19 minutes.

6062. (Refer to figures 102, 104, 105, 106, and 118.) What is the en route time of the cruise leg for Operating Condition B-32?

1—1 hour 13 minutes.
2—1 hour 15 minutes.
3—1 hour 20 minutes.

6063. (Refer to figures 102, 104, 105, 106, and 118.) What is the en route time of the cruise leg for Operating Condition B-33?

1—1 hour 50 minutes.
2—1 hour 36 minutes.
3—1 hour 46 minutes.

6064. (Refer to figures 102, 104, 105, 106, and 118.) What is the en route time of the cruise leg for Operating Condition B-34?

1—1 hour 6 minutes.
2—1 hour 3 minutes.
3—1 hour 11 minutes.

6065. (Refer to figures 102, 104, 105, 106, and 118.) What is the en route time of the cruise leg for Operating Condition B-35?

1—1 hour 6 minutes.
2—1 hour 8 minutes.
3—1 hour 10 minutes.

6066. (Refer to figures 102, 104, 105, 106, and 118.) What is the fuel consumption during the cruise leg for Operating Condition B-31?

1—812 pounds.
2—749 pounds.
3—870 pounds.

6067. (Refer to figures 102, 104, 105, 106, and 118.) What is the fuel consumption during the cruise leg for Operating Condition B-32?

1—1,028 pounds.
2—896 pounds.
3—977 pounds.

6068. (Refer to figures 102, 104, 105, 106, and 118.) What is the fuel consumption during the cruise leg for Operating Condition B-33?

1—1,165 pounds.
2—1,373 pounds.
3—976 pounds.

6069. (Refer to figures 102, 104, 105, 106, and 118.) What is the fuel consumption during the cruise leg for Operating Condition B-34?

1—668 pounds.
2—718 pounds.
3—737 pounds.

6070. (Refer to figures 102, 104, 105, 106, and 118.) What is the fuel consumption during the cruise leg for Operating Condition B-35?

1—900 pounds.
2—1,030 pounds.
3—954 pounds.

6071. (Refer to figure 107.) What are the time and distance to descend from 18,000 feet to 2,500 feet?

1—10.3 minutes, 39 NAM.
2—9.8 minutes, 33 NAM.
3—10.0 minutes, 36 NAM.

6072. (Refer to figure 107.) What are the distance and fuel consumption to descend from 22,000 feet to 4,500 feet?

1—44 NAM, 117 pounds.
2—48 NAM, 112 pounds.
3—56 NAM, 125 pounds.

6073. (Refer to figure 107.) What are the time and distance to descend from 16,500 feet to 3,500 feet?

1—9.3 minutes, 37 NAM.
2—9.1 minutes, 35 NAM.
3—8.7 minutes, 33 NAM.

6074. (Refer to figure 107.) What are the distance and fuel consumption to descend from 13,500 feet to 1,500 feet?

1—30 NAM, 87 pounds.
2—29 NAM, 80 pounds.
3—38 NAM, 100 pounds.

6075. (Refer to figure 107.) What are the time and distance to descend from 23,000 feet to 600 feet with an average 15-knot headwind?

1—14.2 minutes, 50 miles.
2—14.6 minutes, 56 miles.
3—14.9 minutes, 59 miles.

6076. (Refer to figures 108 and 109.) What is the landing distance over a 50-foot obstacle for Operating Condition B-36?

1—1,900 feet.
2—1,625 feet.
3—950 feet.

6077. (Refer to figures 108 and 109.) What are the approach speed and ground roll when landing under Operating Condition B-36?

1—113 knots and 950 feet.
2—113 knots and 1,950 feet.
3—112 knots and 900 feet.

6078. (Refer to figures 108 and 109.) What is the remaining runway length when stopped after landing over a 50-foot obstacle for Operating Condition B-37?

1—2,500 feet.
2—2,000 feet.
3—2,600 feet.

6079. (Refer to figures 108 and 109.) What are the approach speed and ground roll when landing under Operating Condition B-37.

1—108 knots and 1,400 feet.
2—109 knots and 900 feet.
3—107 knots and 1,350 feet.

6080. (Refer to figures 108 and 109.) What is the landing distance over a 50-foot obstacle for Operating Condition B-38?

1—1,850 feet.
2—1,700 feet.
3—1,800 feet.

6081. (Refer to figures 108 and 109.) What is the total runway used when touchdown is at the 1,000-foot marker for Operating Condition B-38?

1—2,000 feet.
2—1,700 feet.
3—1,800 feet.

6082. (Refer to figures 108 and 109.) What is the remaining runway length when stopped after landing over a 50-foot obstacle for Operating Condition B-39?

1—2,300 feet.
2—2,400 feet.
3—2,500 feet.

6083. (Refer to figures 108 and 109.) What are the approach speed and ground roll when landing under Operating Condition B-39?

1—111 knots and 1,550 feet.
2—110 knots and 1,400 feet.
3—109 knots and 1,300 feet.

6084. (Refer to figures 108 and 109.) What is the landing distance over a 50-foot obstacle for Operating Condition B-40?

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

6085. (Refer to figures 108 and 109.) What is the total runway used when touching down at the 1,000-foot marker for Operating Condition B-40?

1—1,800 feet.
2—1,650 feet.
3—1,550 feet.

6086. (Refer to figure 110.) Given the following conditions, what is the maximum allowable measured gas temperature (MGT) during the power assurance check?

Engine torque....................57 percent
Pressure altitude....................2,500 ft
Temperature (OAT)....................+5° C

1—810° C.
2—815° C.
3—828° C.

6087. (Refer to figure 110.) Given the following conditions, what is the maximum allowable measured gas temperature (MGT) during the power assurance check?

Engine torque....................49 percent
Pressure altitude....................5,500 ft
Temperature (OAT)....................+25° C

1—870° C.
2—855° C.
3—880° C.

6088. (Refer to figure 110.) Given the following conditions, what is the maximum allowable measured gas temperature (MGT) during the power assurance check?

Engine torque....................54 percent
Pressure altitude....................500 ft
Temperature (OAT)....................+25° C

1—840° C.
2—830° C.
3—820° C.

6089. (Refer to figure 110.) Given the following conditions, what is the maximum allowable measured gas temperature (MGT) during the power assurance check?

Engine torque........43 percent
Pressure altitude........9,000 ft
Temperature (OAT)........-15° C

1—782° C.
2—768° C.
3—750° C.

6090. (Refer to figure 110.) Given the following conditions, what is the maximum allowable measured gas temperature (MGT) during the power assurance check?

Engine torque........52 percent
Pressure altitude........1,500 ft
Temperature (OAT)........+35° C

1—880° C.
2—865° C.
3—872° C.

6091. (Refer to figure 111.) What is the maximum gross weight for hovering in ground effect at 3,000 feet pressure altitude and +25° C?

1—17,300 pounds.
2—14,700 pounds.
3—16,600 pounds.

6092. (Refer to figure 111.) What is the maximum gross weight for hovering in ground effect at 6,000 feet pressure altitude and +15° C?

1—17,200 pounds.
2—16,600 pounds.
3—14,200 pounds.

6093. (Refer to figure 111.) What is the maximum gross weight for hovering in ground effect at 7,000 feet pressure altitude and +35° C?

1—13,000 pounds.
2—14,700 pounds.
3—12,100 pounds.

6094. (Refer to figure 111.) What is the maximum gross weight for hovering in ground effect at 4,500 feet pressure altitude and +20° C?

1—14,500 pounds.
2—16,500 pounds
3—17,000 pounds.

6095. (Refer to figure 111.) What is the maximum gross weight for hovering in ground effect at 2,500 feet pressure altitude and +35° C?

1—16,200 pounds.
2—16,600 pounds.
3—14,600 pounds.

6096. (Refer to figure 112.) What is the maximum gross weight for hovering out of ground effect at 3,000 feet pressure altitude and +30° C?

1—17,500 pounds.
2—14,300 pounds.
3—13,400 pounds.

6097. (Refer to figure 112.) What is the maximum gross weight for hovering out of ground effect at 6,000 feet pressure altitude and + ' C?

1—16,800 pounds.
2—13,500 pounds.
3—14,400 pounds.

6098. (Refer to figure 112.) What is the maximum gross weight for hovering out of ground effect at 7,000 feet pressure altitude and +35° C?

1—14,000 pounds.
2—11,600 pounds.
3—12,500 pounds.

6099. (Refer to figure 112.) What is the maximum gross weight for hovering out of ground effect at 4,500 feet pressure altitude and +20° C?

1—14,500 pounds.
2—14,000 pounds.
3—17,000 pounds.

6100. (Refer to figure 112.) What is the maximum gross weight for hovering out of ground effect at 2,500 feet pressure altitude and +30° C?

1—17,400 pounds.
2—15,000 pounds.
3—14,500 pounds.

6101. (Refer to figure 113.) Given the following, what is the takeoff distance over a 50-foot obstacle?

Pressure altitude........3,500 ft
Temperature (OAT)........+20° C
Gross weight........15,000 lb

1—1,070 feet.
2—1,020 feet.
3—1,100 feet.

6102. (Refer to figure 113.) Given the following, what is the takeoff distance over a 50-foot obstacle?

Pressure altitude........5,000 ft
Temperature (OAT)........-10° C
Gross weight........11,000 lb

1—1,000 feet.
2—920 feet.
3—870 feet.

6103. (Refer to figure 113.) Given the following, what is the takeoff distance over a 50-foot obstacle?

Pressure altitude.. 6,500 ft
Temperature (OAT).. 0° C
Gross weight.. 13,500 lb

1—1,500 feet.
2—1,050 feet.
3—1,100 feet.

6104. (Refer to figure 113.) Given the following, what is the takeoff distance over a 50-foot obstacle?

Pressure altitude.. 9,000 ft
Temperature (OAT).. +20° C
Gross weight.. 15,000 lb

1—1,300 feet.
2—1,350 feet.
3—1,250 feet.

6105. (Refer to figure 113.) Given the following, what is the takeoff distance over a 50-foot obstacle?

Pressure altitude..–1,000 ft
Temperature (OAT).. +25° C
Gross weight.. 14,000 lb

1—1,000 feet.
2—900 feet.
3—950 feet.

6106. (Refer to figure 114.) Given the following, what is the climb performance with both engines operating?

Pressure altitude.. 9,500 ft
Temperature (OAT)..–5° C
Heater.. ON

1—925 ft/min.
2—600 ft/min.
3—335 ft/min.

6107. (Refer to figure 114.) Given the following, what is the climb performance with both engines operating?

Pressure altitude.. 7,500 ft
Temperature (OAT)..+5° C
Heater.. ON

1—905 ft/min.
2—765 ft/min.
3—1,080 ft/min.

6108. (Refer to figure 114.) Given the following, what is the climb performance with both engines operating?

Pressure altitude.. 6,500 ft
Temperature (OAT).. +25° C
Heater.. OFF

1—285 ft/min.
2—600 ft/min.
3—400 ft/min.

6109. (Refer to figure 114.) Given the following, what is the climb performance with both engines operating?

Pressure altitude.. 11,500 ft
Temperature (OAT).. –15° C
Heater.. ON

1—645 ft/min.
2—375 ft/min.
3—330 ft/min.

6110. (Refer to figure 114.) Given the following, what is the climb performance with both engines operating?

Pressure altitude.. 3,500 ft
Temperature (OAT).. –10° C
Heater.. ON

1—985 ft/min.
2—1,300 ft/min.
3—1,360 ft/min.

6111. (Refer to figure 115.) Given the following, what is the single-engine climb or descent performance?

Pressure altitude.. 7,500 ft
Temperature (OAT).. 0° C

1—80 ft/min descent.
2—10 ft/min climb.
3—50 ft/min climb.

6112. (Refer to figure 115.) Given the following, what is the single-engine climb or descent performance?

Pressure altitude.. 3,000 ft
Temperature (OAT).. +35° C

1—150 ft/min descent.
2—350 ft/min climb.
3—100 ft/min descent.

6113. (Refer to figure 115.) Given the following, what is the single-engine climb or descent performance?

Pressure altitude.. 4,700 ft
Temperature (OAT).. +20° C

1—420 ft/min climb.
2—60 ft/min climb.
3—60 ft/min descent.

6114. (Refer to figures 115.) Given the following, what is the single-engine climb or descent performance?

Pressure altitude.. 9,500 ft
Temperature (OAT).. –10° C

1—600 ft/min descent.
2—840 ft/min descent.
3—280 ft/min descent.

6115. (Refer to figure 115.) Given the following, what is the single-engine climb or descent performance?

Pressure altitude... 1,500 ft
Temperature (OAT).. +45° C

1—100 ft/min descent.
2—360 ft/min climb.
3—200 ft/min descent.

6116. (Refer to figure 116.) Given the following, what is the airspeed limit (V_{NE})?

Gross weight...16,500 lb
Pressure altitude... 5,000 ft
Temperature (OAT).. -15° C

1—128 KIAS.
2—133 KIAS.
3—126 KIAS.

6117. (Refer to figure 116.) Given the following, what is the airspeed limit (V_{NE})?

Gross weight...17,500 lb
Pressure altitude... 4,000 ft
Temperature (OAT).. +10° C

1—114 KIAS.
2—120 KIAS.
3—130 KIAS.

6118. (Refe[illegible]ure 116.) Given the following, what is the airspeed lir[illegible] ?

Gross we[illegible] ....15,000 lb
Pressure [illegible] .... 6,000 ft
Temperat[illegible]).. 0° C

1—135 K[illegible]
2—127 K[illegible]
3—143 KIA[illegible].

6119. (Refer to figure 116.) Given the following, what is the airspeed limit (V_{NE})?

Gross weight...14,000 lb
Pressure altitude... 8,000 ft
Temperature (OAT).. -15° C

1—121 KIAS.
2—123 KIAS.
3—113 KIAS.

6120. (Refer to figure 116.) Given the following, what is the airspeed limit (V_{NE})?

Gross weight...12,500 lb
Pressure altitude... 14,000 ft
Temperature (OAT).. -20° C

1—99 KIAS.
2—108 KIAS.
3—103 KIAS.

6121. (Refer to figure 117.) Given the following, what is the single-engine landing distance over a 50-foot obstacle?

Gross weight...12,000 lb
Pressure altitude... 3,500 ft
Temperature (OAT).. +30° C

1—850 feet.
2—900 feet.
3—1,000 feet.

6122. (Refer to figure 117.) Given the following, what is the single-engine landing distance over a 50-foot obstacle?

Gross weight...16,500 lb
Pressure altitude... 5,500 ft
Temperature (OAT).. -10° C

1—1,700 feet.
2—1,550 feet.
3—1,600 feet.

6123. (Refer to figure 117.) Given the following, what is the single-engine landing distance over a 50-foot obstacle?

Gross weight...15,000 lb
Pressure altitude... 8,000 ft
Temperature (OAT).. +20° C

1—1,900 feet.
2—1,800 feet.
3—2,000 feet.

6124. (Refer to figure 117.) Given the following, what is the single-engine landing distance over a 50-foot obstacle?

Gross weight...14,000 lb
Pressure altitude... 1,000 ft
Temperature (OAT).. +10° C

1—650 feet.
2—720 feet.
3—800 feet.

6125. (Refer to figure 117.) Given the following, what is the single-engine landing distance over a 50-foot obstacle?

Gross weight...17,000 lb
Pressure altitude... 4,000 ft
Temperature (OAT).. +40° C

1—1,850 feet.
2—2,200 feet.
3—2,000 feet.

6126. Under which conditions is hydroplaning most likely to occur?

1—When a landing is made at minimum landing speed with an abrupt initial runway contact during heavy precipitation.
2—During conditions of standing water, slush, high speed, and smooth runway texture.
3—During a landing on any wet runway when brake application is delayed until a wedge of water begins to build ahead of the tires.

6127. What effect, if any, will landing at a higher-than-recommended touchdown speed have on hydroplaning?

1—No effect on hydroplaning, but increases landing roll.
2—Reduces hydroplaning potential if heavy braking is applied.
3—Increases hydroplaning potential regardless of braking.

6128. A takeoff is not recommended if standing water, slush, or wet snow on the runway is more than what maximum depth?

1—1/4 inch.
2—1/2 inch.
3—1 inch.

6129. What is the best method of speed reduction if hydroplaning is experienced on landing?

1—Apply full main wheel braking only.
2—Apply nosewheel and main wheel braking alternately and abruptly.
3—Apply aerodynamic braking to the fullest advantage.

6130. Compared to dynamic hydroplaning, at what speed does viscous hydroplaning occur when landing on a smooth, wet runway?

1—At approximately 2.0 times the speed that dynamic hydroplaning occurs.
2—At a lower speed than dynamic hydroplaning.
3—At the same speed as dynamic hydroplaning.

6131. What term is used to describe hydroplaning which occurs when an airplane's tire is held off a smooth runway by steam generated from the heat of friction?

1—Reverted rubber hydroplaning.
2—Dynamic hydroplaning.
3—Viscous hydroplaning.

6132. At what minimum speed will dynamic hydroplaning begin if a tire has an air pressure of 70 PSI?

1—85 knots.
2—80 knots.
3—75 knots.

6133. At what minimum speed will dynamic hydroplaning begin if a tire has an air pressure of 90 PSI?

1—85 knots.
2—88 knots.
3—90 knots.

6134. At what minimum speed will dynamic hydroplaning begin if a tire has an air pressure of 110 PSI?

1—103 knots.
2—98 knots.
3—94 knots.

6135. At what minimum speed will dynamic hydroplaning begin if a tire has an air pressure of 95 PSI?

1—80 knots.
2—88 knots.
3—90 knots.

6136. At what minimum speed will dynamic hydroplaning begin if a tire has an air pressure of 80 PSI?

1—80 knots.
2—86 knots.
3—92 knots.

6137. Which flight conditions of a large jet airplane create the most severe flight hazard by generating wingtip vortices of the greatest strength?

1—Heavy, slow, gear and flaps up.
2—Heavy, slow, gear and flaps down.
3—Heavy, fast, gear and flaps down.

6138. Hazardous vortex turbulence that might be encountered behind large aircraft is created only when that aircraft is

1—developing lift.
2—operating at high airspeeds.
3—using high power settings.

6139. Wingtip vortices created by large aircraft tend to

1—sink below the aircraft generating the turbulence.
2—rise from the surface to traffic pattern altitude.
3—accumulate and remain for a period of time at the point where the takeoff roll began.

6140. How does the wake turbulence vortex circulate around each wingtip?

1—Inward, upward, and around the wingtip.
2—Counterclockwise when viewed from behind the aircraft.
3—outward, upward, and around the wingtip.

6141. Which statement is true concerning the wake turbulence produced by a large transport aircraft?

1—Vortices can be avoided by flying 300 feet below and behind the flightpath of the generating aircraft.
2—The vortex characteristics of any given aircraft may be altered by extending the flaps or changing the speed.
3—Wake turbulence behind a propeller-driven aircraft is negligible because jet engine thrust is a necessary factor in the formation of vortices.

6142. What effect would a light crosswind have on the wingtip vortices generated by a large airplane that has just taken off?

1—The upwind vortex will tend to remain on the runway longer than the downwind vortex.
2—A crosswind will rapidly dissipate the strength of both vortices.
3—The downwind vortex will tend to remain on the runway longer than the upwind vortex.

6143. To avoid the wingtip vortices of a departing jet airplane during takeoff, the pilot should

1—lift off at a point well past the jet airplane's flightpath.
2—climb above and stay upwind of the jet airplane's flightpath.
3—remain below the flightpath of the jet airplane.

6144. What wind condition prolongs the hazards of wake turbulence on a landing runway for the longest period of time?

1—Direct tailwind.
2—Light quartering tailwind.
3—Light quartering headwind.

6145. If you take off behind a heavy jet that has just landed, you should plan to lift off

1—prior to the point where the jet touched down.
2—beyond the point where the jet touched down.
3—at the point where the jet touched down and on the upwind edge of the runway.

6146. What action is appropriate when encountering the first ripple of reported clear air turbulence?

1—Extend flaps to decrease wing loading.
2—Extend gear to provide more drag and increase stability.
3—Adjust airspeed to that recommended for rough air.

6147. If severe turbulence is encountered which procedure is recommended?

1—Maintain a constant altitude.
2—Maintain a constant attitude.
3—Maintain constant airspeed and altitude.

6148. What is the expected duration of an individual microburst?

1—Five minutes with maximum winds lasting approximately 2-4 minutes.
2—One microburst may continue for as long as an hour.
3—Seldom longer than 15 minutes from the time the burst strikes the ground until dissipation.

6149. Maximum downdrafts in a microburst encounter may be as strong as

1—1,500 feet per minute.
2—4,500 feet per minute.
3—6,000 feet per minute.

6150 An aircraft that encounters a headwind of 40 knots, within a microburst, may expect a total shear across the microburst of

1—40 knots.
2—80 knots.
3—90 knots.

6151. (Refer to figure 119.) If involved in a microburst encounter between which aircraft positions will the most severe downdraft occur?

1—4 and 5.
2—3 and 4.
3—2 and 3.

6152. (Refer to figure 119.) When penetrating a microburst, which aircraft will experience an increase in performance without a change in pitch or power?

1—3.
2—2.
3—1.

6153. (Refer to figure 119.) The aircraft in position 3 will experience which effect in a microburst encounter?

1—Decreasing headwind.
2—Increasing tailwind.
3—Strong downdraft.

6154. (Refer to figure 119.) What effect will a microburst encounter have upon the aircraft in position 4?

1—Strong tailwind.
2—Strong updraft.
3—Significant performance increase.

6155. (Refer to figure 119.) How will the aircraft in position 4 be affected by a microburst encounter?

1—Performance increasing with a tailwind and updraft.
2—Performance decreasing with a tailwind and downdraft.
3—Performance decreasing with a headwind and downdraft.

6156. Which cockpit indications occur when a constant tailwind component shears to a calm wind?

1—Altitude increases; pitch and indicated airspeed decrease.
2—Altitude, pitch, and indicated airspeed increase.
3—Altitude decreases; pitch and indicated airspeed increase.

6157. What effect will a change in wind direction have upon maintaining a 3° glide slope at a constant true airspeed?

1—When groundspeed decreases, rate of descent must increase.
2—When groundspeed increases, rate of descent must increase.
3—Rate of descent must be constant to remain on the glide slope

6158. When passing through an abrupt wind shear which involves a shift from a tailwind to a headwind, what power management would normally be required to maintain a constant indicated airspeed and remain on the ILS glide slope?

1—Lower-than-normal power initially, followed by a further decrease as the wind shear is encountered, then an increase.
2—Higher-than-normal power initially, followed by a decrease as the shear is encountered, then an increase.
3—Lower-than-normal power initially, followed by an increase as the shear is encountered, then a decrease.

6159. While flying an ILS glide slope, a constant tailwind shears to a calm wind. Which conditions should the pilot expect?

1—Airspeed and pitch attitude decrease, and a tendency to go below the glide slope.
2—Airspeed and pitch attitude increase, and a tendency to go above the glide slope.
3—Airspeed and pitch attitude decrease, and a tendency to go above the glide slope.

6160 While flying an ILS glide slope, a headwind shears to a tailwind. Which conditions should the pilot expect?

1—Airspeed and pitch attitude decrease, and a tendency to go below the glide slope.
2—Airspeed and pitch attitude increase, and a tendency to go above the glide slope.
3—Airspeed and pitch attitude decrease, and a tendency to go above the glide slope.

6161. During an en route descent in a fixed thrust and fixed-pitch attitude configuration, both the ram air input and drain hole of the pitot system become completely blocked by ice. What airspeed indication can be expected?

1—Increase in indicated airspeed.
2—Decrease in indicated airspeed.
3—Indicated airspeed remains at the value prior to icing.

6162. What can a pilot expect if the pitot system ram air input and drain hole are blocked by ice?

1—The airspeed indicator may act as an altimeter.
2—The airspeed indicator will show a decrease with an increase in altitude.
3—No airspeed indicator change will occur during climbs or descents.

6163. If both the ram air input and drain hole of the pitot system are blocked by ice, what airspeed indication can be expected?

1—No variation of indicated airspeed in level flight if large power changes are made.
2—Decrease of indicated airspeed during a climb.
3—Constant indicated airspeed during a descent.

6164. What effect does an uphill runway slope have upon takeoff performance?

1—Increases takeoff distance.
2—Decreases takeoff speed.
3—Decreases takeoff distance.

6165. Under which condition during the landing roll are the main wheel brakes at maximum effectiveness?

1—When wing lift has been reduced.
2—At high groundspeeds.
3—When the wheels are locked and skidding.

6166. Which condition has the effect of reducing critical engine failure speed?

1—Slush on the runway or inoperative antiskid.
2—Low gross weight.
3—High density altitude.

6167. How should thrust reversers be applied to reduce landing distance for turbojet aircraft?

1—Immediately after ground contact.
2—Immediately prior to touchdown.
3—After applying maximum wheel braking.

6168. Throughout the landing roll, what is the most effective method of deceleration regardless of runway surface?

1—Application of aerodynamic drag devices.
2—Continuous use of thrust reversers.
3—Judicious use of wheel brakes.

6169. During the takeoff roll, which factor decreases as airspeed increases?

1—Aerodynamic drag.
2—Rolling friction.
3—Coefficient of lift.

6170. Which condition reduces the required runway for takeoff?

1—Higher-than-recommended airspeed before rotation.
2—Lower-than-standard air density.
3—Increased headwind component.

6171. Which performance factor decreases as airplane gross weight increases?

1—Critical engine failure speed.
2—Rotation speed.
3—Accelerate-stop distance.

6172. Maximum range performance of a turbojet aircraft is obtained by which procedure as aircraft weight reduces?

1—Increasing speed or altitude.
2—Increasing altitude or decreasing speed.
3—Increasing speed or decreasing altitude.

6173. Which procedure produces the minimum fuel consumption for a given leg of the cruise flight?

1—Increase speed for a headwind.
2—Increase speed for a tailwind.
3—Increase altitude for a headwind, decrease altitude for a tailwind.

6174. How should reverse thrust propellers be used during landing for maximum effectiveness in stopping?

1—Gradually increase reverse power to maximum as rollout speed decreases.
2—Use maximum reverse power as soon as possible after touchdown.
3—Select reverse-pitch after landing and use idle power setting of the engines.

6175. To obtain optimum range conditions in a turbojet airplane, cruising flight should be planned

1—at any altitude within the troposphere.
2—at, or above the tropopause.
3—at any altitude above the jetstream level.

6176. Which place in the turbojet engine is subjected to the highest temperature?

1—Compressor discharge.
2—Fuel spray nozzles.
3—Turbine inlet.

6177. What effect would a change in ambient temperature or air density have on gas-turbine-engine performance?

1—As air density decreases, thrust increases.
2—As temperature increases, thrust increases.
3—As temperature increases, thrust decreases.

6178. The most important restriction to the operation of turbojet or turboprop engines is

1—limiting compressor speed.
2—limiting exhaust gas temperature.
3—limiting torque.

6179. As outside air pressure decreases, thrust output will

1—increase due to greater efficiency of jet aircraft in thin air.
2—remain the same since compression of inlet air will compensate for any decrease in air pressure.
3—decrease due to higher density altitude.

6180. What effect will an increase in altitude have upon the available equivalent shaft horsepower (ESHP) of a turboprop engine?

1—Lower air density and engine mass flow will cause a decrease in power.
2—Higher propeller efficiency will cause an increase in usable power (ESHP) and thrust.
3—Power will remain the same but propeller efficiency will decrease.

6181. What effect, if any, does high ambient temperature have upon the thrust output of a turbine engine?

1—Thrust will be reduced due to the decrease in air density.
2—Thrust will remain the same, but turbine temperature will be higher.
3—Thrust will be higher because more heat energy is extracted from the hotter air.

6182. What characterizes a transient compressor stall?

1—Loud, steady roar accompanied by heavy shuddering.
2—Sudden loss of thrust accompanied by a loud whine.
3—Intermittent "bang," as backfires and flow reversals take place.

6183. What indicates that a compressor stall has developed and become steady?

1—Strong vibrations and loud roar.
2—Occasional loud "bang" and flow reversal.
3—Complete loss of power with severe reduction in airspeed.

6184. Which type of compressor stall has the greatest potential for severe engine damage?

1—Intermittent "backfire" stall.
2—Transient "backfire" stall.
3—Steady, continuous flow reversal stall.

6185. What recovery would be appropriate in the event of compressor stall?

1—Reduce fuel flow, reduce angle of attack, and increase airspeed.
2—Advance throttle, lower angle of attack, and reduce airspeed.
3—Reduce throttle, reduce airspeed, and increase angle of attack.

6186. Under normal operating conditions, which combination of MAP and RPM produce the most severe wear, fatigue, and damage to high performance reciprocating engines?

1—High RPM and low MAP.
2—Low RPM and high MAP.
3—High RPM and high MAP.

6187. What effect does high relative humidity have upon the maximum power output of modern aircraft engines?

1—Neither turbojet or reciprocating engines are affected.
2—Reciprocating engines will experience a significant loss of BHP.
3—Turbojet engines will experience a significant loss of thrust.

6188. Equivalent shaft horsepower (ESHP) of a turboprop engine is a measure of

1—turbine inlet temperature.
2—shaft horsepower and jet thrust.
3—propeller thrust only.

6189. Minimum specific fuel consumption of the turboprop engine is normally available in which altitude range?

1—10,000 feet to 25,000 feet.
2—25,000 feet to the tropopause.
3—The tropopause to 45,000 feet.

6190. Where is the critical altitude of a supercharged-reciprocating engine?

1—The highest altitude at which a desired manifold pressure can be obtained.
2—Highest altitude where the mixture can be leaned to best power ratio.
3—The altitude at which maximum allowable BMEP can be obtained.

6191. What is controlled by the waste gate of a turbocharged-reciprocating engine?

1—Supercharger gear ratio.
2—Exhaust gas discharge.
3—Throttle opening.

6192. How is manual lean (best economy) cruising mixture setting obtained on a large, supercharged, reciprocating engine?

1—Lean to best power BMEP, then enrichen a specific RPM drop.
2—Lean to the detonation point, then enrichen a specific BMEP rise.
3—Lean to best power BMEP, then lean to a specific BMEP drop.

6193. What occurs when operating above 35,000 feet in the event of a complete cabin pressure loss?

1—The oxygen pressure within the lungs cannot be maintained without a positive increase of inhaled oxygen pressure.
2—Vision improves significantly as cabin altitude increases because carbon dioxide is released from the body.
3—Gases trapped in the body contract and prevent nitrogen from escaping the bloodstream.

6194. What is a symptom of carbon monoxide poisoning?

1—Rapid, shallow breathing.
2—Pain and cramping of the hands and feet.
3—Dizziness.

6195. Which would most likely result in hyperventilation?

1—A stressful situation causing anxiety.
2—The excessive consumption of alcohol.
3—An extremely slow rate of breathing and insufficient oxygen.

6196. What causes hypoxia?

1—Excessive carbon dioxide in the atmosphere.
2—An increase in nitrogen content of the air at high altitudes.
3—A decrease of oxygen partial pressure.

6197. Which is a common symptom of hyperventilation?

1—Tingling of the hands, legs, and feet.
2—Increased vision keenness.
3—Decreased breathing rate.

6198. Loss of cabin pressure may result in hypoxia because as cabin altitude increases

1—the percentage of nitrogen in the air is increased.
2—the percentage of oxygen in the air is decreased
3—oxygen partial pressure is decreased.

6199. Hypoxia is the result of which of these conditions?

1—Insufficient oxygen reaching the brain.
2—Excessive carbon dioxide in the bloodstream.
3—Limited oxygen reaching the heart muscles.

6200. Rapid or extra deep breathing can cause a condition known as

1—hypoxia.
2—vertigo
3—hyperventilation.

6201. What is the effect of alcohol consumption on functions of the body?

1—Alcohol has an adverse effect, especially as altitude increases.
2—Small amounts of alcohol in the human system increase judgment and decision-making abilities.
3—Alcohol has little effect if followed by equal quantities of black coffee.

6202. A pilot is more subject to spatial disorientation when

1—ignoring or overcoming the sensations of muscles and inner ear.
2—eyes are moved often in the process of cross-checking the flight instruments.
3—body sensations are used to interpret flight attitudes.

6203. Which procedure is recommended to prevent or overcome spatial disorientation?

1—Reduce head and eye movement to the greatest possible extent.
2—Rely on the kinesthetic sense.
3—Rely entirely on the indications of the flight instruments.

6204. What is the most effective way to use the eyes during night flight?

1—Look only at far away, dim lights.
2—Scan slowly to permit off center viewing.
3—Concentrate directly on each object for a few seconds.

6205. Microbursts are small-scale intense downdrafts which

1—are easily detected visually due to their association with heavy rain showers.
2—dissipate prior to reaching the surface when the wind gradient is positive.
3—upon reaching the surface, spread outward in all directions.

6206. The illusion of being in a noseup attitude which may occur during a rapid acceleration takeoff is known as

1—inversion illusion.
2—autokinesis.
3—somatogravic illusion.

6207. In the dark, a stationary light will appear to move when stared at for a period of time. This illusion is known as

1—somatogravic illusion.
2—ground lighting illusion.
3—autokinesis.

6208. When making a landing over darkened or featureless terrain such as water or snow, a pilot should be aware of the possibility of illusion. The approach may appear to be too

1—high.
2—low.
3—shallow.

6209. When making an approach to a narrower-than-usual runway, without VASI assistance, the pilot should be aware that the approach

1—altitude may be higher than it appears.
2—altitude may be lower than it appears.
3—may result in leveling off too high and landing hard.

6210. While making prolonged constant rate turns under IFR conditions, an abrupt head movement can create the illusion of rotation on an entirely different axis. This is known as

1—autokinesis.
2—Coriolis illusion.
3—the leans.

6211. Which observed target aircraft would be of most concern with respect to collision avoidance?

1—One which appears to be ahead and moving from left to right at high speed.
2—One which appears to be ahead and moving from right to left at slow speed.
3—One which appears to be ahead with no lateral or vertical movement and is increasing in size.

6212. Scanning procedures for effective collision avoidance should constitute

1—looking outside for 15 seconds, then inside for 5 seconds, then repeat.
2—1 minute inside scanning, then 1 minute outside scanning , then repeat.
3—looking outside every 30 seconds except in radar contact when outside scanning is unnecessary.

6213. When using the Earth's horizon as a reference point to determine the relative position of other aircraft, most concern would be for aircraft

1—above the horizon and increasing in size.
2—on the horizon with little relative movement.
3—on the horizon and increasing in size.

6214. Where should a non-ambulatory handicapped passenger be seated to expeditiously accomplish emergency evacuation?

1—At the beginning of a line of passengers that would be evacuated through an overwing exit.
2—Near the beginning of a line of passengers that would be evacuated through a main exit.
3—Near the end of a line of passengers that would be evacuated through a floor-level, non-overwing exit.

6215. An ambulatory handicapped passenger should be seated in an area where emergency evacuation can be accomplished through

1—the aft normal or emergency exit.
2—an overwing exit.
3—a floor-level exit.

6216. Which activity is not considered to be a form of "holding out"?

1—Word-of-mouth information that charter flight services are continuously available.
2—Full-time employment as pilot of a company-owned aircraft.
3—Posting a schedule of available charter flight services in a fixed-base operator's pilot lounge.

6217. Which term describes a type of private carrier?

1—Contract carrier.
2—Restricted commercial carrier.
3—Common carrier.

6218. Which statement best describes the term "holding out"?

1—Offers to the public: the carriage of persons or property for hire, either intrastate or interstate.
2—Carriage of persons or property for hire for a few selected customers on an intrastate basis.
3—Carriage of cargo for an industrial firm on an intrastate basis.

6219. Which is the key factor that determines that an operator is a common carrier rather than a private carrier?

1—Engaging in intrastate carriage of persons or property.
2—Expression of willingness to carry all customers.
3—Engaging in a limited operation of the intrastate carriage of manufactured components for one company.

6220. An operator who occasionally refuses to transport persons or property, and who holds out on an informal basis,

1—may be considered to meet the criteria for common carriage.
2—may be considered a common carrier only if the transportation of persons or property is interstate.
3—is a private carrier unless operating under a contract, charter, or mail agreement.

6221. An aircraft configured for air ambulance operations should include

1—four-point floor anchor points and approved web-type restraints for securing stretchers.
2—a seat near the patient for an attendant.
3—a nitrous oxide supply and breathing mask for in-flight patient sedation.

6222. Which is a factor that tends to establish an operator as a private carrier?

1—Charter flying for only one organization although flights are open to the public.
2—Carriage of selected customers on a long-term basis where no holding out is involved.
3—Making known publicly, through reputation (not advertising), that all customers will be provided transportation service.

6223. A carrier which offers transportation pursuant to separately negotiated contracts, and is holding out by reputation only,

1—is engaged in private carriage whether operations are intrastate or interstate.
2—may be classified as a common carrier.
3—meets the criteria of private carriage if the contracts stipulate interstate operations.

6224. An intrastate commercial operator meets the criteria that has been established for a common carrier if it

1—carries only employees of one corporation for hire within the boundaries of one state, on a long-term basis.
2—does not hold out transportation service to the public and operates with very few contracts.
3—offers to carry manufactured components under 15 individual contracts on interstate flights.

6225. On a number of occasions an operator makes verbal offers to senior citizens' groups to transport them in his aircraft to a casino located in another state. This operator would be considered to be

1—a common carrier if compensation is received from the passengers.
2—a private carrier because there is no published holding out of services.
3—engaged in common carriage if the trip generates a profit and private carriage if no profit is realized.

6226. What is a characteristic of the troposphere?

1—It contains all the moisture of the atmosphere.
2—There is an overall decrease of temperature with an increase of altitude.
3—The average altitude of the top of the troposphere is about 6 miles.

6227. The primary cause of all changes in the Earth's weather is

1—variations of solar energy at the Earth's surface.
2—changes in air pressure over the Earth's surface.
3—movement of airmasses from moist areas to dry areas.

6228. A ground based inversion is characterized by

1—convection currents at the surface.
2—cold temperatures.
3—poor visibility.

6229. What feature is associated with a temperature inversion?

1—A stable layer of air.
2—An unstable layer of air.
3—Airmass thunderstorms.

6230. When does minimum temperature normally occur during a 24-hour period?

1—After sunrise
2—About 1 hour before sunrise.
3—At midnight.

6231. Where is a common location for an inversion?

1—At the tropopause.
2—In the stratosphere.
3—At the base of cumulus clouds.

6232. The most frequent type of ground- or surface-based temperature inversion is produced by

1—the movement of colder air under warm air, or the movement of warm air over cold air.
2—widespread sinking of air within a thick layer aloft resulting in heating by compression.
3—terrestrial radiation on a clear, relatively calm night.

6233. Which term applies when the temperature of the air changes by compression or expansion with no heat added or removed?

1—Katabatic.
2—Advection.
3—Adiabatic.

6234. Unsaturated air flowing upslope will cool at the rate of about

1—3° C per 1,000 feet.
2—2° C per 1,000 feet.
3—4° C per 1,000 feet.

6235. If the ambient temperature is warmer than standard at FL350, what is the density altitude compared to pressure altitude?

1—Lower than pressure altitude.
2—Higher than pressure altitude.
3—Impossible to determine without information on possible inversion layers at lower altitudes.

6236. If the ambient temperature is colder than standard at FL310, what is the relationship between true altitude and pressure altitude?

1—They are both the same, 31,000 feet.
2—True altitude is lower than 31,000 feet.
3—Pressure altitude is lower than true altitude.

6237. Which pressure is defined as station pressure?

1—Altimeter setting.
2—Actual pressure at field elevation.
3—Station barometric pressure reduced to sea level.

6238. Isobars on a surface weather chart represent lines of equal pressure

1—at the surface.
2—reduced to sea level.
3—at a given atmospheric pressure altitude.

6239. En route at FL250, the altimeter is set correctly. On descent, a pilot fails to set the local altimeter setting of 30.32. If the field elevation is 800 feet, and the altimeter is functioning properly, what will it indicate upon landing?

1—1,200 feet.
2—400 feet.
3—Sea level.

6240. En route at FL270, the altimeter is set correctly. On descent, a pilot fails to set the local altimeter setting of 30.57. If the field elevation is 650 feet, and the altimeter is functioning properly, what will it indicate upon landing?

1—535 feet.
2—1,300 feet.
3—Sea level.

6241. What is corrected altitude (approximate true altitude)?

1—Pressure altitude corrected for instrument error.
2—Indicated altitude corrected for temperature variation from standard.
3—Density altitude corrected for temperature variation from standard.

6242. An elongated area of low pressure is called a

1—trough.
2—ridge.
3—hurricane or typhoon.

6243. What is an important characteristic of wind shear?

1—It is primarily associated with the lateral vortices generated by thunderstorms.
2—It usually exists only in the vicinity of thunderstorms, but may be found near a strong temperature inversion.
3—It may be associated with either a wind shift or a windspeed gradient at any level in the atmosphere.

6244. "SOUTH BOUNDARY WIND ONE SIX ZERO AT TWO FIVE, WEST BOUNDARY WIND TWO FOUR ZERO AT THREE FIVE."

This information from the control tower indicates that

1—a downburst is located at the center of the airport.
2—wake turbulence exists on the west side of the active runway.
3—there is a possibility of wind shear over or near the airport.

6245. At which location does Coriolis force have the least effect on wind direction?

1—At the poles.
2—Middle latitudes (30° to 60°).
3—At the Equator.

6246. How does Coriolis force affect wind direction in the Southern Hemisphere?

1—Causes clockwise rotation around a low.
2—Causes wind to flow out of a low toward a high.
3—Has exactly the same effect as in the Northern Hemisphere.

6247. Which weather condition is defined as an anticyclone?

1—Calm.
2—High pressure area.
3—COL.

6248. Which area or areas of the Northern Hemisphere experience a generally east to west movement of weather systems?

1—Arctic only.
2—Arctic and subtropical.
3—Subtropical only.

6249. At lower levels of the atmosphere, friction causes the wind to flow across isobars into a low because the friction

1—decreases windspeed and Coriolis force.
2—decreases pressure gradient force.
3—creates air turbulence and raises atmospheric pressure.

6250. Which type wind flows down-slope becoming warmer and dryer?

1—Land breeze.
2—Valley wind.
3—Katabatic wind.

6251. What is a feature of air movement in a high pressure area?

1—Ascending from the surface high to lower pressure at higher altitudes.
2—Descending to the surface and then outward.
3—Moving outward from the high at high altitudes and into the high at the surface.

6252. What is the normal direction of a valley wind?

1—Up the mountain slope in the day time.
2—Down the mountain slope in the day time.
3—Up the mountain slope on the west side due to prevailing westerly winds.

6253. Where is the usual location of a thermal low?

1—Over the arctic region.
2—Over the eye of a hurricane.
3—Over the surface of a dry, sunny region.

6254. Freezing rain encountered during climb is normally evidence that

1—a climb can be made to a higher altitude without encountering more than light icing.
2—there exists a layer of warmer air above.
3—ice pellets at higher altitudes have changed to rain in the warmer air below.

6255. What temperature condition is indicated if precipitation in the form of wet snow occurs during flight?

1—The temperature is above freezing at flight altitude.
2—The temperature is above freezing at higher altitudes.
3—There is an inversion with colder air below.

6256. Which conditions result in the formation of frost?

1—The temperature of the collecting surface is at or below freezing and small droplets of moisture are falling.
2—Dew collects on the surface and then freezes because the surface temperature is lower than the air temperature.
3—Temperature of the collecting surface is below the dewpoint and the dewpoint is also below freezing.

6257. Ice pellets encountered during flight always indicate that there

1—are thunderstorms at higher levels.
2—is freezing rain at higher levels.
3—is snow at higher levels.

6258. When will frost most likely form on aircraft surfaces?

1—On clear nights with stable air and light winds.
2—On overcast nights with freezing drizzle precipitation.
3—On clear nights with convective action and a small temperature/dewpoint spread.

6259. What is the result when water vapor changes to the liquid state while being lifted in a thunderstorm?

1—Latent heat is released to the atmosphere.
2—Latent heat is transformed into pure energy.
3—Latent heat is absorbed from the surrounding air by the water droplet.

6260. What is a feature of supercooled water?

1—The water drop sublimates to an ice particle upon impact.
2—The unstable water drop freezes upon striking an exposed object.
3—The temperature of the water drop remains at 0° C until it impacts a part of the airframe, then clear ice accumulates.

6261. What minimum thickness of cloud layer is indicated if precipitation is reported as light or greater intensity?

1—4,000 feet thick.
2—2,000 feet thick.
3—A thickness which allows the cloud tops to be higher than the freezing level.

6262. Which condition produces weather on the lee side of a large lake?

1—Warm air flowing over a colder lake may produce fog.
2—Cold air flowing over a warmer lake may produce advection fog.
3—Warm air flowing over a cool lake may produce rain showers.

6263. Stability of the atmosphere can be determined by measurement of the

1—ambient temperature lapse rate.
2—atmospheric pressure at various levels.
3—surface temperature/dewpoint spread.

6264. What is indicated about an airmass if the temperature remains unchanged or decreases slightly as altitude is increased?

1—The air is unstable.
2—A temperature inversion exists.
3—The air is stable.

6265. What weather condition occurs at the altitude where the dewpoint lapse rate and the dry adiabatic lapse rate converge?

1—Cloud bases form.
2—Precipitation starts.
3—Stable air changes to unstable air.

6266. Which process causes adiabatic cooling?

1—Expansion of air as it rises.
2—Movement of air over a colder surface.
3—Release of latent heat during the vaporization process.

6267. When saturated air moves downhill its temperature increases

1—at a faster rate than dry air because of the release of latent heat.
2—at a slower rate than dry air because vaporization uses heat.
3—at a slower rate than dry air because condensation releases heat.

6268. Which condition is present when a local parcel of air is stable?

1—The parcel of air resists convection.
2—The parcel of air cannot be forced uphill.
3—As the parcel of air moves upward, its temperature becomes warmer than the surrounding air.

6269. Convective clouds which penetrate a stratus layer can produce which threat to instrument flight?

1—Freezing rain.
2—Clear air turbulence.
3—Embedded thunderstorms.

6270. Which type clouds are indicative of very strong turbulence?

1—Nimbostratus.
2—Standing lenticular.
3—Cirrocumulus.

6271. What is a feature of a stationary front?

1—The warm front surface moves about half the speed of the cold front surface.
2—Weather conditions are a combination of strong cold front and strong warm front weather.
3—Surface winds tend to flow parallel to the frontal zone.

6272. Which event usually occurs after an aircraft passes through a front into the colder air?

1—Temperature/dewpoint spread decreases.
2—Wind direction shifts to the left.
3—Atmospheric pressure increases.

6273. What type weather change is to be expected in an area where frontolysis is reported?

1—The frontal weather is becoming stronger.
2—The front is dissipating.
3—The front is moving at a faster speed.

6274. Which weather condition is an example of a nonfrontal instability band?

1—Squall line.
2—Advective fog.
3—Frontogenesis.

6275. Which atmospheric factor causes rapid movement of surface fronts?

1—Upper winds blowing across the front.
2—Upper low located directly over the surface low.
3—The cold front overtaking and lifting the warm front.

6276. Frontal waves and low pressure areas may form on

1—warm fronts or occluded fronts
2—slow moving cold fronts or stationary fronts.
3—cold front occlusions.

6277. What weather difference is found on each side of a "dry line"?

1—Extreme temperature difference.
2—Dewpoint difference.
3—Stratus versus cumulus clouds.

6278. Under what conditions would clear air turbulence (CAT) most likely be encountered?

1—When constant pressure charts show 20-knot isotachs less than 90 NM apart.
2—When constant pressure charts show 60-knot isotachs less than 20 NM apart.
3—When a sharp trough is moving at a speed less than 20 knots.

6279. Which is a necessary condition for the occurrence of a low-level temperature inversion wind shear?

1—The temperature differential between the cold and warm layers must be at least 10° C.
2—A calm or light wind near the surface and a relatively strong wind just above the inversion.
3—A wind direction difference of at least 30° between the wind near the surface and the wind just above the inversion.

6280. What is the lowest cloud in the stationary group associated with a mountain wave?

1—Rotor cloud.
2—Standing lenticular.
3—Low stratus.

6281. What action is recommended when encountering turbulence due to a wind shift associated with a sharp pressure trough?

1—Establish a course across the trough.
2—Climb or descend to a smoother level.
3—Increase speed to get out of the trough as soon as possible.

6282. In comparison to an approach in a moderate headwind, which is an indication of a possible wind shear due to a decreasing headwind when descending on the glide slope?

1—Less power is required.
2—Higher pitch attitude is required.
3—Lower descent rate is required.

6283. Which factor changes to cause a loss of lift when the airplane encounters a downburst during an otherwise stable ILS approach?

1—Pitch attitude decreases.
2—Downward loading of the tail surfaces increases.
3—Angle of attack decreases.

6284. Which maximum speed increase is recommended when making an approach where wind shear is suspected?

1—V_{REF} plus 20.
2—V_{REF} plus 30.
3—V_2 plus 30.

6285. What condition is necessary for the formation of structural icing in flight?

1—Supercooled water drops.
2—Water vapor.
3—Visible water.

6286. How will the airspeed indicator react if the ram air input to the pitot head is blocked by ice, but the drain hole and static port are not?

1—Indication will drop to zero.
2—Indication will rise to the top of the scale.
3—Indication will remain constant but will increase in a climb.

6287. Which type precipitation is an indication that supercooled water is present?

1—Wet snow.
2—Freezing rain.
3—Ice pellets.

6288. Which type of icing is associated with the smallest size of water droplet similar to that found in low level stratus clouds?

1—Clear ice.
2—Frost ice.
3—Rime ice.

6289. Which weather phenomenon signals the beginning of the mature stage of a thunderstorm?

1—The appearance of an anvil top.
2—The start of rain at the surface.
3—Growth rate of the cloud is at its maximum.

6290. During the life cycle of a thunderstorm, which stage is characterized predominately by downdrafts?

1—Cumulus.
2—Dissipating.
3—Mature.

6291. What feature is normally associated with the cumulus stage of a thunderstorm?

1—Beginning of rain at the surface.
2—Frequent lightning.
3—Continuous updraft.

6292. What is indicated by the term embedded thunderstorms?

1—Severe thunderstorms are embedded in a squall line.
2—Thunderstorms are predicted to develop in a stable airmass.
3—Thunderstorms are obscured by other types of clouds.

6293. Where do squall lines most often develop?

1—In an occluded front.
2—Ahead of a cold front.
3—Behind a stationary front.

6294. Where can the maximum hazard zone caused by wind shear associated with a thunderstorm be found?

1—In front of the thunderstorm cell (anvil side) and on the southwest side of the cell.
2—Ahead of the roll cloud or gust front and directly under the anvil cloud.
3—On all sides and directly under the thunderstorm cell.

6295. Which type cloud is associated with violent turbulence and a tendency toward the production of funnel clouds?

1—Cumulonimbus mamma.
2—Standing lenticular.
3—Stratocumulus.

6296. A clear area in a line of thunderstorm echos on a radar scope indicates

1—the absence of clouds in the area.
2—an area of no convective turbulence.
3—an area where precipitation drops are not detected.

6297. When flying over the top of a severe thunderstorm, the cloud should be overflown by at least

1—1,000 feet for each 10 knots windspeed.
2—2,500 feet.
3—500 feet above any moderate to severe turbulence layer.

6298. Atmospheric pressure changes due to a thunderstorm will be at the lowest value

1—during the downdraft and heavy rain showers.
2—when the thunderstorm is approaching.
3—immediately after the rain showers have stopped.

6299. Downdrafts in a mature thunderstorm are hazardous because they

1—are kept cool by cold rain which tends to accelerate the downward velocity.
2—converge toward a central location under the storm after striking the surface.
3—become warmer than the surrounding air and reverse into an updraft before reaching the surface.

6300. What is a difference between an airmass thunderstorm and a steady-state thunderstorm?

1—Airmass thunderstorms produce precipitation which falls outside of the updraft.
2—Airmass thunderstorm downdrafts and precipitation retard and reverse the updrafts.
3—Steady-state thunderstorms are associated with local surface heating.

6301. Which type storms are most likely to produce funnel clouds or tornadoes?

1—Airmass thunderstorms.
2—Cold front or squall line thunderstorms.
3—Storms associated with icing and supercooled water.

6302. When advection fog has developed, what may tend to dissipate or lift the fog into low stratus clouds?

1—Temperature inversion.
2—Wind stronger than 15 knots.
3—Surface radiation.

6303. Which conditions are necessary for the formation of upslope fog?

1—Moist, stable air being moved over gradually rising ground by a wind.
2—A clear sky, little or no wind, and 100 percent relative humidity.
3—Rain falling through stratus clouds and a 10- to 25-knot wind moving the precipitation up the slope.

6304. Haze layers are cleared or dispersed by

1—convective mixing in cool night air.
2—a wind or the movement of air.
3—evaporation similar to the clearing of fog.

6305. Which feature is associated with the tropopause?

1—Absence of wind and turbulence.
2—Absolute upper limit of cloud formation.
3—Abrupt change of temperature lapse rate.

6306. Turbulence encountered above 15,000 feet AGL, not associated with cloud formations, should be reported as

1—convective turbulence.
2—high altitude turbulence.
3—clear air turbulence.

6307. A strong wind shear can be expected

1—on the low-pressure side of a 100-knot jetstream core.
2—where the 20-knot isotachs are spaced 100 NM or closer together.
3—if the 5° C isotherms are spaced 100 NM or closer together.

6308. A most likely location of clear air turbulence is

1—in an upper trough on the polar side of a jetstream.
2—near a ridge aloft on the equatorial side of a high pressure flow.
3—downstream of the equatorial side of a jetstream.

6309. The strength and location of a jetstream is normally

1—stronger and farther north in the winter.
2—weaker and farther north in the summer.
3—weaker and farther south in the winter.

6310. Where do the maximum winds associated with the jetstream usually occur?

1—In the vicinity of breaks in the tropopause on the polar side of the jet core.
2—Below the jet core where a long straight stretch of the jetstream is located.
3—On the equatorial side of the jetstream where moisture has formed cirriform clouds.

6311. Which type jetstream can be expected to cause the greater turbulence?

1—A straight jetstream associated with a high pressure ridge.
2—A jetstream associated with a wide isotherm spacing.
3—A curving jetstream associated with a deep low pressure trough.

6312. What weather feature occurs at altitude levels near the tropopause?

1—Maximum winds and narrow wind shear zones.
2—Abrupt temperature increase above the tropopause.
3—Thin layers of cirrus (ice crystal) clouds at the tropopause level.

6313. Where are jetstreams normally located?

1—In areas of strong low pressure systems in the stratosphere.
2—At the tropopause where intensified temperature gradients are located.
3—In a single continuous band, encircling the Earth, where there is a break between the equatorial and polar tropopause.

6314. Where is the normal location of the jetstream relative to surface lows and fronts?

1—The jetstream is located north of the surface systems.
2—The jetstream is located south of the low and warm front.
3—The jetstream is located over the low and crosses both the warm front and the cold front.

6315. Which type frontal system is normally crossed by the jetstream?

1—Cold front and warm front.
2—Warm front.
3—Occluded front.

6316. Which type clouds may be associated with the jetstream?

1—Cumulonimbus cloud line where the jetstream crosses the cold front.
2—Cirrus clouds on the equatorial side of the jetstream.
3—Cirrostratus cloud band on the polar side and under the jetstream.

6317. Which action is recommended if jetstream turbulence is encountered with a direct headwind or tailwind?

1—Increase airspeed to get out of the area quickly.
2—Change course to fly on the polar side of the jetstream.
3—Change altitude or course to avoid a possible elongated turbulent area.

6318. Which action is recommended regarding an altitude change to get out of jetstream turbulence?

1—Descend if ambient temperature is falling.
2—Descend if ambient temperature is rising.
3—Maintain altitude if ambient temperature is not changing.

6319. Clear air turbulence associated with a mountain wave may extend as far as

1—1,000 miles or more downstream of the mountain.
2—5,000 feet above the tropopause.
3—100 miles or more upwind of the mountain.

6320. Summer thunderstorms in the Arctic region will generally move

1—northeast to southwest in polar easterlies.
2—southwest to northeast with the jetstream flow.
3—directly north to south with the low level polar airflow.

6321. Which arctic flying hazard is caused when a cloud layer of uniform thickness overlies a snow or ice covered surface?

1—Ice fog.
2—Whiteout.
3—Blowing snow.

6322. Which weather condition is associated with the "Intertropical Convergence Zone" near the Equator?

1—Permanent low-pressure area at the surface.
2—Air rising, frequent thunderstorms, and heavy rains.
3—Development of tropical cyclones which may grow into hurricanes or typhoons.

6323. Which weather condition is present when the tropical storm is upgraded to a hurricane?

1—Highest windspeed, 100 knots or more.
2—A clear area or hurricane eye has formed.
3—Sustained winds of 65 knots or more.

6324. What is the general direction of movement of a hurricane located in the Caribbean or Gulf of Mexico region?

1—Northwesterly curving to northeasterly.
2—Westerly, until encountering land, then easterly.
3—Counterclockwise over open water, then dissipating outward over land.

6325. (Refer to figure 120.) What was the local Central Standard Time of the surface report at Austin (AUS)?

1—11:53 a.m.
2—5:53 p.m.
3—10:53 p.m.

6326. (Refer to figure 120.) What type of report is listed for Dalhart (DHT)?

1—A report made by an automatic weather reporting system.
2—A special report concerning very low station pressure.
3—A record of a special report about a significant weather change.

6327. (Refer to figure 120.) What method was used to obtain the SP report at Marfa (MRF)?

1—Staffed AMOS station.
2—Automatic weather observing station (AMOS).
3—A military station observation of temperature, dewpoint, wind, and station pressure only.

6328. (Refer to figure 120.) What condition is reported at Childress (CDS)?

1—Distant heavy rain showers.
2—Heavy rain showers began 20 minutes after the hour.
3—The ceiling is solid overcast at an estimated 1,800 feet above sea level.

6329. (Refer to figure 120.) What condition is reported at Dallas (DAL)?

1—The station pressure is 1008.7 millibars.
2—Temperature/dewpoint spread is 16° C.
3—Altimeter setting is 30.07.

6330. (Refer to figure 120.) The pilot report at Fort Worth (FTW) indicates

1—several overcast layers including one above 9,500 feet.
2—a clear layer between 3,600 feet and 6,000 feet.
3—the base of an overcast layer at 7,500 feet.

6331. (Refer to figure 120.) The SP report at Galveston (GLS) indicates which condition?

1—Wind 170° magnetic at 5 knots.
2—No precipitation since last synoptic report.
3—Sea level pressure 1000.7 millibars.

6332. (Refer to figure 120.) What was the difference between the reported weather at Houston Hobby (HOU) and Houston International (IAH)?

1—HOU had a higher ceiling.
2—Wind direction was more southerly at IAH.
3—IAH had better visibility.

6333. (Refer to figure 120.) What weather improvement was reported at Lubbock (LBB) between 1750 and 1818 UTC?

1—The rain showers stopped.
2—The ceiling improved by 1,800 feet.
3—Visibility improved.

6334. (Refer to figure 120.) What cloud condition is indicated by a B-727 pilot over Lubbock (LBB)?

1—Ceiling was at 4,500 feet MSL.
2—Base of broken clouds was at 4,500 feet AGL.
3—Cloud tops varied between 5,300 feet and 6,000 feet MSL.

6335. (Refer to figure 120.) What weather condition is indicated by the report at Midland (MAF)?

1—Rain of unknown intensity was observed in the 090 to 180 quadrant.
2—The ceiling was at 25,000 feet MSL.
3—Wind was 020° magnetic at 20 knots.

6336. (Refer to figure 121.) What information is contained in the PIREP at San Antonio (SAT)?

1—Time of report was unknown.
2—Type of aircraft was unknown.
3—Top of the scattered layer was 4,000 feet AGL.

6337. (Refer to figure 121.) What change took place at Wichita Falls (SPS) between 1757 and 1820 UTC?

1—The rain became heavier.
2—Atmospheric pressure increased.
3—The ceiling lowered.

6338. (Refer to figure 121.) What was the ceiling at Fort Smith (FSM)?

1—8,000 feet AGL.
2—2,500 feet AGL.
3—2,900 feet MSL.

6339. (Refer to figure 121.) What change had taken place between 1755 and 1825 UTC at Harrison (HRO)?

1—Wind shifted from south to north-northwest.
2—Thundershowers began at 25 minutes after the hour.
3—Visibility reduced to IFR conditions.

6340. Runway visual range is measured in which of the following units?

1—Meters/1,000.
2—Feet/100.
3—Miles and fractions of miles.

6341. The purpose of the transmissometer is to measure

1—braking action on a wet runway.
2—the bases of obscuring precipitation.
3—the distance a pilot can see down the runway.

6342. Which measurement is reported as runway visibility?

1—Visibility reported by a ground observer from the airport control tower.
2—Slant range visibility in the landing area of the active runway.
3—Distance down the runway a pilot can see unlighted objects.

6343. What does the RVR value depicted on instrument approach procedure charts represent?

1—The horizontal distance a pilot can see high-intensity runway lights.
2—The horizontal distance down the runway a pilot can see unlighted objects.
3—The slant visual range a pilot will see down the final approach during landing.

6344. If squalls are reported at the destination airport, what wind conditions existed at the time?

1—Sudden increases in windspeed of at least 15 knots, lasting for at least 1 minute.
2—Peak gusts of at least 35 knots for a sustained period of 1 minute or longer.
3—Rapid variation in wind direction of at least 20° and changes in speed of at least 10 knots between peaks and lulls.

6345. Which type of weather can only be directly observed during flight and then reported in a PIREP?

1—Structural icing.
2—Jetstream type winds.
3—Level of the tropopause.

6346. What is indicated by a PIREP which is preceded in the Surface Weather Report by the letters "UUA"?

1—Unconfirmed PIREP.
2—Urgent PIREP.
3—PIREP from an unknown type aircraft and at an unknown flight altitude.

6347. Which pattern on a weather radar scope is an indication of a tornado?

1—A hook echo.
2—A line echo wave pattern.
3—An echo indicating severe hail.

6348. Weather satellite images show tropopause weather by reporting which reflections from the surface and clouds?

1—Ultraviolet and infrared reflections.
2—Infrared and visible light reflections.
3—Solar radiation and terrestrial radiation.

6349. What is the single source reference that contains information regarding frontal movement, turbulence, and icing conditions for a specific region?

1—Weather Depiction Chart.
2—Area Forecast.
3—Terminal Forecast.

6350. Which primary source contains information regarding the expected weather at the destination airport and at the ETA?

1—Low Level Prog Chart.
2—Radar Summary and Weather Depiction Charts.
3—Terminal Forecast.

6351. The body of a Terminal Forecast covers a geographical area within

1—a 5-mile radius of the center of a runway complex.
2—25 miles of the center of an airport.
3—10 miles of the station originating the forecast.

6352. The absence of a visibility entry in a Terminal Forecast specifically implies that the surface visibility

1—is at least 1 SM above the minimum visibility requirement for an approach to the primary instrument runway.
2—exceeds 6 SM.
3—is at least 15 SM in all directions from the center of the runway complex.

6353. What sources reflect the most accurate information on current and forecast icing conditions?

1—Low Level Sig Weather Prog Chart, RADAT's, and the Area Forecast.
2—PIREP's, Area Forecast, and the Freezing Level Chart.
3—PIREP's, AIRMET's, and SIGMET's.

6354. What weather is predicted by the term "TRW VICINITY" in a Terminal Forecast?

1—Thunderstorms are expected between 5 and 25 miles of the runway complex.
2—Rain showers may occur over the station and within 50 miles of the station.
3—Scattered thundershowers are predicted within the Terminal Control Area.

6355. (Refer to figure 122.) What weather is predicted at Alice TX (ALI) at 1500Z?

1—Marginal VFR due to ceilings.
2—Surface wind gusting to 25 knots.
3—Visibility 6 statute miles in haze.

6356. (Refer to figure 122.) The categorical outlook for Austin (AUS) indicates

1—marginal VFR due to ceilings and thunderstorms.
2—a chance of 1,000 feet AGL ceilings.
3—ceiling 1,400 broken and thunder showers.

6357. (Refer to figure 122.) At which time is IFR weather first predicted at Lubbock (LBB)?

1—1500Z.
2—1700Z.
3—0900Z.

6358. (Refer to figure 122.) What type conditions can be expected for a flight scheduled to land at San Angelo (SJT) at 1500Z?

1—Chance of 1 nautical mile visibility.
2—Occasional ceilings 800 feet in thunderstorms.
3—IFR conditions due to low ceilings, rain, and fog.

6359. (Refer to figure 123.) The weather system forecast from Tennessee to Texas is expected to be influenced by a

1—dry line producing thunderstorms.
2—warm front in the east and cold front in the west.
3—stationary front with moist, low-level flow.

6360. (Refer to figure 123.) The area forecast indicates that aviation weather hazards are predicted for

1—OK, AR, TN, AL, and TX.
2—TX, LA, MS, AR, and Coastal Waters.
3—OK, AR, LA, TN, MS, AL, TX, and Coastal Waters.

6361. (Refer to figure 123.) According to the forecast, the freezing level is expected to be

1—16,000 feet MSL with icing in south Texas.
2—13,000 feet MSL in northern Arkansas and Tennessee.
3—13,000 feet AGL in northern Oklahoma.

6362. (Refer to figure 123.) The forecast for IFR conditions in Texas and Oklahoma anticipates

1—ceilings of 1,000 feet MSL or less.
2—visibility restrictions due to fog.
3—turbulence in the stratus layers to as high as 24,000 feet MSL.

6363. (Refer to figure 123.) What is the categorical outlook for the areas of Texas and Oklahoma where thunderstorms are predicted?

1—Light rain and scattered, embedded thundershowers.
2—Cumulonimbus clouds with tops up to 35,000 feet MSL.
3—Ceilings lowering from 1,500-2,500 feet AGL to less than 1,000 feet AGL.

6364. (Refer to figure 123.) What weather is forecast for extreme Western Tennessee?

1—Mountains obscured by low stratus clouds and precipitation.
2—Generally ceilings 9,000 feet AGL, occasional ceilings 1,500-2,500 feet AGL.
3—IFR ceilings due to thunderstorms.

6365. TWEB Route Forecasts provide predicted weather for

1—a corridor 25 miles either side of a numbered cross-country route.
2—a 50-mile radius of the takeoff and landing airports.
3—any route of flight specified by the requesting pilot.

6366. How can the pilot obtain TWEB Route Forecast information?

1—From the TEL TWEB and Telephone Voice Response Systems (VRS).
2—From the ATIS and Pilots Automatic Telephone Weather.
3—From ARTCC and Automated Flight Service Station briefings.

6367. What information is provided by this TWEB Route Forecast excerpt?

249 TWEB 252317 GFK-MOI-ISN, GFK VCNTY CIGS AOA 5 THSD TILL 12Z...

1—Grand Forks (GFK) ceilings at or above 5,000 feet MSL.
2—Route No. 249, from GFK to MOI to ISN.
3—Ceilings within a 50-mile radius of Grand Forks (GFK) are 5,000 feet AGL.

6368. (Refer to figure 124.) Which system in the Convective Sigmet listing has the potential of producing the most severe storm?

1—The storms in Texas and Oklahoma.
2—The storms in Colorado, Kansas, and Oklahoma.
3—The isolated storm 50 miles northeast of Memphis (MEM).

6369. (Refer to figure 124.) What time period is covered by the outlook section of the Convective Sigmet?

1—24 hours after the valid time.
2—2 to 6 hours after the valid time.
3—No more than 2 hours after the valid time.

6370. Which type weather conditions are covered in the Convective Sigmet?

1—Embedded thunderstorms, lines of thunderstorms, and thunderstorms with 3/4 inch hail or tornadoes.
2—Cumulonimbus clouds with tops above the tropopause and thunderstorms with 1/2 inch hail or funnel clouds.
3—Any thunderstorm with a severity level of VIP 2 or more.

6371. (Refer to figure 125.) What approximate wind direction, speed, and temperature (relative to ISA) are expected for a flight over OKC at FL370?

1—265° true; 27 knots; ISA +1° C.
2—260° true; 27 knots; ISA +6° C.
3—260° magnetic; 27 knots; ISA -5° C.

6372. (Refer to figure 125.) What approximate wind direction, speed, and temperature (relative to ISA) are expected for a flight over TUS at FL270?

1—347° magnetic; 5 knots; ISA -10° C.
2—350° true; 5 knots; ISA +5° C.
3—010° true; 5 knots; ISA +13° C.

6373. (Refer to figure 125.) What approximate wind direction, speed, and temperature (relative to ISA) are expected for a flight over INK at 16,000 feet?

1—025° magnetic; 7 knots; ISA -10° C.
2—035° true; 8 knots; ISA +5° C.
3—030° true; 7 knots; ISA +15° C.

6374. (Refer to figure 125.) What approximate wind direction, speed, and temperature (relative to ISA) are expected for a flight over JAN at FL350?

1—230° true; 2 knots; ISA +10° C.
2—295° true; 8 knots; ISA -10° C.
3—230° magnetic; 3 knots; ISA +5° C.

6375. (Refer to figure 125.) What approximate wind direction, speed, and temperature (relative to ISA) are expected for a flight over MKC at FL260?

1—260° true; 43 knots; ISA +10° C.
2—260° true; 45 knots; ISA -10° C.
3—260° magnetic; 42 knots; ISA +9° C.

6376. (Refer to figure 125.) What will be the wind and temperature trend for a HOU-DAL-OKC flight at FL390?

1—Wind direction shift from north to west.
2—Windspeed increase.
3—Temperature decrease.

6377. (Refer to figure 125.) What will be the wind and temperature trend for a SAT-ELP-TUS flight at 16,000 feet?

1—Temperature decrease slightly.
2—Windspeed decrease.
3—Wind direction shift from southeast to east.

6378. (Refer to figure 125.) What will be the wind and temperature trend for a STL-MEM-MSY flight at FL330?

1—Windspeed decrease.
2—Wind shift from west to north.
3—Temperature increase 5° C.

6379. (Refer to figure 125.) What will be the wind and temperature trend for a DEN-ICT-OKC flight at 11,000 feet?

1—Temperature decrease.
2—Windspeed increase slightly.
3—Wind shift from calm to a westerly direction.

6380. (Refer to figure 125.) What will be the wind and temperature trend for a DSM-LIT-SHV flight at 12,000 feet?

1—Windspeed decrease.
2—Temperature decrease.
3—Wind direction shift from northwest to southeast.

6381. (Refer to figure 125.) What is the forecast temperature at ATL for the 3,000-foot level?

1— +6° C.
2— +6° F.
3— Not reported.

6382. What wind direction and speed aloft are forecast by this FD report for FL390 - "750649"?

1—350° at 64 knots.
2—250° at 106 knots.
3—150° at 6 knots.

6383. What wind direction and speed aloft are forecast by this FD report for FL390 - "731960"?

1—230° at 119 knots.
2—131° at 96 knots.
3—073° at 196 knots.

6384. (Refer to figure 126.) Which marginal VFR condition was reported in north-central Wyoming?

1—Sky obscured, visibility restricted by smoke.
2—Sky partially obscured, ceiling 2,000 feet, visibility 5 miles in haze.
3—Broken ceiling measured at 200 feet.

6385. (Refer to figures 126 and 127.) Which conditions caused the IFR weather which was reported in West Virginia?

1—Heavy thundershowers.
2—Visibility 2-4 miles in rain.
3—Sky obscured, visibility less than 1 mile in fog.

6386. (Refer to figures 126 and 127.) The IFR conditions behind the cold front in central Georgia were mostly a result of

1—continuous rain and low ceilings.
2—thunderstorms with tops over 30,000 feet.
3—warm, moist air flowing inland from Atlantic coastal waters.

6387. (Refer to figures 126 and 127.) The thunderstorm area in northern Georgia was moving

1—the same direction as the cold front.
2—north-northeast at 20 knots.
3—southeast with tops of 21,000 feet.

6388. (Refer to figures 126 and 127.) A flight from New Orleans to central Florida over the Gulf from 1000Z to 1135Z would probably have encountered

1—IFR conditions with continuous rain, conditions improving after passing the cold front.
2—strong to very strong thunderstorms with tops of 30,000 feet or higher.
3—marginal VFR conditions with thundershower intensity decreasing.

6389. (Refer to figure 127.) The thunderstorm area approaching the Washington, DC vicinity from Virginia was moving

1—northeast at 30 knots.
2—north at 17 knots.
3—north-northeast at 15 knots.

6390. (Refer to figures 126 and 127.) A flight planned from Washington, DC to Atlanta (north-central Georgia) at 1200Z should expect

1—thunderstorms with tops in the vicinity of 21,000 feet.
2—a wind shift because of passing through a cold front.
3—VFR or marginal VFR conditions for the entire flight.

6391. (Refer to figures 126 and 127.) The IFR weather off the New Jersey shore and approaching New York City in the warm front included

1—a strong thunderstorm area moving northeast at 10 knots.
2—a VIP 3 to 4 thunderstorm area with a cell top of 27,000 feet.
3—marginal VFR conditions with ceilings of 6,000 feet, visibility 5 miles in light fog.

6392. (Refer to figure 127.) The thunderstorms in the Gulf to the south of the western Florida panhandle contained

1—a very strong storm area with all tops above 40,000 feet.
2—thunderstorms with little movement and tops of 18,000 feet.
3—at least one strong to very strong cell with a top above the tropopause.

6393. (Refer to figure 126.) The cold front stretching from the Great Lakes to the Texas Panhandle is drawn to show its position

1—6 hours after the chart was issued.
2—1 hour before the reported IFR and MVFR contour line positions.
3—1 hour before the forecast weather at each reporting station.

6394. (Refer to figures 126 and 127.) Which conditions were reported by those stations in Arizona which did not report clear skies?

1—Breaks in the overcast.
2—Scattered to broken clouds.
3—Radar observations unavailable.

6395. (Refer to figures 126 and 127.) The IFR conditions in the vicinity of Lakes Superior, Huron, and Michigan were caused by

1—overcast sky and haze.
2—convective action during the cold front passage.
3—obscured skies and fog.

6396. What is a feature of the Radar Summary Chart?

1—Severe weather watches are shown for the valid time.
2—Tops and bases of all cloud cover in the reporting area are shown.
3—Predicted location of solid thunderstorm lines are highlighted.

6397. A Weather Depiction Chart indicates

1—actual sky cover, visibility restrictions, and type of precipitation at reporting stations.
2—forecast ceilings and visibilities over a large geographic area.
3—actual en route weather conditions between reporting stations.

6398. What is indicated on the Weather Depiction Chart by a continuous smooth line enclosing a hatched geographic area?

1—The entire area has ceilings less than 1,000 feet and/or visibility less than 3 miles.
2—More than 50 percent of the area enclosed by the smooth line is predicted to have IFR conditions.
3—Reporting stations within the enclosed area are all showing IFR conditions at the time of the report.

6399. For the most effective use of the Radar Summary Chart a flight planner should

1—consult the chart to obtain the most accurate measurement of freezing levels, cloud cover, and wind conditions between reporting stations.
2—compare the chart information with the Weather Depiction Chart to get a three-dimensional picture of clouds and precipitation.
3—analyze the chart for information on ceilings, cloud tops, and cloud coverage between reporting stations.

6400. What information is provided by the Radar Summary Chart that is not shown on other weather charts?

1—Lines and cells of hazardous thunderstorms.
2—Types of precipitation between reporting stations.
3—Ceilings and precipitation between reporting stations.

6401. (Refer to figure 128.) Which conditions are predicted for southern Florida on the 24-Hour Surface Prognostic Chart?

1—Moderate to severe turbulence over more than half the area.
2—Rain showers and thunderstorms over less than half the area.
3—MVFR flight conditions.

6402. (Refer to figure 128.) The warm front along the southeast states coastal areas will be producing

1—showery precipitation covering half or more of the area.
2—continuous IFR conditions with rain and thundershowers.
3—high winds due to hurricane Florence.

6403. (Refer to figure 128.) What type weather will be associated with the cold front depicted from Canada through the south-central states?

1—Convective activity in Texas and Oklahoma.
2—Moderate turbulence and scattered rain showers in the Great Lakes area.
3—Continuous rain and rain showers in south-central Cana..

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6404. (Refer to figure 128.) What type turbulence is expected in the southeastern state area?

1—Light to moderate turbulence up to the 240 millibar level.
2—Severe clear air turbulence up to FL240.
3—Moderate to severe turbulence from the surface to 24,000 feet MSL.

6405. (Refer to figure 128.) The freezing level in the Lake Michigan area is forecast to be

1—above the turbulence level.
2—at the surface.
3—at the 120 millibar level.

6406. (Refer to figure 128.) What type weather is associated with the low-pressure areas in California?

1—Moderate turbulence up to 12,000 feet MSL.
2—Low ceilings due to the approaching cold front.
3—Unusually low barometric pressure.

6407. (Refer to figure 128.) What is the forecast activity of the trough in eastern Montana during the 0000Z to 1200Z period?

1—Completely dissipate due to the strengthening high-pressure area.
2—Move southward and merge with the western half of the cold front.
3—Move eastward into the Lake Superior area.

6408. (Refer to figure 128.) Which location includes a prediction of continuous rain?

1—Central Gulf of Mexico.
2—South-central Canada.
3—Coastal areas of Georgia and the Carolinas.

6409. (Refer to figure 128.) What weather information is shown for the storm system which has been named "Florence"?

1—The system is a tropical cyclone with no associated thunderstorms.
2—The system will develop to hurricane strength between 0000Z and 1200Z Sep 09.
3—The storm is moving toward and merging with the warm front.

6410. (Refer to figure 128.) What are the lowest and highest sea level atmospheric pressures predicted on the 24-Hour Surface Prog Chart?

1—1006.0 millibars to 1016.0 millibars.
2—1000.0 millibars to 1018.0 millibars.
3—1004.0 millibars to 1011.8 millibars.

6411. Freezing Point Depressant (FPD) fluid is intended to be applied

1—as an anti-ice and deice medium before takeoff.
2—during flight, to wings and critical surfaces not protected by a hot air anti-ice system.
3—on the ground during snow or freezing rain to all air carrier airplanes and helicopters.

6412. The effectiveness of applied Freezing Point Depressant (FPD) fluid during snow or freezing precipitation will

1—remain at full strength until takeoff.
2—deteriorate as water is absorbed in the FPD film.
3—become better as hot air type anti-ice systems are activated during the taxi-out period.

6413. Which source is recommended for an initial look at the weather expected for a planned flight?

1—En Route Flight Advisory Service (EFAS).
2—Hazardous In-Flight Weather Advisory Service (HIWAS)
3—A.M. Weather Telecast on PBS.

6414. What method can be used to get recorded weather information from the Interim Voice Response System (IVRS)?

1—Contact the AFSS on a local or long distance telephone line for a personal briefing.
2—Use a touch-tone telephone and follow recorded menu instructions.
3—Contact the local FSS using a rotary dial telephone and follow recorded instructions.

6415. What basic information is provided automatically by the Interim Voice Response System (IVRS) recording?

1—Surface Observations, Terminal Forecasts, Winds Aloft Forecasts, and Selected Weather Warnings.
2—Terminal Forecasts, Radar Summaries, Weather Depiction, and AIRMET's.
3—Observed weather at the takeoff and landing airports, and current ATIS recordings.

6416. What information does the pilot supply to obtain recorded weather related to the flight from the Interim Voice Response System (IVRS)?

1—Telephone number where the FSS briefer can contact the pilot.
2—Location identifiers (LOCIDS), route, altitude, and times for the flight.
3—Flight information in the same order as on the FAA Flight Plan Form.

6417. An unscheduled air traffic advisory, for use by air carrier crews to anticipate and avoid adverse weather at a busy terminal is known as

1—center weather advisories (CWA).
2—severe weather watch bulletins (WW).
3—special flight forecasts (SFF).

6418. Which forecast provides specific information concerning expected sky cover, cloud tops, visibility, weather, and obstruction to vision in a route format?

1—DFW FA 131240.
2—249 TWEB 252317.
3—CHI WA 300300.

6419. Forecast winds and temperatures aloft for an international flight may be obtained by consulting

1—Area Forecasts published by the departure location host country.
2—the current International Weather Depiction Chart appropriate to the route.
3—Wind and Temperature Aloft Charts prepared by a Regional Area Forecast Center (RAFC).

6420. How will an area of thunderstorm activity, that may grow to severe intensity, be indicated on the Severe Weather Outlook Chart?

1—SLGT within cross-hatched areas.
2—APCHG within any area.
3—SVR within any area.

6421. For international flights, a High Level Significant Prognostic Chart is prepared for use at

1—any flight level above 290.
2—FL250 to FL600.
3—FL180 to FL600.

6422. The Low Level Prognostic Chart depicts weather conditions

1—that are forecast to exist at a specific time shown on the chart.
2—as they existed at the time the chart was prepared.
3—that are forecast to exist 6 hours after the chart was prepared.

6423. A station is forecasting wind and temperature aloft to be 280° at 205 knots; temperature -51° C at FL390. How would this data be encoded in the FD?

1—7800-51.
2—789951.
3—280051.

6424. At what time are current AIRMET's broadcast in their entirety by the AFSS?

1—15 minutes after the hour only.
2—Every 15 minutes until the AIRMET is canceled.
3—15 and 45 minutes after the hour during the first hour after issuance.

6425. If a SIGMET alert is announced, how can information contained in the SIGMET be obtained?

1—ATC will announce the hazard and advise when information will be provided in the FSS broadcast.
2—By contacting a weather watch station.
3—By contacting the nearest AFSS.

6426. What type service should normally be expected from an En Route Flight Advisory Service?

1—Weather advisories pertinent to the type of flight, intended route of flight, and altitude.
2—Severe weather information, changes in flight plans, and receipt of position reports.
3—Radar vectors for traffic separation, route weather advisories, and altimeter settings.

6427. Below FL180, en route weather advisories should be obtained from an FSS on

1—122.1 MHz.
2—122.0 MHz.
3—123.6 MHz.

6428. What type turbulence should be reported when it causes slight, rapid, and somewhat rhythmic bumpiness without appreciable changes in attitude or altitude, less than one-third of the time?

1—Occasional light chop.
2—Moderate turbulence.
3—Moderate chop.

6429. What type turbulence should be reported when it causes changes in altitude and/or attitude more than two-thirds of the time, with the aircraft remaining in positive control at all times?

1—Continuous severe chop.
2—Continuous moderate turbulence.
3—Intermittent moderate turbulence.

6430. What type turbulence should be reported when it momentarily causes slight, erratic changes in altitude and/or attitude, one-third to two-thirds of the time?

1—Occasional light chop.
2—Moderate chop.
3—Intermittent light turbulence.

6431. (Refer to figures 129 through 131.) What is the wind velocity at 39,000 feet around the low pressure center in Canada?

1—10 knots.
2—20 knots.
3—30 knots.

6432. (Refer to figure 129.) Which area has the greatest potential for condensation as inferred by the temperature/dewpoint spread on the 500 MB Constant Pressure Chart?

1—Along the Oregon and California coast.
2—Western U.S. along the 55880 meter height contour.
3—Around the low pressure center in Canada.

6433. (Refer to figures 129 through 131.) Which flight level should afford the best wind conditions for a northbound flight along the California Coast?

1—FL180.
2—FL280.
3—FL380.

6434. (Refer to figure 131.) What is the height of the 200 MB level at the low-pressure center in Canada?

1—1,850 meters MSL.
2—18,500 meters MSL.
3—11,850 meters MSL.

6435. (Refer to figure 130.) What is the height of the 300 MB level at the low pressure center in Canada?

1—9,120 meters MSL.
2—18,000 meters MSL.
3—11,850 meters MSL.

6436. Interpret the path of the jetstream from figures 129 through 131.

1—Southern California, Nevada, Utah, Nebraska/Kansas, and then southeastward.
2—Oregon, Idaho, Wyoming, Nebraska, Iowa, and across the Great Lakes.
3—The Alaska area, across Canada to Montana, North Dakota, then across the Great Lakes area.

6437. The system depicted on the 500 MB chart, figure 129, that is approaching the California Coast from the west is a

1—LOW.
2—HIGH.
3—cold front.

6438. What type weather is inferred by the almost vertical extent of the LOW in Canada as depicted in figures 129 through 131?

1—A rapid moving system with little chance of developing cloudiness, precipitation, and adverse flying conditions.
2—A slow moving storm which may cause extensive and persistent cloudiness, precipitation, and generally adverse flying weather.
3—A rapid moving storm, leaning to west with altitude, which encourages line squalls ahead of the system with a potential of severe weather.

6439. (Refer to figures 129 through 131.) What is the approximate temperature for a flight from southern California to central Kansas at FL350?

1— -16° C.
2— -39° C.
3— -41° C.

6440. (Refer to figures 129 through 131.) Determine the approximate wind direction and velocity at FL240 over the station in central Oklahoma.

1—280° at 10 knots.
2—320° at 10 knots.
3—330° at 13 knots.

6441. (Refer to figures 129 through 131.) What is the relative moisture content of the airmass approaching the California coast?

1—Dry.
2—Moist enough for condensation.
3—Very wet with high potential for clouds and precipitation.

6442. (Refer to figures 129 through 131.) What movement of the LOW in Mexico is inferred by the winds plotted on the Constant Pressure Charts?

1—Very slow movement.
2—Rapid movement.
3—Northward movement.

6443. (Refer to figure 129.) What change in height of the 500 MB level over central Oklahoma has occurred in the last 12 hours?

1—Lowered 300 meters.
2—Raised 30 meters.
3—Raised 20 meters.

6444. From figures 132A through 132D, determine an area of potential wind shear.

1—South central Canada.
2—Northeast United States coast and Canada.
3—Over the Pacific Ocean west of the United States coast.

6445. (Refer to figures 132A through 132D.) What is the direction of windflow along the United States Atlantic coast?

1—Westerly.
2—Northeasterly.
3—Southwesterly.

6446. From figures 132A through 132D, determine the forecast position of the jetstream at the tropopause.

1—From the California/Mexico border eastward across the southern states and over the Atlantic Ocean east of Florida.
2—From central California eastward across the United States and northeastward across the Atlantic Ocean from North Carolina.
3—From the Alaska area southeastward to Montana and North Dakota, across the Great Lakes to New York and then northeast over the Atlantic.

6447. (Refer to figures 132A through 132D.) What vertical wind shear can be expected at the tropopause on a line from the Great Lakes to Florida?

1—60 knots.
2—30 knots.
3—2 knots.

6448. (Refer to figures 132A through 132D.) What is the approximate height of the tropopause over most of the United States?

1—35,000 to 45,000 feet.
2—45,000 to 50,000 feet.
3—Over 50,000 feet.

6449. (Refer to figures 132A through 132D.) What are the strongest observed winds at the tropopause?

1—70 knots.
2—80 knots.
3—90 knots.

6450. (Refer to figure 132C.) What are the coverage and vertical extent of the isolated embedded thunderstorms over the southeastern United States?

1—one-eighth to five-eighths coverage, surface to FL420.
2—one-eighth to five-eighths coverage, below FL240 to FL450.
3—Less than one-eighth coverage, below FL240 to FL420.

6451. (Refer to figure 132C.) The large arrow over the north-central, United States depicts

1—the jetstream to be 90 knots west-southwest at 37,000 feet.
2—thunderstorm movement with winds in the thunderstorms at 90 knots.
3—strongest winds at the tropopause to be 90 knots from west-southwest.

6452. (Refer to figure 132C.) What turbulence is expected in the Florida area as implied by the High Level Significant Weather Chart?

1—Light to moderate.
2—Moderate or greater.
3—Severe.

6453. The shaded area labeled "MDT" in figures 133A and 133B represents

1—moderate intensity thunderstorms.
2—severe thunderstorms with a coverage of 6 to 10 percent of the area.
3—moderate weather with embedded thunderstorms of unknown intensity.

6454. (Refer to figures 133A and 133B.) What is the primary purpose of the Severe Weather Outlook charts?

1—Advanced planning for future storm development.
2—Specific information on intensity of severe weather.
3—Positive information on severe weather in progress.

6455. (Refer to figures 133A and 133B.) In what areas are probable general thunderstorm activity forecast?

1—In the shaded area labeled "LGT."
2—Between the two lines with an arrowhead.
3—On the east of each line with an arrowhead.

6456. What information is indicated by the note, "APCHG" in figure 133A?

1—Approaching storms are forecast to have large hail 3/4-inch in diameter.
2—Approaching storms deteriorating with clearing the next 12 hours.
3—Probable general thunderstorm activity may approach severe intensity.

6457. Convergence on a grid chart is defined as the angle between

1—grid north and true north.
2—magnetic north and true north.
3—grid north and magnetic north.

6458. An ISOGRIV is defined correctly by which of the following responses? Line of

1—equal grivation.
2—equal variation.
3—zero grivation.

6459. Which chart projection is most commonly used for grid flights in subpolar areas?

1—Lambert conformal.
2—Gnomonic.
3—Mercator.

6460. Grid meridians often are parallel to the

1—Equator.
2—180° meridian.
3—Greenwich Meridian.

6461. Which chart projection is used only for planning grid polar flights?

1—Transverse Mercator.
2—Polar stereographic.
3—Polar gnomonic.

6462. Which chart projection is most commonly used for aeronautical navigation?

1—Mercator.
2—Lambert conformal.
3—Stereographic.

6463. Which features are associated with the Lambert Conformal Conic Projection?

1—A straight line approximates a great circle.
2—Meridians are straight lines, equally spaced.
3—Straight lines cross meridians at constant angles.

6464. Which publication deals solely with solutions concerning selected stars?

1—H.O. Pub. No. 249, Sight Reduction Tables, Volume I.
2—H.O. Pub. No. 249, Sight Reduction Tables, Volume II.
3—H.O. Pub. No. 249, Sight Reduction Tables, Volume III.

6465. How are select stars that are best suited for fixing purposes identified in the H.O. Pub. No. 249, Sight Reduction Tables?

1—Name printed in bold type.
2—Marked by a number symbol.
3—Marked by diamonds.

6466. Precession and nutation corrections are only applied to

1—the Moon.
2—select stars.
3—the Sun.

6467. Nutation is defined as

1—bending of the light as it passes through the atmosphere.
2—error caused by mechanical faults in the sextant.
3—nodding or wobbling of the Earth on its axis.

6468. When is parallax error the greatest?

1—When the body being observed is on the horizon.
2—When the HS is greatest (i.e., close to 90).
3—When the altitude of the observer aircraft is high.

6469. A parallax correction is applied to a celestial observation of the

1—Sun.
2—planets.
3—Moon.

6470. What causes refraction error in a sextant?

1—Improper alignment of the optical system in the sextant.
2—Poorly aligned sextant mount in the aircraft.
3—Bending of the light as it passes through the atmosphere.

6471. How is the correction for a refraction error applied to the HS (height sighted)?

1—Subtracted for Moon observations only.
2—Subtracted for all celestial observations.
3—Added for Sun, Moon, and the planets.

6472. When observing the Moon HS, which corrections are always additive?

1—Index.
2—Parallax.
3—Refraction.

6473. When observing the Moon HS, which correction is always subtracted?

1—Index.
2—Parallax.
3—Refraction.

6474. Why is the intercept method used to plot celestial fixes?

1—It provides a rapid means of computing the observations.
2—It eliminates the need to correct for precision.
3—The subpoint of most bodies would be too far to plot on most aeronautical charts.

6475. What measurement does the intercept method provide when determining an LOP for a celestial fix?

1—Nautical miles between the actual circle of equal altitude and that of the assumed position.
2—Nautical miles between the position and the celestial body's nadir.
3—The distance in nautical miles between the position and the celestial body's subpoint.

6476. Noonday fixes (local apparent noon) can best be obtained at

1—lower latitudes.
2—middle latitudes.
3—higher latitudes.

6477. How can latitude be determined from a celestial observation of Polaris?

1—By applying a Coriolis correction to the HO (observed altitude).
2—By applying a "Q" correction to the HO (observed altitude).
3—By using the formula R = RO X f.

6478. A line extending southward from the western side of the square of Pegasus leads to the star

1—Diphda.
2—Fomalhaut.
3—Achenar.

6479. The first magnitude star approximately midway between Betelgeuse and the Pleiades is

1—Elnath.
2—Pollux.
3—Aldebaran.

6480. The star at the end of the handle of the Little Dipper (URSA minor) is

1—Dubhe.
2—Kochab.
3—Polaris.

6481. The star at the tail of Scorpius (the scorpion) is

1—Shaula.
2—Antares.
3—Nunki.

6482. To determine latitude by an observation of Polaris, it is necessary to adjust the HO altitude

1—to the altitude of the poles.
2—for erratic orbit of Polaris.
3—for change in LHA of Aries.

6483. The correction used during a Polaris observation is

1—Q correction.
2—motion of the body.
3—index error.

6484. Which of the listed planets is most often used for a celestial observation?

1—Mercury.
2—Uranus.
3—Pluto.

6485. Which planet is most often used for celestial observations?

1—Uranus.
2—Mars.
3—Pluto.

6486. The celestial reference lines that are counterparts of parallels of latitude are called

1—declination circles.
2—hour circles.
3—diurnal circles.

6487. At what location are all celestial bodies circumpolar?

1—30°.
2—60°.
3—Either pole.

6488. At what location are none of the celestial bodies circumpolar?

1—The Equator.
2—30°.
3—60°.

6489. What is the name of the celestial counterpart for longitude?

1—Declination.
2—Hour circles.
3—Diurnal circles.

6490. What is the name of the point directly above the observer's position on the celestial sphere?

1—Nadir.
2—Zenith.
3—Aries.

6491. From which publication can the GHA of the Sun, Moon, planets, and Aries be obtained?

1—H.O. Pub. No. 216, Air Navigation.
2—H.O. Pub. No. 249, Sight Reduction Tables, Volume I.
3—Air Almanac.

6492. How is the first point of Aries defined?

1—Point where the Sun crosses the observer's upper branch.
2—Point where the Sun appears to cross the celestial Equator from north to south.
3—Point where the Sun appears to cross the celestial Equator from south to north.

6493. What is the LHA of a celestial body using the following information?

Longitude of the observer	65° E
GHA Aries	38°
SHA of an observed body	47°

1—85°.
2—150°.
3—330°.

6494. What is the LHA of a celestial body using the following information?

Longitude of the observer	35° W
GHA Aries	95°
SHA of an observed body	45°

1—45°.
2—105°.
3—140°.

6495. Time of transit refers to

1—the altitude of a body above the observer's celestial horizon.
2—the time when a body passes the observer's meridian.
3—when the Sun passes overhead in the sky.

6496. A 1-hour time zone is equal to how many degrees or minutes of longitude on the Earth's surface?

1—15°.
2—1°.
3—15 minutes.

6497. How many degrees of longitude does the mean Sun travel in 3 hours 20 minutes?

1—45°.
2—50°.
3—55°.

6498. How many degrees of longitude does the mean Sun travel in 2 hours 40 minutes?

1—35°.
2—40°.
3—45°.

6499. Sidereal time is defined as

1—time measured by reference to the upper branch of the first point of Aries.
2—when the Sun passes from north to south declination across the equinoctial.
3—time measured from the Greenwich Meridian to the observer's lower branch.

6500. Where should the course be measured when plotting on a Lambert Conformal Chart?

1—Any longitude.
2—Mid-longitude.
3—Mid-latitude.

6501. On which chart does a straight line represent a rhumb line?

1—Mercator.
2—Lambert conformal.
3—Stereographic.

6502. True airspeed is defined as the

1—reading taken from the airspeed indicator.
2—indicated airspeed corrected for pitot-static error.
3—calibrated or equivalent airspeed corrected for temperature and pressure altitude.

6503. Calibrated airspeed is defined as the

1—indicated airspeed corrected for pitot-static error.
2—indicated airspeed corrected for compressibility.
3—calibrated or equivalent airspeed corrected for temperature and pressure altitude.

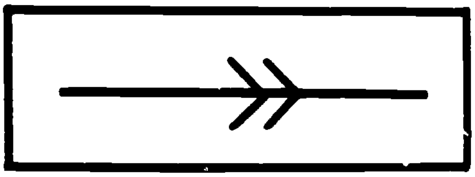
6504. Track is defined as the

1—intended horizontal direction of travel of an aircraft over the ground.
2—horizontal component of the actual path of an aircraft over the ground.
3—horizontal component of the intended path of the aircraft comprising both direction and magnitude.

6505. An AP (air position) is defined as

1—a point on the Earth established by keeping an accurate account of time, groundspeed, and track since the last known position.
2—an accurate position determined by electronic equipment.
3—the location of an aircraft in relation to the airmass surrounding it.

6506. The following symbol represents



1—an air position.
2—a ground track.
3—a wind vector.

6507. How is Doppler groundspeed determined?

1—By comparing the frequency from the forward beam with the frequency from the aft beam.
2—By the automatic astrotracker
3—By comparing electronic signals sent from a master station with those received from a slave station.

6508. The Doppler system provides

1—true airspeed.
2—true air temperature.
3—drift angle and groundspeed.

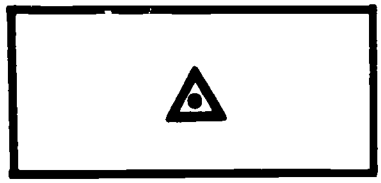
6509. Which is a basic component of an INS?

1—Antenna.
2—Accelerometer.
3—Amplifier.

6510. The key to a successful inertial system is

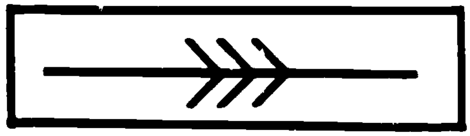
1—absolute accuracy in measuring horizontal acceleration.
2—ability to maintain a constant reference to true north.
3—synchronization of signals.

6511. The following symbol represents



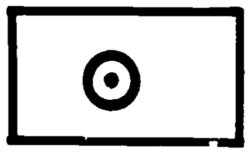
1—a DR position.
2—an air position.
3—a fix.

6512. The following symbol represents



1—an air vector.
2—an air position.
3—a wind vector.

6513. The following symbol represents



1—a DR position.
2—an air vector.
3—a wind vector.

6514. With a relative bearing of 095°, a compass heading of 303°, and a local variation of 2° west, what is the true bearing TO the NDB?

FOR (MAGNETIC)	N	30	60	E	120	150
STEER (COMPASS)	0	28	57	86	117	148
FOR (MAGNETIC)	S	210	240	W	300	330
STEER (COMPASS)	180	212	243	274	303	332

1—033°.
2—037°.
3—213°.

6515. With a relative bearing of 120°, a compass heading of 212°, and a local variation of 9° west, what is the true bearing TO the NDB?

FOR (MAGNETIC)	N	30	60	E	120	150
STEER (COMPASS)	0	28	57	86	117	148
FOR (MAGNETIC)	S	210	240	W	300	330
STEER (COMPASS)	180	212	243	274	303	332

1—141°.
2—159°.
3—321°.

6516. A Schuler-tuned inertial system

1—dampens drift input.
2—measures horizontal acceleration.
3—prevents errors caused by gravity.

6517. When the star Alpheratz is on the upper branch of an observer's meridian, what is the Local Sidereal Time?

1—0000.
2—0600.
3—1200.

Flight Navigator Problem No. 1, Part 1 — Jacksonville, Florida, to Bermuda Island — Preflight Planning.
NOTE: Flight navigator applicants must provide their own plotters, dividers, computers, flight logs, and celestial forms. They may provide their own charts (GNC 9 or equivalent) or may use a copy of the charts, figures 154, 155, 156, 157 and Celestial Charts, figures 134 through 153. The test monitor will assure that the logs, forms, and charts are free of markings that would compromise the test. The monitor will also determine that the applicant's computer is acceptable.

Instructions for Preflight Planning Problem No. 1, Part 1:

1. Zero deviation will be used, i.e., compass heading and magnetic heading are the same.
2. Preflight a trip from Jacksonville, Florida, VORTAC (30°27'N—081°33'W) to Bermuda VOR (32°21'N—064°41'W) via direct route. Estimated time of departure (EDT) is 2100Z, September 19, 1978. The flight is planned for FL190 and 200 KTAS.
3. Winds aloft are forecast as follows:
   a. 30°30'N-081°00'W — 200°, 30 knots.
   b. 31°00'N-078°30'W — 225°, 35 knots.
   c. 31°00'N-076°00'W — 245°, 20 knots.
   d. 32°00'N-071°30'W — 285°, 30 knots.
   e. 32°00'N-069°00'W — 305°, 35 knots.
   f. 32°00'N-000°30'W — 325°, 40 knots.
4. Using the forecast winds given in item 3, develop a preflight log for the following legs:
   a. Jacksonville VORTAC to 080°00'W.
   b. 080°00'W to 077°30'W.
   c. 077°30'W to 075°00'W.
   d. 075°00'W to 072°30'W.
   e. 072°30'W to 070°00'W.
   f. 070°00'W to 067°30'W.
   g. 067°30'W to Bermuda VOR.
5. Answer questions 6518 through 6521 by referring to your preflight log and calculations.

6518. (Refer to instructions 1 through 5 for Part 1.) What is the magnetic heading shown on the preflight log for the leg from 077°30'W to 075°00'W?

1—085°.
2—090°.
3—095°.

6519. (Refer to instructions 1 through 5 for Part 1.) What is the preflight groundspeed for the leg from 072°30'W to 070°00'W?

1—228 knots.
2—232 knots.
3—237 knots.

6520. (Refer to instructions 1 through 5 for Part 1.) What is the preflight ETE from Jacksonville VORTAC to Bermuda VOR?

1—3 hours 56 minutes.
2—4 hours 03 minutes.
3—4 hours 06 minutes.

6521. (Refer to instructions 1 through 5 for Part 1.) What is the preflight distance from Jacksonville VORTAC to Bermuda VOR?

1—852 NM.
2—860 NM.
3—868 NM.

Flight Navigator Problem No. 1, Part 2 — Jacksonville, Florida, to Bermuda Island — En Route.

Instructions for En Route Planning Problem No. 1, Part 2:

1. See figures 134 through 153 for required celestial data and tables.

2. Alter headings, when instructed, at specified fix positions.

3. Navigation aids:

   a. Jacksonville VORTAC — 30°27'N — 081°34'W.
   b. Johns Island NDB — 32°42'N — 080°00'W.
   c. Bermuda VOR — 32°21'N — 064°42'W.
   d. Grand Bahama NDB — 26°38'N — 078°22'W.

4 Complete the following scenario and answer the en route questions by referring to your preflight logs and calculations (Part 1)

   a. Depart Jacksonville VORTAC at 2130Z, level 19,000 feet, 200 KTAS, magnetic heading 089°.

      (1) Pressure altitude — 19,025 feet. (Assume altitude readings are taken over water.)
      (2) Absolute altitude — 20,150 feet. (Assume altitude readings are taken over water.)

   b. Compute an ETA for crossing the 80°00'W longitude on the first leg using preflight winds.

   c. Determine position at 2220Z based on the following data:

      (1) Johns Island (JZI) NDB indicates a 319° magnetic bearing to the station.
      (2) Pressure altitude — 19,000 feet.
      (3) Absolute altitude — 20,285 feet.
      (4) The Sun is observed with an HS of 10°45'.

   d. Alter heading to next position (31°24'N — 075°00'W) from the 2220Z fix position (disregard the DR position).

   e. Determine the position at 2310Z based on the following data:

      (1) Polaris is observed with an HS of 31°19' at 2306Z.
      (2) Venus is observed with an HS of 16°33' at 2310Z.
      (3) Grand Bahama (GBN) NDB indicates a 223° magnetic bearing to the station.
      (4) Pressure altitude — 19,000 feet.
      (5) Absolute altitude — 20,575 feet.

(NOTE: Expect jetstream influence on this leg.)

   f. Alter heading to next position (31°55'N — 070°00'W) from the 2310Z position (disregard the DR position).

   g. Determine the position at 0000Z based on the following data:

      (1) Alpheratz is observed with an HS of 28°11' at 0000Z.
      (2) Alkaid is observed with an HS of 27°30' at 0004Z.
      (3) Pressure altitude — 18,900 feet.
      (4) Absolute altitude — 20,760 feet.

(NOTE: Expect jetstream influence on this leg.)

   h. Alter heading to Bermuda VOR (32°21'N — 064°42'W) from the 0000Z fix position (disregard the DR position).

   i. Determine the position at 0050Z based on the following data:

      (1) Polaris is observed with an HS of 31°38' at 0046Z.
      (2) The upper limb of the Moon is observed with an HS of 03°42' at 0050Z.
      (3) Bermuda (NWU) NDB indicates 059° MB to the station.

   j. Alter heading to Bermuda VOR (32°21'N — 064°42'W from the 0050Z fix position (disregard the DR position).

k. Complete the flight log from the 0050Z fix position to Bermuda VOR.

(NOTE: This is an academic problem; therefore, the wind velocity, direction, and atmospheric pressure may not be typical for the area and the time of year.)

5. Answer questions 6522 through 6535 by referring to the in-flight log and calculations.

6522. (Refer to instructions 1 through 5 for Part 2.) After departing over the Jacksonville VORTAC, what is the ETA at 30°42'N — 080°00'W?

1—2153Z.
2—2158Z.
3—2201Z.

6523. (Refer to instructions 1 through 5 for Part 2.) What is the position of the 2220Z fix?

1—31°12'N - 078°17'W.
2—31°09'N - 078°12'W.
3—31°17'N - 078°23'W.

6524. (Refer to instructions 1 through 5 for Part 2.) What is the true course from the 2220Z fix to the next position, 31°24'N — 075°00'W?

1—076°.
2—079°.
3—086°.

6525. (Refer to instructions 1 through 5 for Part 2.) What is the distance from the 2220Z fix to the next position, 31°24'N — 075°00'W?

1—159 NM.
2—169 NM.
3—175 NM.

6526. (Refer to instructions 1 through 5 for Part 2.) What is the position of the 2310Z fix?

1—31°33'N — 074°00'W.
2—31°46'N — 074°15'W.
3—31°58'N — 074°10'W.

6527. (Refer to instructions 1 through 5 for Part 2.) What is the distance between the 2220Z fix and the 2310Z fix?

1—211 NM.
2—217 NM.
3—222 NM.

6528. (Refer to instructions 1 through 5 for Part 2.) What is the magnetic heading between the 2310Z fix and 31°55'N — 070°00'W?

1—105°.
2—110°.
3—116°.

6529. (Refer to instructions 1 through 5 for Part 2.) What is the position of the 0000Z fix?

1—31°25'N — 069°32'W.
2—31°37'N — 069°40'W.
3—31°51'N — 069°42'W.

6530. (Refer to instructions 1 through 5 for Part 2.) What is the wind between the 2310Z fix and the 0000Z fix?

1—240°, 99 knots.
2—238°, 88 knots.
3—251°, 105 knots.

6531. (Refer to instructions 1 through 5 for Part 2.) What is the ETE between the 0000Z fix and Bermuda VOR 32°21'N — 064°42'W?

1—50 minutes.
2—55 minutes.
3—60 minutes.

6532. (Refer to instructions 1 through 5 for Part 2.) What is the position of the 0050Z fix?

1—31°31'N — 065°48'W.
2—31°40'N — 065°32'W.
3—31°37'N — 065°40'W.

6533. (Refer to instructions 1 through 5 for Part 2.) What is the groundspeed between the 0000Z fix and the 0050Z fix?

1—239 knots.
2—244 knots.
3—250 knots.

6534. (Refer to instructions 1 through 5 for Part 2.) What is the true heading between the 0050Z fix and the Bermuda VOR?

1—041°.
2—046°.
3—059°.

6535. (Refer to instructions 1 through 5 for Part 2.) What is the ETA at Bermuda VOR from the 0050Z fix?

1—0051Z.
2—0058Z.
3—0107Z.

Flight Navigator Problem No. 2, Part 1 — Corpus Christi, Texas to Key West, Florida — Preflight Planning.

NOTE: Flight navigator applicants must provide their own plotters, dividers, computers, flight logs, and celestial forms. They may provide their own charts (GNC 9 or equivalent) or may use a copy of the charts in figures 154, 155, 156, 157, and Celestial Charts, figures 134 through 153. The test monitor will assure that the logs, forms, and charts are free of markings that would compromise the test. The monitor will also determine that the applicant's computer is acceptable.

Instructions for Preflight Planning Problem No. 2, Part 1:

1. Zero deviation will be used, i.e. compass heading and magnetic heading are the same.
2. Preflight a trip from Corpus Christi, Texas, VORTAC (27°54'N — 097°26'W) to Key West, Florida, VORTAC (24°35'N — 081°48'W) via direct route. Estimated time of departure (EDT) is 0900Z, September 20, 1978. The flight is planned for FL190 and 200 KTAS.
3. Winds aloft are forecast as follows:
   a. 27°30'N — 096°00'W — 310°, 25 knots.
   b. 27°30'N — 092°30'W — 290°, 30 knots.
   c. 26°00'N — 089°00'W — 270°, 35 knots.
   d. 25°30'N — 086°00'W — 260°, 35 knots.
   e. 25°00'N — 083°30'W — 250°, 40 knots.
4. Using the forecast winds given in item 3, develop a preflight log for the following legs:
   a. Corpus Christi VORTAC to 095°00'W.
   b. 095°00'W to 092°30'W.
   c. 092°30'W to 090°00'W.
   d. 090°00'W to 087°30'W.
   e. 087°30'W to 085°00'W.
   f. 085°00'W to Key West VORTAC.
5. Answer questions 6536 through 6539 by referring to the preflight log and calculations.

6536. (Refer to instructions 1 through 5 for Part 1.) What is the magnetic heading shown on the preflight log/form for the leg from 092°30'W to the 090°00'W en route to Key West VORTAC?

1—092°.
2—097°.
3—103°.

6537. (Refer to instructions 1 through 5 for Part 1.) What is the preflight groundspeed for the leg from 090°00'W to 087°30'W longitude en route to Key West?

1—225 knots.
2—229 knots.
3—234 knots.

6538. (Refer to instructions 1 through 5 for Part 1.) What is the preflight ETE from Corpus Christi VORTAC to Key West VORTAC?

1—3 hours 46 minutes.
2—3 hours 51 minutes.
3—3 hours 55 minutes.

6539. (Refer to instructions 1 through 5 for Part 1.) What is the preflight distance from Corpus Christi VORTAC to Key West VORTAC?

1—866 NM.
2—872 NM.
3—877 NM.

Flight Navigator Problem No. 2, Part 2 — Corpus Christi, Texas to Key West, Florida — En Route.

Instructions for En Route Planning Problem No. 2, Part 2:

1. See figures 134 through 153 for required celestial data and tables.
2. Alter headings, when instructed, at specified fix positions.
3. Navigation aids:
   a. Corpus Christi VORTAC — 27°54′N — 097°26′W.
   b. Brazos Santos NDB — 26°04′N — 097°09′W.
   c. Leeville VORTAC — 29°10′N — 090°06′W.
   d. Key West VORTAC — 24°35′N — 081°48′W.
   e. Sarasota VORTAC — 27°23′N — 082°33′W.
4. Complete the following scenario and answer the en route questions by referring to your preflight logs and calculations (Part 2).
   a. Depart over Corpus Christi VORTAC at 0930Z, level 19,000 feet, 200 KTAS, magnetic heading 091°.
      (1) Pressure altitude — 19,000 feet. (Assume altitude readings are taken over water.)
      (2) Absolute altitude — 20,470 feet. (Assume altitude readings are taken over water.)
   b. Compute an ETA for the 095°00′W position on the first leg using preflight winds.
   c. Determine the position at 1010Z based on the following data:
      (1) The upper limb of the Moon is observed with an HS of 70°34′ at 1006Z.
      (2) Jupiter is observed with an HS of 27°29′ at 1010Z.
      (3) Brazos Santiago NDB indicates a 235° magnetic bearing to the station.
      (4) Pressure altitude — 19,060 feet.
      (5) Absolute altitude — 20,370 feet.
   d. Alter heading to next position (26°32′N — 090°00′W) from the 1010Z fix position (disregard the DR position).
   e. Determine the position at 1100Z based on the following data:
      (1) Polaris is observed at 1100Z with an HS of 27°44′.
      (2) Pressure altitude — 19,060 feet.
      (3) Absolute altitude — 20,300 feet.
      (4) The RMI indicates the Leeville VOR 202 magnetic radial.
   f. Alter heading to the next position (26°00′N — 087°30′W) from the 1100Z fix position (disregard the DR position).
   g. Determine the position at 1150Z based on the following data:
      (1) Dubhe is observed with an HS of 28°45′ at 1146Z.
      (2) Hamal is observed with an HS of 38°29′ at 1150Z.
      (3) Sirius is observed with an HS of 45°36′ at 1154Z.
      (4) Pressure altitude — 19,150 feet.
      (5) Absolute altitude — 20,400 feet.
   h. Alter heading to the next position (25°23′N — 085°00′W) from the 1150Z fix position (disregard the DR position).
   i. Determine the position at 1240Z based on the following data:
      (1) The upper limb of the Moon is observed with an HS of 31°03′ at 1240Z.
      (2) The Sun is observed with an HS of 16°53′ at 1244Z.
      (3) Pressure altitude — 19,150 feet.
      (4) Absolute altitude — 20,625 feet.
      (5) The RMI indicates the Sarasota VOR 229 magnetic radial.
   j. Alter heading to the Key West VORTAC from the 1240Z fix position (disregard the DR position).
   k. Complete the flight log from the 1240Z fix to the Key West VORTAC.

(NOTE: This is an academic problem; therefore, the wind velocity, direction, and atmospheric pressure may not be typical for the area and the time of year.)

5. Answer questions 6540 through 6553 by referring to the in-flight log and calculations.

6540. (Refer to instructions 1 through 5 for Part 2.) After departing over the Corpus Christi VORTAC, what is the ETA over 27°30'N — 095°00'W?

1—0956Z.
2—1000Z.
3—1006Z.

6541. (Refer to instructions 1 through 5 for Part 2.) What is the position of the 1010Z fix?

1—27°03'N — 094°36'W.
2—27°11'N — 094°55'W.
3—27°24'N — 094°29'W.

6542. (Refer to instructions 1 through 5 for Part 2.) What is the true course from the 1010Z fix to the next position, 26°32'N — 090°00'W?

1—091°.
2—094°.
3—098°.

6543. (Refer to instructions 1 through 5 for Part 2.) What is the distance from the 1010Z fix to the next position, 26°32'N — 090°00'W?

1—257 NM.
2—266 NM.
3—273 NM.

6544. (Refer to instructions 1 through 5 for Part 2.) What is the position of the 1100Z fix?

1—27°09'N — 091°03'W.
2—27°05'N — 091°17'W.
3—26°59'N — 091°09'W.

6545. (Refer to instructions 1 through 5 for Part 2.) What is the distance between the 1010Z fix and the 1100Z fix?

1—190 NM.
2—204 NM.
3—219 NM.

6546. (Refer to instructions 1 through 5 for Part 2.) What is the magnetic heading between the 1100Z fix and 26°00'N — 087°30'W?

1—095°.
2—098°.
3—102°.

6547. (Refer to instructions 1 through 5 for Part 2.) What is the position of the 1150Z fix?

1—26°15'N — 087°42'W.
2—26°27'N — 087°53'W.
3—26°33'N — 087°57'W.

6548. (Refer to instructions 1 through 5 for Part 2.) What is the wind between the 1100Z fix and the 1150Z fix?

1—252°, 30 knots.
2—260°, 22 knots.
3—262°, 25 knots.

6549. (Refer to instructions 1 through 5 for Part 2.) What is the ETE between the 1150 fix and the next position, 25°23'N — 085°00'W?

1—40 minutes.
2—45 minutes.
3—49 minutes.

6550. (Refer to instructions 1 through 5 for Part 2.) What is the position of the 1240Z fix?

1—25°34'N — 084°33'W.
2—25°45'N — 084°43'W.
3—25°52'N — 084°52'W.

6551. (Refer to instructions 1 through 5 for Part 2.) What is the groundspeed between the 1150Z fix and the 1240Z fix?

1—211 knots.
2—218 knots.
3—224 knots.

6552. (Refer to instructions 1 through 5 for Part 2.) What is the true heading between the 1240Z fix and the Key West VORTAC?

1—120°.
2—125°.
3—130°.

6553. (Refer to instructions 1 through 5 for Part 2.) What is the ETA to the Key West VORTAC from over the 1240Z fix?

1—1332Z.
2—1340Z.
3—1345Z.

APPENDIX 1

DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION

SUBJECT MATTER KNOWLEDGE CODES

To determine the knowledge area in which a particular question was incorrectly answered, compare the subject matter code(s) on AC Form 8080-2, Airmen Written Test Report, to the subject matter outline that follows. The total number of test items missed may differ from the number of subject matter codes shown on the AC Form 8080-2, since you may have missed more than one question in a certain subject matter code.

FAR 1 **Definitions and Abbreviations**

A01 General Definitions
A02 Abbreviations and Symbols

FAR 23 **Airworthiness Standards: Normal, Utility, and Acrobatic Category Aircraft**

A10 General

FAR 43 **Maintenance, Preventive Maintenance, Rebuilding and Alteration**

A15 General
A16 Appendices

FAR 61 **Certification: Pilots and Flight Instructors**

A20 General
A21 Aircraft Ratings and Special Certificates
A22 Student Pilots
A23 Private Pilots
A24 Commercial Pilots
A25 Airline Transport Pilots
A26 Flight Instructors
A27 Appendix A: Practical Test Requirements for Airline Transport Pilot Certificates and Associated Class and Type Ratings
A28 Appendix B: Practical Test Requirements for Rotorcraft Airline Transport Pilot Certificates with a Helicopter Class Rating and Associated Type Ratings

FAR 63 **Certification: Flight Crewmembers Other Than Pilots**

A30 General
A31 Flight Engineers
A32 Flight Navigators

FAR 65 **Certification: Airmen Other Than Flight Crewmembers**

A40 General
A41 Aircraft Dispatchers

FAR 67 **Medical Standards and Certification**

A50 General
A51 Certification Procedures

FAR 71 **Designation of Federal Airways, Area Low Routes, Controlled Airspace, and Reporting Points**

A60 General
A61 Airport Radar Service Areas

FAR 73 **Special Use Airspace**

A70 General
A71 Restricted Areas
A72 Prohibited Areas

FAR 75 **Establishment of Jet Routes and Area High Routes**

A80 General

FAR 77 **Objects Affecting Navigable Airspace**

A90 General

FAR 91 **General Operating Rules**

B01 General
B02 Flight Rules
B03 Maintenance, Preventive Maintenance, and Alterations
B04 Large and Turbine-Powered Multiengine Airplanes
B05 Operating Noise Limits
B06 Appendix A: Category II Operations Manual, Instruments, Equipment, and Maintenance

FAR 103 **Ultralight Vehicles**

C01 General
C02 Operating Rules

FAR 108 **Airplane Operator Security**

C10 General

FAR 121 **Certification and Operations: Domestic, Flag and Supplemental Air Carriers and Commercial Operators of Large Aircraft**

D01 General
D02 Certification Rules for Domestic and Flag Air Carriers
D03 Certification Rules for Supplemental Air Carriers and Commercial Operators

D04	Rules Governing all Certificate Holders Under This Part
D05	Approval of Routes: Domestic and Flag Air Carriers
D06	Approval of Areas and Routes for Supplemental Air Carriers and Commercial Operators
D07	Manual Requirements
D08	Aircraft Requirements
D09	Airplane Performance Operating Limitations
D10	Special Airworthiness Requirements
D11	Instrument and Equipment Requirements
D12	Maintenance, Preventive Maintenance, and Alterations
D13	Airman and Crewmember Requirements
D14	Training Program
D15	Crewmember Qualifications
D16	Aircraft Dispatcher Qualifications and Duty Time Limitations: Domestic and Flag Air Carriers
D17	Flight Time Limitations and Rest Requirements: Domestic Air Carriers
D18	Flight Time Limitations: Flag Air Carriers
D19	Flight Time Limitations: Supplemental Air Carriers and Commercial Operators
D20	Flight Operations
D21	Dispatching and Flight Release Rules
D22	Records and Reports
D23	Crewmember Certificate: International
D24	Special Federal Aviation Regulation SFAR No. 14
FAR 125	**Certification and Operations: Airplanes Having a Seating Capacity of 20 or More Passengers or a Maximum Payload Capacity of 6,000 Pounds or More**
D30	General
D31	Certification Rules and Miscellaneous Requirements
D32	Manual Requirements
D33	Airplane Requirements
D34	Special Airworthiness Requirements
D35	Instrument and Equipment Requirements
D36	Maintenance
D37	Airman and Crewmember Requirements
D38	Flight Crewmember Requirements
D39	Flight Operations
D40	Flight Release Rules
D41	Records and Reports
FAR 135	**Air Taxi Operators and Commercial Operators**
E01	General
E02	Flight Operations
E03	Aircraft and Equipment
E04	VFR/IFR Operating Limitations and Weather Requirements
E05	Flight Crewmember Requirements
E06	Flight Crewmember Flight Time Limitations and Rest Requirements
E07	Crewmember Testing Requirements
E08	Training
E09	Airplane Performance Operating Limitations
E10	Maintenance, Preventive Maintenance, and Alterations
E11	Appendix A: Additional Airworthiness Standards for 10 or More Passenger Airplanes
E12	Special Federal Aviation Regulations SFAR No. 36
E13	Special Federal Aviation Regulations SFAR No. 38
FAR 143	**Certification: Ground Instructors**
F01	General
US HMR 172	**Hazardous Materials Table**
F02	General
US HMR 175	**Materials Transportation Bureau Hazardous Materials Regulations (HMR)**
G01	General Information and Regulations
G02	Loading, Unloading, and Handling
G03	Specific Regulation Applicable According to Classification of Material
NTSB 830	**Rules Pertaining to the Notification and Reporting of Aircraft Accidents or Incidents and Overdue Aircraft, and Preservation of Aircraft Wreckage, Mail, Cargo, and Records**
G10	General
G11	Initial Notification of Aircraft Accidents, Incidents, and Overdue Aircraft
G12	Preservation of Aircraft Wreckage, Mail, Cargo, and Records
G13	Reporting of Aircraft Accidents, Incidents, and Overdue Aircraft
AC 61-23	**Pilot's Handbook of Aeronautical Knowledge**
H01	Principles of Flight
H02	Airplanes and Engines
H03	Flight Instruments
H04	Airplane Performance
H05	Weather
H06	Basic Calculations Using Navigational Computers or Electronic Calculators
H07	Navigation
H08	Flight Information Publications
H09	Appendix 1: Obtaining FAA Publications
AC 91-23	**Pilot's Weight and Balance Handbook**
H10	Weight and Balance Control
H11	Terms and Definitions
H12	Empty Weight Center of Gravity
H13	Index and Graphic Limits
H14	Change of Weight
H15	Control of Loading — General Aviation
H16	Control of Loading — Large Aircraft

AC 60-14 Aviation Instructor's Handbook

H20 The Learning Process
H21 Human Behavior
H22 Effective Communication
H23 The Teaching Process
H24 Teaching Methods
H25 The Instructor as a Critic
H26 Evaluation
H27 Instructional Aids
H30 Flight Instructor Characteristics and Responsibilities
H31 Techniques of Flight Instruction
H32 Planning Instructional Activity
H40 Aircraft Maintenance Instructor Characteristics and Responsibilities
H41 Integrated Job Training
H42 Planning Aircraft Maintenance Instructional Activities
H43 Appendix

AC 61-21 Flight Training Handbook

H50 Introduction to Flight Training
H51 Introduction to Airplanes and Engines
H52 Introduction to the Basics of Flight
H53 The Effect and Use of Controls
H54 Ground Operations
H55 Basic Flight Maneuvers
H56 Airport Traffic Patterns and Operations
H57 Takeoffs and Departure Climbs
H58 Landing Approaches and Landings
H59 Faulty Approaches and Landings
H60 Proficiency Flight Maneuvers
H61 Cross-Country Flying
H62 Emergency Flight by Reference to Instruments
H63 Night Flying
H64 Seaplane Operations
H65 Transition to Other Airplanes
H66 Principles of Flight and Performance Characteristics

AC 61-13 Basic Helicopter Handbook

H70 General Aerodynamics
H71 Aerodynamics of Flight
H72 Loads and Load Factors
H73 Function of the Controls
H74 Other Helicopter Components and Their Functions
H75 Introduction to the Helicopter Flight Manual
H76 Weight and Balance
H77 Helicopter Performance
H78 Some Hazards of Helicopter Flight
H79 Precautionary Measures and Critical Conditions
H80 Helicopter Flight Maneuvers
H81 Confined Area, Pinnacle, and Ridgeline Operations
H82 Glossary

Gyroplane Flight Training Manual

H90 Gyroplane Systems
H91 Gyroplane Terms
H92 Use of Flight Controls (Gyroplane)
H93 Fundamental Maneuvers of Flight (Gyroplane)
H94 Basic Flight Maneuvers (Gyroplane)

AC 61-27 Instrument Flying Handbook

I01 Training Considerations
I02 Instrument Flying: Coping with Illusions in Flight
I03 Aerodynamic Factors Related to Instrument Flying
I04 Basic Flight Instruments
I05 Attitude Instrument Flying — Airplanes
I06 Attitude Instrument Flying — Helicopters
I07 Electronic Aids to Instrument Flying
I08 Using the Navigation Instruments
I09 Radio Communications Facilities and Equipment
I10 The Federal Airways System and Controlled Airspace
I11 Air Traffic Control
I12 ATC Operations and Procedures
I13 Flight Planning
I14 Appendix: Instrument Instructor Lesson Guide — Airplanes
I15 Segment of En Route Low Altitude Chart

AC 00-6 Aviation Weather

I20 The Earth's Atmosphere
I21 Temperature
I22 Atmospheric Pressure and Altimetry
I23 Wind
I24 Moisture, Cloud Formation, and Precipitation
I25 Stable and Unstable Air
I26 Clouds
I27 Air Masses and Fronts
I28 Turbulence
I29 Icing
I30 Thunderstorms
I31 Common IFR Producers
I32 High Altitude Weather
I33 Arctic Weather
I34 Tropical Weather
I35 Soaring Weather
I36 Glossary of Weather Terms

AC 00-45 Aviation Weather Services

I40 The Aviation Weather Service Program
I41 Surface Aviation Weather Reports
I42 Pilot and Radar Reports and Satellite Pictures
I43 Aviation Weather Forecasts
I44 Surface Analysis Chart
I45 Weather Depiction Chart
I46 Radar Summary Chart
I47 Significant Weather Prognostics
I48 Winds and Temperatures Aloft

I49	Composite Moisture Stability Chart
I50	Severe Weather Outlook Chart
I51	Constant Pressure Charts
I52	Tropopause Data Chart
I53	Tables and Conversion Graphs

AIM **Airman's Information Manual**

J01	Air Navigation Radio Aids
J02	Radar Services and Procedures
J03	Airport Lighting Aids
J04	Air Navigation and Obstruction Lighting
J05	Airport Marking Aids
J06	Airspace — General
J07	Uncontrolled Airspace
J08	Controlled Airspace
J09	Special Use Airspace
J10	Other Airspace Areas
J11	Service Available to Pilots
J12	Radio Communications Phraseology and Techniques
J13	Airport Operations
J14	ATC Clearance/Separations
J15	Preflight
J16	Departure Procedures
J17	En Route Procedures
J18	Arrival Procedures
J19	Pilot/Controller Roles and Responsibilities
J20	National Security and Interception Procedures
J21	Emergency Procedures — General
J22	Emergency Services Available to Pilots
J23	Distress and Urgency Procedures
J24	Two-Way Radio Communications Failure
J25	Meteorology
J26	Altimeter Setting Procedures
J27	Wake Turbulence
J28	Bird Hazards, and Flight Over National Refuges, Parks, and Forests
J29	Potential Flight Hazards
J30	Safety, Accident, and Hazard Reports
J31	Fitness for Flight
J32	Type of Charts Available
J33	Pilot Controller Glossary
J34	Airport/Facility Directory
J35	En Route Low Altitude Chart
J36	En Route High Altitude Chart
J37	Sectional Chart
J38	WAC Chart
J39	Terminal Area Chart
J40	Standard Instrument Departure (SID) Chart
J41	Standard Terminal Arrival (STAR) Chart
J42	Instrument Approach Procedures
J43	Helicopter Route Chart

AC 67-2 **Medical Handbook for Pilots**

J50	The Flyer's Environment
J51	The Pressure is On
J52	Hypoxia
J53	Hyperventilation
J54	The Gas in the Body
J55	The Ears
J56	Alcohol
J57	Drugs and Flying
J58	Carbon Monoxide
J59	Vision
J60	Night Flight
J61	Cockpit Lighting
J62	Disorientation (Vertigo)
J63	Motion Sickness
J64	Fatigue
J65	Noise
J66	Age
J67	Some Psychological Aspects of Flying
J68	The Flying Passenger

ADDITIONAL ADVISORY CIRCULARS

K01	AC 00-24, Thunderstorms
K02	AC 00-30, Rules of Thumb for Avoiding or Minimizing Encounters with Clear Air Turbulence
K03	AC 00-34, Aircraft Ground Handling and Servicing
K04	AC 00-50, Low Level Wind Shear
K10	AC 20-5, Plane Sense
K11	AC 20-29, Use of Aircraft Fuel Anti-icing Additives
K12	AC 20-32, Carbon Monoxide (CO) Contamination in Aircraft — Detection and Prevention
K13	AC 20-43, Aircraft Fuel Control
K14	AC 20-64, Maintenance Inspection Notes for Lockheed L-188 Series Aircraft
K15	AC 20-76, Maintenance Inspection Notes for Boeing B-707/720 Series Aircraft
K16	AC 20-78, Maintenance Inspection Notes for McDonnell Douglas DC-8 Series Aircraft
K17	AC 20-84, Maintenance Inspection Notes for Boeing B-727 Series Aircraft
K18	AC 20-99, Antiskid and Associated Systems
K19	AC 20-101, Omega and Omega/VLF Navigation Systems Approvals for Use in the Conterminous United States and Alaska
K20	AC 20-103, Aircraft Engine Crankshaft Failure
K21	AC 20-106, Aircraft Inspection for the General Aviation Aircraft Owner
K22	AC 20-113, Pilot Precautions and Procedures to be Taken in Preventing Aircraft Reciprocating Engine Induction System and Fuel System Icing Problems
K23	AC 20-121, Airworthiness Approval of Airborne Loran-C Systems for Use in the U.S. National Airspace System
K24	AC 20-125, Water in Aviation Fuels
K30	AC 23.679-1, Control System Locks
K31	AC 23.1521-1, Approval of Automobile Gasoline (Autogas) in Lieu of Aviation Gasoline (Avgas) in Small Airplanes with Reciprocating Engines
K40	AC 25-4, Inertial Navigation Systems (INS)
K41	AC 25.253-1, High-Speed Characteristics
K50	AC 29-2, Certification of Transportation Category Rotorcraft

K60 AC 33.65-1, Surge and Stall Characteristics of Aircraft Turbine Engines
K70 AC 43-9, Maintenance Records
K71 AC 43-12, Preventive Maintenance
K80 AC 60-4, Pilot's Spatial Disorientation
K81 AC 60-6, Airplane Flight Manuals (AFM), Approved Manual Materials, Markings, and Placards — Airplanes
K90 AC 60-12, Availability of Industry-Developed Guidelines for the Conduct of the Biennial Flight Review
L01 AC 61-9, Pilot Transition Courses for Complex Single-Engine and Light, Twin-Engine Airplanes
L02 AC 61-10, Private and Commercial Pilots Refresher Courses
L03 AC 61-12, Student Pilot Guide
L04 AC 61-47, Use of Approach Slope Indicators for Pilot Training
L05 AC 61-65, Certification: Pilot and Flight Instructors
L06 AC 61-66, Annual Pilot In Command Proficiency Checks
L07 AC 61-67, Hazards Associated with Spins in Airplanes Prohibited from Intentional Spinning
L08 AC 61-84, Role of Preflight Preparation
L09 AC 61-89, Pilot Certificates: Aircraft Type Ratings
L10 AC 61-92, Use of Distractions During Pilot Certification Flight Tests
L11 AC 61-94, Pilot Transition Course for Self-Launching or Powered Sailplanes (Motor gliders)
L20 AC 67-1, Medical Information for Air Ambulance Operators
L30 AC 90-23, Aircraft Wake Turbulence
L31 AC 90-34, Accidents Resulting from Wheelbarrowing in Tricycle-Gear Equipped Aircraft
L32 AC 90-42, Traffic Advisory Practices at Nontower Airports
L33 AC 90-45, Approval of Area Navigation Systems for Use in the U.S. National Airspace System
L34 AC 90-48, Pilots' Role in Collision Avoidance
L35 AC 90-58, VOR Course Errors Resulting from 50 kHz Channel Mis-Selection
L36 AC 90-66, Recommended Standard Traffic Patterns for Airplane Operations at Uncontrolled Airports
L37 AC 90-67, Light Signals from the Control Tower for Ground Vehicles, Equipment, and Personnel
L38 AC 90-79, Recommended Practices and Procedures for the Use of Electronic Long Range Navigation Equipment
L39 AC 90-82, Random Area Navigation Routes
L40 AC 90-83, Terminal Control Areas (TCA)
L41 AC 90-85, Severe Weather Avoidance Plan (SWAP)
L42 AC 90-87, Helicopter Dynamic Rollover
L43 AC 90-88, Airport Radar Service Area (ARSA)
L50 AC 91-6, Water, Slush, and Snow on the Runway
L51 AC 91-8, Use of Oxygen by Aviation Pilots/Passengers
L52 AC 91-13, Cold Weather Operation of Aircraft
L53 AC 91-14, Altimeter Setting Sources
L54 AC 91-16, Category II Operations — General Aviation Airplanes
L55 AC 91-32, Safety In and Around Helicopters
L56 AC 91-42, Hazards of Rotating Propeller and Helicopter Rotor Blades
L57 AC 91-43, Unreliable Airspeed Indications
L58 AC 91-44, Operational and Maintenance Practices for Emergency Locator Transmitters and Receivers
L59 AC 91-46, Gyroscopic Instruments — Good Operating Practices
L60 AC 91-49, General Aviation Procedures for Flight in North Atlantic Minimum Navigation Performance Specifications Airspace
L61 AC 91-50, Importance of Transponder Operation and Altitude Reporting
L62 AC 91-51, Airplane Deice and Anti-Ice Systems
L63 AC 91-53, Noise Abatement Departure Profile
L64 AC 91-55, Reduction of Electrical System Failures Following Aircraft Engine Starting
L65 AC 91-58, Use of Pyrotechnic Visual Distress Signaling Devices in Aviation
L66 AC 91-64, Use of Remote Altimeter Settings Instrument Approach Procedures
L67 AC 91-83, Canceling or Closing Flight Plans
L70 AC 97-1, Runway Visual Range (RVR)
L80 AC 103-4, Hazard Associated with Sublimation of Solid Carbon Dioxide (Dry Ice) Aboard Aircraft
L81 AC 103-6, Ultralight Vehicle Operations Airports, ATC, and Weather
L82 AC 103-7, The Ultralight Vehicle
M01 AC 120-12, Private Carriage Versus Common Carriage of Persons or Property
M02 AC 120-27, Aircraft Weight and Balance Control
M03 AC 120-29 Criteria for Approving Category I and Category II Landing Minima for FAR 121 Operators
M04 AC 120-32, Air Transportation of Handicapped Persons
M10 AC 121-6, Portable Battery-Powered Megaphones
M11 AC 121-24, Passenger Safety Information Briefing and Briefing Cards
M12 AC 121-25, Additional Weather Information: Domestic and Flag Air Carriers
M13 AC 121-195, Alternate Operational Landing Distances for Wet Runways; Turbojet Powered Transport Category Airplanes

M20	AC 125-1, Operations of Large Airplanes Subject to Federal Aviation Regulations Part 125
M30	AC 135-3, Air Taxi Operators and Commercial Operators
M31	AC 135-9, FAR Part 135 Icing Limitations
M32	AC 135-12, Passenger Information, FAR Part 135: Passenger Safety Information Briefing and Briefing Cards
M40	AC 150/5345-28, Precision Approach Path Indicator (PAPI) Systems
M50	AC 20-34, Prevention of Retractable Landing Gear Failures
M51	AC 20-117,Hazards Following Ground Deicing and Ground Operations in Conditions Conducive to Aircraft Icing

American Soaring Handbook — Gliders

N01	A History of American Soaring
N02	Training
N03	Ground Launch
N04	Airplane Tow
N05	Meteorology
N06	Cross-Country and Wave Soaring
N07	Instruments and Oxygen
N08	Radio, Rope, and Wire
N09	Aerodynamics
N10	Maintenance and Repair

Soaring Flight Manual — Gliders

N20	Sailplane Aerodynamics
N21	Performance Considerations
N22	Flight Instruments
N23	Weather for Soaring
N24	Medical Factors
N25	Flight Publications and Airspace
N26	Aeronautical Charts and Navigation
N27	Computations for Soaring
N28	Personal Equipment
N29	Preflight and Ground Operations
N30	Aerotow Launch Procedures
N31	Ground Launch Procedures
N32	Basic Flight Maneuvers and Traffic Patterns
N33	Soaring Techniques
N34	Cross-Country Soaring

Taming The Gentle Giant — Balloons

O01	Design and Construction of Balloons
O02	Fuel Source and Supply
O03	Weight and Temperature
O04	Flight Instruments
O05	Balloon Flight Tips
O06	Glossary

Balloon Federation Of America — Flight Instructor Manual

O10	Flight Instruction Aids
O11	Human Behavior and Pilot Proficiency
O12	The Flight Check and the Designated Examiner

The Balloon Federation Of America Handbook — Propane Systems

O20	Propane Glossary
O21	Chemical and Physical Systems
O22	Cylinders
O23	Lines and Fittings
O24	Valves
O25	Regulators
O26	Burners
O27	Propane Syste — Schematics
O28	Propane References

The Balloon Federation Of America Handbook — Avoiding Powerline Accidents

O30	Excerpts

Balloon Flight Manual

O40	Excerpts

Airship Operations Manual

P01	Buoyancy
P02	Aerodynamics
P03	Free Ballooning
P04	Aerostatics
P05	Envelope
P06	Car
P07	Powerplant
P08	Airship Ground Handling
P09	Operating Instructions
P10	History

International Flight Information Manual

Q01	Passport and Visa
Q02	International NOTAM Availability and Distribution
Q03	National Security
Q04	International Interception Procedures
Q05	Intercept Pattern for Identification of Transport Aircraft
Q06	Flight Planning Notes
Q07	North Atlantic Minimum Navigation Requirements
Q08	North American Routes for North Atlantic Traffic
Q09	U.S. Aeronautical Telecommunications Services
Q10	Charts and Publications for Flights Outside the U.S.
Q11	Oceanic Long-Range Navigation Information

Aerodynamics For Naval Aviators, NAVWEPS 00-80T-80

R01	Wing and Airfoil Forces
R02	Planform Effects and Airplane Drag
R10	Required Thrust and Power
R11	Available Thrust and Power
R12	Items of Airplane Performance
R21	General Concepts and Supersonic Flow Patterns
R22	Configuration Effects

R31 Definitions
R32 Longitudinal Stability and Control
R33 Directional Stability and Control
R34 Lateral Stability and Control
R35 Miscellaneous Stability Problems
R40 General Definitions and Structural Requirements
R41 Aircraft Loads and Operating Limitations
R50 Application of Aerodynamics to Specific Problems of Flying

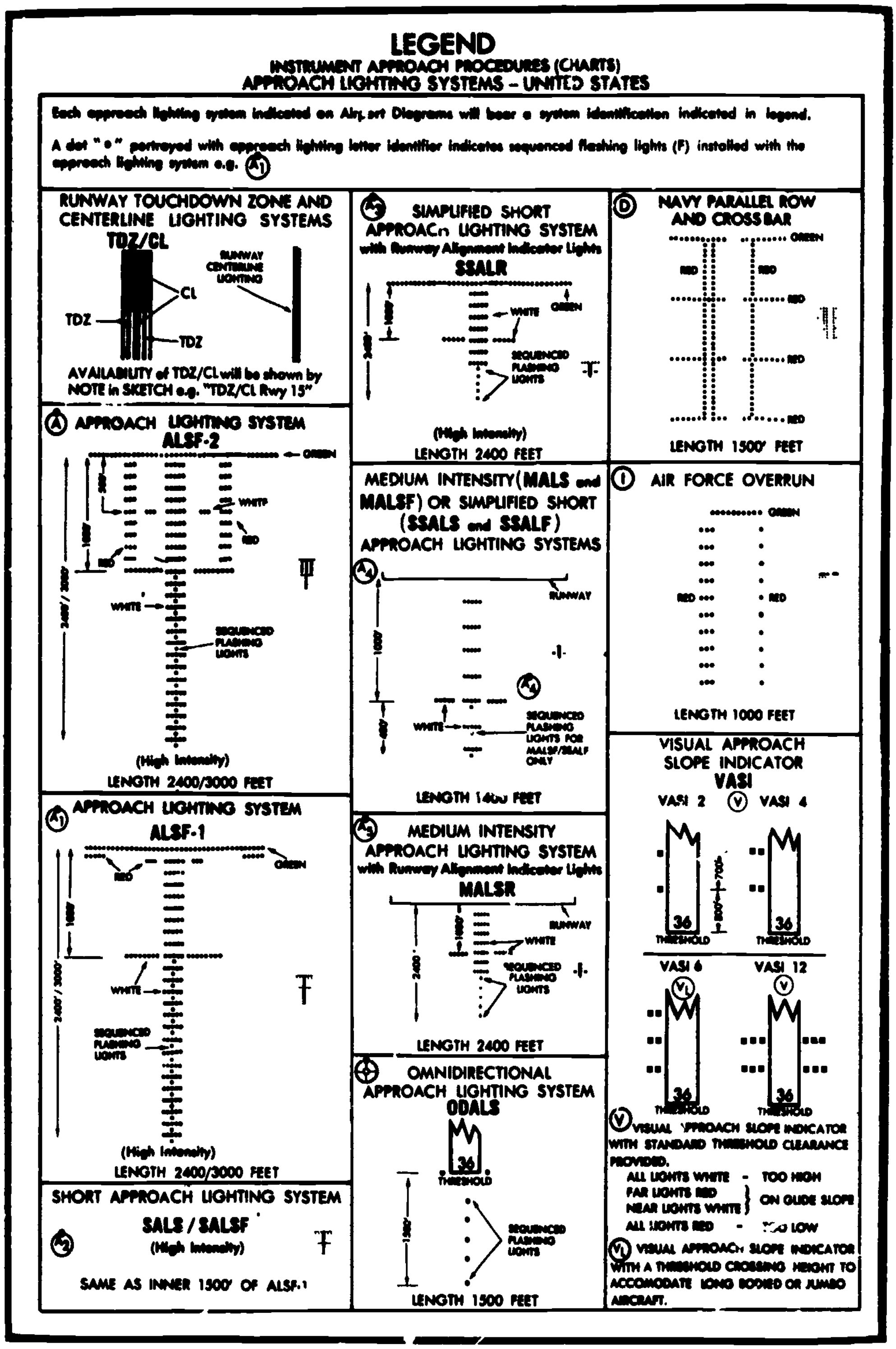
Transport Airplane Operations Manual

S01 Reserved
T01 Reserved
U01 Reserved
V01 Reserved
W01 Reserved
X01 Reserved
Y01 Reserved
Z01 Visual Flight Rules Chart Users Guide
Z02 Pilot's Guide to IVRS

NOTE: Most of the references and study materials listed in these subject matter knowledge codes are available through government outlets such as U.S. Government Printing Office bookstores. AC 00-2, Advisory Circular Checklist, transmits the status of all FAA AC's (advisory circulars), as well as FAA internal publications and miscellaneous flight information such as AIM, Airport/Facility Directory, written test question books, practical test standards, and other material directly related to a certificate or rating. To obtain a free copy of the AC 00-2, send your request to:

U.S. Department of Transportation
Utilization and Storage Section, M-443.2
Washington, DC 20590

APPENDIX 2



LEGEND 1.—Instrument Approach Procedures Chart (Approach Lighting Systems).

7295 Julian Date of Last Revision GENERAL INFORMATION & ABBREVIATIONS

* Indicates control tower or ATIS operates non-continuously, or non-standard Pilot Controlled Lighting.
Distances in nautical miles (except visibility in statute miles and Runway Visual Range in hundreds of feet).
Runway Dimensions in feet. Elevations in feet Mean Sea Level (MSL). Ceilings in feet above airport elevation.
Radials/bearings/headings/courses are magnetic
\# Indicates control tower temporarily closed UFN.

ADF	Automatic Direction Finder
ALS	Approach Light System
ALSF	Approach Light System with Sequenced Flashing Lights
APP CON	Approach Control
ARR	Arrival
ASR/PAR	Published Radar Minimums at this Airport
ATIS	Automatic Terminal Information Service
AWOS	Automated Weather Observing System
AZ	Azimuth
BC	Back Course
C	Circling
CAT	Category
CCW	Counter Clockwise
Chan	Channel
CLNC DEL	Clearance Delivery
CTAF	Common Traffic Advisory Frequency
CW	Clockwise
DH	Decision Heights
DME	Distance Measuring Equipment
DR	Dead Reckoning
ELEV	Elevation
FAF	Final Approach Fix
FM	Fan Marker
GPI	Ground Point of Interception
GS	Glide Slope
HAA	Height Above Airport
HAL	Height Above Landing
HAT	Height Above Touchdown
HIRL	High Intensity Runway Lights
IAF	Initial Approach Fix
ICAO	International Civil Aviation Organization
IM	Inner Marker
Intcp	Intercept
INT	Intersection
LDA	Localizer Type Directional Aid
Ldg	Landing
LDIN	Lead in Light System
LIRL	Low Intensity Runway Lights
LOC	Localizer
LR	Lead Radial. Provides at least 2 NM (Copter 1 NM) of lead to assist in turning onto the intermediate/final course
MALS	Medium Intensity Approach Light System
MALSR	Medium Intensity Approach Light Systems with RAIL
MAP	Missed Approach Point
MDA	Minimum Descent Altitude
MIRL	Medium Intensity Runway Lights
MLS	Microwave Landing System
MM	Middle Marker
NA	Not Authorized
NDB	Non-directional Radio Beacon
NM	Nautical Miles
NoPT	No Procedure Turn Required (Procedure Turn shall not be executed without ATC clearance)
ODALS	Omnidirectional Approach Light System
OM	Outer Marker
R	Radial
RA	Radio Altimeter setting height
Radar Required	Radar vectoring required for this approach
RAIL	Runway Alignment Indicator Lights
RBn	Radio Beacon
RCLS	Runway Centerline Light System
REIL	Runway End Identifier Lights
RNAV	Area Navigation
RPI	Runway Point of Intercept(ion)
RRL	Runway Remaining Lights
Runway Touchdown Zone	First 3000' of Runway
Rwy	Runway
RVR	Runway Visual Range
S	Straight-in
SALS	Short Approach Light System
SSALR	Simplified Short Approach Light System with RAIL
SDF	Simplified Directional Facility
TA	Transition Altitude
TAC	TACAN
TCH	Threshold Crossing Height (height in feet Above Ground Level)
TDZ	Touchdown Zone
TDZE	Touchdown Zone Elevation
TDZ/CL	Touchdown Zone and Runway Centerline Lighting
TDZL	Touchdown Zone Lights
TLv	Transition Level
VASI	Visual Approach Slope Indicator
VDP	Visual Descent Point
WPT	Waypoint (RNAV)
X	Radar Only Frequency

PILOT CONTROLLED AIRPORT LIGHTING SYSTEMS

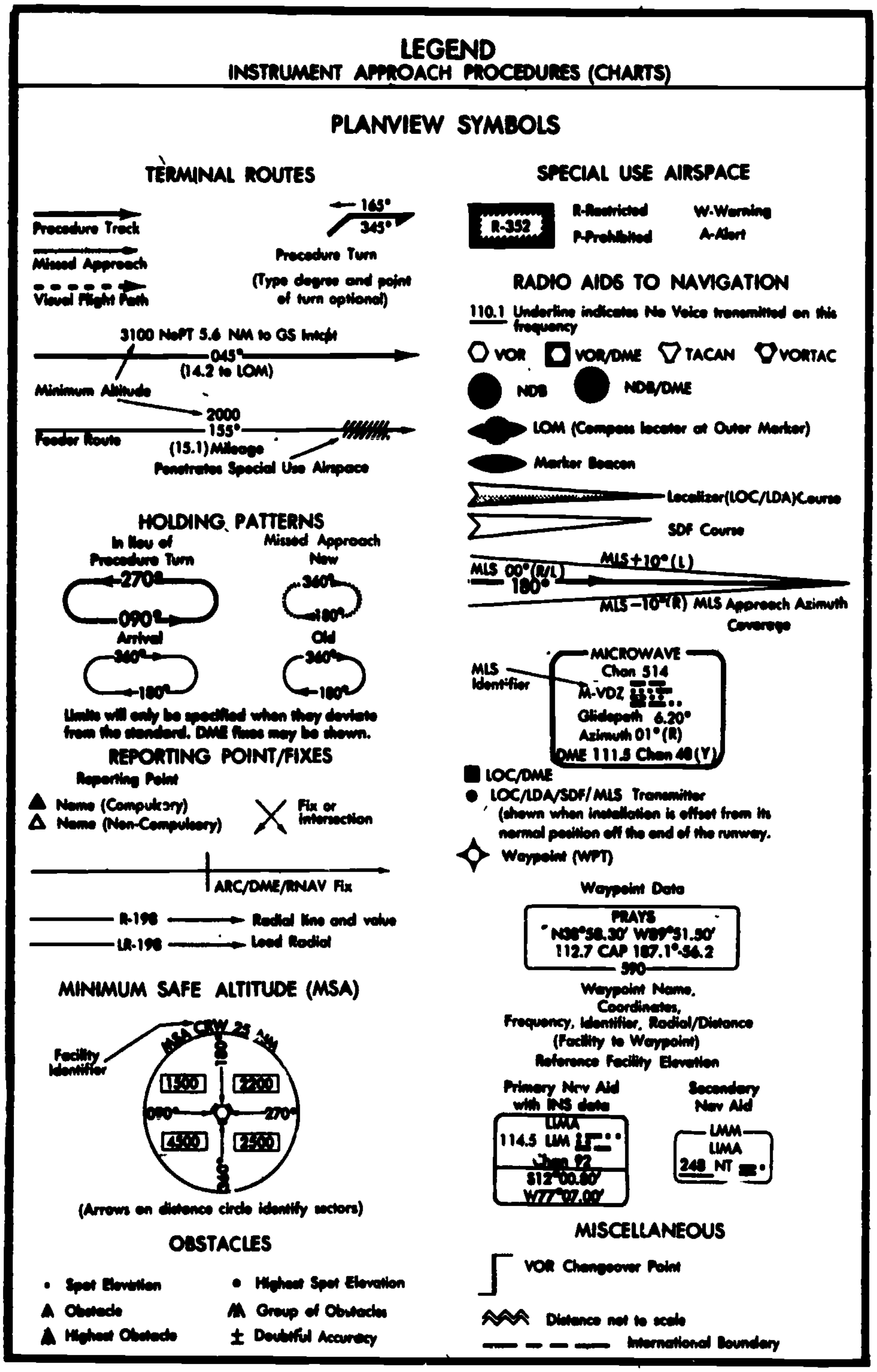
Available pilot controlled lighting (PCL) systems are indicated as follows:

1. Approach lighting systems that bear a system identification are symbolized using negative symbology, e.g.,
2. Approach lighting systems that do not bear a system identification are indicated with a negative " " beside the name

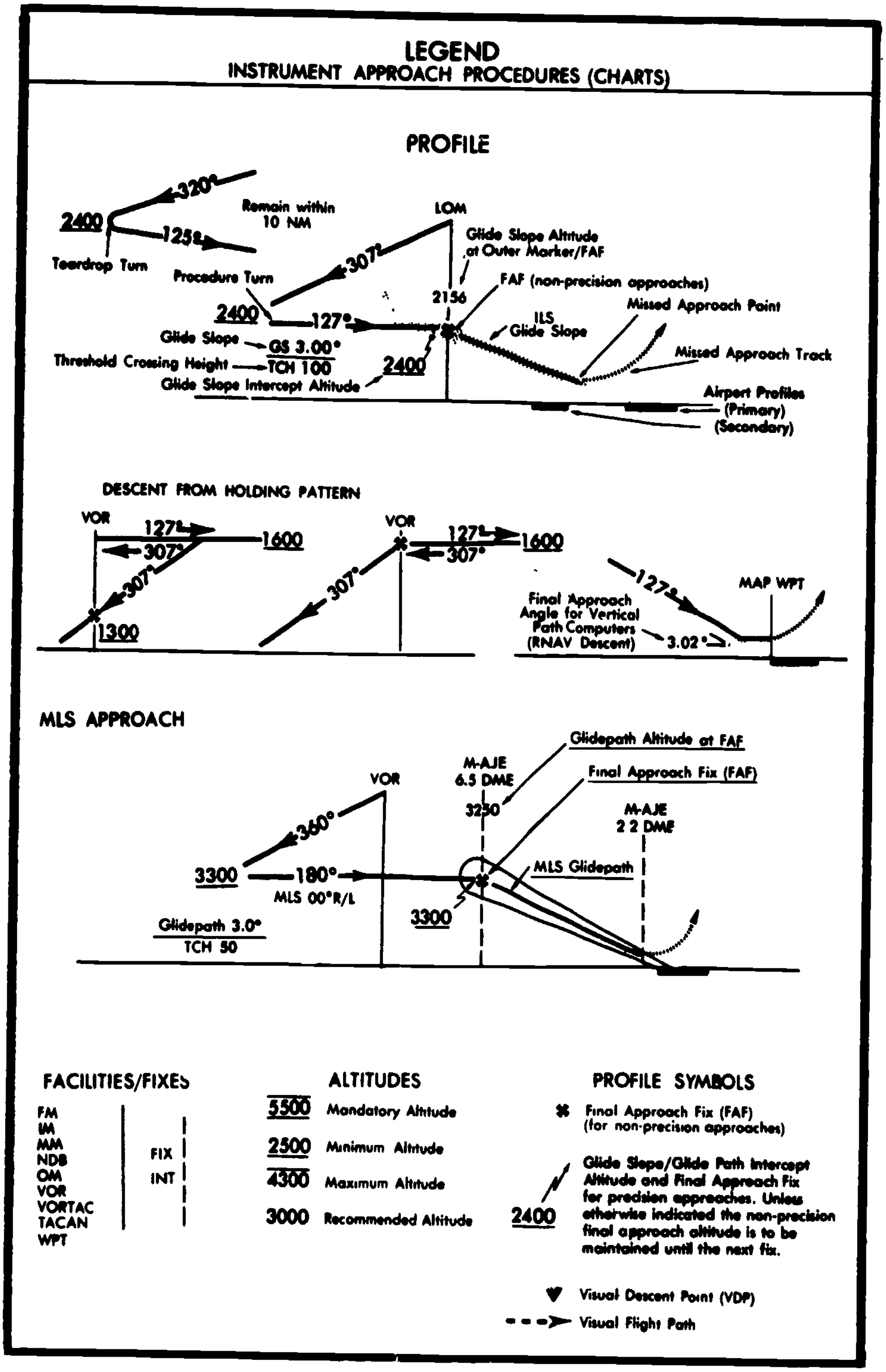
A star (*) indicates non-standard PCL, consult Directory/Supplement, e.g.,
To activate lights use frequency indicated in the communication section of the chart with a or the appropriate lighting system identification e.g., UNICOM 122.8 , ,

KEY MIKE	FUNCTION
7 times within 5 seconds	Highest intensity available
5 times within 5 seconds	Medium or lower intensity (Lower REIL or REIL-off)
3 times within 5 seconds	Lowest intensity available (Lower REIL or REIL-off)

LEGEND 2.—General Information and Abbreviations.



LEGEND 3.—Instrument Approach Procedures Chart (Planview).



LEGEND 4.—Instrument Approach Procedures Chart (Profile).

LEGEND
INSTRUMENT APPROACH PROCEDURES (CHARTS)

AIRPORT DIAGRAM/AIRPORT SKETCH

Runways

Hard Surface · Other Than Hard Surface · Overruns, Taxiways, Parking Areas · Displaced Threshold

Closed Runways · Closed Taxiways · Under Construction · Metal Surface · Runway Centerline Lighting

Arresting Gear

uni-directional · bi-directional · Jet Barrier

Helicopter Alighting Areas

Negative Symbols used to identify Copter Procedure landing point............

Runway TDZ elevation .... TDZE 123

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

■ 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.

REFERENCE FEATURES

Buildings ....

Tanks ....

Obstruction ....

Airport Beacon # ....

Runway Radar Reflectors..........................

Control Tower # ....

When Control Tower and Rotating Beacon are co-located, Beacon symbol will be used and further identified as TWR.

Approach light symbols are shown on a separate legend.

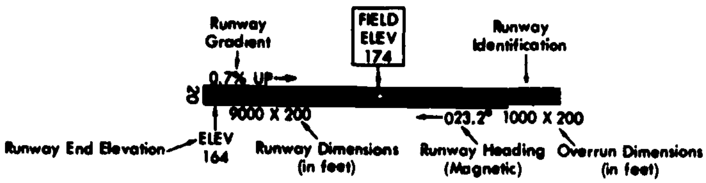
Airport diagram scales are variable

True/magnetic North orientation may vary from diagram to diagram.

Coordinate values are shown in 1' or ½ minute increments. They are further broken down into 6 second ticks, within each 1 minute increment.

Positional accuracy within ±600 feet unless otherwise noted on the chart

NOTE:
Airport diagrams that are referenced to the World Geodetic System (WGS) (noted on appropriate diagram), may not be compatible with local coordinates published in FLIP.



GENERAL INFORMATION (NOS)
SCOPE

Airport diagrams are specifically designed to assist in the movement of ground traffic at locations with complex runway/taxiway configurations and provide information for updating Inertial Navigation Systems (INS) aboard aircraft. Airport diagrams are not intended to be used for approach and landing or departure operations. Requisition for the creation of airport diagrams must meet the above criteria and will be approved by the FAA or DOD on a case-by-case basis.

MINIMA DATA

▲ Alternate Minimums not standard. Civil users refer to tabulation USA/USN/USAF pilots refer to appropriate regulations.

▲NA Alternate minimums are Not Authorized due to unmonitored facility or absence of weather reporting service.

▼ Take-off Minimums not standard and/or Departure Procedures are published. Refer to tabulation.

LEGEND 5.—Instrument Approach Procedures Chart (Airport Diagram).

INSTRUMENT APPROACH PROCEDURE CHARTS
RATE OF DESCENT TABLE
(ft. per min.)

A rate of descent table is provided for use in planning and executing precision descents under known or approximate ground speed conditions. It will be especially useful for approaches when the localizer only is used for course guidance. A best speed, power, attitude combination can be programmed which will result in a stable glide rate and attitude favorable for executing a landing if minimums exist upon breakout. Care should always be exercised so that the minimum descent altitude and missed approach point are not exceeded.

ANGLE OF DESCENT (degrees and tenths)	GROUND SPEED (knots)										
	30	45	60	75	90	105	120	135	150	165	180
2.0	105	160	210	265	320	370	425	475	530	585	635
2.5	130	200	265	330	395	465	530	595	665	730	795
3.0	160	240	320	395	480	555	635	715	795	875	955
3.5	185	280	370	465	555	650	740	835	925	1020	1110
4.0	210	315	425	530	635	740	845	955	1060	1165	1270
4.5	240	355	475	595	715	835	955	1075	1190	1310	1430
5.0	265	395	530	660	795	925	1060	1190	1325	1455	1590
5.5	290	435	580	730	875	1020	1165	1310	1455	1600	1745
6.0	315	475	635	795	955	1110	1270	1430	1590	1745	1905
6.5	345	515	690	860	1030	1205	1375	1550	1720	1890	2065
7.0	370	555	740	925	1110	1295	1480	1665	1850	2035	2220
7.5	395	595	795	990	1190	1390	1585	1785	1985	2180	2380
8.0	425	635	845	1055	1270	1480	1690	1905	2115	2325	2540
8.5	450	675	900	1120	1345	1570	1795	2020	2245	2470	2695
9.0	475	715	950	1190	1425	1665	1900	2140	2375	2615	2855
9.5	500	750	1005	1255	1505	1755	2005	2255	2510	2760	3010
10.0	530	790	1055	1320	1585	1845	2110	2375	2640	2900	3165
10.5	555	830	1105	1385	1660	1940	2215	2490	2770	3045	3320
11.0	580	870	1160	1450	1740	2030	2320	2610	2900	3190	3480
11.5	605	910	1210	1515	1820	2120	2425	2725	3030	3335	3635
12.0	630	945	1260	1575	1890	2205	2520	2835	3150	3465	3780

LEGEND 6.—Rate-of-Descent Table.

INSTRUMENT TAKEOFF PROCEDURE CHARTS
RATE OF CLIMB TABLE
(ft. per min.)

A rate of climb table is provided for use in planning and executing takeoff procedures under known or approximate ground speed conditions.

REQUIRED CLIMB RATE (ft. per NM)	GROUND SPEED (KNOTS) 30	60	80	90	100	120	140
200	100	200	267	300	333	400	467
250	125	250	333	375	417	500	583
300	150	300	400	450	500	600	700
350	175	350	467	525	583	700	816
400	200	400	533	600	667	800	933
450	225	450	600	675	750	900	1050
500	250	500	667	750	833	1000	1167
550	275	550	733	825	917	1100	1283
600	300	600	800	900	1000	1200	1400
650	325	650	867	975	1083	1300	1516
700	350	700	933	1050	1167	1400	1633

REQUIRED CLIMB RATE (ft. per NM)	GROUND SPEED (KNOTS) 150	180	210	240	270	300
200	500	600	700	800	900	1000
250	625	750	875	1000	1125	1250
300	750	900	1050	1200	1350	1500
350	875	1050	1225	1400	1575	1750
400	1000	1200	1400	1600	1700	2000
450	1125	1350	1575	1800	2025	2250
500	1250	1500	1750	2000	2250	2500
550	1375	1650	1925	2200	2475	2750
600	1500	1800	2100	2400	2700	3000
650	1625	1950	2275	2600	2925	3250
700	1750	2100	2450	2800	3150	3500

LEGEND 7.—Rate-of-Climb Table.

Instrument Approach Procedures (Charts)
INOPERATIVE COMPONENTS OR VISUAL AIDS TABLE

Landing minimums published on instrument approach procedure charts are based upon full operation of all components and visual aids associated with the particular instrument approach chart being used. Higher minimums are required with inoperative components or visual aids as indicated below. If more than one component is inoperative, each minimum is raised to the highest minimum required by any single component that is inoperative. ILS glide slope inoperative minimums are published on instrument approach charts as localizer minimums. This table may be amended by notes on the approach chart. Such notes apply only to the particular approach category(ies) as stated. See legend page for description of components indicated below.

(1) ILS, MLS, and PAR

Inoperative Component or Aid	Approach Category	Increase DH	Increase Visibility
MM*	ABC	50 feet	None
MM*	D	50 feet	¼ mile
ALSF 1 & 2, MALSR, & SSALR	ABCD	None	¼ mile

*Not applicable to PAR

(2) ILS with visibility minimum of 1,800 or 2,000 RVR.

MM	ABC	50 feet	To 2400 RVR
MM	D	50 feet	To 4000 RVR
ALSF 1 & 2, MALSR, & SSALR	ABCD	None	To 4000 RVR
TDZL, RCLS	ABCD	None	To 2400 RVR
RVR	ABCD	None	To ½ mile

(3) VOR, VOR/DME, VORTAC, VOR (TAC), VOR/DME (TAC), LOC, LOC/DME, LDA, LDA/DME, SDF, SDF/DME, RNAV, and ASR

Inoperative Visual Aid	Approach Category	Increase MDA	Increase Visibility
ALSF 1 & 2, MALSR, & SSALR	ABCD	None	½ mile
SSALS, MALS & ODALS	ABC	None	¼ mile

(4) NDB

ALSF 1 & 2, MALSR, & SSALR	C	None	½ mile
	ABD	None	¼ mile
MALS, SSALS, ODALS	ABC	None	¼ mile

LEGEND 8.—Inoperative Components or Visual Aids Table.

INSTRUMENT APPROACH PROCEDURES EXPLANATION OF TERMS

The United States Standard for Terminal Instrument Procedures (TERPS) is the approved criteria for formulating instrument approach procedures.

AIRCRAFT APPROACH CATEGORIES

Speeds are based on 1.3 times the stall speed in the landing configuration at maximum gross landing weight. An aircraft shall fit in only one category. If it is necessary to maneuver at speeds in excess of the upper limit of a speed range for a category, the minimums for the next higher category should be used. For example, an aircraft which falls in Category A, but is circling to land at a speed in excess of 91 knots, should use the approach Category B minimums when circling to land. See following category limits:

MANEUVERING TABLE

Approach Category	A	B	C	D	E
Speed (Knots)	0-90	91-120	121-140	141-165	Abv 165

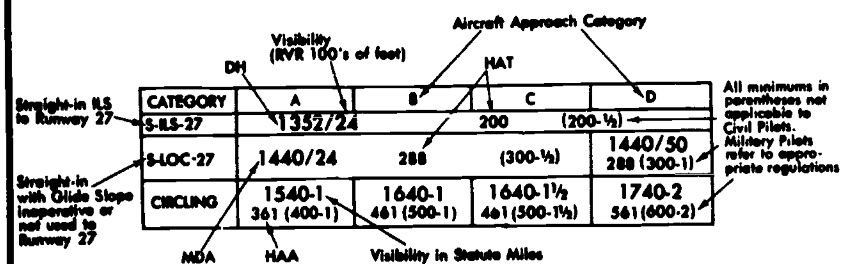
RVR/Meteorological Visibility Comparable Values

The following table shall be used for converting RVR to meteorological visibility when RVR is not reported for the runway of intended operation. Adjustment of landing minima may be required – see Inoperative Components Table.

RVR (feet)	Visibility (statute miles)	RVR (feet)	Visibility (statute miles)
1600	1/4	4500	7/8
2400	1/2	5000	1
3200	5/8	6000	1 1/4
4000	3/4		

LANDING MINIMA FORMAT

In this example airport elevation is 1179, and runway touchdown zone elevation is 1152



CORRECTIONS, COMMENTS AND/OR PROCUREMENT

FOR CHARTING ERRORS:

Contact National Ocean Service
NOAA, N/CG31
6010 Executive Blvd.
Rockville, MD. 20852
Telephone Toll -Free 800-626-3677

FOR CHANGES, ADDITIONS, OR RECOMMENDATIONS ON PROCEDURAL ASPECTS:

Contact Federal Aviation Administration, ATO-258
800 Independence Avenue, S.W.
Washington, D.C. 20591
Telephone (202) 267-9297

PROCURE FROM:

National Ocean Service
NOAA, N/CG33
Distribution Branch
Riverdale, MD. 20737
Telephone (301) 436-6993

8

87351

INSTRUMENT APPROACH PROCEDURES (CHARTS)

▼IFR TAKE-OFF MINIMUMS AND DEPARTURE PROCEDURES

Civil Airports and Selected Military Airports

CIVIL USERS: FAR 91 prescribes take-off rules and establishes take-off minimums as follows.
(1) Aircraft having two engines or less – one statute mile. (2) Aircraft having more than two engines – one-half statute mile.
MILITARY USERS: Special IFR departure procedures, not published as Standard Instrument Departure (SIDs), and civil take-off minima are included below and are established to assist pilots in obstruction avoidance. Refer to appropriate service directives for take-off minimums.
Airports with IFR take-off minimums other than standard are listed below. Departure procedures and/or ceiling visibility minimums are established to assist pilots conducting IFR flight in avoiding obstructions during climb to the minimum enroute altitude. Take-off minimums and departures apply to all runways unless otherwise specified. Altitudes, unless otherwise indicated, are minimum altitudes in feet MSL.

87295

INSTRUMENT APPROACH PROCEDURES (CHARTS)

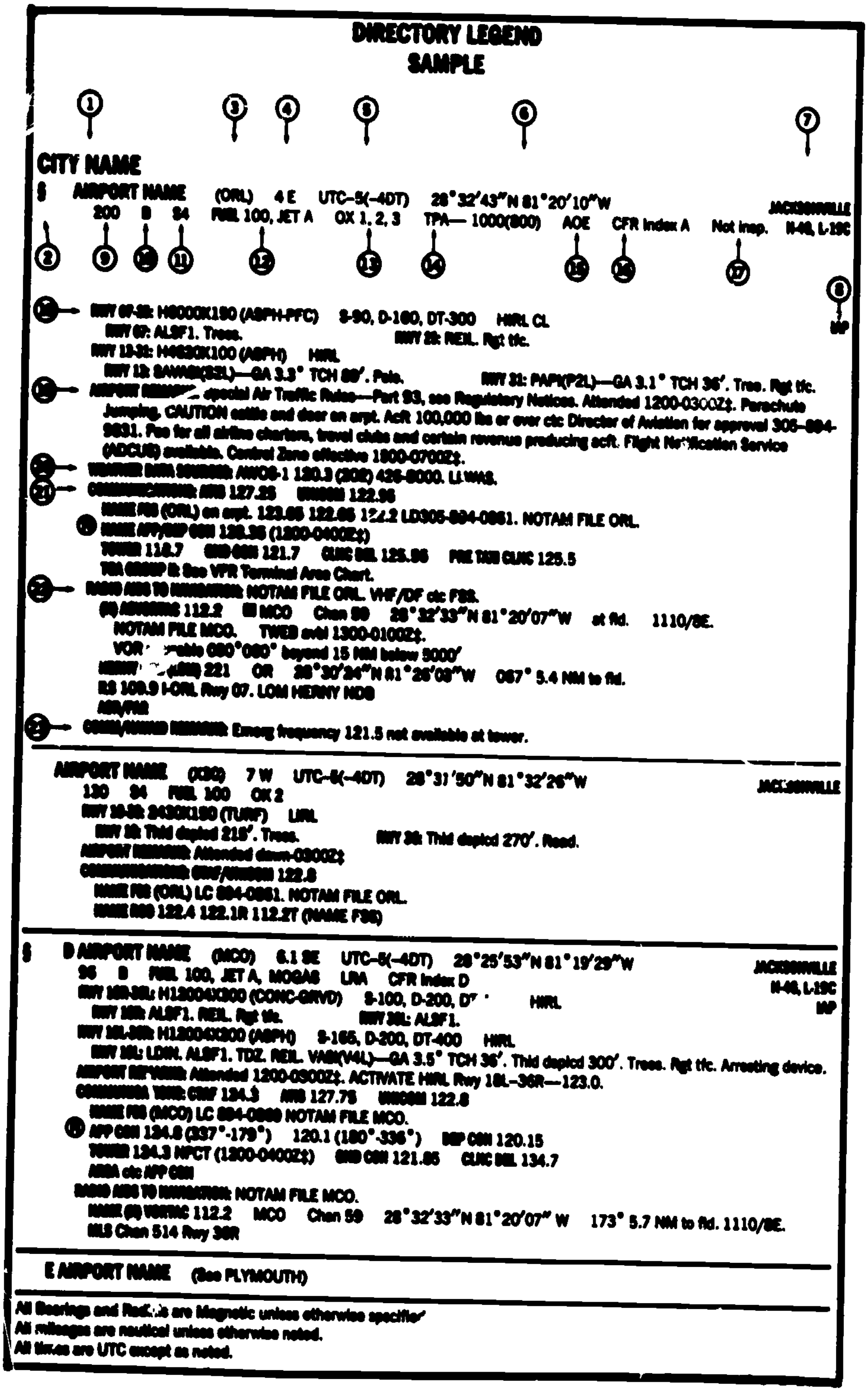
▲IFR ALTERNATE MINIMUMS

(NOT APPLICABLE TO USA/USN/USAF)

Standard alternate minimums for nonprecision approaches are 800-2 (NDB, VOR, LOC, TACAN, LDA, VORTAC, VOR/DME or ASR); for precision approaches 600-2 (ILS or PAR). Airports within this geographical area that require alternate minimums other than standard or alternate minimums with restrictions are listed below. NA - means alternate minimums are not authorized due to unmonitored facility or absence of weather reporting service. Civil pilots see FAR 91. USA/USN/USAF pilots refer to appropriate regulations.

Appendix 2

LEGEND 9.—Instrument Approach Procedures Explanation of Terms.



DIRECTORY LEGEND
SAMPLE

CITY NAME
§ AIRPORT NAME (ORL) 4 E UTC–5(–4DT) 28°32'43"N 81°20'10"W JACKSONVILLE
200 B S4 FUEL 100, JET A OX 1, 2, 3 TPA— 1000(800) AOE CFR Index A Not insp. H-4G, L-19C
IAP
RWY 07-25: H6000X150 (ASPH-PFC) S-90, D-160, DT-300 HIRL CL
RWY 07: ALSF1. Trees. RWY 25: REIL. Rgt tfc.
RWY 13-31: H4620X100 (ASPH) HIRL
RWY 13: SAVASI(S2L)—GA 3.3° TCH 60'. Pole. RWY 31: PAPI(P2L)—GA 3.1° TCH 36'. Tree. Rgt tfc.
AIRPORT REMARKS: Special Air Traffic Rules—Part 93, see Regulatory Notices. Attended 1200-0300Z‡. Parachute Jumping. CAUTION cattle and deer on arpt. Acft 100,000 lbs or over ctc Director of Aviation for approval 305-894-9831. Fee for all airline charters, travel clubs and certain revenue producing acft. Flight Notification Service (ADCUS) available. Control Zone effective 1800-0700Z‡.
WEATHER DATA SOURCES: AWOS-1 120.3 (202) 426-8000. LLWAS.
COMMUNICATIONS: ATIS 127.25 UNICOM 122.95
NAME FSS (ORL) on arpt. 123.65 122.65 122.2 LD305-894-0861. NOTAM FILE ORL.
NAME APP/DEP CON 128.35 (1200-0400Z‡)
TOWER 118.7 GND CON 121.7 CLNC DEL 125.55 PRE TAXI CLNC 125.5
TCA GROUP II: See VFR Terminal Area Chart.
RADIO AIDS TO NAVIGATION: NOTAM FILE ORL. VHF/DF ctc FSS.
(H) ABVORTAC 112.2 MCO Chan 59 28°32'33"N 81°20'07"W at fld. 1110/8E.
NOTAM FILE MCO. TWEB avbl 1300-0100Z‡.
VOR unusable 050°-080° beyond 15 NM below 5000'
HERNY NDB (LOM) 221 OR 28°30'24"N 81°26'03"W 067° 5.4 NM to fld.
ILS 109.9 I-ORL Rwy 07. LOM HERNY NDB
ASR/PAR
COMM/NAVAID REMARKS: Emerg frequency 121.5 not available at tower.

AIRPORT NAME (X30) 7 W UTC–5(–4DT) 28°31'50"N 81°32'26"W JACKSONVILLE
130 S4 FUEL 100 OX 2
RWY 18-36: 2430X150 (TURF) LIRL
RWY 18: Thld dsplcd 218'. Trees. RWY 36: Thld dsplcd 270'. Road.
AIRPORT REMARKS: Attended dawn-0300Z‡
COMMUNICATIONS: CTAF/UNICOM 122.8
NAME FSS (ORL) LC 894-0861. NOTAM FILE ORL.
NAME RCO 122.4 122.1R 112.2T (NAME FSS)

§ D AIRPORT NAME (MCO) 6.1 SE UTC–5(–4DT) 28°25'53"N 81°19'29"W JACKSONVILLE
96 B FUEL 100, JET A, MOGAS LRA CFR Index D H-4G, L-19C
RWY 18R-36L: H12004X300 (CONC-GRVD) S-100, D-200, DT-400 HIRL IAP
RWY 18R: ALSF1. REIL. Rgt tfc. RWY 36L: ALSF1.
RWY 18L-36R: H12004X300 (ASPH) S-165, D-200, DT-400 HIRL
RWY 18L: LDIN. ALSF1. TDZ. REIL. VASI(V4L)—GA 3.5° TCH 36'. Thld dsplcd 300'. Trees. Rgt tfc. Arresting device.
AIRPORT REMARKS: Attended 1200-0300Z‡. ACTIVATE HIRL Rwy 18L–36R—123.0.
COMMUNICATIONS: CTAF 124.3 ATIS 127.75 UNICOM 122.8
NAME FSS (MCO) LC 894-0860 NOTAM FILE MCO.
APP CON 134.8 (337°-179°) 120.1 (180°-336°) DEP CON 120.15
TOWER 124.3 NFCT (1200-0400Z‡) GND CON 121.85 CLNC DEL 134.7
ARSA ctc APP CON
RADIO AIDS TO NAVIGATION: NOTAM FILE MCO.
NAME (H) VORTAC 112.2 MCO Chan 59 28°32'33"N 81°20'07" W 173° 5.7 NM to fld. 1110/8E.
ILS Chan 514 Rwy 36R

E AIRPORT NAME (See PLYMOUTH)

All Bearings and Radials are Magnetic unless otherwise specified
All mileages are nautical unless otherwise noted.
All times are UTC except as noted.

LEGEND 10.—Directory Legend (Sample).

DIRECTORY LEGEND

LEGEND

This Directory is an alphabetical listing of data on record with the FAA on all airports that are open to the public, associated terminal control facilities, air route traffic control centers and radio aids to navigation within the conterminous United States, Puerto Rico and the Virgin Islands. Airports are listed alphabetically by associated city name and cross referenced by airport name. Facilities associated with an airport, but with a different name, are listed individually under their own name, as well as under the airport with which they are associated.

The listing of an airport in this directory merely indicates the airport operator's willingness to accommodate transient aircraft, and does not represent that the facility conforms with any Federal or local standards, or that it has been approved for use on the part of the general public.

The information on obstructions is taken from reports submitted to the FAA. It has not been verified in all cases. Pilots are cautioned that objects not indicated in this tabulation (or on charts) may exist which can create a hazard to flight operation.

Detailed specifics concerning services and facilities tabulated within this directory are contained in Airman's Information Manual, Basic Flight Information and ATC Procedures.

The legend items that follow explain in detail the contents of this Directory and are keyed to the circled numbers on the sample on the preceding page.

1 CITY/AIRPORT NAME

Airports and facilities in this directory are listed alphabetically by associated city and state. Where the city name is different from the airport name the city name will appear on the line above the airport name. Airports with the same associated city name will be listed alphabetically by airport name and will be separated by a dashed rule line. All others will be separated by a solid rule line.

2 NOTAM SERVICE

§—NOTAM "D" (Distance teletype dissemination) and NOTAM "L" (local dissemination) service is provided for airport. Absence of annotation § indicates NOTAM "L" (local dissemination), only is provided for airport. Airport NOTAM file identifier will be shown as "NOTAM FILE IAD" for all public-use airports. See AIM, Basic Flight Information and ATC Procedures for detailed descriptions of NOTAM.

3 LOCATION IDENTIFIER

A three or four character code assigned to airports. These identifiers are used by ATC in lieu of the airport name in flight plans, flight strips and other written records and computer operations.

4 AIRPORT LOCATION

Airport location is expressed as distance and direction from the center of the associated city in nautical miles and cardinal points, i.e., 4 NE.

5 TIME CONVERSION

Hours of operation of all facilities are expressed in Coordinated Universal Time (UTC) and shown as "Z" time. The directory indicates the number of hours to be subtracted from UTC to obtain local standard time and local daylight saving time UTC−5(−4DT). The symbol ‡ indicates that during periods of Daylight Saving Time effective hours will be one hour earlier than shown. In those areas where daylight saving time is not observed that (−4DT) and ‡ will not be shown. All states observe daylight savings time except Arizona and that portion of Indiana in the Eastern Time Zone and Puerto Rico and the Virgin Islands.

6 GEOGRAPHIC POSITION OF AIRPORT

7 CHARTS

The Sectional Chart and Low and High Altitude Enroute Chart and panel on which the airport or facility is located. Helicopter Chart locations will be indicated as, i.e., COPTER.

8 INSTRUMENT APPROACH PROCEDURES

IAP indicates an airport for which a prescribed (Public Use) FAA Instrument Approach Procedure has been published.

9 ELEVATION

Elevation is given in feet above mean sea level and is the highest point on the landing surface. When elevation is sea level it will be indicated as (00). When elevation is below sea level a minus (−) sign will precede the figure.

10 ROTATING LIGHT BEACON

B indicates rotating beacon is available. Rotating beacons operate dusk to dawn unless otherwise indicated in AIRPORT REMARKS.

11 SERVICING

S1: Minor airframe repairs.
S2: Minor airframe and minor powerplant repairs.
S3: Major airframe and minor powerplant repairs.
S4: Major airframe and major powerplant repairs.

LEGEND 11.—Directory Legend.

DIRECTORY LEGEND

12 FUEL

CODE	FUEL
80	Grade 80 gasoline (Red)
100	Grade 100 gasoline (Green)
100LL	Grade 100LL gasoline (low lead) (Blue)
115	Grade 115 gasoline
A	Jet A—Kerosene freeze point–40° C.
A1	Jet A-1 —Kerosene, freeze point–50° C.
A1+	Jet A-1—Kerosene with icing inhibitor, freeze point–50° C.
MOGAS	Automobile gasoline which is to be used as aircraft fuel.
B	Jet B—Wide-cut turbine fuel, freeze point–50° C.
B+	Jet B—Wide-cut turbine fuel with icing inhibitor, freeze point–50° C.

NOTE: Automobile Gasoline. Certain automobile gasoline may be used in specific aircraft engines if a FAA supplemental type certificate has been obtained. Automobile gasoline which is to be used in aircraft engines will be identified as "MOGAS", however, the grade/type and other octane rating will not be published.

Data shown on fuel availability represents the most recent informtion the publisher has been able to acquire. Because of a variety of factors, the fuel listed may not always be obtainable by transient civil pilots. Confirmation of availability of fuel should be made directly with fuel dispensers at locations where refueling is planned.

13 OXYGEN

OX 1 High Pressure
OX 2 Low Pressure
OX 3 High Pressure—Replacement Bottles
OX 4 Low Pressure—Replacement Bottles

14 TRAFFIC PATTERN ALTITUDE

Traffic Pattern Altitude (TPA)—The first figure shown is TPA above mean sea level. The second figure in parentheses is TPA above airport elevation.

15 AIRPORT OF ENTRY AND LANDING RIGHTS AIRPORTS

AOE—Airport of Entry—A customs Airport of Entry where permission from U.S. Customs is not required, however, at least one hour advance notice of arrival must be furnished.

LRA—Landing Rights Airport—Application for permission to land must be submitted in advance to U.S. Customs. At least one hour advance notice of arrival must be furnished.

NOTE: Advance notice of arrival at both an AOE and LRA airport may be included in the flight plan when filed in Canada or Mexico, where Flight Notification Service (ADCUS) is available the airport remark will indicate this service. This notice will also be treated as an application for permission to land in the case of an LRA. Although advance notice of arrival may be relayed to Customs through Mexico, Canadian, and U.S. Communications facilities by flight plan, the aircraft operator is solely responsible for insuring that Customs receives the notification. (See Customs, Immigration and Naturalization, Public Health and Agriculture Department requirements in the International Flight Information Manual for further details.)

16 CERTIFICATED AIRPORT (FAR 139)

Airports serving Department of Transportation certified carriers and certified under FAR, Part 139, are indicated by the CFR index; i.e., CFR index A, which relates to the availability of crash, fire, rescue equipment.

FAR–PART 139 CERTIFICATED AIRPORTS

INDICES AND AIRCRAFT FIRE FIGHTING AND RESCUE EQUIPMENT REQUIREMENTS

Airport Index	*Required No. Vehicles*	*Aircraft Length*	*Scheduled Departures*	*Agent + Water for Foam*
A	1	<90′	≥1	500#DC or HALON 1211 or 450#DC + 100 gal H_2O
B	1 or 2	≥90′, <126′	≥5	Index A + 1500 gal H_2O
		≥126′, <159′	<5	
C	2 or 3	≥126′, <159′	≥5	Index A + 3000 gal H_2O
		≥159′, <200′	<5	
D	3	≥159′, <200′ >200′	≥5 <5	Index A + 4000 gal H_2O
E	3	≥200′	≥5	Index A + 6000 gal H_2O

> Greater Than; < Less Than; ≥ Equal or Greater Than; ≤ Equal or Less Than; H_2O–Water; DC–Dry Chemical.

LEGEND 12.—Directory Legend (Codes).

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DIRECTORY LEGEND

The listing of ARFF index does not necessarily assure coverage for non-air carrier operations or at other than prescribed times for air carrier ARFF index Ltd —indicates ARFF coverage may or may not be available, for information contact airport manager prior to flight.

17 FAA INSPECTION

All airports not inspected by FAA will be identified by the note Not insp This indicates that the airport information has been provided by the owner or operator of the field.

18 RUNWAY DATA

Runway information is shown on two lines That information common to the entire runway is shown on the first line while information concerning the runway ends are shown on the second or following line. Lengthy information will be placed in the Airport Remarks.

Runway direction, surface, length, width, weight bearing capacity, lighting, gradient and appropriate remarks are shown for each runway. Direction, length, width, lighting and remarks are shown for sealanes The full dimensions of helipads are shown, i.e., 50X150.

RUNWAY SURFACE AND LENGTH

Runway lengths prefixed by the letter "H" indicate that the runways are hard surfaced (concrete, asphalt) If the runway length is not prefixed, the surface is sod, clay, etc The runway surface composition is indicated in parentheses after runway length as follows:

(AFSC)—Aggregate friction seal coat
(ASPH)—Asphalt
(CONC)—Concrete
(DIRT)—Dirt
(GRVD)—Grooved
(GRVL)—Gravel, or cinders
(PFC)—Porous friction courses
(RFSC)—Rubberized friction seal coat
(TURF)—Turf
(TRTD)—Treated
(WC)—Wire combed

RUNWAY WEIGHT BEARING CAPACITY

Runway strength data shown in this publication is derived from available information and is a realistic estimate of capability at an average level of activity. It is not intended as a maximum allowable weight or as an operating limitation. Many airport pavements are capable of supporting limited operations with gross weights of 25-50% in excess of the published figures. Permissible operating weights, insofar as runway strengths are concerned, are a matter of agreement between the owner and user When desiring to operate into any airport at weights in excess of those published in the publication, users should contact the airport management for permission. Add 000 to figure following S, D, DT, DDT and MAX for gross weight capacity

S—Runway weight bearing capacity for aircraft with single- wheel type landing gear, (DC-3), etc.
D—Runway weight bearing capacity for aircraft with dual-wheel type landing gear, (DC-6), etc
DT—Runway weight bearing capacity for aircraft with dual-tandem type landing gear, (707), etc
DDT—Runway weight bearing capacity for aircraft with double dual- tandem type landing gear, (747), etc

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

Omission of weight bearing capacity indicates information unknown.

RUNWAY LIGHTING

Lights are in operation sunset to sunrise. Lighting available by prior arrangement only or operating part of the night only and/or pilot controlled and with specific operating hours are indicated under airport remarks. Since obstructions are usually lighted, obstruction lighting is not included in this code. Unlighted obstructions on or surrounding an airport will be noted in airport remarks. Runway lights nonstandard (NSTD) are systems for which the light fixtures are not FAA approved L-800 series: color, intensity, or spacing does not meet FAA standards Nonstandard runway lights, VASI, or any other system not listed below will be shown in airport remarks.

Temporary, emergency or limited runway edge lighting such as flares, smudge pots, lanterns or portable runway lights will also be shown in airport remarks.

Types of lighting are shown with the runway or runway end they serve.

NSTD—Light system fails to meet FAA standards
LIRL—Low Intensity Runway Lights
MIRL—Medium Intensity Runway Lights
HIRL—High Intensity Runway Lights
REIL—Runway End Identifier Lights
CL—Centerline Lights
TDZ—Touchdown Zone Lights
ODALS—Omni Directional Approach Lighting System
AF OVRN—Air Force Overrun 1000′ Standard Approach Lighting System.
LDIN—Lead-In Lighting System.
MALS—Medium Intensity Approach Lighting System
MALSF—Medium Intensity Approach Lighting System with Sequenced Flashing Lights.
MALSR—Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights
SALS—Short Approach Lighting System
SALSF—Short Approach Lighting System with Sequenced Flashing Lights
SSALS—Simplified Short Approach Lighting System.
SSALF—Simplified Short Approach Lighting System with Sequenced Flashing Lights
SSALR—Simplified Short Approach Lighting System with Runway Alignment Indicator Lights
ALSAF—High Intensity Approach Lighting System with Sequenced Flashing Lights
ALSF1—High Intensity Approach Lighting System with Sequenced Flashing Lights, Category I, Configuration
ALSF2—High Intensity Approach Lighting System with Sequenced Flashing Lights, Category II, Configuration.
VASI—Visual Approach Slope Indicator System

NOTE: Civil ALSF-2 may be operated as SSALR during favorable weather conditions.

LEGEND 13.—Directory Legend (Runway Data).

DIRECTORY LEGEND

VISUAL GLIDESLOPE INDICATORS

VASI—Visual Approach Slope Indicator
SAVASI—Simplified Abbreviated Visual Approach Slope Indicator
PAPI—Precision Approach Path Indicator

P2R	2-identical light units placed on right side of runway
P2L	2-identical light units placed on left side of runway
P4R	4-identical light units placed on right side of runway
P4L	4-identical light units placed on left side of runway
S2L	2-box SAVASI on left side of runway
S2R	2-box SAVASI on right side of runway
V2R	2-box VASI on right side of runway
V2L	2-box VASI on left side of runway
V4R	4-box VASI on right side of runway
V4L	4-box VASI on left side of runway
V6R	6-box VASI on right side of runway
V6L	6-box VASI on left side of runway
V12	12-box VASI on both sides of runway
V16	16-box VASI on both sides of runway
*NSTD	Nonstandard VASI, VAPI, or any other system not listed above

PAPI/VASI approach slope angle and threshold crossing height will be shown when available; i.e., GA 3.5° TCH 37'.

PILOT CONTROL OF AIRPORT LIGHTING

Key Mike	Function
7 times within 5 seconds	Highest intensity available
5 times within 5 seconds	Medium or lower intensity (Lower REIL or REIL-Off)
3 times within 5 seconds	Lowest intensity available (Lower REIL or REIL-Off)

Available systems will be indicated in the Airport Remarks, as follows:

ACTIVATE MALSR Rwy 7, HIRL Rwy 7-25-122.8.
or
ACTIVATE MIRL Rwy 18-36-122.8.
or
ACTIVATE VASI and REIL, Rwy 7-122.8.

Where the airport is not served by an instrument approach procedure and/or has an independent type system of different specification installed by the airport sponsor, descriptions of the type lights, method of control, and operating frequency will be explained in clear text. See AIM, "Basic Flight Information and ATC Procedures," for detailed description of pilot control of airport lighting.

RUNWAY GRADIENT

Runway gradient will be shown only when it is 0.3 percent or more. When available the direction of slope upward will be indicated, i.e., 0.5% up NW.

RUNWAY END DATA

Lighting systems such as VASI, MALSR, REIL; obstructions; displaced thresholds will be shown on the specific runway end. "Rgt tfc"—Right traffic indicates right turns should be made on landing and takeoff for specified runway end.

19 AIRPORT REMARKS

Landing Fee indicates landing charges for private or non-revenue producing aircraft. In addition, fees may be charged for planes that remain over a couple of hours and buy no services, or at major airline terminals for all aircraft.
Remarks—Data is confined to operational items affecting the status and usability of the airport.
Parachute Jumping.—See "PARACHUTE" tabulation for details.

20 WEATHER DATA SOURCES

AWOS—Automated Weather Observing System

AWOS-1—reports altimeter setting, wind data and usually temperature, dewpoint and density altitude.
AWOS-2—reports the same as AWOS-1 plus visibility.
AWOS-3—reports the same as AWOS-1 plus visibility and cloud/ceiling data.
See AIM, Basic Flight Information and ATC Procedures for detailed description of AWOS.

SAWRS—identifies airports that have a Supplemental Aviation Weather Reporting Station available to pilots for current weather information.
LAWRS—Limited Aviation Weather Reporting Station where observers report cloud height, weather, obstructions to vision, temperature and dewpoint (in most cases), surface wind, altimeter and pertinent remarks.
LLWAS—indicates a Low Level Wind Shear Alert System consisting of a center field and several field perimeter anemometers.
HIWAS—See RADIO AIDS TO NAVIGATION

LEGEND 14.—Directory Legend (Visual Glideslope Indicator).

DIRECTORY LEGEND

21 COMMUNICATIONS

Communications will be listed in sequence in the order shown below:
Common Traffic Advisory Frequency (CTAF), Automatic Terminal Information Service (ATIS) and Aeronautical Advisory Stations (UNICOM) along with their frequency is shown, where available, on the line following the heading "COMMUNICATIONS." When the CTAF and UNICOM is the same frequency, the frequency will be shown as CTAF/UNICOM freq.
Flight Service Station (FSS) information. The associated FSS will be shown followed by the identifier and information concerning availability of telephone service, e.g., Direct Line (DL), Local Call (LC-384-2341), Long Distance (LD 202-426-8800 or LD 1-202-555-1212) etc. The airport NOTAM file identifier will be shown as "NOTAM FILE IAD." Where the FSS is located on the field it will be indicated as "on arpt" following the identifier. Frequencies available will follow. The FSS telephone number will follow along with any significant operational information. FSS's whose name is not the same as the airport on which located will also be listed in the normal alphabetical name listing for the state in which located. Remote Communications Outlet (RCO) providing service to the airport followed by the frequency and name of the Controlling FSS.
FSS's provide information on airport conditions, radio aids and other facilities, and process flight plans. Airport Advisory Service is provided on the CTAF by FSS's located at non-tower airports or airports where the tower is not in operation.
(See AIM, Par. 157/158 Traffic Advisory Practices at airports where a tower is not in operation or AC 90 - 42C.)
Aviation weather briefing service is provided by FSS specialists. Flight and weather briefing services are also available by calling the telephone numbers listed.
Remote Communications Outlet (RCO)—An unmanned air/ ground communications facility, remotely controlled and providing UHF or VHF communications capability to extend the service range of an FSS.
Civil Communications Frequencies—Civil communications frequencies used in the FSS air/ground system are now operated simplex on 122.0, 122.2, 122.3, 122.4, 122.6, 123.6; emergency 121.5; plus receive-only on 122.05, 122.1, 122.15, and 123.6.

a. 122.0 is assigned as the Enroute Flight Advisory Service channel at selected FSS's.
b. 122.2 is assigned to all FSS's as a common enroute simplex service.
c. 123.6 is assigned as the airport advisory channel at non-tower FSS locations, however, it is still in commission at some FSS's collocated with towers to provide part time Airport Advisory Service.
d. 122.1 is the primary receive-only fruquency at VOR's. 122.05, 122.15 and 123.6 are assigned at selected VOR's meeting certain criteria.
e. Some FSS's are assigned 50 kHz channels for simplex operation in the 122-123 MHz band (e.g. 122.35). Pilots using the FSS A/G system should refer to this directory or appropriate charts to determine frequencies available at the FSS or remoted facility through which they wish to communicate.

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

Emergency frequency 121.5 is available at all Flight Service Stations, Towers, Approach Control and RADAR facilities, unless indicated as not available.
Frequencies published followed by the letter "T" or "R", indicate that the facility will only transmit or receive respectively on that frequency. All radio aids to navigation frequencies are transmit only.

TERMINAL SERVICES

CTAF—A program designed to get all vehicles and aircraft at uncontrolled airports on a common frequency.
ATIS—A continuous broadcast of recorded non-control information in selected areas of high activity.
UNICOM—A non-government air/ground radio communications facility utilized to provide general airport advisory service.
APP CON—Approach Control. The symbol Ⓡ indicates radar approach control.
TOWER—Control tower
GND CON—Ground Control
DEP CON—Departure Control. The symbol Ⓡ indicates radar departure control.
CLNC DEL—Clearance Delivery.
PRE TAXI CLNC—Pre taxi clearance
VFR ADVSY SVC—VFR Advisory Service. Service provided by Non-Radar Approach Control.
Advisory Service for VFR aircraft (upon a workload basis) ctc APP CON.
STAGE II SVC—Radar Advisory and Sequencing Service for VFR aircraft
STAGE III SVC—Radar Sequencing and Separation Service for participating VFR Aircraft within a Terminal Radar Service Area (TRSA)
ARSA—Airport Radar Service Area
TCA—Radar Sequencing and Separation Service for all aircraft in a Terminal Control Area (TCA)
TOWER, APP CON and DEP CON RADIO CALL will be the same as the airport name unless indicated otherwise.

LEGEND 15.—Directory Legend (Communications).

DIRECTORY LEGEND

㉒ RADIO AIDS TO NAVIGATION

The Airport Facility Directory lists by facility name all Radio Aids to Navigation, except Military TACANS, that appear on National Ocean Service Visual or IFR Aeronautical Charts and those upon which the FAA has approved an Instrument Approach Procedure.

All VOR, VORTAC ILS and MLS equipment in the National Airspace System has an automatic monitoring and shutdown feature in the event of malfunction. Unmonitored, as used in this publication for any navigational : d, means that FSS or tower personnel cannot observe the malfunction or shutdown signal. The NAVAID NOTAM file identifier will be shown as "NOTAM FILE IAD" and will be listed on the Radio Aids to Navigation line. When two or more NAVAIDS are listed and the NOTAM file identifier is different than shown on the Radio Aids to Navigation line, then it will be shown with the NAVAID listing. Hazardous Inflight Weather Advisory Service (HIWAS) will be shown where this service is broadcast over selected VOR's.

NAVAID information is tabulated as indicated in the following sample:

TWEB — TACAN/DME Channel — Geographical Position — Site Elevation

K-WE (L) ABVORTAC 117.55 ■ ABE Chan 122(Y) 40°43'36"N 75°27'18"W 180° 4.1 NM to fld 1110/8E. HIWAS.

Class — Frequency — Identifier — Bearing and distance facility to airport — Magnetic Variation — Hazardous Inflight Weather Advisory Service

VOR unusable 020°-060° beyond 26 NM below 3500'

Restriction within the normal altitude/range of the navigational aid (See primary alphabetical listing for restrictions on VORTAC and VOR/DME).

Note: Those DME channel numbers with a (Y) suffix require TACAN to be placed in the "Y" mode to receive distance information.

HIWAS—Hazardous Inflight Weather Advisory Service is a continuous broadcast of inflight weather advisories including summarized SIGMETs, convective SIGMETs, AIRMETs and urgent PIREPs. HIWAS is presently broadcast over selected VOR's and will be implemented throughout the conterminous U.S.

ASR/PAR—Indicates that Surveillance (ASR) or Precision (PAR) radar instrument approach minimums are published in U.S Government Instrument Approach Procedures.

RADIO CLASS DESIGNATIONS

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

Normal Usable Altitudes and Radius Distances

Class	Altitudes	Distance (miles)
(T)	12,000' and below	25
(L)	Below 18,000'	40
(H)	Below 18,000'	40
(H)	Within the Conterminous 48 States only, between 14,500' and 17,999'	100
(H)	18,000' FL 450	130
(H)	Above FL 450	100

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

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

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

AB	Automatic Weather Broadcast (also shown with ■ following frequency.)
DF	Direction Finding Service.
DME	UHF standard (TACAN compatible) distance measuring equipment.
DME(Y)	UHF standard (TACAN compatible) distance measuring equipment that require TACAN to be placed in the "Y" mode to receive DME.
H	Non-directional radio beacon (homing), power 50 watts to less than 2,000 watts (50 NM at all altitudes).
HH	Non-directional radio beacon (homing), power 2,000 watts or more (75 NM at all altitudes).
H-SAB	Non-directional radio beacons providing automatic transcribed weather service.
ILS	Instrument Landing System (voice, where available, on localizer channel).
ISMLS	Interim Standard Microwave Landing System.
LDA	Localizer Directional Aid.

LEGEND 16.—Directory Legend (Radio Aids to Navigation).

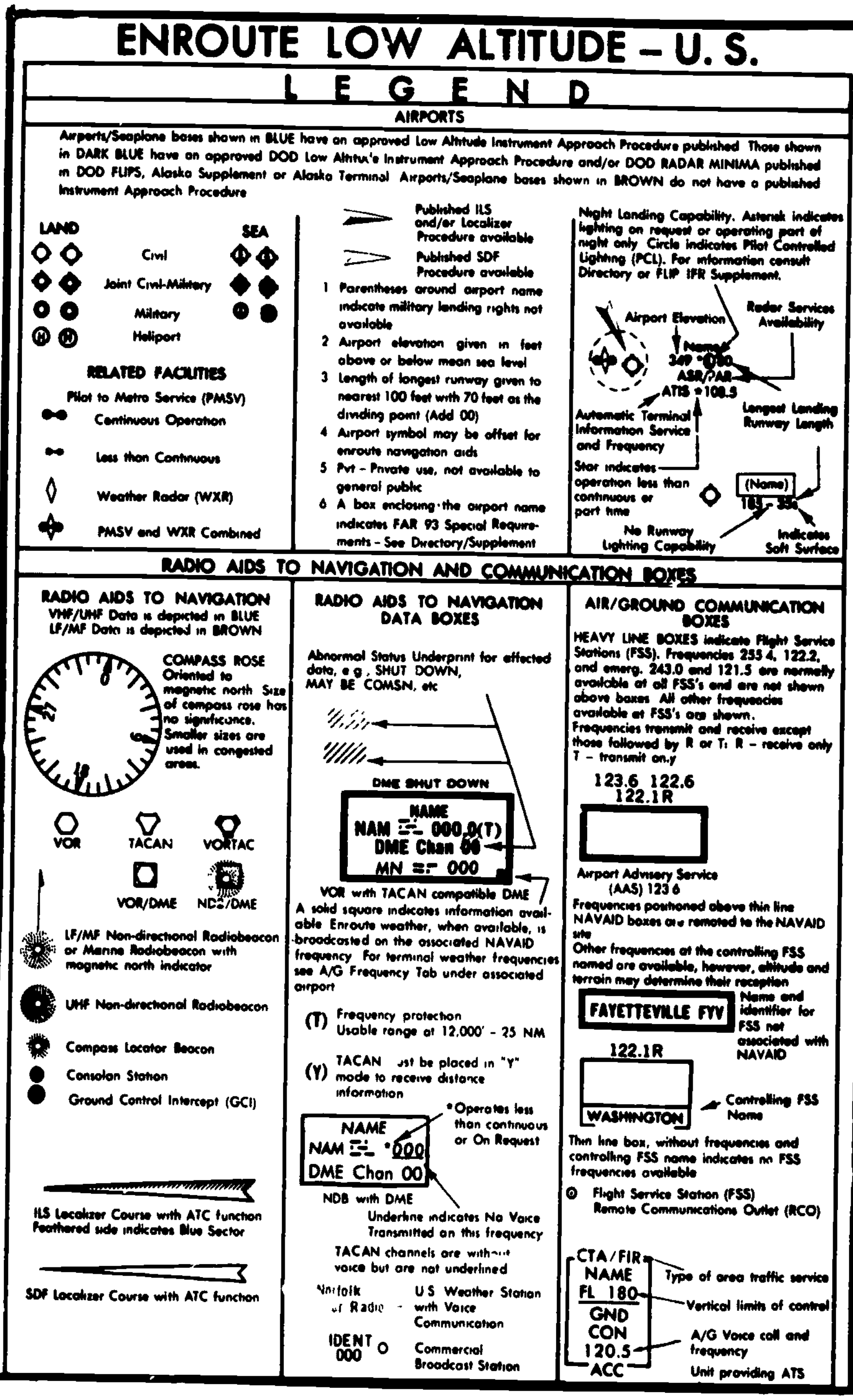
DIRECTORY LEGEND

LMM ______ Compass locator station when installed at middle marker site (15 NM at all altitudes).
LOM ______ Compass locator station when installed at outer marker site (15 NM at all altitudes).
MH ______ Non-directional radio beacon (homing) power less than 50 watts (25 NM at all altitudes).
MLS ______ Microwave Landing System
S ______ Simultaneous range homing signal and/or voice
SABH ______ Non-directional radio beacon not authorized for IFR or ATC. Provides automatic weather broadcasts.
SDF ______ Simplified Direction Facility.
TACAN ______ UHF navigational facility-omnidirectional course and distance information
VOR ______ VHF navigational facility-omnidirectional course only.
VOR/DME ______ Collocated VOR navigational facility and UHF standard distance measuring equipment.
VORTAC ______ Collocated VOR and TACAN navigational facilities.
W ______ Without voice on radio facility frequency.
Z ______ VHF station location marker at a LF radio facility.

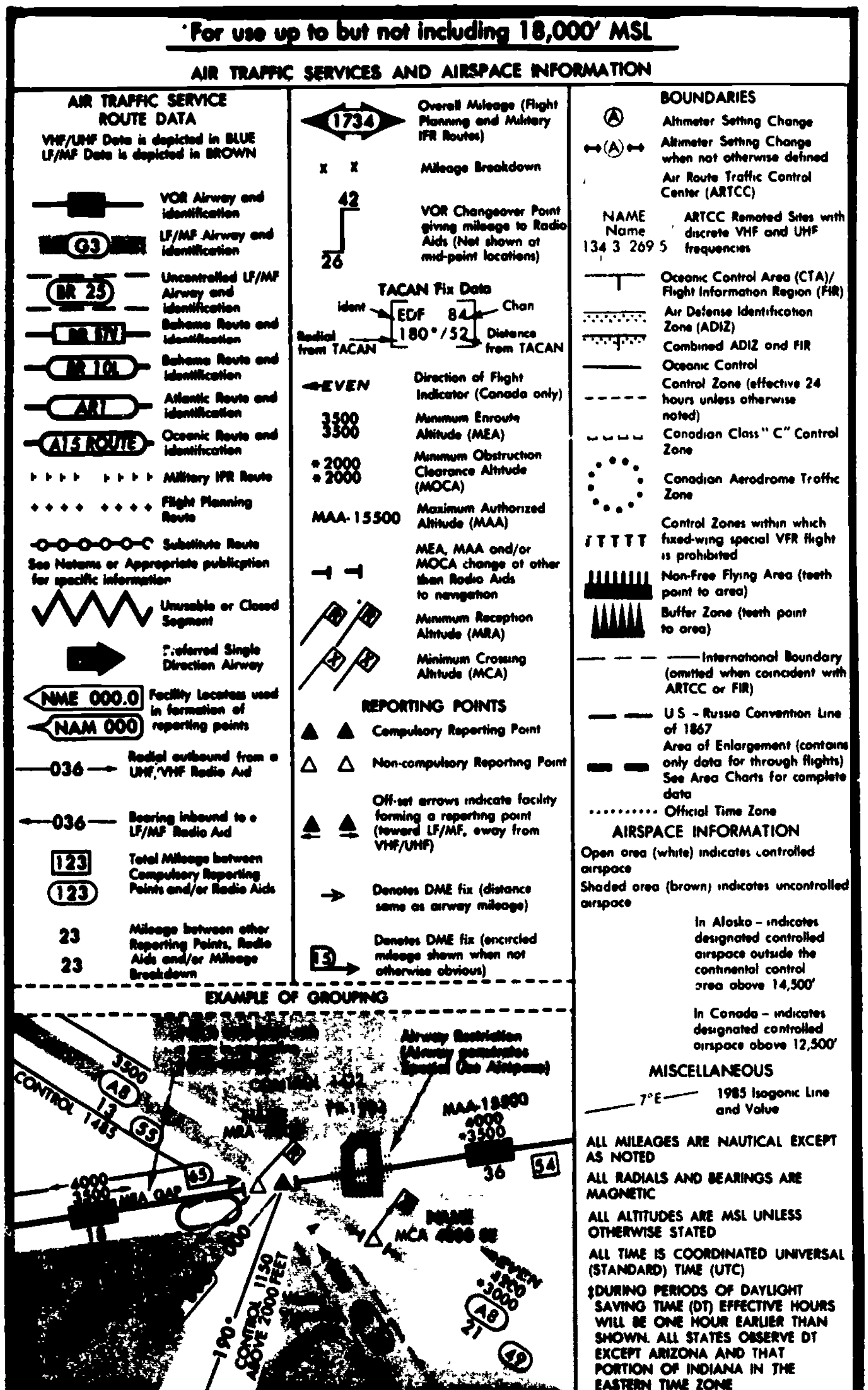
FREQUENCY PAIRING PLAN AND MLS CHANNELING

MLS CHANNEL	VHF FREQUENCY	TACAN CHANNEL	MLS CHANNEL	VHF FREQUENCY	TACAN CHANNEL	MLS CHANNEL	VHF FREQUENCY	TACAN CHANNEL
500	108.10	18X	568	109.45	31Y	634	114.05	87Y
502	108.30	20X	570	109.55	32Y	636	114.15	88Y
504	108.50	22X	572	109.65	33Y	638	114.25	89Y
506	108.70	24X	574	109.75	34Y	640	114.35	90Y
508	108.90	26X	576	109.85	35Y	642	114.45	91Y
510	109.10	28X	578	109.95	36Y	644	114.55	92Y
512	109.30	30X	580	110.05	37Y	646	114.65	93Y
514	109.50	32X	582	110.15	38Y	648	114.75	94Y
516	109.70	34X	584	110.25	39Y	650	114.85	95Y
518	109.90	36X	586	110.35	40Y	652	114.95	96Y
520	110.10	38X	588	110.45	41Y	654	115.05	97Y
522	110.30	40X	590	110.55	42Y	656	115.15	98Y
524	110.50	42X	592	110.65	43Y	658	115.25	99Y
526	110.70	44X	594	110.75	44Y	660	115.35	100Y
528	110.90	46X	596	110.85	45Y	662	115.45	101Y
530	111.10	48X	598	110.95	46Y	664	115.55	102Y
532	111.30	50X	600	111.05	47Y	666	115.65	103Y
534	111.50	52X	602	111.15	48Y	668	115.75	104Y
536	111.70	54X	604	111.25	49Y	670	115.85	105Y
538	111.90	56X	606	111.35	50Y	672	115.95	106Y
540	108.05	17Y	608	111.45	51Y	674	116.05	107Y
542	108.15	18Y	610	111.55	52Y	676	116.15	108Y
544	108.25	19Y	612	111.65	53Y	678	116.25	109Y
546	108.35	20Y	614	111.75	54Y	680	116.35	110Y
548	108.45	21Y	616	111.85	55Y	682	116.45	111Y
550	108.55	22Y	618	111.95	56Y	684	116.55	112Y
552	108.65	23Y	620	113.35	80Y	686	116.65	113Y
554	108.75	24Y	622	113.45	81Y	688	116.75	114Y
556	108.85	25Y	624	113.55	82Y	690	116.85	115Y
558	108.95	26Y	626	113.65	83Y	692	116.95	116Y
560	109.05	27Y	628	113.75	84Y	694	117.05	117Y
562	109.15	28Y	630	113.85	85Y	696	117.15	118Y
564	109.25	29Y	632	113.95	86Y	698	117.25	119Y
566	109.35	30Y						

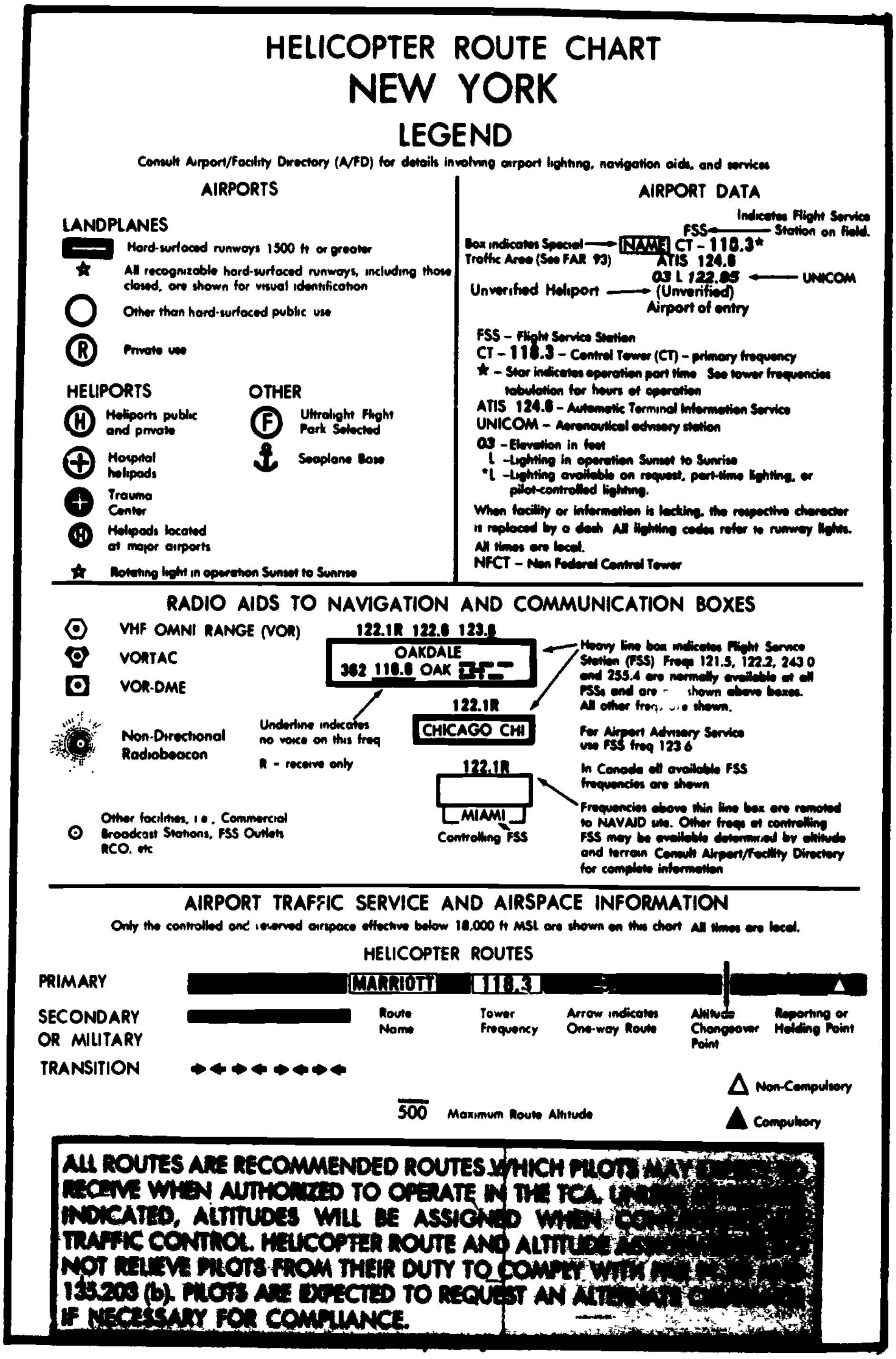
LEGEND 17.—Directory Legend (Frequency Pairing Plan and MLS Channeling).



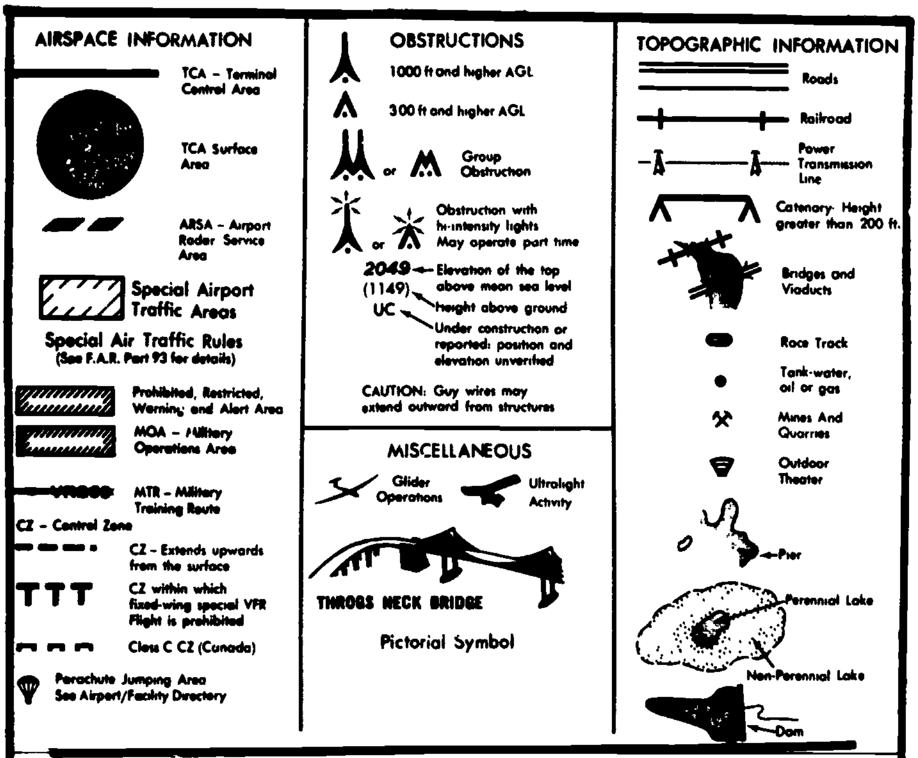
LEGEND 18.—En Route Low Altitude - U.S.



LEGEND 19.—Air Traffic Services and Airspace Information.



LEGEND 20.—Helicopter Route Chart.



TERMINAL CONTROL AREA ALTITUDES

70 - -Ceiling of TCA in hundreds of feet MSL

+10 - -Floor of TCA in hundreds of feet MSL

(Floors extending "upward from above" a certain altitude are preceded by a + Operation at and below these altitudes are outside of TCA)

ATTENTION

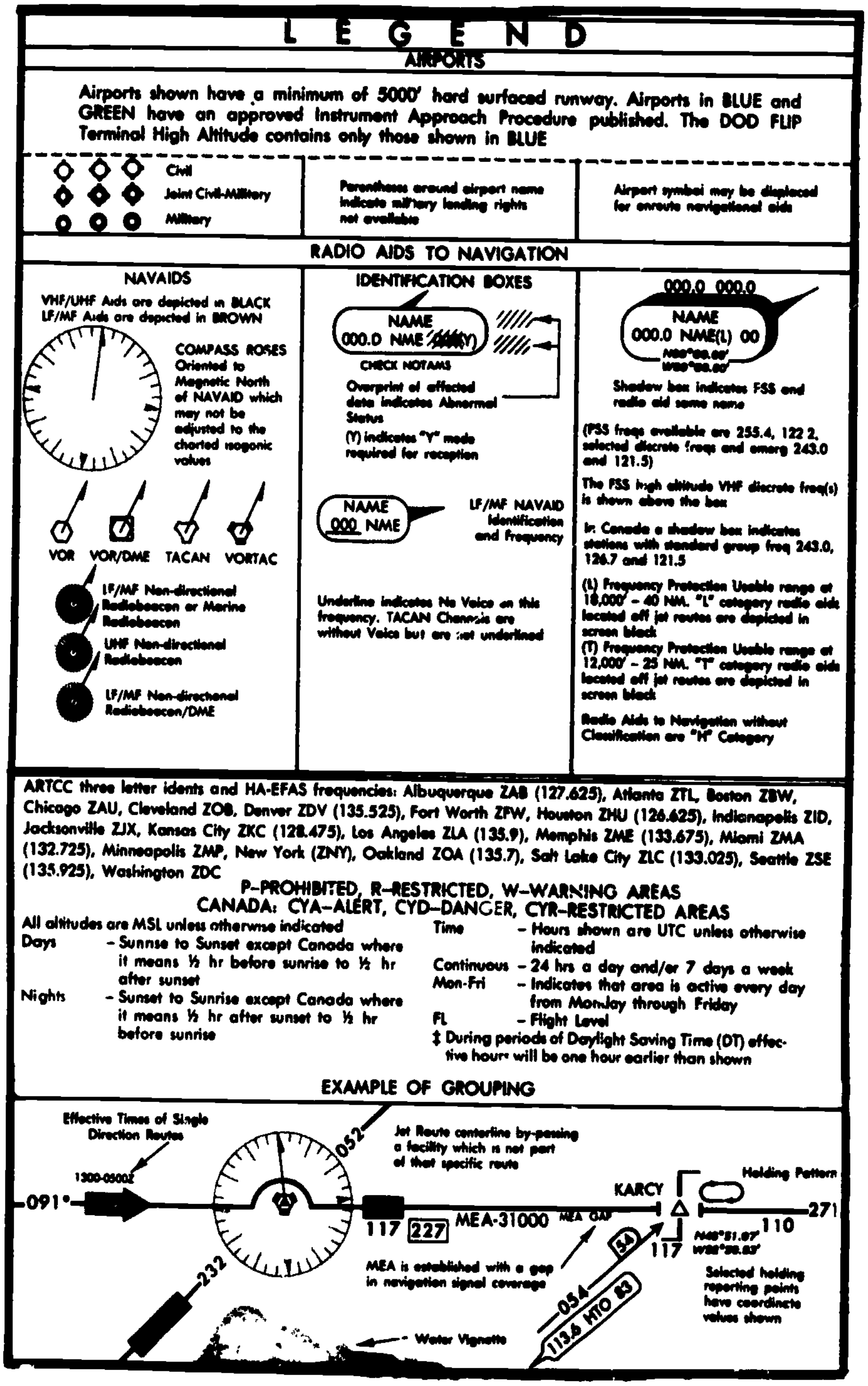
THIS CHART CONTAINS MAXIMUM ELEVATION FIGURES (MEF)
The Maximum Elevation Figures shown in quadrangles bounded by ticked lines of latitude and longitude are represented in THOUSANDS and HUNDREDS of feet above mean sea level. The MEF is based on information available concerning the highest known feature in each quadrangle, including terrain and obstructions (trees, towers, antennas, etc.)

Example· 12,500 feet .... **1^{25}**

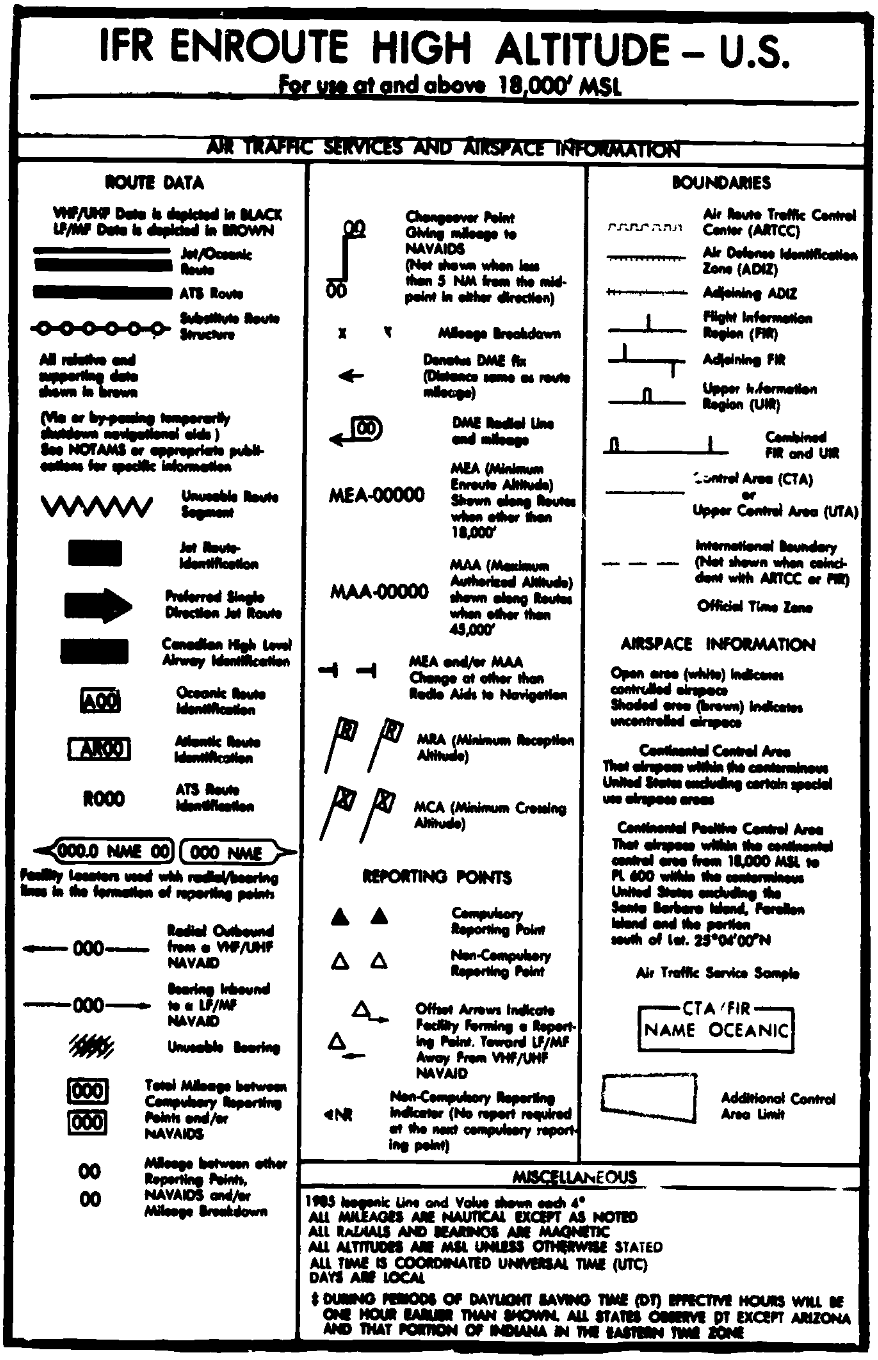
NOTICE TO USERS OF THIS CHART

You are urgently requested to inform us of corrections and additions that come to your attention while using this chart. Postage-paid Chart Correction cards are available at authorized chart sales agents and at FAA Flight Service Stations. Where delineation of data is required, such information should be indicated clearly and accurately on a current chart (a replacement copy will be returned). Mail to National Ocean Service, NOAA, N/CG31, 6010 Executive Blvd., Rockville, MD 20852 or call toll-free 800-626-3677.

LEGEND 21.—Helicopter Route Chart.



LEGEND 22.—Airports.



LEGEND 23.—IFR En Route High Altitude Chart.

EXCERPT FROM CFR 49 PART 172

§172.10 Materials Table

(1) */W/A	(2) Hazardous materials descriptions and proper shipping names	(3) Hazard class	(4) Label(s) required (if not excepted)	Packaging (a) Exceptions	Packaging (b) Specific requirements	(6) Maximum net quantity in one package (a) Passenger carrying aircraft or railcar	(6) Maximum net quantity in one package (b) Cargo only aircraft	(7) Water shipments (a) Cargo vessel	(7) Water shipments (b) Passenger vessel	(7) Water shipments (c) Other requirements
	Accumulator, pressurized (*pneumatic or hydraulic*), *containing nonflammable gas*	Nonflammable gas	Nonflammable gas	173 306		No limit	No limit	1,2	1,2	
	Acetal	Flammable liquid	Flammable liquid	173 118	173 119	1 quart	10 gallons	1,3	4	
	Acetaldehyde (*ethyl aldehyde*)	Flammable liquid	Flammable liquid	None	173 119	Forbidden	10 gallons	1,3	5	
A	Acetaldehyde ammonia	ORM-A	None	173 505	173 510	No limit	No limit			
*	Acetic acid (*aqueous solution*)	Corrosive material	Corrosive	173 244	173 245	1 quart	10 gallons	1,2	1,2	Stow separate from nitric acid or oxidizing materials
	Acetic acid, glacial	Corrosive material	Corrosive	173 244	173 245	1 quart	10 gallons	1,2	1,2	Stow separate from nitric acid or oxidizing materials. Segregation same as for flammable liquids
	Acetic anhydride	Corrosive material	Corrosive	173 244	173 245	1 quart	1 gallon	1,2	1,2	
	Acetone	Flammable liquid	Flammable liquid	173 118	173 119	1 quart	10 gallons	1,3	4	
	Acetone cyanohydrin	Poison B	Poison	None	173 346	Forbidden	55 gallons	1	5	Shade from radiant heat. Stow away from corrosive materials
	Acetone oil	Flammable liquid	Flammable liquid	173 118	173 119	1 quart	10 gallons	1,2	1	
	Acetonitrile	Flammable liquid	Flammable liquid	173 118	173 119	1 quart	10 gallons	1	4	Shade from radiant heat
	Acetyl benzoyl peroxide, solid	Forbidden								
	Acetyl benzoyl peroxide solution, *not over 40% peroxide*	Organic peroxide	Organic peroxide	None	173 2[illegible]2	Forbidden	1 quart	1,2	1	
	Acetyl bromide	Corrosive material	Corrosive	173 244	173 247	1 quart	1 gallon	1	1	Keep dry. Glass carboys not permitted on passenger vessels

LEGEND 24.—Hazardous Materials Table (CFR 49 Part 172).

§172.101 Hazardous Materials Table (cont'd)

(1) */W/A	(2) Hazardous materials descriptions and proper shipping names	(3) Hazard class	(4) Label(s) required (if not excepted)	(5) Packaging (a) Exceptions	(5) Packaging (b) Specific requirements	(6) Maximum net quantity in one package (a) Passenger carrying aircraft or railcar	(6) Maximum net quantity in one package (b) Cargo only aircraft	(7) Water shipments (a) Cargo vessel	(7) Water shipments (b) Passenger vessel	(7) Water shipments (c) Other requirements
	Acetyl chloride	Flammable liquid	Flammable liquid	173 244	173 247	1 quart	1 gallon	1	1	Stow away from alcohols. Keep cool and dry. Separate longitudinally by an intervening complete compartment or hold from explosives
	Acetylene	Flammable gas	Flammable gas	None	173 303	Forbidden	300 pounds	1	1	Shade from radiant heat
A	Acetylene tetrabromide	ORM-A	None	173 505	173 510	10 gallons	55 gallons			
	Acetyl iodide	Corrosive material	Corrosive	173 244	173 247	1 quart	1 gallon	1	1	Keep dry. Glass carboys not permitted on passenger vessels
	Acetyl peroxide solution, *not over 25% peroxide*	Organic peroxide	Organic peroxide	173 153	173 222	Forbidden	1 quart	1,2	1	
	Acid butyl phosphate	Corrosive material	Corrosive	173 244	173 245	1 quart	5 gallons	1,2	1,2	Glass carboys in hampers not permitted under deck
	Acid carboy empty *See* Carboy, empty									
*	Acid, liquid, n.o.s.	Corrosive material	Corrosive	173 244	173 2[illegible]	1 quart	5 pints	1	4	Keep cool
*	Acid, sludge	Corrosive material	Corrosive	None	173 248	Forbidden	1 quart	1,2	1	
	Acrolein, inhibited	Flammable liquid	Flammable liquid and Poison	None	173 122	Forbidden	1 quart	1,2	5	Keep cool. Stow away from living quarters
	Acrylic acid	Corrosive material	Corrosive	173 244	173 245	1 quart	5 pints	1	1	
	Acrylonitrile	Flammable liquid	Flammable liquid and Poison	None	173 119	Forbidden	1 quart	1,2	5	Keep cool

LEGEND 25.—Hazardous Materials Table (CFR 49 Part 172) (Cont'd).

§172.101 Hazardous Materials Table (cont'd)

(1)	(2)	(3)	(4)	(5)		(6)		(7)		
				Packaging		Maximum net quantity in one package		Water shipments		
*/ W/ A	Hazardous materials descriptions and proper shipping names	Hazard class	Label(s) required (if not excepted)	(a) Exceptions	(b) Specific requirements	(a) Passenger carrying aircraft or railcar	(b) Cargo only aircraft	(a) Cargo vessel	(b) Passenger vessel	(c) Other requirements
	Alkyl aluminum halides *See* Pyrophoric liquid, n o s									
A	Allethrin	ORM-A	None	173 505	173 [illegible]	No limit	No limit			
	Allyl alcohol	Flammable liquid	Flammable liquid and Poison	173 118	17[illegible]9	1 quart	10 gallons	1,2	1	
	Allyl bromide	Flammable liquid	Flammable liquid	173 118	173 119	Forbidden	10 gallons	1,2	1	
	Allyl chloride	Flammable liquid	Flammable liquid	None	173 119	Forbidden	10 gallons	1,3	5	
	Allyl chlorocarbonate	Flammable liquid	Flammable liquid	None	173 288	Forbidden	5 pints	1	5	Keep dry Separate longitudinally by an intervening complete hold or compartment from explosives Segregation same as for corrosive materials
	Allyl chloroformate *See* Allyl chlorocarbonate									
	Allyl trichlorosilane	Corrosive material	Corrosive	None	173 280	Forbidden	10 gallons	1	1	Keep dry
	Aluminum alkyls *See* Pyrophoric liquid, n o s									
	Aluminum bromide, anhydrous	Corrosive material	Corrosive	173 244	173 245b	25 pounds	100 pounds	1,2	1,2	Keep dry
	Aluminum dross, wet *or* hot *See* Sec 173 173									
	Aluminum hydride	Flammable solid	Flammable solid and Dangerous when wet	None	173 206	Forbidden	25 pounds	1,2	5	Segregation same as for flammable solid labeled Dangerous When Wet

LEGEND 26.—Hazardous Materials Table (CFR 49 Part 172) (Cont'd).

EXCERPT FROM CFR 49 PART 175

PART 175—CARRIAGE BY AIRCRAFT

Subpart A—General Information and Regulations

Subpart B—Loading, Unloading and Handling

Subpart C—Specific Regulations Applicable According to Classification of Material

LEGEND 27.—Excerpt from CFR 49 Part 175.

157

EXCERPT FROM CFR 49 PART 175

Sec.
175.640 Special requirements for other regulated materials.
175.700 Special requirements for radioactive materials.
175.710 Special requirements for fissile Class III radioactive materials.

AUTHORITY: 49 U.S.C. 1803, 1804, 1808; 49 CFR 1.53(e), unless otherwise noted.

SOURCE: Amdt. 175-1, 41 FR 16106, Apr. 15, 1976, unless otherwise noted.

NOTE: Nomenclature changes to Part 175 appear at 43 FR 48645, Oct. 19, 1978 (Amdt. 175-6).

Subpart A—General Information and Regulations

§ 175.1 Purpose and scope.

This part prescribes requirements, in addition to those contained in Parts 171, 172 and 173 of this subchapter, to be observed by aircraft operators with respect to the transportation of hazardous materials aboard (including attached to or suspended from) civil aircraft.

§ 175.3 Unacceptable hazardous materials shipments.

A shipment of hazardous materials that is not prepared for shipment in accordance with Parts 172 and 173 of this subchapter may not be accepted for transportation or transported aboard an aircraft.

§ 175.5 Applicability.

This part contains regulations pertaining to the acceptance of hazardous materials for transportation, and the loading and transportation of hazardous materials, in any civil aircraft in the United States and in civil aircraft of United States registry anywhere in air commerce, except aircraft of United States registry under lease to and operated solely by foreign nationals outside the United States.

§ 175.10 Exceptions.

(a) This subchapter does not apply to—

(1) Aviation fuel and oil in tanks that are in compliance with the installation provisions of 14 CFR, Chapter 1.

(2) Aircraft parts, equipment, and supplies (other than fuel) carried by an aircraft operator if authorized or required aboard his aircraft for their operation including:

(i) Fire extinguishers;

(ii) Cylinders containing compressed gases;

(iii) Aerosol dispensers;

(iv) Distilled spirits;

(v) Hydraulic accumulators;

(vi) Non-spillable batteries;

(vii) First-aid kits;

(viii) Signaling devices;

(ix) Tires; and

(x) Items of replacement therefor, except that batteries, aerosol dispensers, and signaling devices must be packed in strong outside containers, and tires must be deflated to a pressure not greater than 100 p.s.i.g.

(3) Hazardous materials loaded and carried in hoppers or tanks of aircraft certificated for use in aerial seeding, dusting, spraying, fertilizing, crop improvement, or pest control, to be dispensed during such an operation.

(4) Medicinal and toilet articles carried by a crewmember or passenger in his baggage (including carry-on baggage) when:

(i) The total capacity of all the containers used by a crewmember or passenger does not exceed 75 ounces (net weight ounces and fluid ounces);

(ii) The capacity of each container other than an aerosol container does not exceed 16 fluid ounces or 1 pound of material.

(5) Small-arms ammunition for personal use carried by a crewmember or passenger in his baggage (excluding carry-on baggage) if securely packed in fiber, wood, or metal boxes.

(6) Prior to May 3, 1981, radioactive materials which meet the requirements of § 173.391(a), (b), or (c) of this subchapter in effect on May 3, 1979.

(7) Oxygen, or any hazardous material used for the generation of oxygen, carried for medical use by a passenger in accordance with 14 CFR 121.574 or 135.114.

(8) Human beings and animals with an implanted medical device, such as a heart pacemaker, that contains radioactive material or with radio-pharmaceuticals that have been injected or ingested.

LEGEND 28.—Excerpt from CFR 49 Part 175.

EXCERPT FROM CFR 49 PART 175

(9) Smoke grenades, flares, or similar devices carried only for use during a sport parachute jumping activity.

(10) Personal smoking materials intended for use by any individual when carried on his person except lighters with flammable liquid reservoirs and containers containing lighter fluid for use in refilling lighters.

(11) Smoke grenades, flares, and pyrotechnic devices affixed to aircraft carrying no person other than a required flight crewmember during any flight conducted at and as a part of a scheduled air show or exhibition of aeronautical skill. The affixed installation accommodating the smoke grenades, flares, or pyrotechnic devices on the aircraft must be approved by the FAA for its intended use.

(12) Hazardous materials which are loaded and carried on or in cargo-only aircraft and which are to be dispensed or expended during flight for weather control, forest preservation and protection, or avalanche control purposes when the following requirements are met:

(i) Operations may not be conducted over densely populated areas, in a congested airway, or near any airport where air carrier passenger operations are conducted.

(ii) Each operator shall prepare and keep current a manual containing operational guidelines and handling procedures, for the use and guidance of flight, maintenance, and ground personnel concerned in the dispensing or expending of hazardous materials. The manual must be approved by the FAA District Office having jurisdiction over the operator's certificate, if any, or the FAA Regional Office in the region where the operator is located. Each operation must be conducted in accordance with the manual.

(iii) No person other than a required flight crewmember, FAA inspector, or person necessary for handling or dispensing the hazardous material may be carried on the aircraft.

(iv) The operator of the aircraft must have advance permission from the owner of any airport to be used for the dispensing or expending operation.

(v) When dynamite and blasting caps are carried for avalanche control flights, the explosives must be handled, and, at all times be, under the control of a blaster who is licensed under a state or local authority identified in writing to the FAA district office having jurisdiction over the operator's certificate, if any, or the FAA regional office in the region where the operator is located.

(49 U.S.C. 1803, 1804, 1806, 1808; 49 CFR 1.53 and App. A to Part 1)

[Amdt. 175-1, 41 FR 16106, Apr. 15, 1976, as amended by Amdt. 175-1A, 41 FR 40686, Sept. 20, 1976]

NOTE: For amendments to § 175.10 see the List of CFR Sections Affected appearing in the Finding Aids section of this volume.

§ 175.20 Compliance.

Unless the regulations in this subchapter specifically provide that another person must perform a duty, each operator shall comply with all the regulations in Parts 102, 171, 172, and 175 of this subchapter and shall thoroughly instruct his employees in relation thereto. (See 14 CFR 121.135, 121.401, 121.433a, 135.27 and 135.140.)

§ 175.30 Accepting shipments.

(a) No person may accept a hazardous material for transportation aboard an aircraft unless the hazardous material is—

(1) Authorized, and is within the quantity limitations specified for carriage aboard aircraft according to § 172.101 of this subchapter;

(2) Described and certified on a shipping paper prepared in duplicate in accordance with Subpart C of Part 172 of this subchapter. The originating aircraft operator must retain one copy of each shipping paper for 90 days;

(3) Labeled and marked, or placarded (when required), in accordance with Subparts D, E and F of Part 172 of this subchapter; and

(4) Labeled with a "CARGO AIRCRAFT ONLY" label (see § 172.448 of this subchapter) if the material as presented is not permitted aboard passenger-carrying aircraft.

(b) Except as provided in paragraph (c) of this section, no person may carry any hazardous material aboard an aircraft unless, prior to placing the material aboard the aircraft, the operator of the aircraft has inspected the package, or the outside container pre-

LEGEND 29.—Excerpt from CFR 49 Part 175.

EXCERPT FROM CFR 49 PART 175

pared in accordance with § 173.25 of this subchapter which contains the material, and has determined that—it has no holes, leakage, or other indication that its integrity has been compromised, and for radioactive materials that the package seal has not been broken.

(c) The requirements of paragraph (b) of this section do not apply to ORM-D materials packed in a freight container and offered for transportation by one consignor.

[Amdt. 175-1, 41 FR 16106, Apr. 15, 1976, as amended by Amdt. 175-1A, 41 FR 40686, Sept. 20, 1976; Amdt. 175-1B, 41 FR 57072, Dec. 30, 1976]

§ 175.33 Notification of pilot-in-command.

When materials subject to the provisions of this subchapter are carried in an aircraft, the operator of the aircraft shall give the pilot-in-command the following information in writing before takeoff:

(a) The information required by §§ 172-202 and 172.203 of this subchapter;

(b) The location of the hazardous material in the aircraft; and

(c) The results of the inspection required by § 175.30(b).

[Amdt. 175-1A, 41 FR 40686, Sept. 20, 1976]

§ 175.35 Shipping papers aboard aircraft.

(a) A copy of the shipping papers required by § 175.30(a)(2) must accompany the shipment it covers during transportation aboard an aircraft.

(b) The documents required by paragraph (a) of this section and § 175.33 may be combined into one document if it is given to the pilot-in-command before departure of the aircraft.

§ 175.40 Keeping and replacement of labels.

(a) Aircraft operators who engage in the transportation of hazardous materials must keep an adequate supply of the labels specified in Subpart E of Part 172 of this subchapter, on hand at each location where shipments are loaded aboard aircraft.

(b) Lost or detached labels for packages of hazardous materials must be replaced in accordance with the information provided on the shipping papers.

§ 175.45 Reporting hazardous materials incidents.

(a) Each operator that transports hazardous materials shall report to the nearest Air Carrier District Office (ACDO), Flight Standards District Office (FSDO), General Aviation District Office (GADO) or other FAA facility, except that in place of reporting to the nearest of those facilities a certificate holder under 14 CFR Part 121, 127, or 135 may report to the FAA District Office holding the carrier's operating certificate and charged with overall inspection of its operations, by telephone at the earliest practicable moment after each incident that occurs during the course of transportation (including loading, unloading or temporary storage) in which as a direct result of any hazardous material—

(1) A person is killed;

(2) A person receives injuries requiring his or her hospitalization;

(3) Estimated carrier or other property damage, or both, exceeds $50,000;

(4) Fire, breakage, or spillage or suspected radioactive contamination occurs involving shipment of radioactive materials (see § 175.700(b));

(5) Fire, breakage, spillage, or suspected contamination occurs involving shipment of etiologic agents. In addition to the report required by paragraph (a) of this section, a report on an incident involving etiologic agents should be telephoned directly to the Director, Center for Disease Control, U.S. Public Health, Atlanta, Georgia, area code 404-633-5313; or

(6) A situation exists of such a nature that, in the judgment of the carrier, it should be reported to the Department even though it does not meet the criteria of paragraph (b)(1), (2), or (3) of this section, e.g., a continuing danger to life exists at the scene of the incident.

(7) If the operator conforms to the provisions of this section, the carrier requirements of § 171.15 except § 171.15(c) of this subchapter shall be deemed to have been satisfied.

(b) The following information shall be furnished in each report:

LEGEND 30.—Excerpt from CFR 49 Part 175.

EXCERPT FROM CFR 49 PART 175

(1) Name of reporting person;

(2) Name and address of carrier represented by reporter;

(3) Phone number where reporter can be contacted;

(4) Date, time, and location of incident;

(5) The extent of the injuries, if any; and

(6) Classification, name and quantity of hazardous material involvement and whether a continuing danger to life exists at the scene.

(c) Each operator who transports hazardous materials shall report in writing, in duplicate, on DOT Form F 5800.1 within 15 days of the date of discovery, each incident that occurs during the course of transportation (including loading, unloading, or temporary storage) in which, as a direct result to hazardous materials, any of the circumstances set forth in paragraph (a) of this section occurs or there has been an unintentional release of hazardous materials from a package. Each operator making a report under this section shall send that report to the Materials Transportation Bureau, Office of Hazardous Materials Regulation, Department of Transportation, Washington, D.C. 20590, with a separate copy to the FAA facility indicated in paragraph (a) of this section.

[Amdt. 175-1, 41 FR 16106, Apr. 15, 1976, as amended by Amdt. 175-1A, 41 FR 40686, Sept. 20, 1976]

Subpart B—Loading, Unloading and Handling

§ 175.75 Quantity limitations aboard aircraft.

(a) Except as provided in § 175.85(b), no person may carry on an aircraft—

(1) A hazardous material except as permitted in Part 172 of this subchapter;

(2) More than 50 pounds net weight of hazardous material (and in addition thereto, 150 pounds net weight of nonflammable compressed gas) permitted to be carried aboard passenger-carrying aircraft—

(i) In an inaccessible cargo compartment,

(ii) In any freight container within an accessible cargo compartment, or

(iii) In any accessible cargo compartment in a cargo-only aircraft in a manner that makes it inaccessible unless in a freight container;

(3) Packages containing radioactive materials when their combined transport indices exceed 50.

(b) No limitation applies to the number of packages of ORM material aboard an aircraft.

[Amdt. 175-1A, 41 FR 40686, Sept. 20, 1976]

§ 175.78 Stowage compatibility of cargo.

(a) No person may stow a package of a corrosive material on an aircraft next to or in a position that will allow contact with a package of flammable solids, oxidizing materials, or organic peroxides.

(b) No person may stow a package labeled BLASTING AGENT on an aircraft next to, or in a position that will allow contact with a package of special fireworks or railway torpedoes.

[Amdt. 175-1, 41 FR 16106, Apr. 15, 1976, as amended by Amdt. 175-8, 44 FR 31184, May 31, 1979]

§ 175.79 Orientation of cargo.

(a) A package containing hazardous materials marked "THIS SIDE UP", "THIS END UP", or with arrows to indicate the proper orientation of the package, must be stored, loaded abroad an aircraft in accordance with such markings, and secured in a manner that will prevent any movement which would change the orientation of the package.

(b) A package containing liquid hazardous materials not marked as indicated in paragraph (a) of this section must be stored and loaded with closures up.

§ 175.85 Cargo location.

(a) No person may carry a hazardous material subject to the requirements of this subchapter in the cabin of a passenger-carrying aircraft.

(b) Each person carrying materials acceptable only for cargo-only aircraft shall carry those materials in a location accessible to a crewmember during flight. However, when materials acceptable for cargo-only or pas-

LEGEND 31.—Excerpt from CFR 49 Part 175.

EXCERPT FROM CFR 49 PART 175

senger carrying aircraft are carried on a small, single pilot, cargo-only aircraft being used where other means of transportation are impracticable or not available, they may be carried without quantity limitation as specified in § 175.75 in a location that is not accessible to the pilot subject to the following conditions.

(1) No person other than the pilot, an FAA inspector, the shipper or consignee of the material or a representative of the shipper or consignee so designated in writing, or a person necessary for handling the material may be carried on the aircraft.

(2) The pilot must be provided with written instructions on characteristics and proper handling of the material.

(3) Whenever a change of pilots occurs while the material is on board, the new pilot must be briefed under a hand-to-hand signature service provided by the operator of the aircraft.

(c) No person may load magnetized material (which might cause an erroneous magnetic compass reading) on an aircraft, in the vicinity of a magnetic compass, or compass master unit, that is a part of the instrument equipment of the aircraft, in a manner that affects its operation. If this requirement cannot be met, a special aircraft swing and compass calibration may be made. No person loading magnetized materials may obscure the warning labels.

(d) No person may carry materials subject to the requirements of this subchapter in an aircraft unless they are suitably safeguarded to prevent their becoming a hazard by shifting. For packages bearing "RADIOACTIVE YELLOW-II" or "RADIOACTIVE YELLOW-III" labels, such safeguarding must prevent movement that would permit the package to be closer to a space that is occupied by a person or an animal than is permitted by § 175.700.

(e) No person may carry a material subject to the requirements of this subchapter that is acceptable for carriage in a passenger-carrying aircraft (other than magnetized materials) unless it is located in the aircraft in a place that is inaccessible to persons other than crew-members.

[Amdt. 175-1, 41 FR 16106, Apr. 15, 1976, as amended by Amdt. 175-1A, 41 FR 40686, Sept. 20, 1976]

§ 175.90 Damaged shipments.

Except as provided for in § 175.700, the operator of an aircraft shall remove from the aircraft any package subject to this subchapter that appears to be damaged or leaking. No person shall place or transport a package that is damaged or appears to be damaged or leaking aboard an aircraft subject to this Part.

[Amdt. 175-1, 41 FR 16106, Apr. 15, 1976, as amended by Amdt. 175-1A, 41 FR 40686, Sept. 20, 1976]

Subpart C—Specific Regulations Applicable According to Classification of Material

§ 175.305 Self-propelled vehicles.

(a) Self-propelled vehicles are exempt from the drainage requirements of § 173.120 of this subchapter when carried in aircraft designed or modified for vehicle ferry operations and when all of the following conditions are met:

(1) Authorization for this type operation has been given by the appropriate authority in the government of the country in which the aircraft is registered;

(2) Each vehicle is secured in an upright position;

(3) Each fuel tank is filled in a manner and only to a degree that will preclude spillage of fuel during loading, unloading, and transportation; and

(4) Ventilation rates to be maintained in the vehicle storage compartment have been approved by the appropriate authority in the government of the country in which the aircraft is registered.

§ 175.310 Transportation of flammable liquid fuel in small, passenger-carrying aircraft.

A small aircraft or helicopter operated entirely within the State of Alaska or into a remote area elsewhere in the United States may carry, in other than scheduled passenger operations, not more than 20 gallons of flammable liquid fuel, if—

LEGEND 32.—Excerpt from CFR 49 Part 175.

EXCERPT FROM CFR 49 PART 175

(a) Transportation by air is the only practical means of providing suitable fuel;

(b) The flight is necessary to meet the needs of a passenger;

(c) The fuel is carried in metal containers that are either—

(1) DOT Specification 2A containers of not more than 5 gallons capacity, each packed inside a DOT Specification 12B fiberboard box or each packed inside a DOT Specification 15A, 15B, 15C, 16A, 19A or 19B wooden box, or in the case of a small aircraft in Alaska, each packed inside a wooden box of at least one-half inch thickness;

(2) Airtight, leakproof, inside containers of not more than 10 gallons capacity and of at least 28-gauge metal, each packed inside a DOT Specification 15A, 15B, 15C, 16A, 19A, or 19B wooden box or, in the case of a small aircraft in Alaska, each packed inside a wooden box of at least one-half inch thickness;

(3) DOT Specification 17E containers of not more than 5 gallons capacity; or

(4) Fuel tanks attached to flammable liquid fuel powered equipment under the following conditions:

(i) Each piece of equipment is secured in an upright position;

(ii) Each fuel tank is filled in a manner that will preclude spillage of fuel during loading, unloading, and transportation; and

(iii) Ventilation rates which are maintained in the compartment in which the equipment is carried have been approved by the FAA district office responsible for inspection and surveillance of the aircraft on which the equipment is carried.

(d) In the case of a helicopter, the fuel is carried on external cargo racks;

(e) The area or compartment in which the fuel is loaded is ventilated so as to prevent the accumulation of fumes;

(f) Before each flight, the pilot-in-command—

(1) Informs each passenger of the location of the fuel and the hazards involved; and

(2) Prohibits smoking, lighting matches, the carrying of any lighted cigar, pipe, cigarette or flame, and the use of anything that might cause an open flame or spark, while loading or unloading or in flight; and

(g) Fuel is transferred to the fuel tanks only while the aircraft is on the surface.

[Amdt. 175-1, 41 FR 16106, Apr. 15, 1976, as amended by Amdt. 175-1A, 41 FR 40686, Sept. 20, 1976]

§ 175.320 Cargo-only aircraft; only means of transportation.

(a) Notwithstanding § 172.101, when means of transportation other than air are impracticable or not available, hazardous materials listed in the following table may be carried on a cargo-only aircraft subject to the conditions stated in the table and in paragraph (b) of this section and, when appropriate, paragraph (c) of this section:

Material description	Class	Conditions
Electric blasting caps (more than 1,000).	Class A explosives	Permitted only when no other cargo is aboard the aircraft. However, if the electric blasting caps are packed in an IME 22 container (see 49 CFR 171.7(d)(9)), they may be transported in the same aircraft with materials that are not classed as hazardous materials.
Electric blasting caps (1,000 or less)	Class C explosives	Permitted only when no other cargo is aboard the aircraft. However, if the electric blasting caps are packed in a DOT MC 201 container (49 CFR 178.318) or an IME 22 container (see 49 CFR 171.7(d)(9)), they may be transported in the same aircraft with materials other than class A or class B explosives.
Gasoline	Flammable liquid	Permitted in metal drums having rated capacities of 55 gal. or less. May not be transported in the same aircraft with materials classed as class A, B, or C explosives, blasting agents, corrosive materials or oxidizing materials. Permitted in installed tanks each having a capacity of more than 110 gal. Subject to the conditions specified in para. (c) of this section.

LEGEND 33.—Excerpt from CFR 49 Part 175.

EXCERPT FROM CFR 49 PART 175

§ 175.320 **Title 49—Transportation**

Material description	Class	Conditions
High explosives	Class A explosives	Limited to explosives to be used for blasting. Permitted only when no other cargo is aboard the aircraft or when being transported in the same aircraft with an authorized shipment of any 1 or more of the following materials to be used for blasting: Ammonium nitrate-fuel oil mixtures Blasting agent, n.o.s. Cordeau detonant fuse. Propellant explosive (solid) class B (water gels only). Propellant explosive (liquid) class B (water gels only).
Oil n.o.s.; petroleum oil or petroleum oil, n.o.s.	Flammable liquid	Permitted in metal drums having rated capacities of 55 gal. or less. May not be transported in the same aircraft with materials classed as class A, B, or C explosives, blasting agents, corrosive materials, or oxidizing materials. Permitted in installed tanks each having a capacity of more than 110 gal. subject to the conditions specified in para. (c) of this section.
Combustible liquid, n.o.s	Combustible liquid	Permitted in installed tanks each having a capacity of more than 110 gal subject to the conditions specified in par. (c) of this section.

(b) The following conditions apply to the carriage of hazardous materials performed under the authority of this section:

(1) No person other than a required flight crewmember, an FAA inspector, the shipper or consignee of the material or a representative of the shipper or consignee so designated in writing, or a person necessary for handling the material may be carried on the aircraft.

(2) The operator of the aircraft must have advance permission from the owner or operator of each manned airport where the material is to be loaded or unloaded or where the aircraft is to land while the material is on board. When the destination is changed after departure because of weather or other unforeseen circumstances, permission from the owner or operator of the alternate airport should be obtained as soon as practicable before landing.

(3) At any airport where the airport owner or operator or authorized representative thereof has designated a location for loading or unloading the material concerned, the material may not be loaded or unloaded at any other location.

(4) If the material concerned can create destructive forces or have lethal or injurious effects over an appreciable area as a result of an accident involving the aircraft or the material, the loading and unloading of the aircraft and its operation in takeoff, en route, and in landing must be conducted at a safe distance from heavily populated areas and from any place of human abode or assembly.

(5) If the aircraft is being operated by a holder of a certificate issued under 14 CFR Part 121, Part 127, or Part 135, operations must be conducted in accordance with conditions and limitations specified in the certificate holder's operations specifications or operations manual accepted by the FAA. If the aircraft is being operated under 14 CFR Part 91, operations must be conducted in accordance with an operations plan accepted and acknowledged in writing by the operator's FAA District Office.

(6) Each pilot of the aircraft must be provided written instructions stating the conditions and limitations of the operation being conducted and the name of the airport official[s] granting the advance permission required by the first sentence of paragraph (b)(2) of this section.

(7) The aircraft and the loading arrangement to be used must be approved for safe carriage of the particular materials concerned by the FAA District Office holding the operator's certificate and charged with overall inspection of its operations, or the appropriate FAA District Office serving the place where the material is to be loaded.

LEGEND 34.—Excerpt from CFR 49 Part 175.

EXCERPT FROM CFR 49 PART 175

(8) When Class A explosives are carried under the authority of this section, the operator of the aircraft shall obtain route approval from the FAA inspector in the operator's FAA District Office.

(9) During loading and unloading, no person may smoke, carry a lighted cigarette, cigar, or pipe, or operate any device capable of causing an open flame or spark within 50 feet of the aircraft.

(c) The following additional conditions apply to the carriage of flammable liquids and combustible liquids in tanks each having a capacity of more than 110 gallons under the authority of this section:

(1) The tanks and their associated piping and equipment and the installation thereof must have been approved for the material to be transported by the appropriate FAA Regional Office.

(2) In the case of an aircraft being operated by a certificate holder, the operator shall list the aircraft and the approval information in its operating specifications. If the aircraft is being operated by other than a certificate holder, a copy of the FAA Regional Office approval required by this section must be carried on the aircraft.

(3) The crew of the aircraft must be thoroughly briefed on the operation of the particular bulk tank system being used.

(4) During loading and unloading and thereafter until any remaining fumes within the aircraft are dissipated:

(i) Only those electrically operated bulk tank shutoff valves that have been approved under a supplemental type certificate may be electrically operated.

(ii) No engine or electrical equipment, avionic equipment, or auxiliary power units may be operated, except position lights in the steady position and equipment required by approved loading or unloading procedures, as set forth in the operator's operations manual, or for operators that are not certificate holders, as set forth in a written statement.

(iii) No person may fill a container, other than an approved bulk tank, with a flammable or combustible liquid or discharge a flammable or combustible liquid from a container, other than an approved bulk tank, while that container is inside or within 50 feet of the aircraft.

(iv) When filling an approved bulk tank by hose from inside the aircraft, the doors and hatches must be fully open to insure proper ventilation.

(v) Static ground wires must be connected between the storage tank or fueler and the aircraft, and between the aircraft and a positive ground device.

[Amdt. 175-1, 41 FR 16106, Apr. 15, 1976, as amended by Amdt. 175-1A, 41 FR 40686, Sept. 20, 1976]

NOTE: For amendments to § 175.320 see the List of CFR Sections Affected appearing in the Finding Aids section of this volume.

§ 175.630 Special requirements for poisons.

(a) No person may transport a package bearing a POISON label aboard an aircraft in the same cargo compartment with material which is marked as or known to be food stuff, feed, or any other edible material intended for consumption by humans or animals.

(b) No person may operate an aircraft that has been used to transport any package bearing a POISON label unless, upon removal of such package, the area in the aircraft in which it was carried is visually inspected for evidence of leakage, spillage, or other contamination. All contamination discovered must be either isolated or removed from the aircraft. The operation of an aircraft contaminated with such poisons is considered to be the carriage of poisonous materials under paragraph (a) of this section.

§ 175.640 Special requirements for other regulated materials.

Asbestos must be loaded, handled, and unloaded, and any asbestos contamination of aircraft removed, in a manner that will minimize occupational exposure to airborne asbestos particles released incident to transportation. (See § 173.1090 of this subchapter.)

[Amdt. 175-7, 43 FR 56668, Dec. 4, 1978]

§ 175.700 Special requirements for radioactive materials.

(a) No person may place any package of radioactive materials bearing

LEGEND 35.—Excerpt from CFR 49 Part 175.

EXCERPT FROM CFR 49 PART 175

"RADIOACTIVE YELLOW-II" or "RADIOACTIVE YELLOW-III" labels in an aircraft closer than the distances shown in the following table to a space (or dividing partition between spaces) which may be continuously occupied by people, or shipments of animals, or closer than the distances shown in the following table to any package containing undeveloped film (if so marked). If more than one of these packages is present, the distance shall be computed from the following table on the basis of the total transport index numbers shown on labels of the individual packages in the aircraft:

Total transport index	Minimum seperation distances in feet to the nearest undeveloped film for various times of transit					Minimum distance in feet to area of persons, or minimum distance in feet from dividing partition of cargo compartment
	Up to 2 hr	2-4 hr	4-8 hr	8-12 hr	Over 12 hr	
None	0	0	0	0	0	0
0.1 to 1.0	1	2	3	4	5	1
1.1 to 5.0	3	4	6	8	11	2
5.1 to 10.0	4	6	9	11	15	3
10.1 to 20.0	5	8	12	16	22	4
20.1 to 30.0	7	10	15	20	29	5
30.1 to 40.0	8	11	17	22	33	6
40.1 to 50.0	9	12	19	24	36	7

(b) In addition to the reporting requirements of § 175.45, the carrier must also notify the shipper at the earliest practicable moment following any incident in which there has been breakage, spillage, or suspected radioactive contamination involving radioactive materials shipments. Aircraft in which radioactive materials have been spilled may not be again placed in service or routinely occupied until the radiation does rate at any accessible surface is less than 0.5 millirem per hour and there is no significant removable radioactive surface contamination (see § 173.397 of this subchapter). In these instances, the package or materials should be segregated as far as practicable from personnel contact. If radiological advice or assistance is needed, the U.S. Energy Research and Development Administration should also be notified. In case of obvious leakage, or if it appears likely that the inside container may have been damaged, care should be taken to avoid inhalation, ingestion, or contact with the radioactive materials. Any loose radioactive materials should be left in a segregated area pending disposal instructions from qualified persons.

(c) No person may carry aboard a passenger-carrying aircraft any package of radioactive material which contains a large quantity (large radioactive source) of radioactivity (as defined in § 173.389(b) of this subchapter), except as specifically approved by the Director, Office of Hazardous Materials Regulation, Materials Transportation Bureau, Department of Transportation.

(d) Except as provided in this paragraph, no person may carry aboard a passenger-carrying aircraft any radioactive material other than a radioactive material intended for use in, or incident to, research or medical diagnosis or treatment. Prior to May 3, 1981, this prohibition does not apply to materials which meet the requirements of § 173.391(a), (b), or (c) of this subchapter in effect on May 3, 1979.

(49 U.S.C. 1803, 1804, 1806, 1808; 49 CFR 1.53 and App. A to Part 1)

[Amdt. 175-1, 41 FR 16106, Apr. 15, 1976, as amended by Amdt. 175-4, 42 FR 22367, May 3, 1977]

NOTE: For amendments to § 175.700 see the List of CFR Sections Affected appearing in the Finding Aids section of this volume.

LEGEND 36.—Excerpt from CFR 49 Part 175.

EXCERPT FROM CFR 49 PART 175

Chapter I—Research and Special Programs Administration **§ 175.710**

§ 175.710 Special requirements for fissile Class III radioactive materials.

(a) No person may carry aboard any aircraft any package of fissile Class III radioactive material (as defined in § 173.389(a)(3) of this subchapter), except as follows:

(1) On a cargo-only aircraft which has been assigned for the sole use of the consignor for the specific shipment of fissile radioactive material. Instructions for such sole use must be provided for in special arrangements between the consignor and carrier, with instructions to that effect issued with shipping papers; or

(2) On any aircraft on which there is no other package of radioactive materials required to bear one of the RADIOACTIVE labels described in §§ 172.436, 172.438, and 172.440 of this subchapter. Specific arrangements must be effected between the shipper and carriers, with instructions to that effect issued with the shipping papers; or

(3) In accordance with any other procedure specifically approved by the Director, Office of Hazardous Materials Regulation, Materials Transportation Bureau.

[Amdt. 175-1, 41 FR 16106, Apr. 15, 1976, as amended by Amdt. 175-6, 43 FR 48645, Oct. 19, 1978]

LEGEND 37.—Excerpt from CFR 49 Part 175.

PIREP

(U)UA ➤ /OV ➤ FL

MSG TYPE LOCATION OF PHENOMENA 3-LTR IDENT RADIAL DISTANCE TIME (Z) FLT LVL

/TP ➤ /SK ➤

TYPE AIRCRAFT SKY COVER BASE AMOUNT TOP

/TA ➤ /WV ➤

TEMPERATURE-CELSIUS WIND-DIRECTION SPEED

/TB ➤ /IC ➤

TURBULENCE-INTENSITY TYPE* ALTITIDE** ICING-INTENSITY TYPE ALTITUDE**

/RM ➤

REMARKS (MOST HAZARDOUS ELEMENT REPORTED FIRST)

LEGEND: ➤ = SPACE SYMBOL *=ONLY FOR CAT **=ONLY IF DIFFERENT FROM FL

TURBULENCE REPORTING CRITERIA TABLE

Intensity	*Aircraft Reaction*	*Reaction Inside Aircraft*
LIGHT	Turbulence that momentarily causes slight, erratic changes in altitude and/or attitude (pitch, roll, yaw). Report as *Light Turbulence*;* or Turbulence that causes slight, rapid and somewhat rhythmic bumpiness without appreciable changes in altitude or attitude. Report as *Light Chop.*	Occupants may feel a slight strain against seat belts or shoulder straps. Unsecured objects may be displaced slightly. Food service may be conducted and little or no difficulty is encountered in walking.
MODERATE	Turbulence that is similar to Light Turbulence but of greater intensity. Changes in altitude and/or attitude occur but the aircraft remains in positive control at all times. It usually causes variations in indicated airspeed. Report as *Moderate Turbulence*;* or Turbulence that is similar to Light Chop but of greater intensity. It causes rapid bumps or jolts without appreciable changes in aircraft altitude or attitude. Report as *Moderate Chop.*	Occupants feel definite strains against seat belts or shoulder straps. Unsecured objects are dislodged. Food service and walking are difficult.
SEVERE	Turbulence that causes large, abrupt changes in ~~altitude~~ and/or attitude. It usualy causes large variations in indicated airspeed. Aircraft may be momentarily out of control. Report as *Severe Turbulence.**	Occupants are forced violently against seat belts or shoulder straps. Unsecured objects are tossed about. Food service and walking are impossible.
EXTREME	Turbulence in which the aircraft is violently tossed about and is practically impossible to control. It may cause structural damage. Report as *Extreme Turbulence.**	

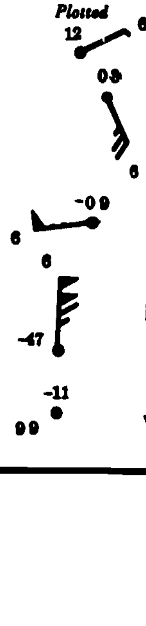
* High level turbulence (normally above 15,000 feet ASL) not associated with cumuliform cloudiness, including thunderstorms, should be reported as CAT (clear air turbulence) preceded by the appropriate intensity, or light or moderate chop.

INTENSITY	ICE ACCUMULATION
Trace	Ice becomes perceptible. Rate of accumulation slightly greater than rate of sublimation. It is not hazardous even though deicing/anti-icing equipment is not utilized, unless encountered for an extended period of time (over 1 hour).
Light	The rate of accumulation may create a problem if flight is prolonged in this environment (over 1 hour). Occasional use of deicing/anti-icing equipment removes/prevents accumulation. It does not present a problem if the deicing/anti-icing equipment is used.
Moderate	The rate of accumulation is such that even short encounters become potentially hazardous and use of deicing/anti-icing equipment or diversion is necessary.
Severe	The rate of accumulation is such that deicing/anti-icing equipment fails to reduce or control the hazard. Immediate diversion is necessary.

Pilot Report: Aircraft Identification, Location, Time (GMT), Intensity of Type,* Altitude/FL, Aircraft Type, IAS and OAT

FORECAST WINDS AND TEMPERATURES ALOFT (FD)

Plotted *Interpretation*



12° C, wind 060° at 5 knots

3° C, wind 160° at 25 knots

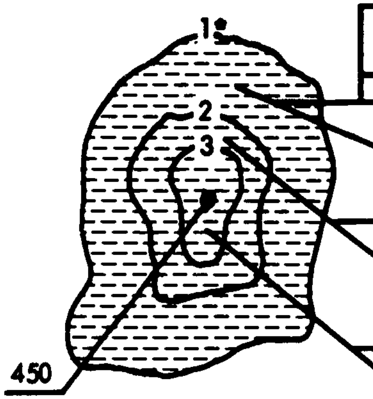
−9° C, wind 260° at 50 knots

−47° C, wind 360° at 115 knots

−11° C, wind calm (light variable)

LEGEND 38.—PIREP.

KEY TO RADAR SUMMARY CHART



Highest precipitation tops in area in hundreds of feet.

LEVEL	ECHO INTENSITY	PRECIPITATION INTENSITY	POSSIBLE TURBULENCE	WIND GUSTS	HAIL	LIGHTNING
1	WEAK	LIGHT	LGT/MDT			
2	MODERATE	MODERATE	LGT/MDT			
3	STRONG	HEAVY	SEVERE			
4	VERY STRONG	VERY HEAVY	SEVERE	POSSIBLE	POSSIBLE	YES
5	INTENSE	INTENSE	SEVERE	ORGANIZED	LIKELY	YES
6	EXTREME	EXTREME	SEVERE	EXTENSIVE	LARGE	YES

* The numbers representing the intensity level do not appear on the chart. Beginning from the first contour line, bordering the area, the intensity level is 1-2; second contour is 3-4; and third contour is 5-6.

SYMBOLS USED ON CHART

SYMBOL	MEANING
R	RAIN
RW	RAIN SHOWERS
A	HAIL
S	SNOW
IP	ICE PELLETS
SW	SNOW SHOWERS
L	DRIZZLE
T	THUNDERSTORM
ZR, ZL	FREEZING PRECIPITATION
NE	NO ECHOES OBSERVED
NA	OBSERVATIONS UNAVAILABLE
OM	OUT FOR MAINTENANCE
STC	STC ON -- all precipitation may not be seen

SYMBOL	MEANING
+	INTENSITY INCREASING OR NEW ECHO
-	INTENSITY DECREASING
NO SYMBOL	NO CHANGE
35 ↗	CELL MOVEMENT TO NE AT 35 KNOTS
→	LINE OR AREA MOVEMENT TO EAST AT 20 KNOTS
MA	ECHOES MOSTLY ALOFT
PA	ECHOES PARTLY ALOFT

SYMBOL	MEANING
/	LINE OF ECHOES
SLD	OVER 9/10 COVERAGE IN A LINE
WS999	THUNDERSTORM WATCH
WT999	TORNADO WATCH
LEWP	LINE ECHO WAVE PATTERN

LEGEND 39.—Key to Radar Summary Chart.

APPENDIX 3

Form Approved OMB No 2120-0026

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

FLIGHT PLAN

(FAA USE ONLY) ☐ PILOT BRIEFING ☐ VNR ☐ STOPOVER | TIME STARTED | SPECIALIST INITIALS

1 TYPE	2 AIRCRAFT IDENTIFICATION	3 AIRCRAFT TYPE/ SPECIAL EQUIPMENT	4 TRUE AIRSPEED	5 DEPARTURE POINT	6 DEPARTURE TIME PROPOSED (Z)	ACTUAL (Z)	7 CRUISING ALTITUDE
VFR ☐ / IFR ☒ / DVFR ☐	N153	JET/R	KTS	LAX			FL270

8 ROUTE OF FLIGHT: LAX FLIPR2.TRM J169 SALOM INT SALOM.ARLIN6

9 DESTINATION (Name of airport and city): PHX PHOENIX

10 EST. TIME ENROUTE: HOURS | MINUTES

11 REMARKS

12 FUEL ON BOARD: HOURS | MINUTES

13 ALTERNATE AIRPORT(S): NA

14 PILOT'S NAME, ADDRESS & TELEPHONE NUMBER & AIRCRAFT HOME BASE

15 NUMBER ABOARD: 85

16 COLOR OF AIRCRAFT

17 DESTINATION CONTACT/TELEPHONE (OPTIONAL)

CIVIL AIRCRAFT PILOTS. FAR Part 91 requires you file an IFR flight plan to operate under instrument flight rules in controlled airspace. Failure to file could result in a civil penalty not to exceed $1,000 for each violation (Section 901 of the Federal Aviation Act of 1958, as amended). Filing of a VFR flight plan is recommended as a good operating practice. See also Part 99 for requirements concerning DVFR flight plans.

FAA Form 7233-1 (8-82) CLOSE VFR FLIGHT PLAN WITH ____________ FSS ON ARRIVAL

FLIGHT LOG

CHECK POINTS FROM	TO	ROUTE / ALTITUDE	MACH NO	WIND / TEMP	SPEED-KTS TAS	GS	DIST NM	TIME LEG	TIME TOT	FUEL LEG	FUEL TOT
LAX	LEVEL OFF	FLIPR / CLIMB							:19		*4400
LEVEL OFF	TRM	J169 / FL 270		330/45 / ISA -2			21				
TRM	BLH	J169 / FL270		330/4[illegible] / ISA -2							
BLH	SALOM INT	J169 / FL270		340/42 / ISA -2							
SALOM INT	PHX	DESCENT AND APPROACH						:10		1250	

OTHER DATA: * Includes 1,000 lbs fuel for taxi.

NOTE: Use 10,500 PPH fuel from level off to SALOM INT.

Use 9,400 PPH fuel flow for reserve requirements.

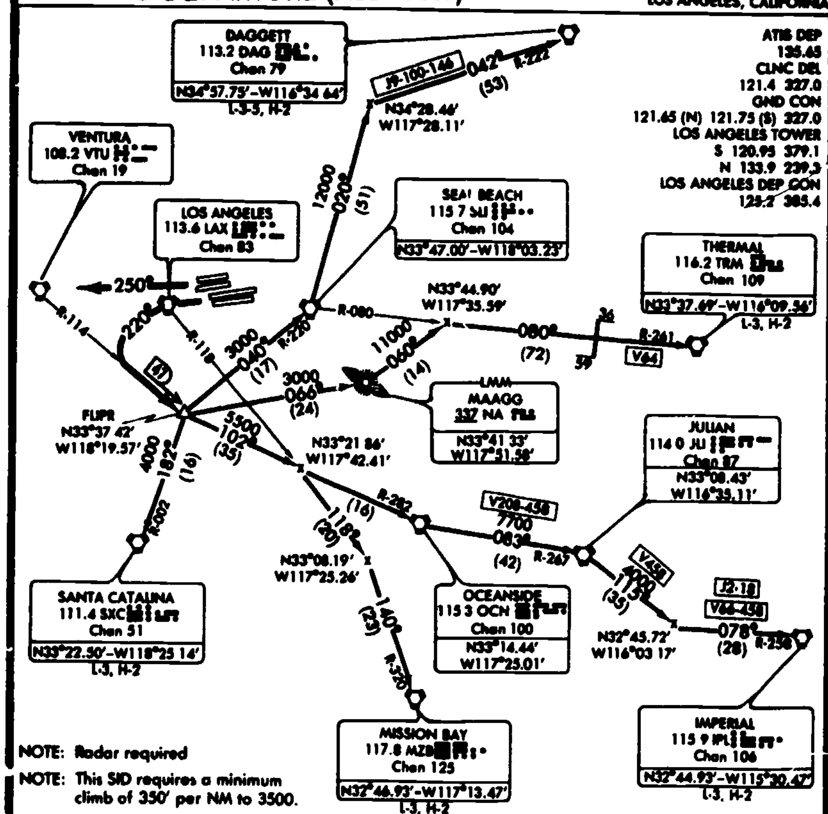
FLIGHT SUMMARY

TIME	FUEL	
		EN ROUTE
		RESERVE
--	1200	MISSED APPR.
		TOTAL

FIGURE 1.—Flight Plan/Flight Log.

FLIPR TWO DEPARTURE (PILOT NAV)

LOS ANGELES INTL
LOS ANGELES, CALIFORNIA



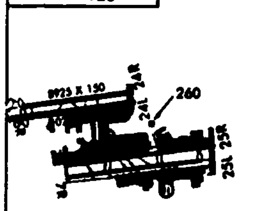
NOTE: Radar required

NOTE: This SID requires a minimum climb of 350' per NM to 3500.

NOTE Chart not to scale

DEPARTURE ROUTE DESCRIPTION

ELEV 126



TAKE-OFF RUNWAYS 24: Climb via heading 250° for vector to intercept and proceed via VTU R-114 to FLIPR INT. Thence . . . .

TAKE-OFF RUNWAYS 25: Climb via runway heading, at LAX VORTAC turn left heading 220° for vector to intercept and proceed via VTU R-114 to FLIPR INT. Thence . . . .

. . . . via (transition) or (assigned route). Expect further clearance to filed altitude five minutes after departure.

DAGGETT TRANSITION (FLIPR2.DAG)

IMPERIAL TRANSITION (FLIPR2.IPL)

MISSION BAY TRANSITION (FLIPR2.MZB)

SANTA CATALINA TRANSITION (FLIPR2.SXC)

THERMAL TRANSITION (FLIPR2.TRM)

FLIPR TWO DEPARTURE (PILOT NAV)
(FLIPR2.FLIPR)

LOS ANGELES, CALIFORNIA
LOS ANGELES INTL

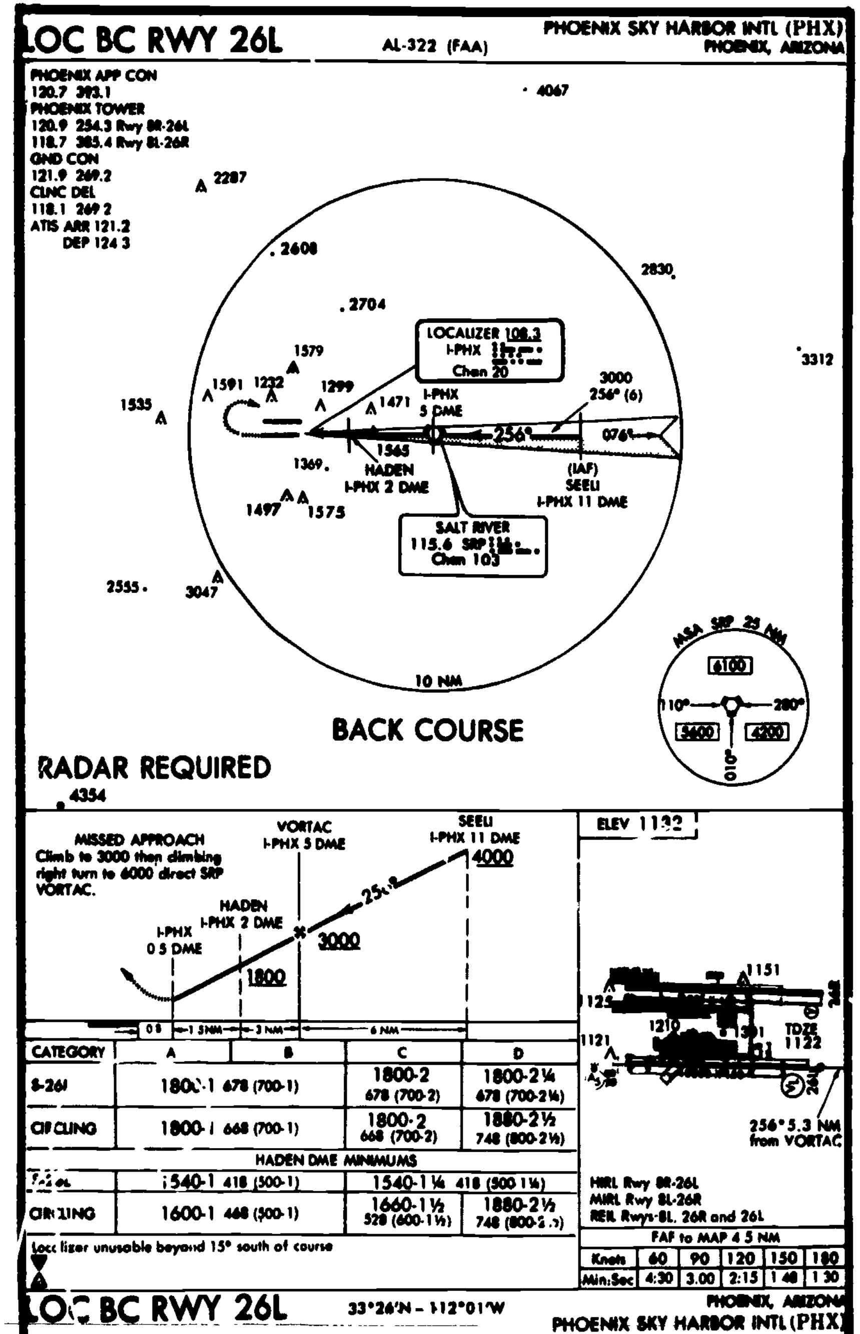
CALIFORNIA

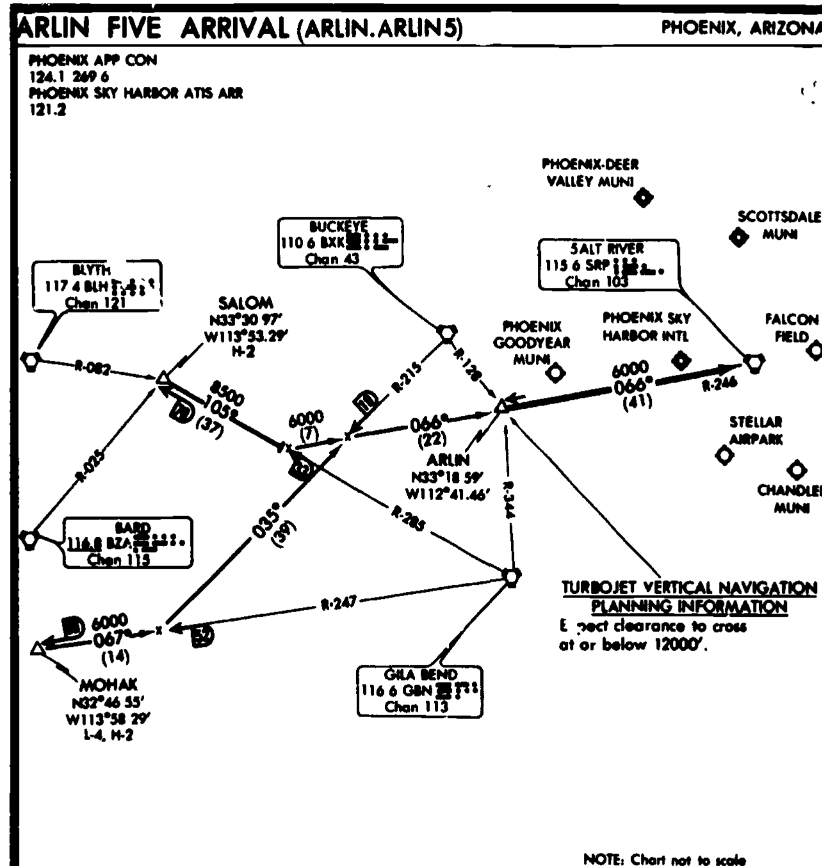
LOS ANGELES

LOS ANGELES INTL (LAX) 9 SW UTC–8(–7DT) 33°56'33"N 118°24'26"W — LOS ANGELES COPTER H-2B, L-3B, A IAP
126 B S4 FUEL 100, JET A OX 4
LRA CFR Index E
RWY 07L-25R: H12091X150 (CONC-GRVD) S-175, D-225, DT-400, DDT-900 HIRL CL
RWY 07L: MALSR. VASI(V4L)—GA 2.5°TCH 59'. Building. Rgt tfc.
RWY 25R: MALSR. Thld dsplcd 962'. Railroad.
RWY 07R-25L: H11096X200 (CONC-GRVD) S-175, D-225, DT-400, DDT-900 HIRL CL
RWY 07R: MALSR. VASI(V4L)—GA 3.0°TCH 56.34'. Lgtd building. Rgt tfc.
RWY 25L: ALSF2. TDZ. Railroad.
RWY 06R-24L: H10285X150 (ASPH—CONC—GRVD) S-110, D-200, DT-325, DDT-750 HIRL
RWY 06R: MALSR. VASI(V6L)—Upper GA 3.25°TCH 92'. Lower GA 3.0°TCH 60' Thld dsplcd 321'.
RWY 24L: MALSR. Rgt tfc.
RWY 06L-24R: H8925X150 (CONC-GRVD) S-175, D-225, DT-400, DDT-900 HIRL CL
RWY 06L: MALSR. VASI(V6L)—Upper GA 3 25°TCH 94'. Lower GA 3 0°TCH 54'
RWY 24R: ALSF2. TDZ. Sign Rgt tfc.
AIRPORT REMARKS: Attended continuously. Use extreme CAUTION—tubulence may be deflected upward from the blast fence 160' E of Rwy 25R. CAUTION. Impaired wing clearance may exist on taxiway J between 30K and 19K when taxilane K occupied; 165' centerline to centerline Twr will advise. Noise sensitive arpt. On westerly tkofs no turns before crossing shoreline. Over ocean apchs utilized 0800-1430Z‡. Rwy 24R ALSF2 operates as SSALR till weather goes below VFR. Rwy 25L ALSF2 operates as SSALR until weather goes below VFR Rwy 07L-25R FAA strength evaluation DC-10-10 540,000 lbs, DC-10-30 600,000 lbs, L-1011 600,000 lbs, B747-SP 630,000 lbs. Rwy 06L-24R FAA strength evaluation DC-10-10 430,000 lbs, DC-10-30 510,000 lbs, L-1011 510,000 lbs. Rwy 07R-25L FAA strength evaluation DC-10-10 400,000 lbs, DC-10-30 600,000 lbs, L-1011 600,000 lbs, B747-SP 710,000 lbs. Rwy 06R-24L FAA strength evaluation DC-10-10 340,000 lbs, DC-10-30 480,000 lbs, L-1011 480,000 lbs. Dual wheel acft up to 200,000 lbs, dual tandem wheel up to 350,000 lbs and double dual tanden wheel up to 834,000 lbs and DC10–10 to 430,000 lbs, DC10–30 to 578,000 lbs and L–1011 to 466,000 lbs and A–300 to 366,000 lbs regularly opr on all rwys. A 700'X500' clearway has been established at west end of Rwy 24L. Numerous birds on and in vicinity of airport. Flight Notification Service (ADCUS) available.
WEATHER DATA SOURCES: LLWAS.
COMMUNICATIONS: ATIS ARRIVAL 133.8 ATIS DEP 135.65 (213) 646-2297 UNICOM 122 95
HAWTHORNE FSS (HHR) LC 644–1020. NOTAM FILE LAX.
Ⓡ APP CON 128.5 (045°-089°), 124.9 (090°-224°), 124 5 (225°–044°)
TOWER 133.9 (N. complex), 120.95 (S. complex), 119 8 120.35 (helicopters),
GND CON 121.75 (S. complex), 121.65 (N. complex) CLNC DEL 121.4
Ⓡ DEP CON 125.2 (249°-044°) 124.3 (045°-248°)
TCA Group I: See VFR Terminal Area chart.
RADIO AIDS TO NAVIGATION: NOTAM FILE LAX.
(H) VORTAC 113.6 LAX Chan 83 33°55'59"N 118°25'52"W at fld 180/15E
VOR unusable 270-280° 17-35 NM below 8000' 280-300° 10-20 NM below 8000'
ROMEN NDB (LOM) 278 OS 33°57'54"N 118°16'37"W 249° 6.2 NM to fld
ILS/DME 108.5 I-OSS Chan 22 Rwy 24R LOM ROMEN NDB
ILS/DME 108.5 I-HQB Chan 22 Rwy 24L LOM ROMEN NDB
ILS/DME 109.9 I-LAX Chan 36 Rwy 25L
ILS/DME 109.9 I-CFN Chan 36 Rwy 25R
ILS/DME 111.7 I-UWU Chan 54 Rwy 06L
ILS/DME 111.7 I-GPE Chan 54 Rwy 06R
ILS/DME 111 1 I-IAS Chan 48 Rwy 07L
ILS/DME 111.1 I-MKZ Chan 48 Rwy 07R

WHITEMAN (WHP) 1 E UTC–8(–7DT) 34°15'35"N 118°24'45"W — LOS ANGELES COPTER L-3B, A
1004 B S4 FUEL 80, 100 TPA—2004(1000)
RWY 12-30: H3725X40 (ASPH) S-15, D-40 LIRL
RWY 12: Thld dsplcd 654' (Unlighted) P-line RWY 30: Thld dsplcd 490' (Unlighted) Trees Rgt tfc
AIRPORT REMARKS: Attended continuously Helicopter ops 2500' MSL (1500 AGL) and below
COMMUNICATIONS: CTAF/UNICOM 122.8
HAWTHORNE FSS (HHR) LC 842–4817
RADIO AIDS TO NAVIGATION: NOTAM FILE VNY
VAN NUYS (L) VORW/DME 113 1 VNY Chan 78 34°13'24"N 118°29'27"W 046° 4 5 NM to fld 810/15E
PACOIMA NDB (MHW) 370 PAI 34°15'35"N 118°24'45"W at fld (VFR only) NOTAM FILE HHR

FIGURE 2.—FLIPR Two Departure (Pilot Nav).





MOHAK TRANSITION (MOHAK.ARLIN5): From over MOHAK DME FIX via GBN R-247, BXK R-215 and SRP R-246 to ARLIN INT Thence. . . .

SALOM TRANSITION (SALOM.ARLIN5): From over SALOM INT via GBN R-285 and SRP R-246 to ARLIN INT. Thence. . . .

. . . .From over ARLIN INT via SRP R-246 to SRP VORTAC. Expect radar vectors after passing ARLIN INT to final approach course.

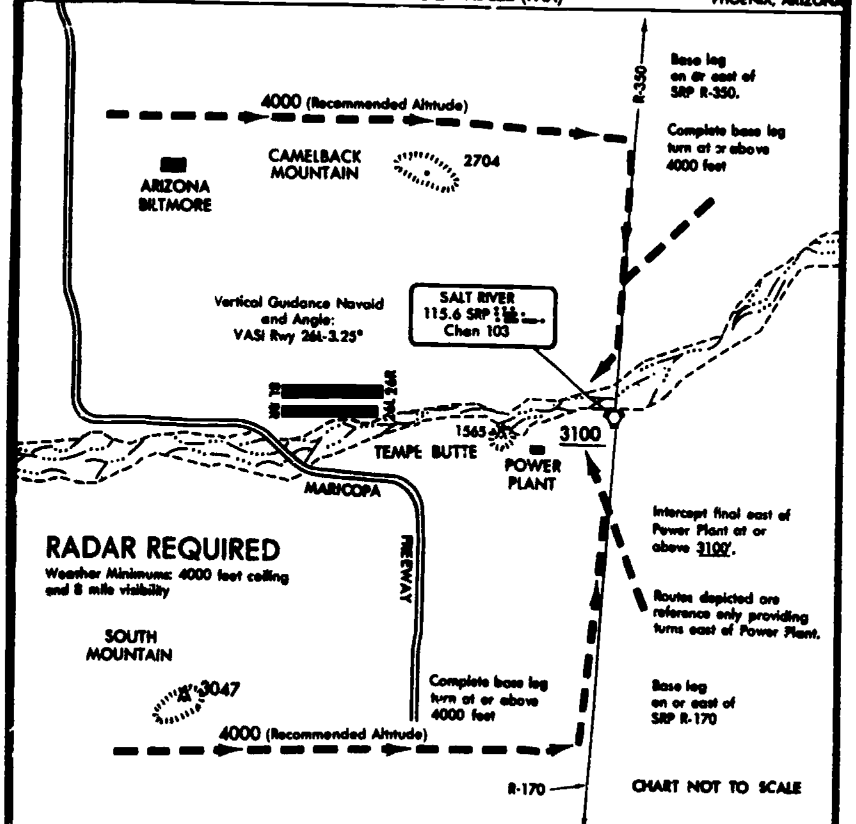
ALL SATELLITE AIRPORTS: Expect radar vectors after crossing ARLIN INT.

ARLIN FIVE ARRIVAL (ARLIN.ARLIN5) PHOENIX, ARIZONA

FIGURE 3.—Arlin Five Arrival/LOC BC RWY 26L.

Appendix 3

POWER PLANT VISUAL RWY 26L AL-322 (FAA) PHOENIX, ARIZONA



POWER PLANT VISUAL RWY 26L

When visual approaches to Runway 26L are in progress, clearances will be given utilizing in part the following phraseology:

"(IDENT) CLEARED FOR A POWER PLANT VISUAL RUNWAY 26L APPROACH."

POWER PLANT VISUAL RWY 26L 33°26'N - 112°01'W PHOENIX, ARIZONA
PHOENIX SKY HARBOR INTL (PHX)

ARIZONA

§ **PHOENIX SKY HARBOR INTL** (PHX) 3 E UTC-7 33°26'10"N 112°00'32"W — PHOENIX H-2H, L-4E IAP

1132 B S4 FUEL 80, 100, 100LL, JET A OX 1, 2, 3, 4 TPA—See Remarks
LRA CFR Index E

RWY 08L-26R: H11001X150 (ASPH-GRVD) S-30, D-170, DT-280, DDT-620 MIRL
RWY 08L: REIL. VASI(V4L)—GA 3.0°TCH 55'. Building.
RWY 26R: REIL. VASI(V4L)—GA 3.0°TCH 60'. Pole Rgt tfc
RWY 08R-26L: H10300X150 (ASPH-GRVD) S-30, D-200, DT-400, DDT-620 HIRL
RWY 08R: MALSR. Rgt tfc.
RWY 26L: REIL. VASI(V6L)—Upper GA 3.25°TCH 90'. Lower GA 3 0°TCH 53' Antenna

AIRPORT REMARKS: Attended continuously. Training by civil turbojet acft prohibited except PPR TPA—2132(1000) lgt acft and non-turbo jets; 2632(1500) heavy acft and turbojets. Unless advised by ATC all turbine acft and acft 12,500 lbs and over remain at or above 3000' MSL until established on final. Fly base leg at least 5 mi from arpt. Overnight parking fee. Fee for all charters; travel clubs and certain revenue producing aircraft. Taxiway A–6, B–4, B–6 limited to 68,000 GWT. Rwy 08L-26R gross weight limit DC-10-10 430,000 pounds, DC-10-30/40 540,000 pounds, L-1011-1 430,000 pounds, aircraft up to DDTW 620,000 pounds, DC-10-10 430,000 pounds, DC-10-30/40 540,000 pounds, L-1011-1 430,000 pounds regularly operate on rwy Rwy 08R-26L gross weight limit DC-10-10 430,000 pounds, DC-10-30/40 540,000 pounds, L-1011-1 430,000 pounds. Flight Notification Service (ADCUS) available.

WEATHER DATA SOURCES: LLWAS.

COMMUNICATIONS: ATIS ARRIVAL 121.2 (602) 244-0963 ATIS DEP 124.3 UNICOM 122.95
PRESCOTT FSS (PRC) LC 257–9792 NOTAM FILE PHX.
RCO 122.6 122.2 (PRESCOTT FSS)
Ⓡ APP/DEP CON 126.8 (259°–309°) 124.9 (053°–146°) 124 1 (147°–258° above 5500') 123 7 (147°–258° 5500' and below) 120.7 (310°–052° 5500' and below) 119.2 (310°–052° above 5500')
TOWER 118.7 (Rwy 08L-26R), 120.9 (Rwy 08R-26L) GND CON 121.9, 121.85 CLNC DEL 118.1
ARSA ctc APP CON

RADIO AIDS TO NAVIGATION: NOTAM FILE PHX.
SALT RIVER (H) VORTAC 115.6 SRP Chan 103 33°25'53"N 111°53'17"W 256°5 3 NM to fld. 1185/14E.
ILS/DME 108.3 I-PHX Chan 20 Rwy 08R GS unusable below 1280' LOC back course unusable beyond 20° south of course.

PIMA

FLYING J RANCH (E37) 4 SW UTC-7 32°30'52"N 109°52'52"W — PHOENIX

3100
RWY 01-19: 2980X80 (TURF)
RWY 01: Brush. RWY 19: Thld dsplcd 250' Brush
AIRPORT REMARKS: Attended continuously. Rwy 01-19 surface in rough condition with water erosion on first 1000' NE end.
COMMUNICATIONS: CTAF 122.9
PRESCOTT FSS (PRC) Toll free call, dial 602–778–0314

PINAL AIRPARK (See MARANA)

PRESCOTT — PHOENIX L-4E

FSS (PRC) on Earnest A Love Fld. 122.4 122.2. 602-778-0314

FIGURE 4.—Power Plant Visual RWY 26L.

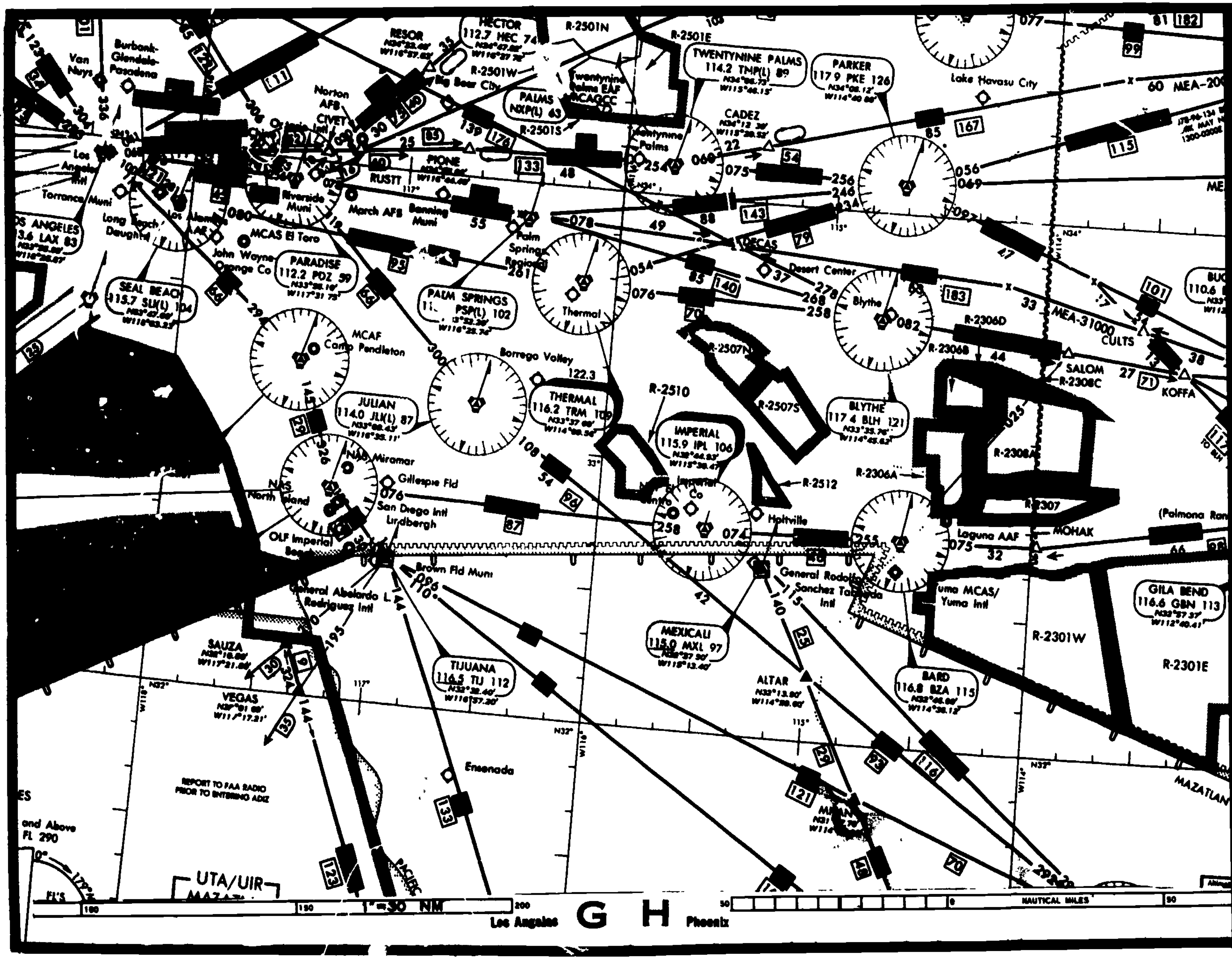


FIGURE 5.—IFR En Route High Altitude Chart Segment.

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Appendix 3

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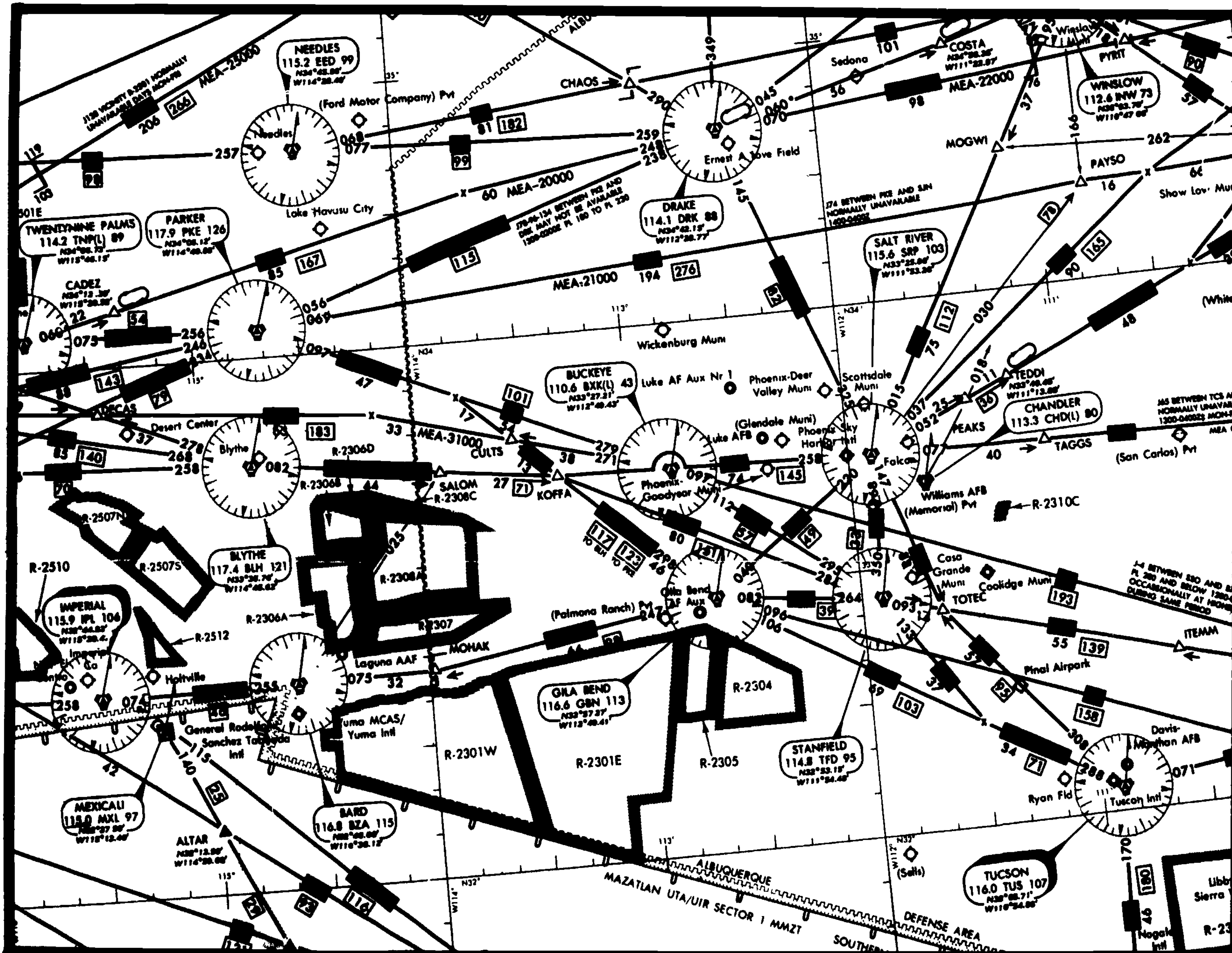

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FIGURE 5A.—IFR En Route High Altitude Chart Segment.

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Form Approved OMB No 2120-0026

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

FLIGHT PLAN

(FAA USE ONLY) ☐ PILOT BRIEFING ☐ VNR ☐ STOPOVER | TIME STARTED | SPECIALIST INITIALS

1 TYPE: ☐ VFR ☑ IFR ☐ DVFR
2 AIRCRAFT IDENTIFICATION: N853PC
3 AIRCRAFT TYPE/SPECIAL EQUIPMENT: BE1900/A
4 TRUE AIRSPEED: 233 KTS
5 DEPARTURE POINT: TUC INTL
6 DEPARTURE TIME: PROPOSED (Z) / ACTUAL (Z)
7 CRUISING ALTITUDE: FL220
8 ROUTE OF FLIGHT: TUC-TUC2.GBN VIA J104 TPN VIA TPN.DOWNE2-LAX
9 DESTINATION (Name of airport and city): LAX INTL LOS ANGELES
10 EST. TIME ENROUTE: HOURS / MINUTES
11 REMARKS
12 FUEL ON BOARD: HOURS / MINUTES
13 ALTERNATE AIRPORT(S): NA
14 PILOT'S NAME, ADDRESS & TELEPHONE NUMBER & AIRCRAFT HOME BASE
15 NUMBER ABOARD: 18
16 COLOR OF AIRCRAFT
17 DESTINATION CONTACT/TELEPHONE (OPTIONAL)

CIVIL AIRCRAFT PILOTS. FAR Part 91 requires you file an IFR flight plan to operate under instrument flight rules in controlled airspace. Failure to file could result in a civil penalty not to exceed $1,000 for each violation (Section 901 of the Federal Aviation Act of 1958, as amended). Filing of a VFR flight plan is recommended as a good operating practice. See also Part 99 for requirements concerning DVFR flight plans.

FAA Form 7233-1 (8-82) CLOSE VFR FLIGHT PLAN WITH ____________ FSS ON ARRIVAL

FLIGHT LOG

CHECK POINTS FROM	CHECK POINTS TO	ROUTE / ALTITUDE	MACH NO	WIND / TEMP	SPEED-KTS TAS	SPEED-KTS GS	DIST NM	TIME LEG	TIME TOT	FUEL LEG	FUEL TOT
TUS	LEVEL OFF	TUS2.GBN / CLIMB					73		:25		*350
LEVEL OFF	GBN	TUS2.GBN / FL220		280/46 / ISA -3							
GBN	INT J104	J104 / FL220		280/46 / ISA -3							
INT J104	PKE	J104 / FL220		280/46 / ISA -3							
PKE	TNP	J104 / FL220		280/46 / ISA -3							
TNP	START DESCENT	J104 / FL220		280/46 / ISA -3							
START DESCENT	DOWNE2 LAX	(DESCENT AND APPROACH)					52	:18		170	

OTHER DATA: * Includes fuel for taxi.
NOTE: Use 676 PPH total fuel flow from level off to start descent.
Use 726 PPH fuel flow for reserve requirements.

FLIGHT SUMMARY

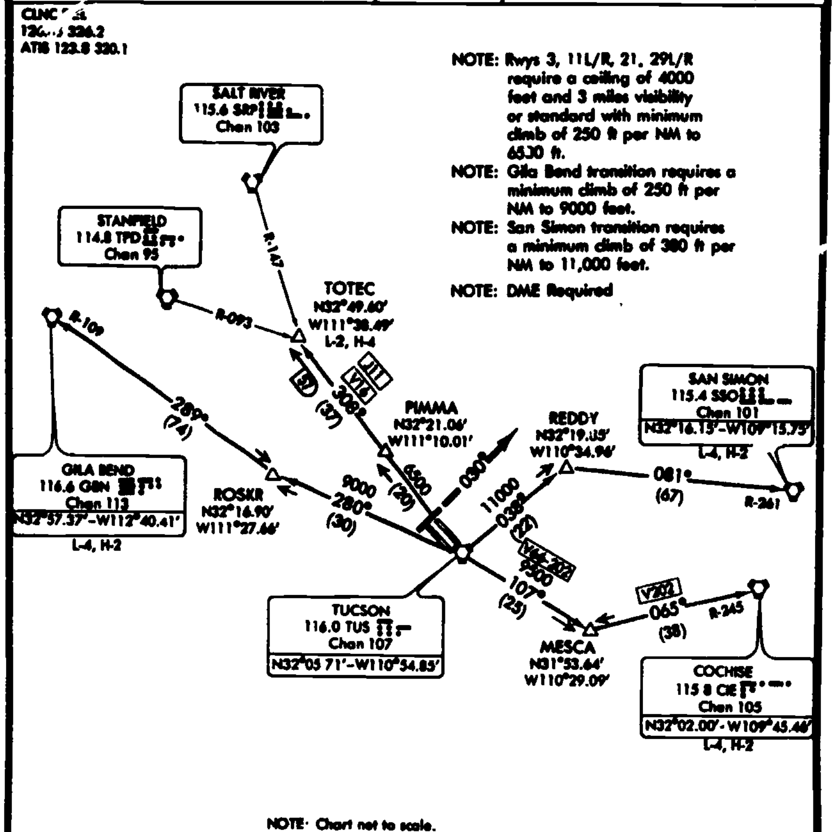
TIME	FUEL	
		EN ROUTE
		RESERVE
--	120	MISSED APPR.
		TOTAL

FIGURE 6.—Flight Plan/Flight Log.

(TUS2.TUS) 87323

TUCSON TWO DEPARTURE (PILOT NAV)

TUCSON INTL
TUCSON, ARIZONA



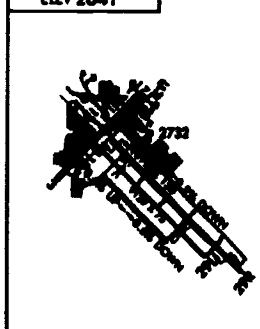
DEPARTURE ROUTE DESCRIPTION

TAKE-OFF RUNWAYS 11L/R, 21, 29L/R: Fly assigned heading to intercept appropriate transition. Maintain 17,000 feet, or assigned lower altitude. Expect clearance to filed flight level 10 minutes after departure.

TAKE-OFF RUNWAY 3: Fly heading 030° for vector to appropriate transition. Maintain 17,000 feet or assigned lower altitude. Expect clearance to filed flight level 10 minutes after departure.

(Continued on next page)

ELEV 2641



TUCSON TWO DEPARTURE (PILOT NAV)
(TUS2.TUS)

TUCSON, ARIZONA
TUCSON INTL

(TUS 2.TUS)

TUCSON TWO DEPARTURE (PILOT NAV)

TUCSON INTL
TUCSON, ARIZONA

DEPARTURE ROUTE DESCRIPTION
(Continued)

SAN SIMON TRANSITION (TUS2.SSO): Via TUS R-038 and SSO R-261 to SSO VORTAC.
COCHISE TRANSITION (TUS2.CIE): Via TUS R-107 and CIE R-245 to CIE VORTAC.
TOTEC TRANSITION (TUS2.TOTEC): Via TUS R-308 to TOTEC INT.
GILA BEND TRANSITION (TUS2.GBN): Via TUS R-280 and GBN R-109 to GBN VORTAC.

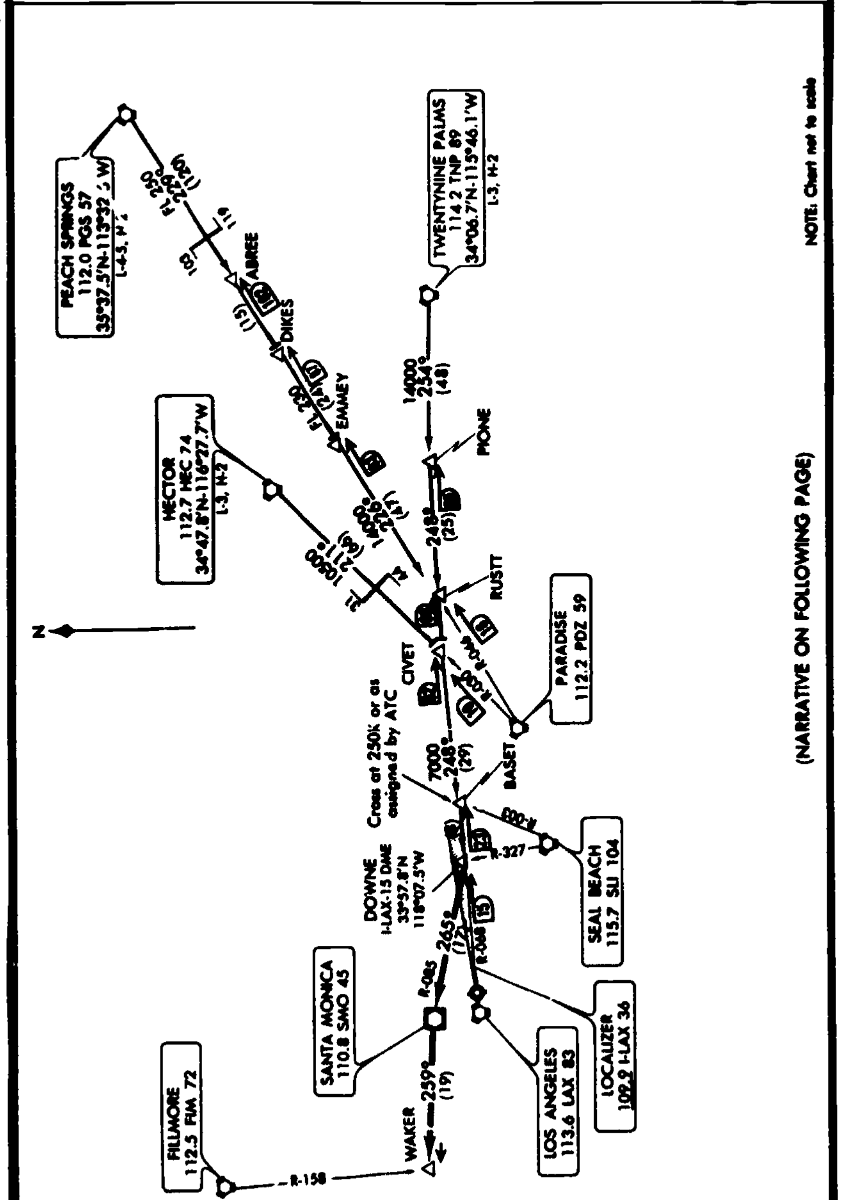
ARIZONA

§ TUCSON INTL (TUS) 6 S UTC–7 32°06'58"N 110°56'26"W — PHOENIX
2641 B S4 FUEL 100, 100LL, JET A OX 1, 2, 3, 4 AOE CFR Index D — H-2H, L-4F
RWY 11L-29R: H10994X150 (ASPH-PFC) S-160, D-200, DT-350, DDT-585 HIRL 0.6% up SE — IAP
RWY 11L: MALSR. Rgt tfc. Arresting device.
RWY 29R: VASI(V6L)—Upper GA 3.25°TCH 94'. Lower GA 3.0°TCH 50'. Arresting device.
RWY 11R-29L: H9129X75 (ASPH) S-120, D-140, DT-220 0.8% up SE
RWY 11R: Thld dsplcd 2143'. Rgt tfc. RWY 29L: Thld dsplcd 1782'. Pole.
RWY 03-21: H7000X150 (ASPH-PFC) S-105, D-137, DT-230, DDT-500 MIRL
RWY 03: Thld dsplcd 841'. Railroad.
RWY 21: REIL. VASI(V4L)—GA 3.0°TCH 50.3'. Tree. Rgt tfc Arresting device.
AIRPORT REMARKS: Attended continuously. Commercial ldg fee and tiedown fee. Acft departing Rwy 11R reqd to attain at least 400' AGL prior to starting turn. Southeast 1002' and northwest 3257' paved stopway Rwy 11L–29R. Rwy 11L–29R and 03–21 both sides have distance remaining markers. Rwy 11L-29R gross weight limit DC-10-10 315,000 lbs, DC-10-30/40 400,000 lbs, L-1011-1 325,000 lbs, L-1011-100/200 340,000 lbs, Rwy 03-21 gross weight limit DC-10-10 300,000 lbs, DC-10-30/40 375,000 lbs, L-1011-01 310,000 lbs, L-1011-100/200 315,000 lbs. Flight Notification Service (ADCUS) available.
WEATHER DATA SOURCES: LLWAS.
COMMUNICATIONS: ATIS 123.8 (602–741–1177) UNICOM 122.95
TUCSON FSS (TUS) on arpt. LC 889–9689. 122.2 NOTAM FILE TUS.
MOUNT LEMMON RCO 122.4 (TUCSON FSS)
Ⓡ APP/DEP CON 125.1 (Rwy 11 090°–285°) (Rwy 29 275°–065°) 118.5 (Rwy 11 286°–089°) (Rwy 29 066°–274°) 128.5 (1300–0700Z) 118.3 (0700–1300)
TOWER 118.3 119.0 GND CON 124.4 CLNC DEL 126.65
RADIO AIDS TO NAVIGATION: NOTAM FILE TUS. VHF/DF ctc TUCSON FSS
(H) VORTAC 116.0 TUS Chan 107 32°05'42"N 110°54'51"W 301° 1.8 NM to fld. 2670/12E.
VORTAC unusable 050°-080° beyond 30 NM below 10,500' 350°-005° beyond 30 NM below 11,200'
ILS/DME 108.5 I-TUS Chan 22 Rwy 11L.

NAME	TAKE-OFF MINIMUMS
TUCSON INTL	Rwys 3, 11L/R, 21, 29L/R, 4000-3 or standard with minimum climb of 250' per NM to 6500. IFR DEPARTURE PROCEDURE: Comply with SID or radar vectors, or turn left or right as assigned by ATC direct TUS VORTAC, climb in holding pattern (NW, right turn, 120 inbound) to depart TUS VORTAC at or above MCA or MEA for assigned airway.

FIGURE 7.—Tucson Two Departure (Pilot Nav).

(DOWNE.DOWNE2) 87267
DOWNE TWO ARRIVAL
LOS ANGELES INTERNATIONAL
LOS ANGELES, CALIFORNIA



DOWNE TWO ARRIVAL
(DOWNE.DOWNE2)
LOS ANGELES, CALIFORNIA
LOS ANGELES INTERNATIONAL

(DOWNE.DOWNE2)
DOWNE TWO ARRIVAL
LOS ANGELES INTERNATIONAL
LOS ANGELES, CALIFORNIA

ARRIVAL DESCRIPTION

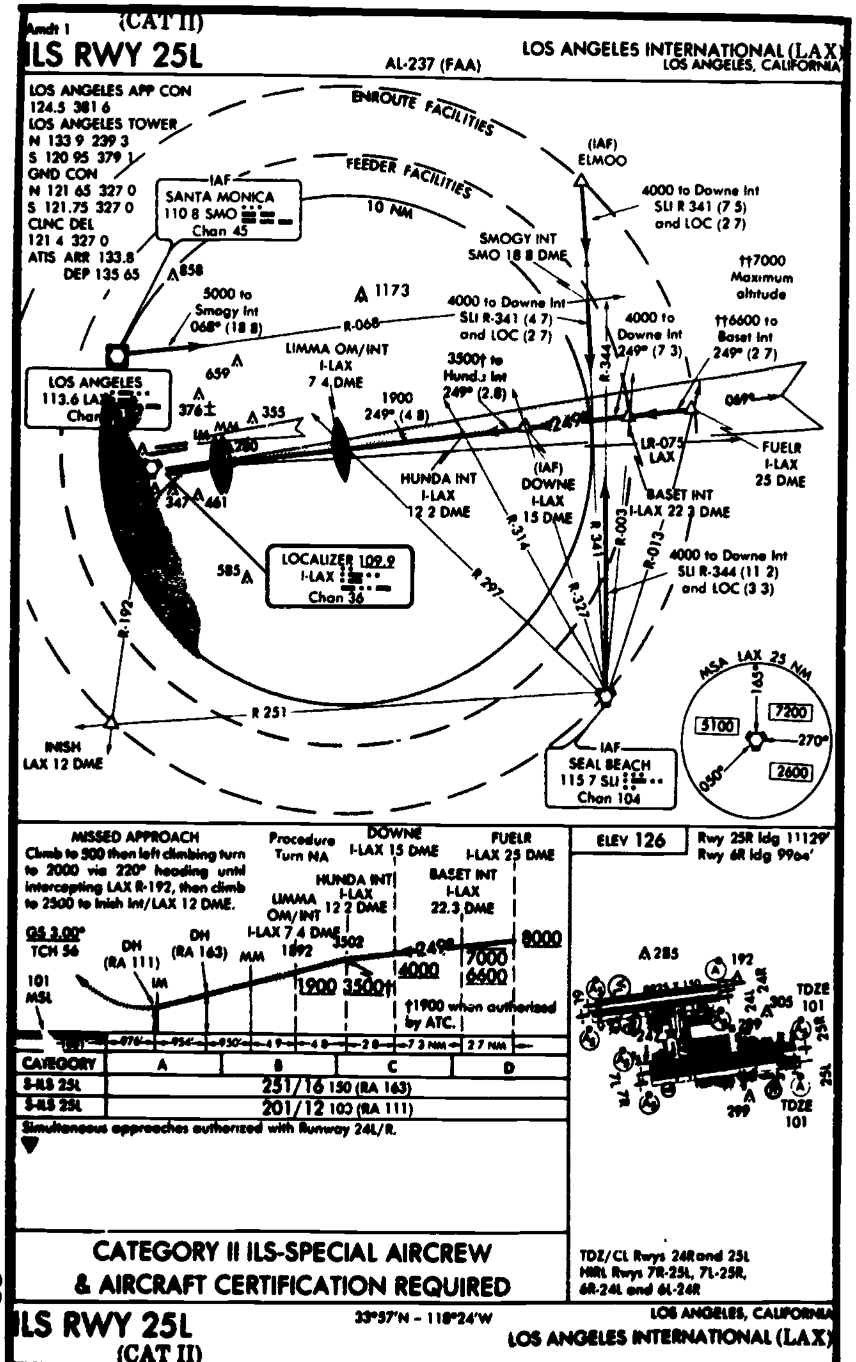
TWENTYNINE PALMS TRANSITION (TNP.DOWNE2): From over TWENTYNINE PALMS VORTAC via TWENTYNINE PALMS R-254 to PIONE DME, then LOS ANGELES R-068 to DOWNE INT. Thence....

HECTOR TRANSITION (HEC.DOWNE2): From over HECTOR VORTAC via HECTOR R-211 and PARADISE R-030 to CIVET INT, then LOS ANGELES R-068 to DOWNE INT. Thence....

PEACH SPRINGS TRANSITION (PGS. DOWNE2): From over PEACH SPRINGS VORTAC via PEACH SPRINGS R-229 and PARADISE R-046 to RUSTT INT, then LOS ANGELES R-068 to DOWNE INT. Thence....

....From DOWNE INT via SMO R-085 to SMO VOR/DME, then via SMO R-259 to WAKER INT, expect vector to final approach course.

FIGURE 8.—Downe Two Arrival (Downe,Downe2).



HELIPORTS

LOS ANGELES INTL (LAX) 9 SW UTC–8(–7DT) 33°56'33"N 118°24'26"W **LOS ANGELES COPTER**

126 B S4 **FUEL** 100, JET A OX 4 LRA CFR Index E

RWY H2: H60X60 (CONC) S-18, D-30 MIRL

RWY H3: H63X63 (CONC) S–15 LIRL

AIRPORT REMARKS: Attended continuously. CAUTION. Turbulence may be deflected upward from the blast fence located 160' east of Rwy 25R. Noise sensitive arpt Numerous birds on and in vicinity of arpt. Flight Notification Service (ADCUS) available. Rwy H2 lgtd on req to USCG. Ovrngt tiedown fee. Rwy H3 ctc twr for tfc pattern

WEATHER DATA SOURCES: LLWAS

COMMUNICATIONS: ATIS ARRIVAL 133.8 **ATIS DEP** 135 65 (213) 646–2297 **UNICOM** 122 95

HAWTHORNE FSS (HHR) LC 644-1020 NOTAM FILE LAX.

TOWER 120.35 (Helicopters east) 119 8 (Helicopters west) **GND CON** 121 75 (S complex) 121.65 (N complex) **CLNC DEL** 121.4

TCA Group I: See VFR Terminal Area chart

FIGURE 9.—ILS RWY 25L (CAT II) - Los Angeles International (LAX).

Form Approved. OMB No 2120-0026

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION **FLIGHT PLAN**	(FAA USE ONLY) ☐ PILOT BRIEFING ☐ VNR ☐ STOPOVER				TIME STARTED	SPECIALIST INITIALS
1 TYPE: VFR / X IFR / DVFR	2 AIRCRAFT IDENTIFICATION: N70FG	3 AIRCRAFT TYPE/SPECIAL EQUIPMENT: BH214/	4 TRUE AIRSPEED: 110 KTS	5 DEPARTURE POINT: Ø02 BAKER	6 DEPARTURE TIME: PROPOSED (Z) / ACTUAL (Z)	7 CRUISING ALTITUDE: 12,000
8 ROUTE OF FLIGHT: Hdg 270° to V394 via V394 POM V210 LAX						
9 DESTINATION (Name of airport and city): LAX LOS ANGELES	10 EST TIME ENROUTE: HOURS / MINUTES	11 REMARKS				
12 FUEL ON BOARD: HOURS / MINUTES	13 ALTERNATE AIRPORT(S): NA	14 PILOT'S NAME, ADDRESS & TELEPHONE NUMBER & AIRCRAFT HOME BASE				15 NUMBER ABOARD: 15
		17 DESTINATION CONTACT/TELEPHONE (OPTIONAL)				
16 COLOR OF AIRCRAFT	CIVIL AIRCRAFT PILOTS. FAR Part 91 requires you file an IFR flight plan to operate under instrument flight rules in controlled airspace. Failure to file could result in a civil penalty not to exceed $1,000 for each violation (Section 901 of the Federal Aviation Act of 1958, as amended). Filing of a VFR flight plan is recommended as a good operating practice. See also Part 99 for requirements concerning DVFR flight plans.					

FAA Form 7233-1 (8-82) CLOSE VFR FLIGHT PLAN WITH ____________ FSS ON ARRIVAL

FLIGHT LOG

CHECK POINTS FROM	CHECK POINTS TO	ROUTE / ALTITUDE	MACH NO	WIND / TEMP	SPEED-KTS TAS	SPEED-KTS GS	DIST NM	TIME LEG	TIME TOT	FUEL LEG	FUEL TOT
BAKER	V394	270° / CLIMB							:10		*250 lbs
JOIN V394	DAG	V394 / 12,000		290/36 / ISA -2	110		15				
DAG	POM	V394 / 12,000		290/36 / ISA -2	110						
POM	PIRRO INT	V394 / 12,000		290/36 / ISA -2	110						
PIRRO INT	LAX	DESCENT AND APPROACH						:17		955	

OTHER DATA: * Includes fuel for taxi.

NOTE: Use 1420 PPH total fuel flow from level off at 15 NM from DAG VORTAC to PIRRO INT.

Use 1235 PPH total fuel flow for reserve requiremnts.

FLIGHT SUMMARY

TIME	FUEL	
		EN ROUTE
		RESERVE
--	200	MISSED APPR.
		TOTAL

FIGURE 10.—Flight Plan/Flight Log.

190

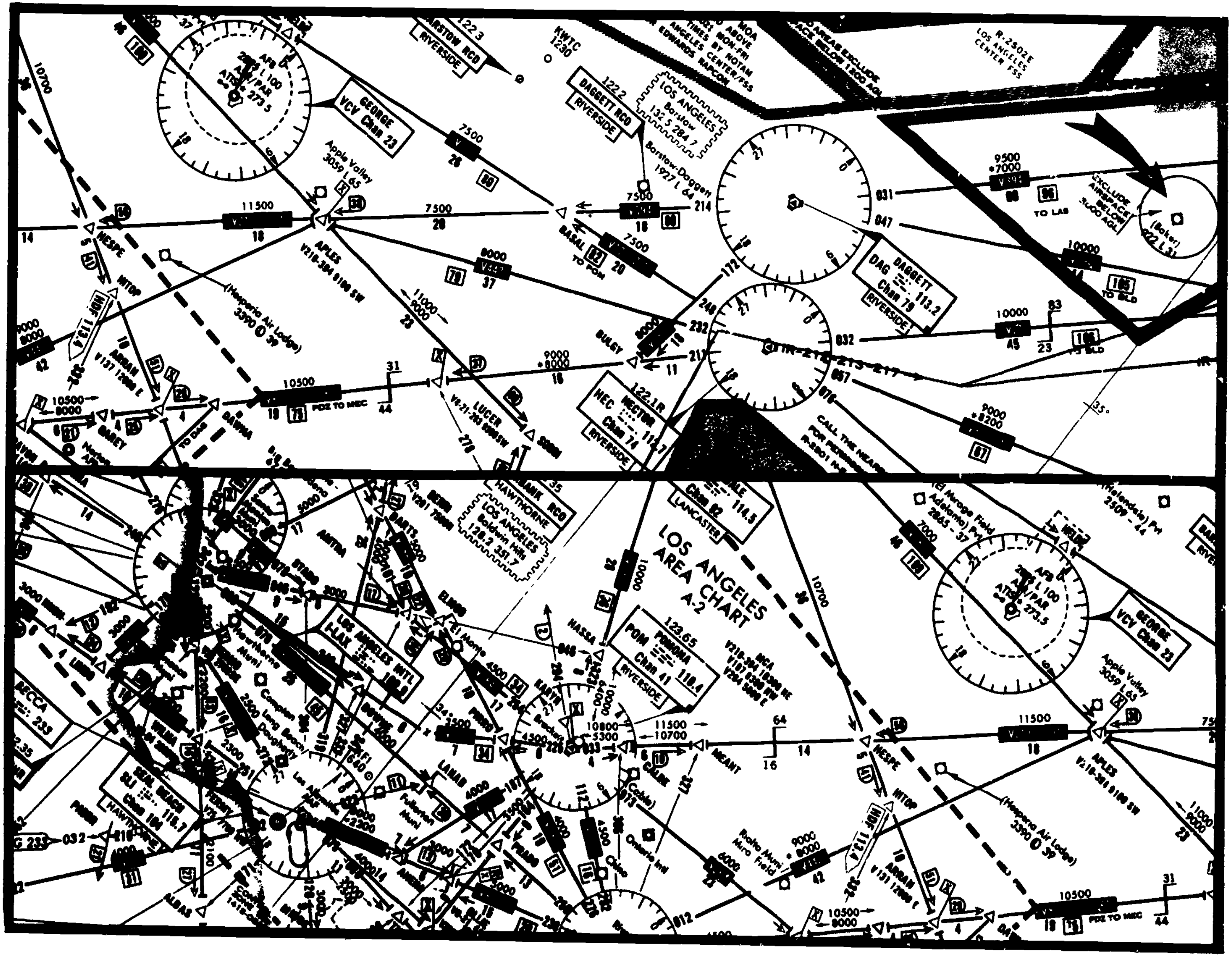


FIGURE 11.—En Route Low Altitude Chart Segment.

Form Approved: OMB No. 2120-0026

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION **FLIGHT PLAN**	(FAA USE ONLY) ☐ PILOT BRIEFING ☐ VNR ☐ STOPOVER	TIME STARTED	SPECIALIST INITIALS

1 TYPE	2 AIRCRAFT IDENTIFICATION	3 AIRCRAFT TYPE/ SPECIAL EQUIPMENT	4 TRUE AIRSPEED	5 DEPARTURE POINT	6 DEPARTURE TIME PROPOSED (Z)	ACTUAL (Z)	7 CRUISING ALTITUDE
VFR X IFR DVFR	N1SGL	JET/	KTS	BUF GREATER BUFFALO INTL			FL310

8 ROUTE OF FLIGHT

BUFFALO ONE HL547 INT J547 J547 OBK

9 DESTINATION (Name of airport and city)	10 EST. TIME ENROUTE HOURS	MINUTES	11 REMARKS
CHICAGO O'HARE INTL			

12 FUEL ON BOARD HOURS	MINUTES	13 ALTERNATE AIRPORT(S)	14 PILOT'S NAME, ADDRESS & TELEPHONE NUMBER & AIRCRAFT HOME BASE	15 NUMBER ABOARD
		NA	17 DESTINATION CONTACT/TELEPHONE (OPTIONAL)	

16 COLOR OF AIRCRAFT

CIVIL AIRCRAFT PILOTS. FAR Part 91 requires you file an IFR flight plan to operate under instrument flight rules in controlled airspace. Failure to file could result in a civil penalty not to exceed $1,000 for each violation (Section 901 of the Federal Aviation Act of 1958, as amended). Filing of a VFR flight plan is recommended as a good operating practice. See also Part 99 for requirements concerning DVFR flight plans.

FAA Form 7233-1 (8-82) CLOSE VFR FLIGHT PLAN WITH ____________ FSS ON ARRIVAL

FLIGHT LOG

CHECK POINTS FROM	CHECK POINTS TO	ROUTE / ALTITUDE	MACH NO	WIND / TEMP	SPEED-KTS TAS	SPEED-KTS GS	DIST NM	TIME LEG	TIME TOT	FUEL LEG	FUEL TOT
BUF	LEVEL OFF	CLIMB					70		:14		* 2900 lbs
LEVEL OFF	YXU	HL547 / FL310		300/46 / ISA +3							
YXU	INT J547	HL547 / FL310		300/46 / ISA +3							
INT J547	**ECK	J547 / FL310		300/46 / ISA +3							
ECK	***START DESCENT	J547 / FL310		280/42 / ISA +2							
DESCENT AND	APPROACH						30	:16		650	

OTHER DATA: * Includes fule for taxi.
NOTE: Use 8,650 PPH total fuel flow from level off to start descent.
Use 7,020 PPH total fuel flow for reserve requirements.
** Variation 7W
*** Variation 3W

FLIGHT SUMMARY

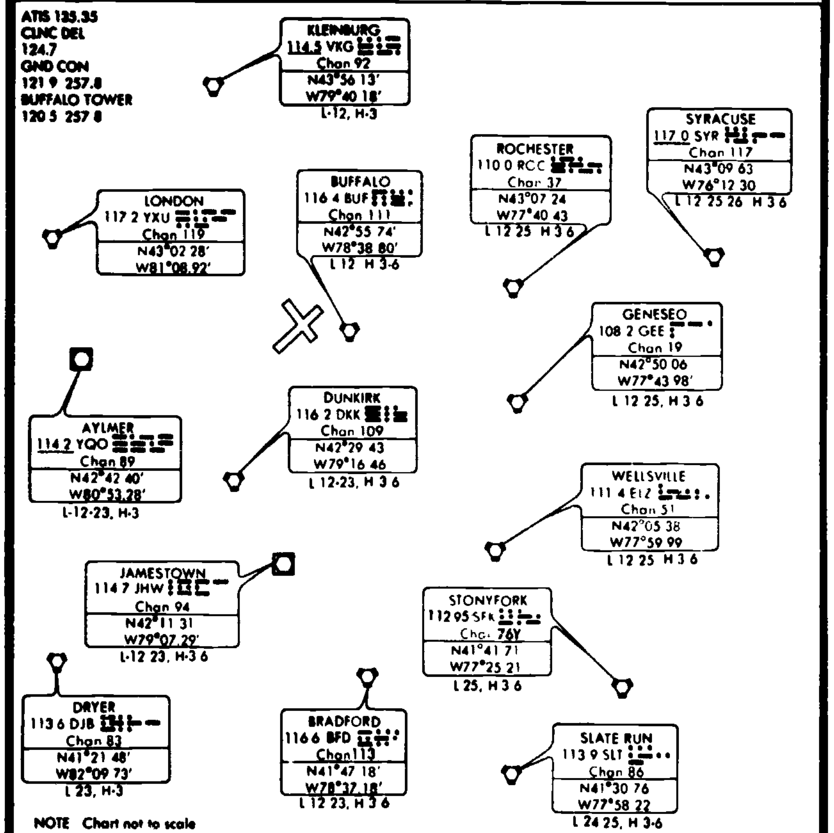
TIME	FUEL	
		EN ROUTE
		RESERVE
--	130	MISSED APPR.
		TOTAL

FIGURE 12.—Flight Plan/Flight Log.

37323

BUFFALO ONE DEPARTURE (VECTOR)

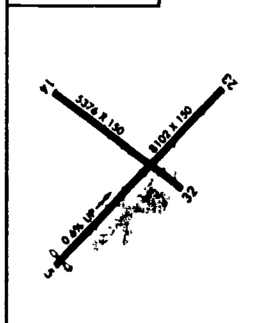
BUFFALO/GREATER BUFFALO INTL
BUFFALO, NEW YORK



▼ DEPARTURE ROUTE DESCRIPTION

All aircraft cleared as filed. Expect vectors to filed route or depicted fix. Maintain 10,000' or assigned lower altitude. Expect further clearance to requested altitude/flight level ten minutes after departure.
All Runways: Maintain runway heading for vectors.

ELEV 724



BUFFALO ONE DEPARTURE (VECTOR)

BUFFALO, NEW YORK
BUFFALO/GREATER BUFFALO INTL

NEW YORK

BUFFALO

§ **BUFFALO AIRFIELD** (9GØ) 6.1 SE UTC-5(-4DT) 42°51'40"N 78°43'00"W — DETROIT L-12H IAP

670 B S2 FUEL 80, 100LL

RWY 06-24: H2665X60 (ASPH) S-8 MIRL

RWY 06: Trees. RWY 24: Tree

AIRPORT REMARKS: Attended daylight hours. CAUTION. Ultralight activity on arpt Airport lgts opr dusk-0700Z‡ For runway lights after 0700Z‡ phone 716-668-4900.

COMMUNICATIONS: CTAF/UNICOM 122.8

BUFFALO FSS (BUF) LC 631-9830. NOTAM FILE BUF

Ⓡ BUFFALO APP DEP/CON 123.8

RADIO AIDS TO NAVIGATION: NOTAM FILE BUF

BUFFALO (H) VORTAC 116 4 BUF Chan 111 42°55'44"N 78°38'48"W 225°4 9 NM to fld. 730/08W.

---

§ **GREATER BUFFALO INTL** (BUF) 5.2 E UTC-5(-4DT) 42°56'26"N 78°43'57"W — DETROIT H-3C, 6I, L-12H IAP

724 B S4 FUEL 100LL, JET A OX 1, 2, 3, 4 LRA CFR Index D

RWY 05-23: H8102X150 (ASPH-GRVD) S-75, D-195, DT-450 HIRL CL 0.6% up NE

RWY 05: SSALR. TDZ. Thld dsplcd 335'. Pole. RWY 23: SSALR. TDZ.

RWY 14-32: H5376X150 (ASPH) S-75, D-100, DT-160 MIRL 0.3% up SE.

RWY 14: VASI(V4L)—GA 3.0°TCH 55'. Tree. RWY 32: REIL. VASI(V4L)—GA 3.0°TCH 55'. Fence.

AIRPORT REMARKS: Attended continuously. Landing fee. CAUTION-Jet engine test stand located approximately 3600' from approach end Rwy 32 1400' south center line . Jet exhaust may reach altitude 100' AGL. Ops conducted occasionally 1300-2300Z‡. CAUTION: Numerous types of birds may be encountered in holding pattern over Grand Island up to 5000'. Heavy concentration of Gulls, Blackbirds, and Starlings up to 5000' on and in vicinity of arpt. Deer on and in vicinity of arpt. Flight Notification Service (ADCUS) available.

WEATHER DATA SOURCES: LLWAS.

COMMUNICATIONS: ATIS 135.35 UNICOM 122.95

BUFFALO FSS (BUF) on arpt. 122.6 122.2 122.1R 116.4T DL NOTAM FILE BUF.

Ⓡ BUFFALO APP DEP/CON 123.8 (055°-194°) 126.5 (195°-279°) 126 15 (280°-054°)

BUFFALO TOWER 120.5 GND CON 121.9

CLNC DEL 124.7 PRE-TAXI CLNC 124.7

ARSA ctc APP CON

RADIO AIDS TO NAVIGATION: NOTAM FILE BUF.

BUFFALO (H) VORTAC 116.4 BUF Chan 111 42°55'44"N 78°38'48"W 288°3.5 NM to fld. 730/08W.

KLUMP NDB (LOM) 231 BU 43°00'01"N 78°39'04"W 233° 4.4 NM to fld.

PLAZZ NDB (LOM) 204 GB 42°52'26"N 78°49'00"W 053° 4.8 NM to fld.

ILS 111.3 I-BUF Rwy 23 LOM KLUMP NDB. Inner marker out of svc indefinitely. Back course unusable beyond 15 NM.

ILS 108.5 I-GBI Rwy 05 LOM PLAZZ NDB.

ASR

Appendix 3

14

FIGURE 13.—Buffalo One Departure (Vector) - Buffalo/Greater Buffalo Intl.

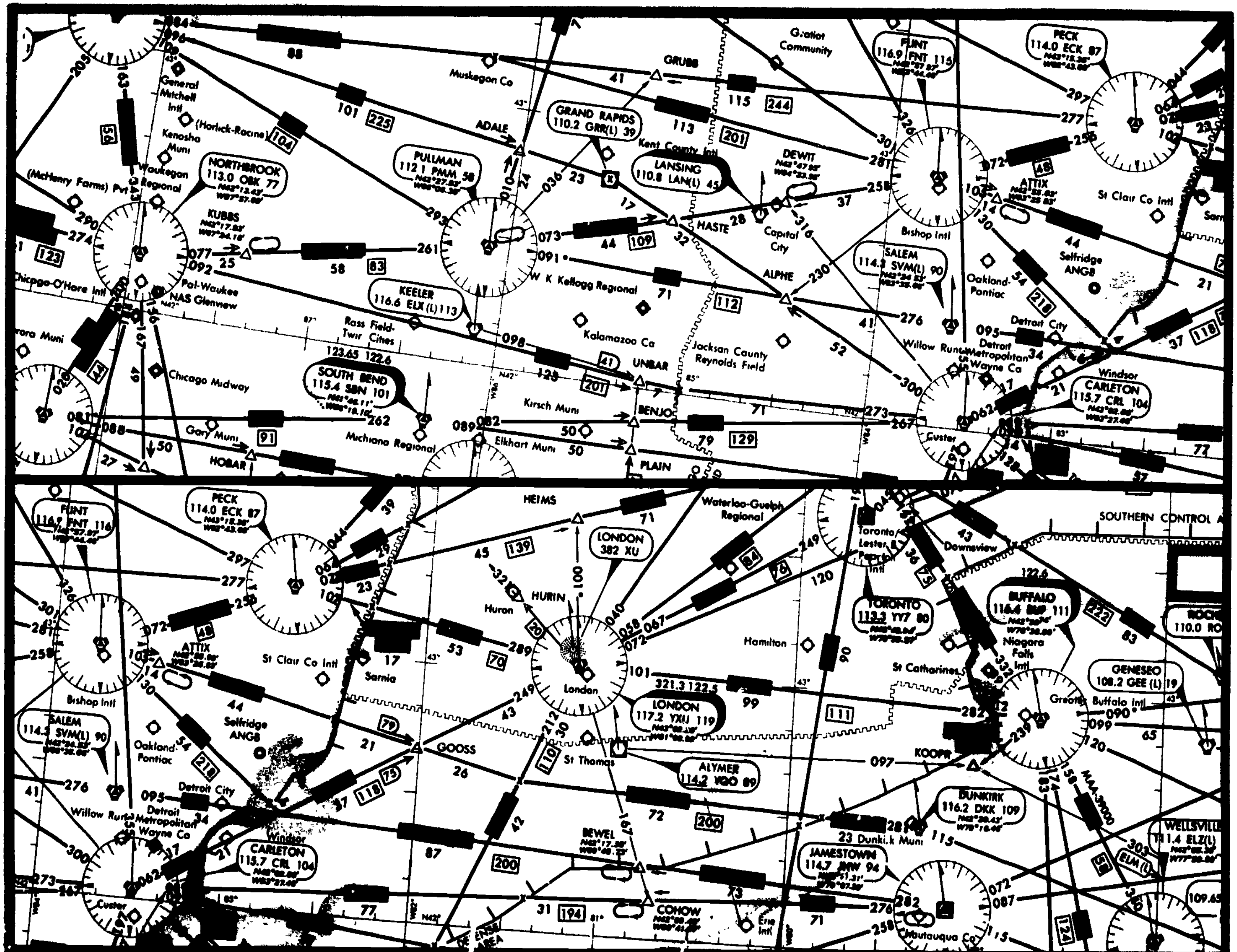


FIGURE 14.—IFR En Route High Altitude Chart Segment.

15

Appendix 3

Form Approved OMB No. 2120-0026

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

FLIGHT PLAN

(FAA USE ONLY) ☐ PILOT BRIEFING ☐ VNR ☐ STOPOVER | TIME STARTED | SPECIALIST INITIALS

1 TYPE	2 AIRCRAFT IDENTIFICATION	3 AIRCRAFT TYPE/ SPECIAL EQUIPMENT	4 TRUE AIRSPEED	5 DEPARTURE POINT	6 DEPARTURE TIME PROPOSED (Z)	ACTUAL (Z)	7 CRUISING ALTITUDE
☐ VFR ☒ IFR ☐ DVFR	N63SM	C402/R	160 KTS	CHICAGO MIDWAY			FL180

8 ROUTE OF FLIGHT
CANAL THREE J146 SBN J554 CRL J586/HL586 YXU HL547/J547 BUF

9 DESTINATION (Name of airport and city)	10 EST. TIME ENROUTE HOURS	MINUTES	11 REMARKS
GREATER BUFFALO			

12 FUEL ON BOARD HOURS	MINUTES	13 ALTERNATE AIRPORT(S)	14 PILOT'S NAME, ADDRESS & TELEPHONE NUMBER & AIRCRAFT HOME BASE	15 NUMBER ABOARD
		NA		

17 DESTINATION CONTACT/TELEPHONE (OPTIONAL)

16 COLOR OF AIRCRAFT

CIVIL AIRCRAFT PILOTS. FAR Part 91 requires you file an IFR flight plan to operate under instrument flight rules in controlled airspace. Failure to file could result in a civil penalty not to exceed $1,000 for each violation (Section 901 of the Federal Aviation Act of 1958, as amended). Filing of a VFR flight plan is recommended as a good operating practice. See also Part 99 for requirements concerning DVFR flight plans.

FAA Form 7233-1 (8-82) CLOSE VFR FLIGHT PLAN WITH ____________ FSS ON ARRIVAL

FLIGHT LOG

CHECK POINTS FROM	TO	ROUTE / ALTITUDE	VAR	WIND / TEMP	SPEED-KTS TAS	GS	DIST NM	TIME LEG	TOT	FUEL LEG	TOT
CANAL THREE	LEVEL OFF	CLIMB							:18		* 105 lb.
LEVEL	SBN	J146 / FL180	1W	260/45 / ISA	160		48				
SBN	CRL	J554 / FL180	3W	260/45 / ISA	160						
CRL	YXU	J586/HL586 / FL180	6W	285/43 / ISA	160						
YXU	START DESCENT	HL547/J547	8W	285/43	160						
DESCENT AND		APPROACH					80	:24		85	

OTHER DATA: * Includes fuel for taxi.
NOTE: Use 146 PPH fuel flow for cruise.
Use 136 PPH fuel flow for reserve requirements.

FLIGHT SUMMARY

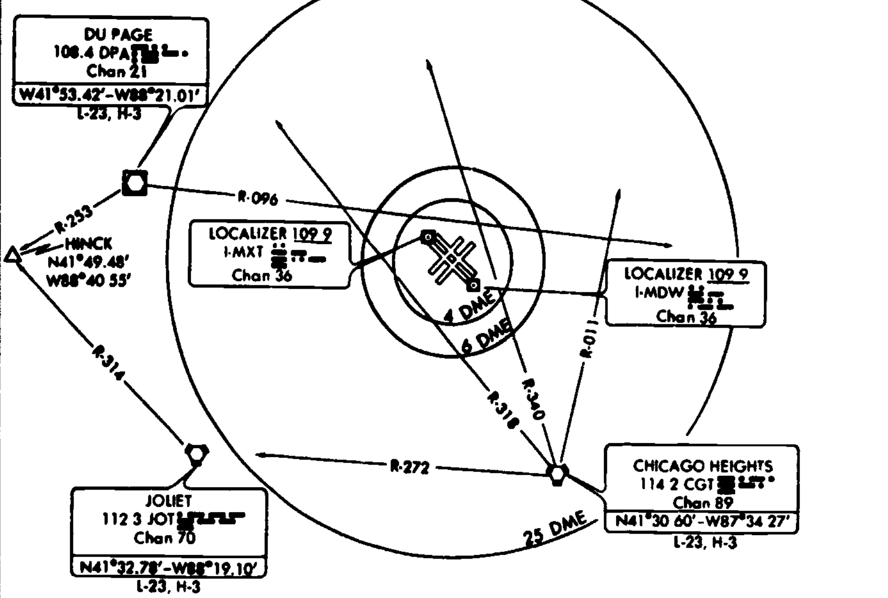
TIME	FUEL	
		EN ROUTE
		RESERVE
--	36	MISSED APPR.
		TOTAL

FIGURE 15.—Flight Plan/Flight Log.

88014
CANAL THREE DEPARTURE (VECTOR)

CHICAGO MIDWAY
CHICAGO, ILLINOIS

ATIS
120.05
MIDWAY CLNC DEL
121.85
MIDWAY GND CON
121.7
MIDWAY TOWER
118.7 226.3
MIDWAY DEP CON
118.4 388.0



ALL IFR deprtures are radar vectored to the first enroute fix, and provided headings that give obstruction clearance.

NOTE: Chart not to scale

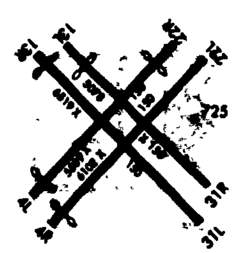
DEPARTURE ROUTE DESCRIPTION

Aircraft departing Runways 13L, 13R, 22L, 22R, 31L, 31R, climb runway heading to 1300' before turning east. Runways 4L, 4R departure climb to 2400' on heading 090° before turning north.

DME EQUIPPED AIRCRAFT
Complete initial turn within 4 DME of MIDWAY. Maintain 2000' until 6 DME from MIDWAY then maintain 3000'. Expect clearance to requested altitude/flight level 25 DME from MIDWAY.

NON-DME EQUIPPED AIRCRAFT
Complete initial turn south of the L . R-096. Thence...
. . . . WEST AND SOUTHBOUND DEPARTURES: Maintain 2000' until crossing the CGT R-318, then maintain 3000'. Expect clearance to requested altitude/flight level crossing the CGT R-272 or the JOT R-314.
. . . . EASTBOUND DEPARTURES: Maintain 2000' until crossing the CGT R-340, then maintain 3000'. Expect clearance to requested altitude/flight level crossing the CGT R-011.

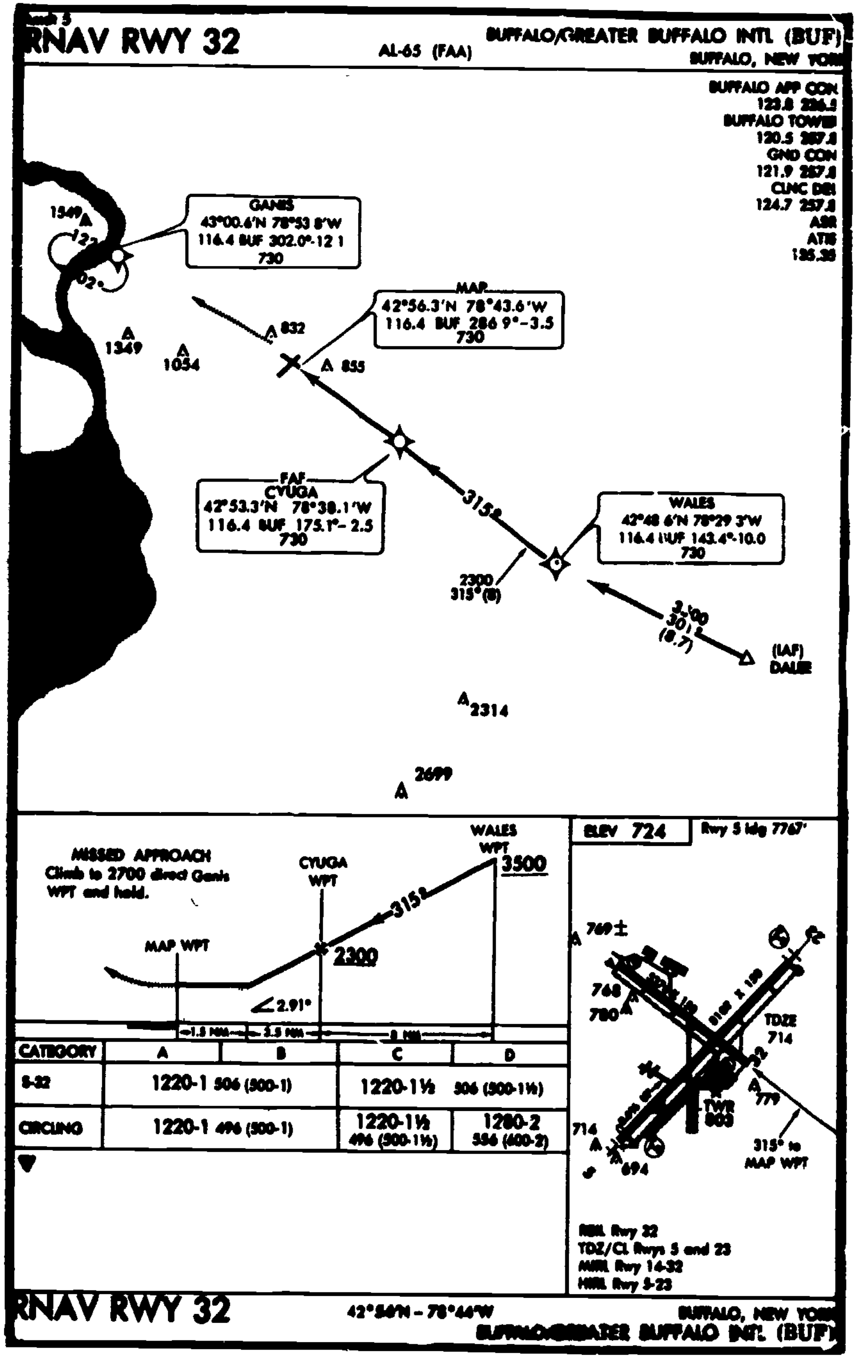
ELEV 619



CANAL THREE DEPARTURE (VECTOR)

CHICAGO, ILLINOIS
CHICAGO MIDWAY

FIGURE 16.—Canal Three Departure (Vector) - Chicago Midway.



§ GREATER BUFFALO INTL (BUF) 5 E UTC-5(-4DT) 42°56'26"N 78°43'57"W — DETROIT
724 B S4 FUEL 100LL, JET A OX 1, 2, 3, 4 LRA ARFF Index D — H-3C, 6I, L-12F
RWY 05-23: H8102X150 (ASPH-GRVD) S-75, D-195, DT-450 HIRL CL 0.6% up NE — IAP
RWY 05: SSALR. TDZ. Thld dsplcd 335' Pole. RWY 23: SSALR. TDZ.
RWY 14-32: H5376X150 (ASPH) S-75, D-100, DT-160 MIRL 0.3% up SE.
RWY 14: VASI(V4L)—GA 3.0°TCH 55' Tree. RWY 32: REIL. VASI(V4L)—GA 3.0°TCH 55'. Fence
AIRPORT REMARKS: Attended continuously Landing fee. CAUTION-Jet engine test stand located approximately 3600' from approach end Rwy 32 1400' south center line . Jet exhaust may reach altitude 100' AGL. Ops conducted occasionally 1300-2300Z‡ CAUTION Numerous types of birds may be encountered in holding pattern over Grand Island up to 5000'. Heavy concentration of Gulls, Blackbirds, and Starlings up to 5000' on and in vicinity of arpt Deer on and in vicinity of arpt. Flight Notification Service (ADCUS) available.
WEATHER DATA SOURCES: LLWAS.
COMMUNICATIONS: ATIS 135.35 UNICOM 122.95
BUFFALO FSS (BUF) on arpt. 122.6 122.2 122.1R 116.4T DL NOTAM FILE BUF.
Ⓡ BUFFALO APP DEP/CON 123.8 (055°-194°) 126.5 (195°-279°) 126.15 (280°-054°)
BUFFALO TOWER 120.5 GND CON 121.9
CLNC DEL 124.7 PRE-TAXI CLNC 124.7
ARSA ctc APP CON
RADIO AIDS TO NAVIGATION: NOTAM FILE BUF.
BUFFALO (H) VORTAC 116.4 BUF Chan 111 42°55'44"N 78°38'48"W 286°3.5 NM to fld. 730/06W
KLUMP NDB (LOM) 231 BU 43°00'01"N 78°39'04"W 233° 4.4 NM to fld. unusable beyond 12 NM
PLAZZ NDB (LOM) 204 GB 42°52'26"N 78°49'00"W 053° 4 8 NM to fld.
ILS 111.3 I-BUF Rwy 23 LOM KLUMP NDB Inner marker out of svc indefinitely. Back course unusable beyond 15 NM.
ILS 108.5 I-GBI Rwy 05 LOM PLAZZ NDB.
ASR

FIGURE 17.—RNAV RWY 32 and Excerpt (BUF).

FIGURE 18.—Helicopter Route Chart.

Form Approved: OMB No. 2120-0026

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION **FLIGHT PLAN**	(FAA USE ONLY) ☐ PILOT BRIEFING ☐ VNR ☐ STOPOVER	TIME STARTED	SPECIALIST INITIALS

1 TYPE	2 AIRCRAFT IDENTIFICATION	3 AIRCRAFT TYPE/ SPECIAL EQUIPMENT	4 TRUE AIRSPEED	5 DEPARTURE POINT	6 DEPARTURE TIME PROPOSED (Z)	ACTUAL (Z)	7 CRUISING ALTITUDE
VFR / X IFR / DVFR	N10GW	BE90/A	248 KTS	DFW			15,000

8 ROUTE OF FLIGHT

DFW V369 BILEE.CUGAR IAH

9 DESTINATION (Name of airport and city)	10 EST. TIME ENROUTE HOURS	MINUTES	11 REMARKS
IAH HOUSTON			

12 FUEL ON BOARD HOURS	MINUTES	13 ALTERNATE AIRPORT(S)	14 PILOT'S NAME, ADDRESS & TELEPHONE NUMBER & AIRCRAFT HOME BASE	15 NUMBER ABOARD
		NA	17 DESTINATION CONTACT/TELEPHONE (OPTIONAL)	

16 COLOR OF AIRCRAFT	CIVIL AIRCRAFT PILOTS. FAR Part 91 requires you file an IFR flight plan to operate under instrument flight rules in controlled airspace. Failure to file could result in a civil penalty not to exceed $1,000 for each violation (Section 901 of the Federal Aviation Act of 1958, as amended). Filing of a VFR flight plan is recommended as a good operating practice. See also Part 99 for requirements concerning DVFR flight plans.

FAA Form 7233-1 (8-82) CLOSE VFR FLIGHT PLAN WITH____________ FSS ON ARRIVAL

FLIGHT LOG

CHECK POINTS FROM	TO	ROUTE / ALTITUDE	MACH NO	WIND / TEMP	SPEED-KTS TAS	GS	DIST NM	TIME LEG	TIME TOT	FUEL LEG	FUEL TOT
DFW	LEVEL OFF	CLIMB					27		:10		*125 lb.
LEVEL OFF	CUGAR	V369 / 15,000		225/36 / ISA	248						
CUGAR4	START DESCENT	CUGAR4 / 15,000		225/36 / ISA	248		12				
DESCENT AND APPROACH								:12		130	

OTHER DATA: * Includes fuel for taxi.

NOTE: Use 650 PPH total fuel flow form level off to descent.

Use 712 PPH total fuel flow for reserve requirements.

FLIGHT SUMMARY

TIME	FUEL	
		EN ROUTE
		RESERVE
--	85	MISSED APPR.
		TOTAL

FIGURE 19.—Flight Plan/Flight Log.

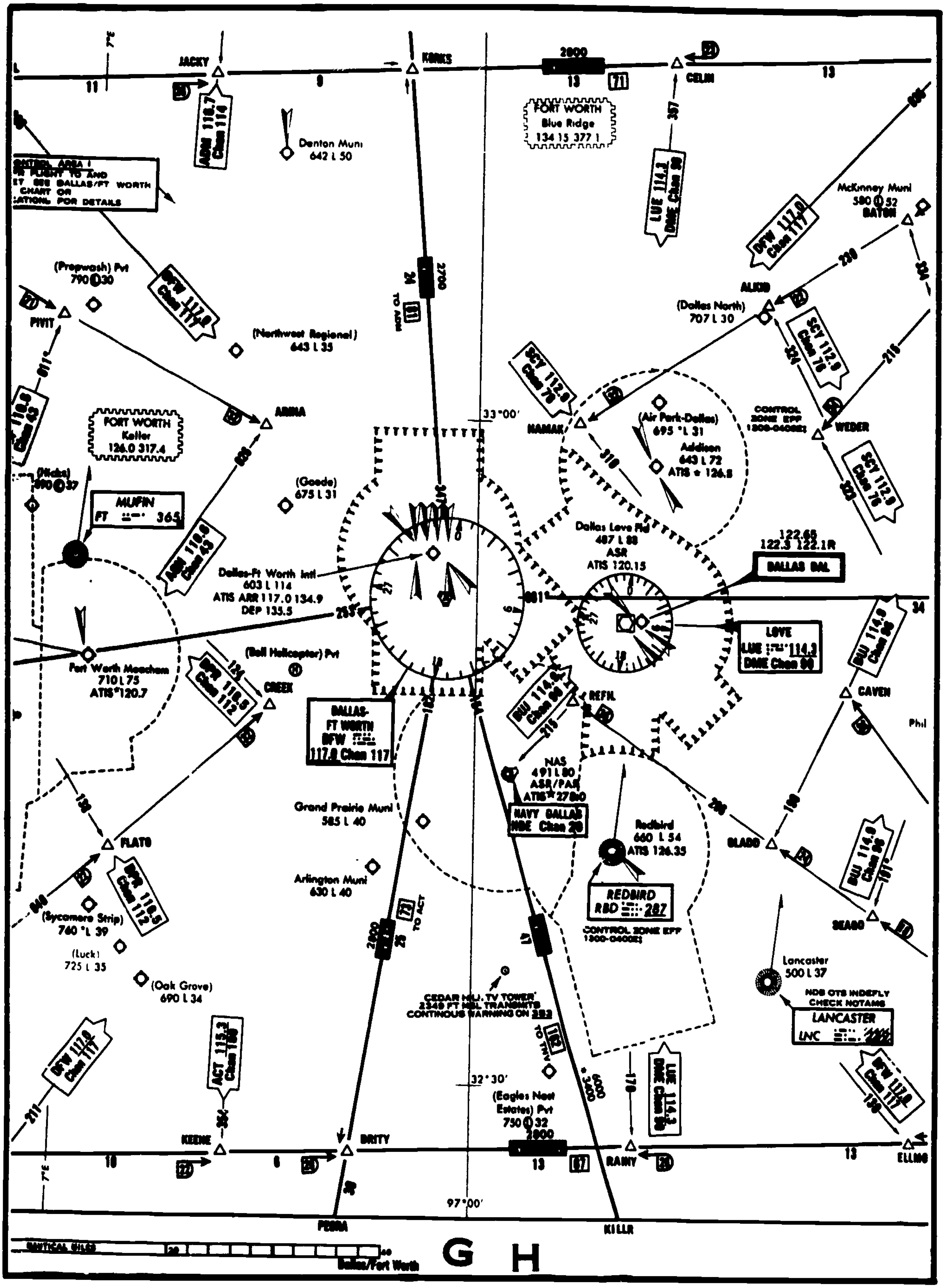


FIGURE 20.—IFR Area Chart Segment.

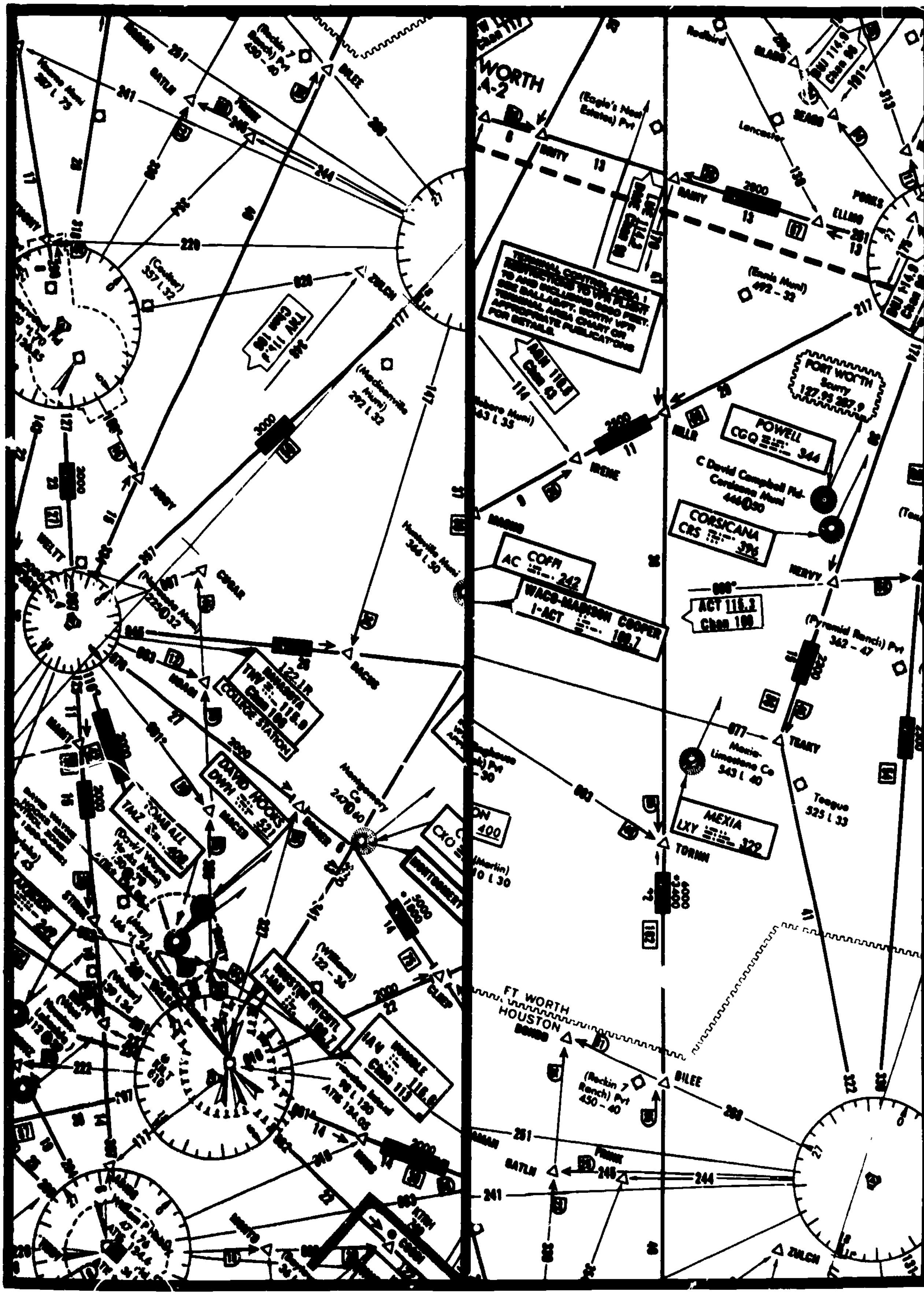


FIGURE 21.—IFR En Route Low Altitude Chart Segment.

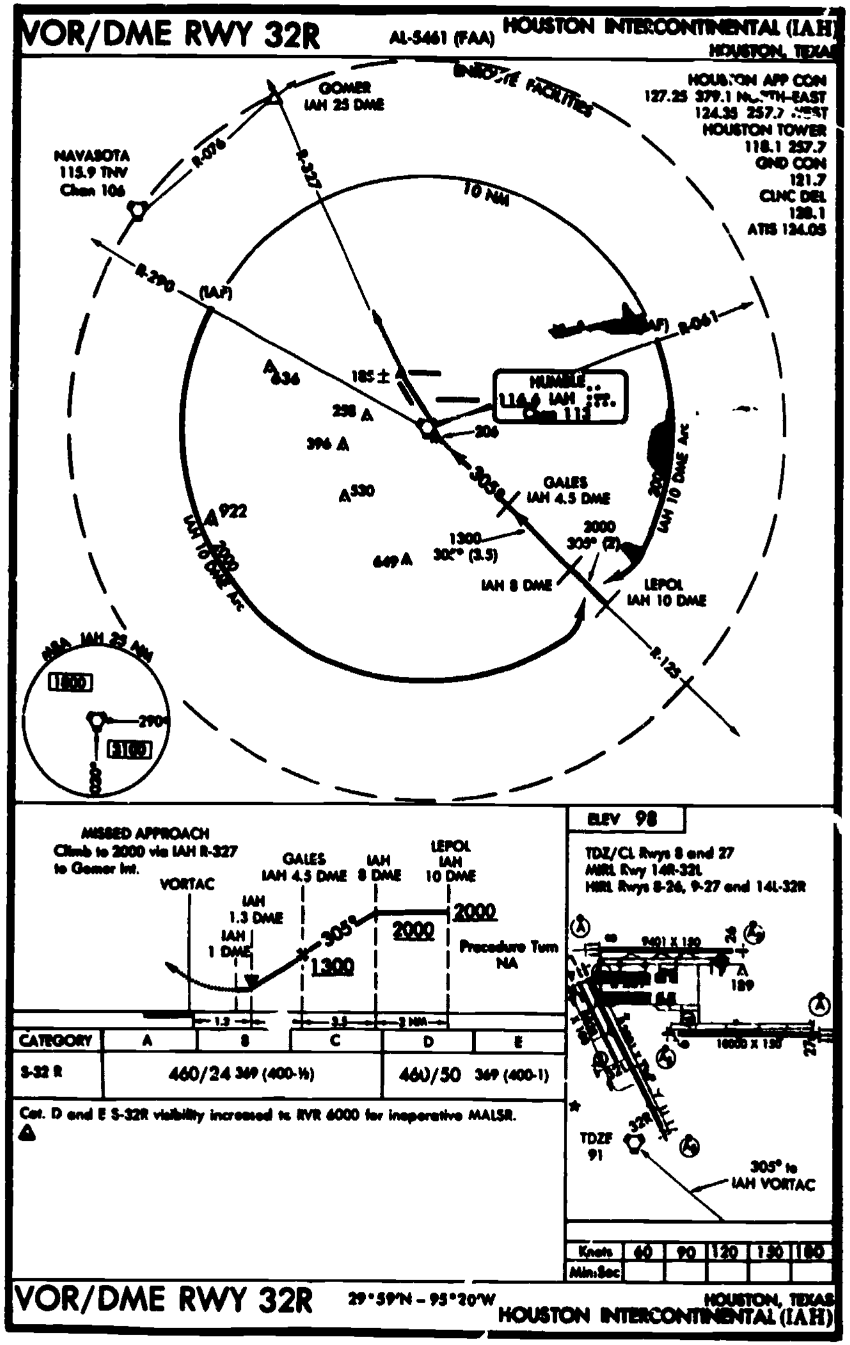
TEXAS

§ **DALLAS-FORT WORTH INTL** (DFW) 12 NW UTC–6(–5DT) 32°53'47"N 97°02'28"W — **DALLAS-FT. WORTH**
603 B **FUEL** 100LL, JET A OX 1, 3 LRA CFR Index E — H-2K, 4F, 5B, L-13C, A
RWY 17L-35R: H11,388X150 (CONC-GRVD) S-120, D-200, DT-600, DDT-850 HIRL, CL — IAP
RWY 17L: ALSF2. TDZ. **RWY 35R:** MALSR. TDZ.
RWY 17R-35L: H11,388X200 (CONC-GRVD) S-120, D-200, DT-600, DDT-850 HIRL, CL
RWY 17R: SSALR TDZ. **RWY 35L:** TDZ. VASI(V6L).
RWY 18L-36R: H11,387X200 (CONC-GRVD) S-120, D-200, DT-600, DDT-850 HIRL, CL
RWY 18L: SSALR. TDZ. **RWY 36R:** TDZ. VASI(V6L).
RWY 18R-36L: H11,388X150 (CONC-GRVD) S-120, D-200, DT-600, DDT-850 HIRL, CL
RWY 18R: ALSF2. TDZ **RWY 36L:** MALSR. TDZ.
RWY 13L-31R: H9000X200 (CONC-GRVD) S-120, D-200, DT-600, DDT-850 HIRL, CL .5% up NW.
RWY 13L: TDZ. VASI(V6L)—Upper GA 3.25°TCH 93'. Lower GA 3.0°TCH 47'.
RWY 31R: MALSR. TDZ.
RWY 13R-31L: H9300X150 (CONC–GRVD) S–120, D–220, DT–600, DDT–850 HIRL, CL
RWY 13R: MALSR. TDZ. **RWY 31L:** TDZ.
RWY 18S-36S: H4000X100 (CONC)
AIRPORT REMARKS: Attended continuously. Prior Permission Required from arpt ops for General Aviation acft to proceed to airline terminal gate except to General Aviation Facility. Rwy 18S-36S located on taxiway G, 4000' long 100' wide restricted to prop acft 12,500 lbs. & below and stol acft daylight VFR plus IFR departures. Prior permission required from the primary tenant airlines to operate within central terminal area, CAUTION: proper minimum clearance may not be maintained within the central terminal area. Landing fee. Clearways 500X1000 each end Rwy 17L–35R, Rwy 17R–35L, Rwy 18L–36R and Rwy 18R–36L. Flight Notification Service (ADCUS) available.
WEATHER DATA SOURCES: LLWAS.
COMMUNICATIONS: ATIS 117.0 134.9 (ARR) 135.5 (DEP) **UNICOM** 122.95
FORT WORTH FSS (FTW) LC 624-8471, Toll free call, dial 1–800–WX–BRIEF. NOTAM FILE DFW
Ⓡ **REGIONAL APP CON** 119.05(E) 119.4(E) 125.8(W) 132.1(W)
REGIONAL TOWER 126.55 (E) 124.15 (W) **GND CON** 121.65 133.15(E) 121.8 (W) **CLNC DEL** 128.25 127.5
Ⓡ **REGIONAL DEP CON** 118.55 (E) 124.25 (WEST) 127.75 (NORTH–SOUTH)
TCA Group I: See VFR Terminal Area chart.
RADIO AIDS TO NAVIGATION: NOTAM FILE DFW.
(H) **VORTACW** 117.0 DFW Chan 117 32°51'57"N 97°01'40"W at fld. 560/08E.
VOR Portion unusable 045°-060° all altitudes and distances, 350–100° beyond 30 NM below 2100'.
ISSUE NDB (LOM) 233 PK 32°-7'35"N 97°01'49"W 353° 5.1 NM to fld.
JIFFY NDB (LOM) 219 FL 32°56'45"N 97°01'46"W 173° 5.1 NM to fld.
ILS/DME 109.5 I-LWN Chan 32 Rwy 13R
ILS/DME 109.1 I-FLQ Chan 28 Rwy 17L LOM JIFFY NDB
ILS 111.5 I-JHZ Rwy 17R LOM JIFFY NDB
ILS 111.3 I-CIX Rwy 18L
ILS/DME 111.9 I-VYN Chan 56 Rwy 18R
ILS 110.9 I-RRA Rwy 31R
ILS/DME 109.1 I-PKQ Chan 28 Rwy 35R LOM ISSUE NDB
ILS/DME 111.9 I-BXN Chan 56 Rwy 36L

§ **HOUSTON INTERCONTINENTAL** (IAH) 15 N UTC–6(–5DT) 29°58'49"N 95°20'22"W — **HOUSTON**
98 B S4 **FUEL** 100LL, JET A OX 2 LRA CFR Index D — H-5B, L-17B
RWY 14L-32R: H12001X150 (CONC-GRVD) S-100, D-200, DT-400, DDT-778 HIRL, CL — IAP
RWY 14L: MALSR. VASI(V4L)—GA 3.0°TCH 54'. **RWY 32R:** MALSR.
RWY 08-26: H10000X150 (ASPH–GRVD) S–75,D–191, DT–400, DDT–850 HIRL, CL
RWY 08: MALSR. TDZ. PAPI(P4L)—GA 3.0° TCH 63'.
RWY 26: ALSF2. TDZ. PAPI(P4L)—GA 3.0° TCH 63'.
RWY 09-27: H9401X150 (CONC-GRVD) S-120, D-155, DT-265 HIRL, CL
RWY 09: MALSR. TDZ. **RWY 27:** ALSF2. TDZ. VASI(V4L)—GA 3.0°TCH 53'.
RWY 14R-32L: H6000X100 (ASPH-GRVD) S-30, D-60, DT-60 MIRL
RWY 14R: VASI(V4L)—GA 3.0°TCH 40'. Road. **RWY 32L:** VASI(V4L)—GA 3.0°TCH 45'.
AIRPORT REMARKS: Attended continuously. CAUTION: Birds on and in vicinity of arpt. CAUTION—Approach end of rwy 26 bright lgts approximately one mile from thld and 900' South of centerline. CAUTION—Deer on and in vicinity of arpt. Rwy 14R-32L CLOSED to acft over 140,000 lbs gross weight. Landing Fee. Flight Notification Service (ADCUS) available.
WEATHER DATA SOURCES: LLWAS.
COMMUNICATIONS: ATIS 124.05 **UNICOM** 122.95
MONTGOMERY COUNTY FSS (CXO) Toll free call, dial 1–800–WX–BRIEF. NOTAM FILE IAH.
Ⓡ **APP CON** 124.35 (West) 127.25 (North and East)
TOWER 118.1 (135.15 copter control) **GND CON** 121.7 **CLNC DEL** 128.1 (135.15 copter control)
Ⓡ **DEP CON** 123.8 (West) 119.7 (North and East)
TCA Group II: VFR Terminal Area chart.
RADIO AIDS TO NAVIGATION: NOTAM FILE IAH.
HUMBLE (H) VORTACW 116.6 IAH Chan 113 29°57'24"N 95°20'44"W at fld. 90/08E. HIWAS.
MARBE NDB (LOM) 379 HS 30°04'29"N 95°24'45"W 146° 5.9 NM to fld.
NIXIN NDB (LOM) 326 JY 29°59'36"N 95°12'54"W 257° 6.5 NM to fld.
ILS/DME 109.7 I-JYV Chan 34 Rwy 26 LOM NIXIN NDB
ILS 111.9 I-HSQ Rwy 14L LOM MARBE NDB
ILS/DME 109.7 I-IAH Chan 34 Rwy 08
ILS/DME 110.9 I-UYO Chan 34 Rwy 09
ILS 111.9 I-CDG Rwy 32R

FIGURE 22.—Airport/Facility Directory Excerpts.

206



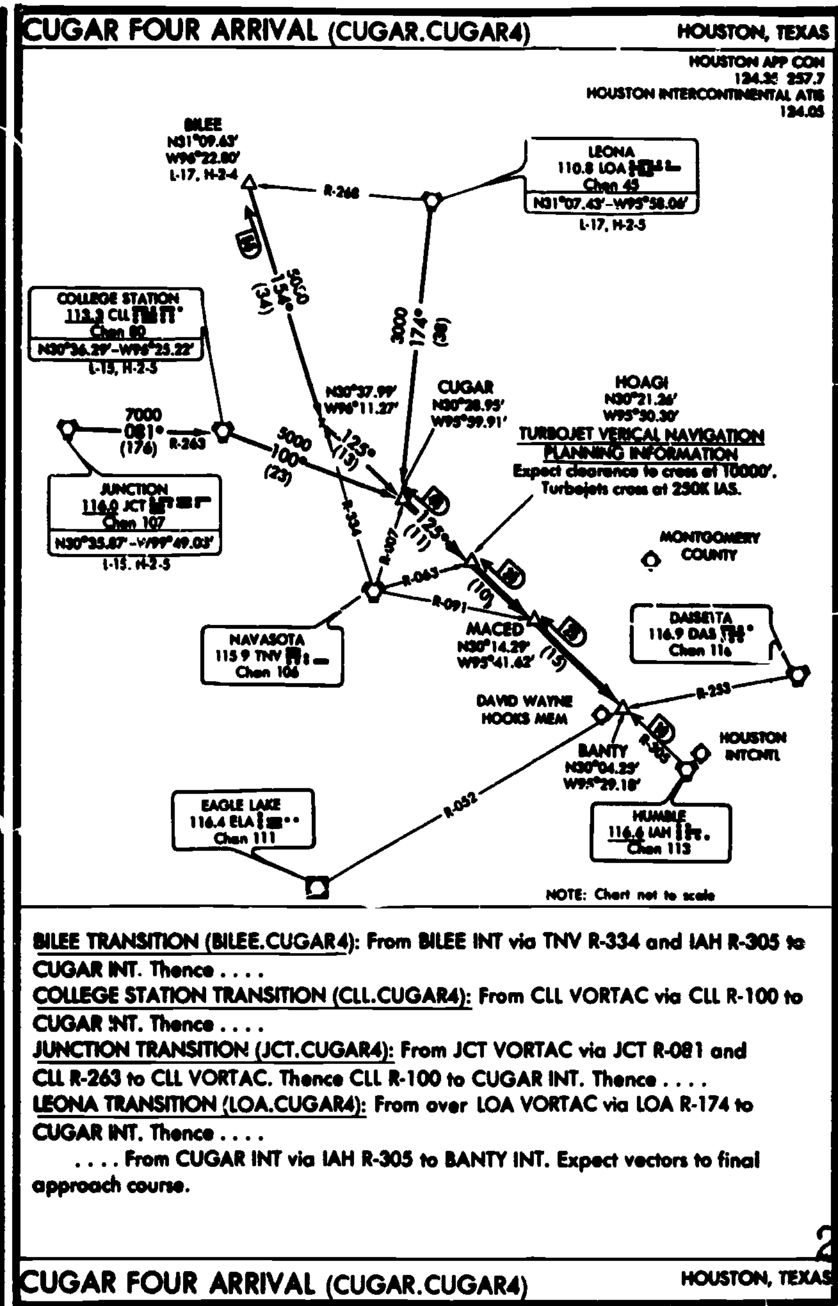


FIGURE 23.—Cugar Four Arrival (Cugar.Cugar4)/VOR/DME RWY 32R (IAH).

Form Approved: OMB No. 2120-0026

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION FLIGHT PLAN	(FAA USE ONLY) ☐ PILOT BRIEFING ☐ VNR ☐ STOPOVER	TIME STARTED	SPECIALIST INITIALS

1 TYPE	2 AIRCRAFT IDENTIFICATION	3 AIRCRAFT TYPE/ SPECIAL EQUIPMENT	4 TRUE AIRSPEED	5 DEPARTURE POINT	6 DEPARTURE TIME PROPOSED (Z)	ACTUAL (Z)	7 CRUISING ALTITUDE
VFR / X IFR / DVFR	N10FG	BH206/A	115 KTS	DFW			7,000

8 ROUTE OF FLIGHT: DFW V369 BILEE.CUGAR4 IAH

9 DESTINATION (Name of airport and city)	10 EST. TIME ENROUTE HOURS	MINUTES	11 REMARKS
IAH HOUSTON			

12 FUEL ON BOARD HOURS	MINUTES	13 ALTERNATE AIRPORT(S)	14 PILOT'S NAME, ADDRESS & TELEPHONE NUMBER & AIRCRAFT HOME BASE	15 NUMBER ABOARD
		NA	17 DESTINATION CONTACT/TELEPHONE (OPTIONAL)	

16 COLOR OF AIRCRAFT

CIVIL AIRCRAFT PILOTS. FAR Part 91 requires you file an IFR flight plan to operate under instrument flight rules in controlled airspace. Failure to file could result in a civil penalty not to exceed $1,000 for each violation (Section 901 of the Federal Aviation Act of 1958, as amended). Filing of a VFR flight plan is recommended as a good operating practice. See also Part 99 for requirements concerning DVFR flight plans.

FAA Form 7233-1 (8-82) CLOSE VFR FLIGHT PLAN WITH ______________ FSS ON ARRIVAL

FLIGHT LOG

CHECK POINTS FROM	TO	ROUTE ALTITUDE	MACH NO	WIND TEMP	SPEED-KTS TAS	GS	DIST NM	TIME LEG	TOT	FUEL LEG	TOT
DFW	LEVEL OFF	CLIMB					23		:14		* 23 lb
LEVEL OFF	CUGAR	V369 15,000		225/36 ISA	115						
CUGAR4	START DESCENT	CUGAR4 15,000		225/36 ISA	115		37				
DESCENT and APPROACH								:16		17	

OTHER DATA: * Includes fuel for taxi.

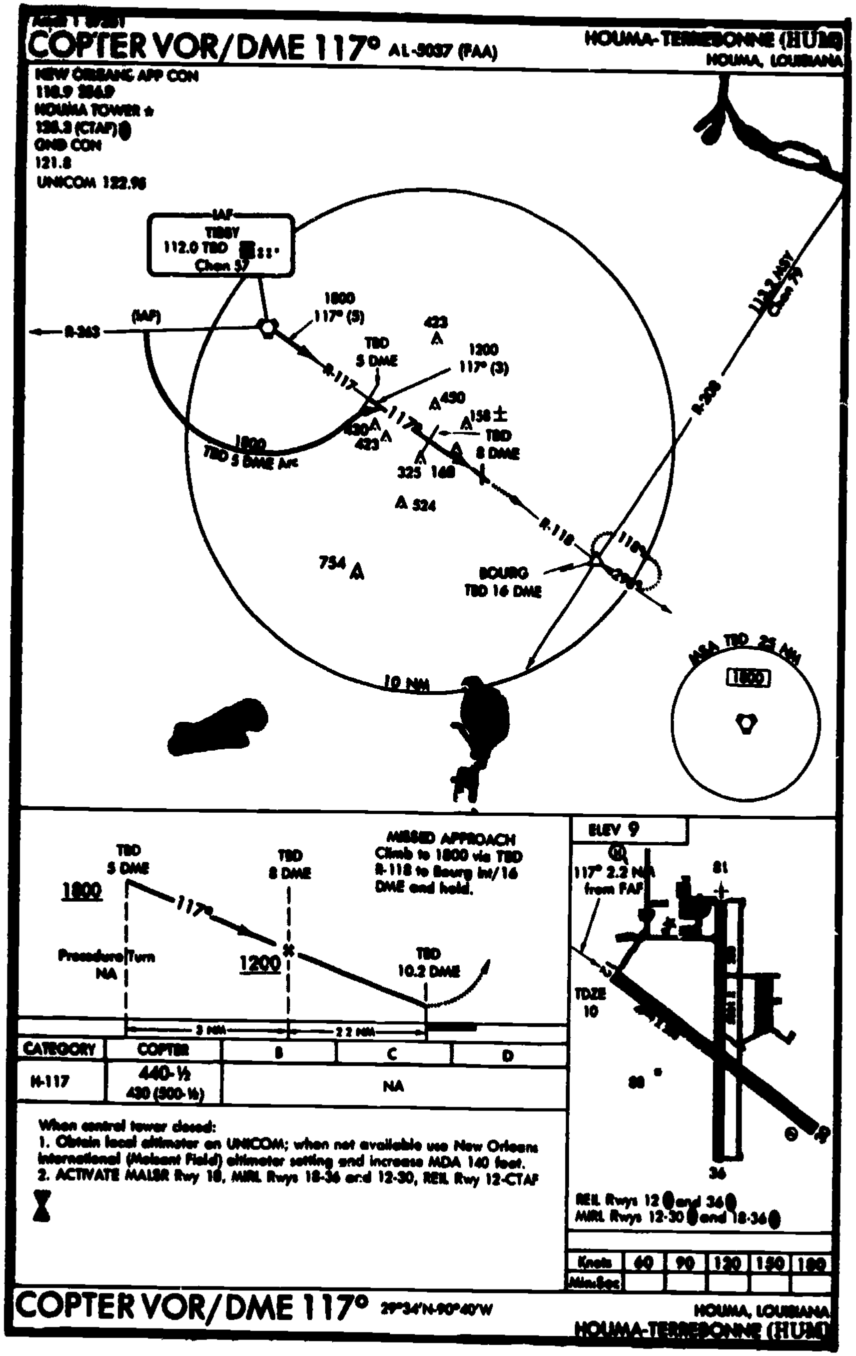
NOTE: Use 65 PPH total fuel flow from level off to descent.

Use 72 PPH total fuel flow for reserve requirements.

FLIGHT SUMMARY

TIME	FUEL	
		EN ROUTE
		RESERVE
--	12	MISSED APPR.
		TOTAL

FIGURE 24.—Flight Plan/Flight Log.



LOUISIANA

§ **HOUMA-TERREBONNE** (HUM) 3 SE UTC-6(-5DT) 29°34'03"N 90°39'37"W — NEW ORLEANS H-5C, L-17D IAP

9 B S4 FUEL 100, 100LL, JET A OX 1, 4 TPA—(See Remarks)

RWY 18-36: H5001X200 (CONC) S-50, D-70, DT-137 MIRL

RWY 18: MALSR. VASI(NSTD)—GA 3.0°TCH 52'. Tree.

RWY 36: REIL. VASI(NSTD)—GA 3.0°TCH 39'.

RWY 12-30: H4999X200 (CONC) S-50, D-70, DT-137 MIRL

RWY 12: REIL. VASI(NSTD)—GA 3.0°TCH 34'. Road.

RWY 30: VASI(V2L)—GA 3.0°TCH 39'.

AIRPORT REMARKS: Attended dawn-dusk. CAUTION: Birds on and in vicinity of arpt. Oxygen avbl by prior request 504-876-0584. ACTIVATE MIRL Rwy 12-30 and Rwy 18-36 and MALSR Rwy 18 and REIL Rwy 12 and Rwy 36—CTAF. TPA—1009'(1000'), turbine powered 1509'(1500'). Control Zone effective 1200-0300Z‡ Mon-Fri, 1400-2400Z‡ Sat and Sun.

WEATHER DATA SOURCES: LAWRS (504) 879-4309.

COMMUNICATIONS: CTAF 125.3 ATIS 120.25 UNICOM 122.95

DE RIDDER FSS (DRI) Toll free call, dial 1-800-WX-BRIEF. NOTAM FILE HUM.

TIBBY RCO 122.1R 112.0T (DE RIDDER FSS)

Ⓡ NEW ORLEANS APP/DEP CON 118.9

TOWER 125.3 118.35 (1200-0300Z‡ Mon-Fri, 1400-2400Z‡ Sat-Sun) GND CON 121.8

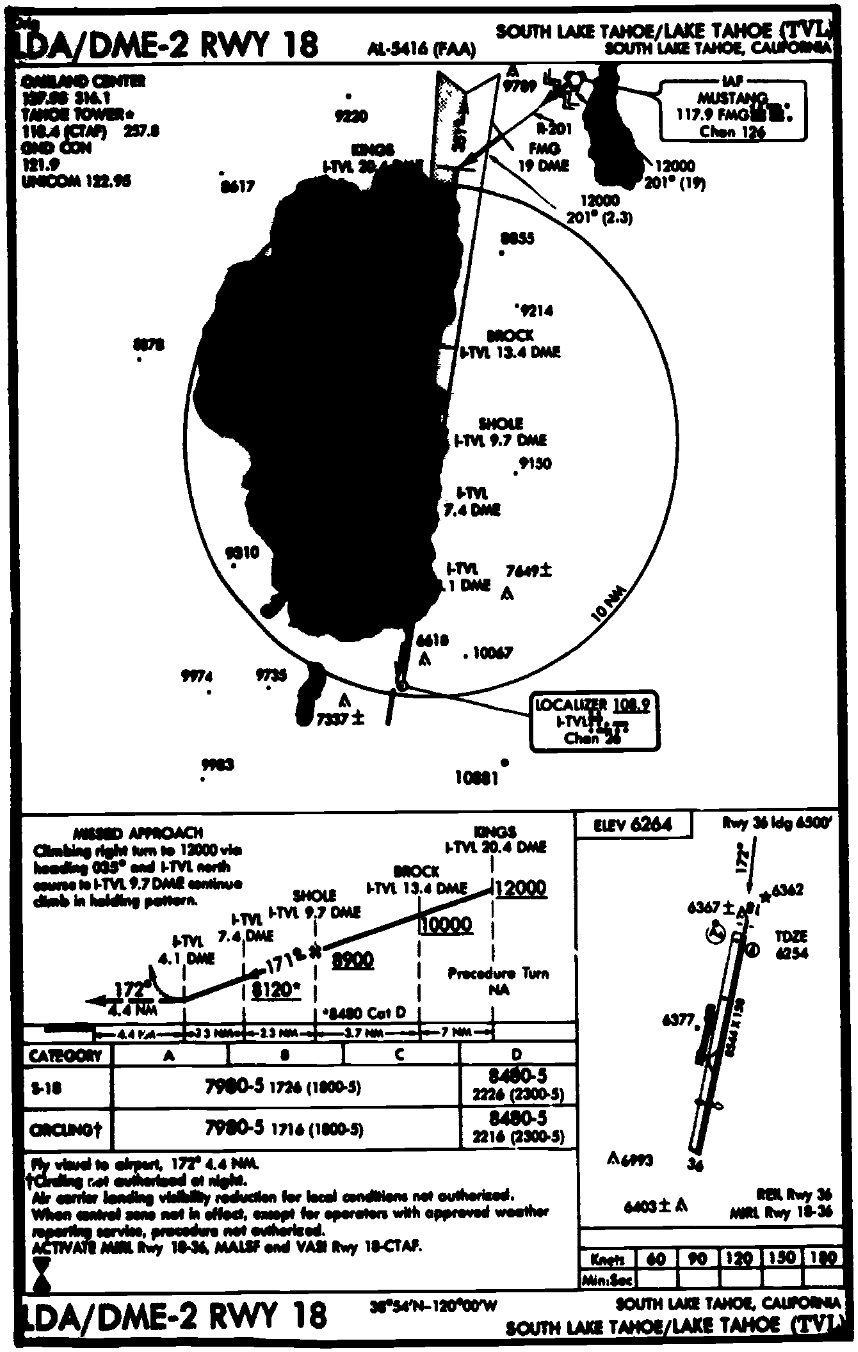
RADIO AIDS TO NAVIGATION: NOTAM FILE DRI.

TIBBY (L) VORTAC 112.0 TBD Chan 57 29°39'51"N 90°49'44"W 117° 10.2 NM to fld. 10/06E

NDB (LOM) 219 HU 29°39'47"N 90°39'34"W 176°5.3 NM to fld. NOTAM FILE HUM.

ILS 108.5 I-HUM RWY 18 LOM HOUMA NDB.

FIGURE 25.—Copter VOR/DME 117° (HUM) and Excerpt from A/FD.



CATEGORY	A	B	C	D
S-18	7980-5 1726 (1800-5)			8480-5 2226 (2300-5)
CIRCLING†	7980-5 1716 (1800-5)			8480-5 2216 (2300-5)

Fly visual to airport, 172° 4.4 NM.
†Circling not authorized at night.
Air carrier landing visibility reduction for local conditions not authorized.
When control zone not in effect, except for operators with approved weather reporting service, procedure not authorized.
ACTIVATE MIRL Rwy 18-36, MALSF and VASI Rwy 18-CTAF.

Knots	60	90	120	150	180
Min:Sec					

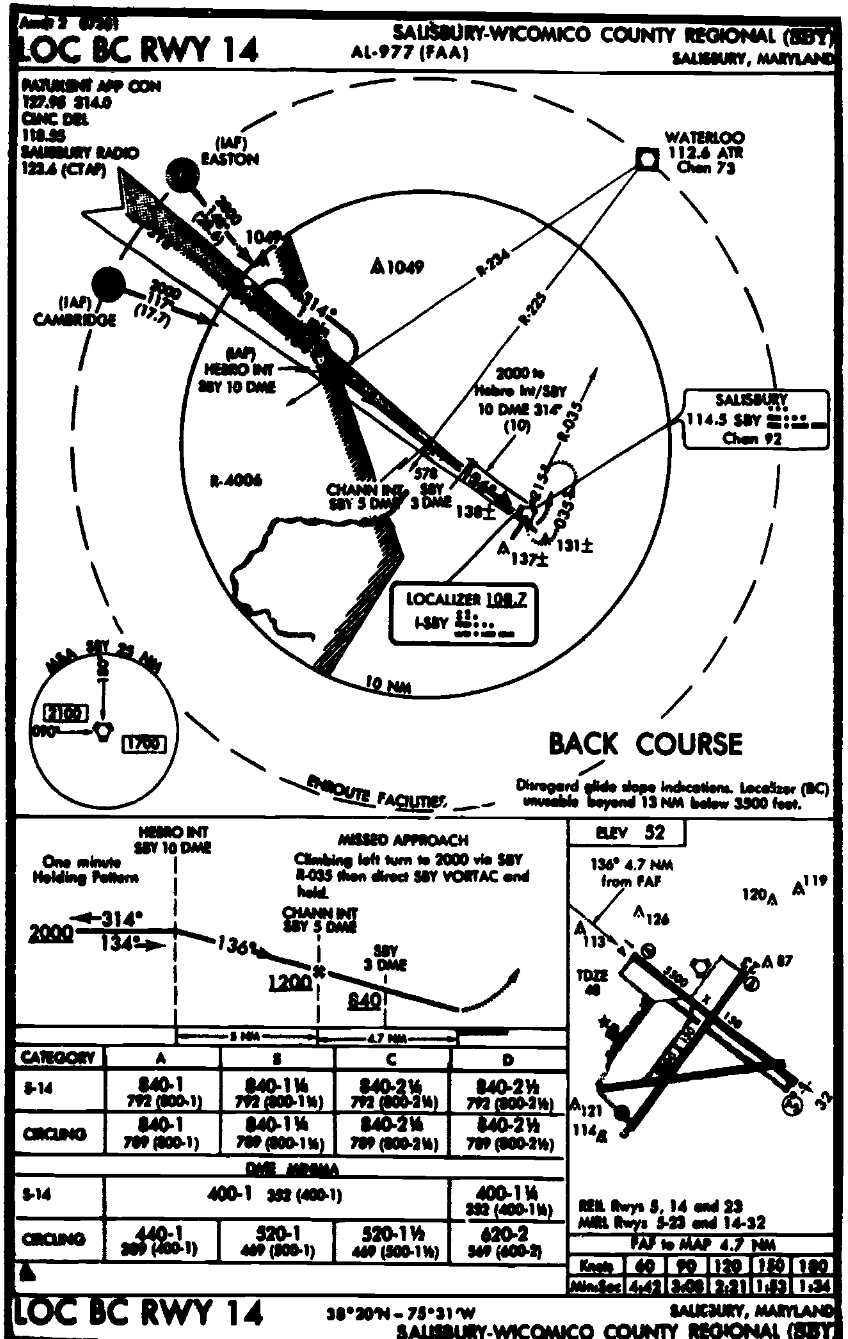
LDA/DME-2 RWY 18 38°54'N-120°00'W SOUTH LAKE TAHOE, CALIFORNIA
SOUTH LAKE TAHOE/LAKE TAHOE (TVL)

CALIFORNIA

SOUTH LAKE TAHOE

§ **LAKE TAHOE** (TVL) 3 SW UTC-8(-7DT) 38°53'38"N 119°59'40"W **SAN FRANCISCO**
6264 B S4 **FUEL** 100LL, JET A OX 3 TPA—See Remarks CFR Index B **H-2B, L-2B, 5A**
RWY 18-36: H8544X150 (ASPH-GRVD) S-70, D-125, DT-210 MIRL **IAP**
RWY 18: MALSF. VASI(S2L)—GA 3.0°TCH 47' (nights only). Tree.
RWY 36: REIL. Thld dsplcd 2037'. Trees. Rgt tfc.
AIRPORT REMARKS: Attended continuously. CAUTION—Down drafts may be encountered close to the mountains. Higher terrain and tall trees restrict control tower visibility in the north, south and west quadrants of the tfc pattern. Tfc advisories and sequencing in the tfc pattern are based on position reports received from pilots in these areas. Pilots are urged to make accurate position reports using distance and direction from the field and to be vigilant for other flight activity in the area. The control tower may be unable to provide visual separation to acft in these areas. Large and high performance acft may dep Rwy 18 into rgt tfc west of arpt and dep on 340° heading over the lake. PPR for Charter/Air Transport category acft. FBO attended continously. CLOSED to Air Carrier Ops with more than 30 passenger seats 0400–1500Z‡ except 12 hours PPR call arpt manager 916–541–4080. Prior written approval must be obtained from Arpt manager for touch and go ldgs for jet and acft over 12,500 lbs. Noise ordinance in effect. Noise sensitive arpt. Noise Goals: 1600–0400Z‡–84 DB(A); 0400–1600Z‡– 77.1 DB(A). Noise monitors at FAA FAR 36 apch dep locations. Noise testing avbl. Acft 77.1 DB(A) or under; emergency/mercy; government acft exempted from night curfew. Operators of acft with older engines that do not meet 84 DB(A) are encouraged to demonstrate against TVL NOISE monitoring equipment to continue access to TVL. Acft not appearing to meet 84 DB(A) include Lear 20 series, HS 125 series with viper engine, Falcon, Gulfstream, Westwind, Sabre (except 65's). Hansa, BAC 111, B727, DC 9–10, 30, 50, Convair, Fairchild F–27–28, etc. Arriving acft cross the shoreline at or above 7500' for noise abatement. Acft departing in Rwy 36 requested upon passing orange arrow approximately one mile pass departing end of rwy turn left to 320° and follow meadow to lake shoreline. Acft climb and remain over the meadow until reaching 7500' and over the lake shore before changing course. This info will be provided thru the FBO. This does not apply to acft remaining in the east tfc pattern except the crosswind turn will not be made prior to reaching end of rwy at 6800' or above. Normal dep Rwy 18 is a wide left downwind dep, left crosswind turn should not be made until reaching south arpt boundary and 7500' MSL. If sufficient altitude is not reached after tkf for crosswind turn to a downwind dep with safety approximately 1.5 miles south is a golf course where you may circle to gain altitude and advise twr of intentions, report leaving golf course/state direction. ACTIVATE MIRL Rwy 18–36, MALSF and VASI Rwy 18 when twr clsd—118.4. North-South taxiway unlgtd. TPA—7500(1236) Small aircraft; 8000(1736) transport/high performance aircraft. Parking fee. Control Zone effective 1600-0400Z‡.
WEATHER DATA SOURCES: LAWRS (916)541-3302.
COMMUNICATIONS: CTAF 118.4 **UNICOM** 122.95
RENO FSS (RNO) Toll free call, dial 1–800–521–1599. NOTAM FILE TVL.
RCO 122.1R 113.2T (RENO FSS)
OAKLAND CENTER APP/DEP CON 127.95 (West), 128.8 (East)
TAHOE TOWER 118.4 (1600-0400Z‡) **GND CON** 121.9
RADIO AIDS TO NAVIGATION: NOTAM FILE TVL.
(L) **ABVORTAC** 113.2 ■ LTA Chan 79 39°10'50"N 120°16'07"W 125° 21.4 NM to fld. 8850/18E.
Route forecast only 0800-1300Z‡.
LDA/DME 108.9 Chan 26 I-TVL Rwy 18.

FIGURE 26.—LDA/DME-2 RWY 18 (TVL) and Excerpt from A/FD.

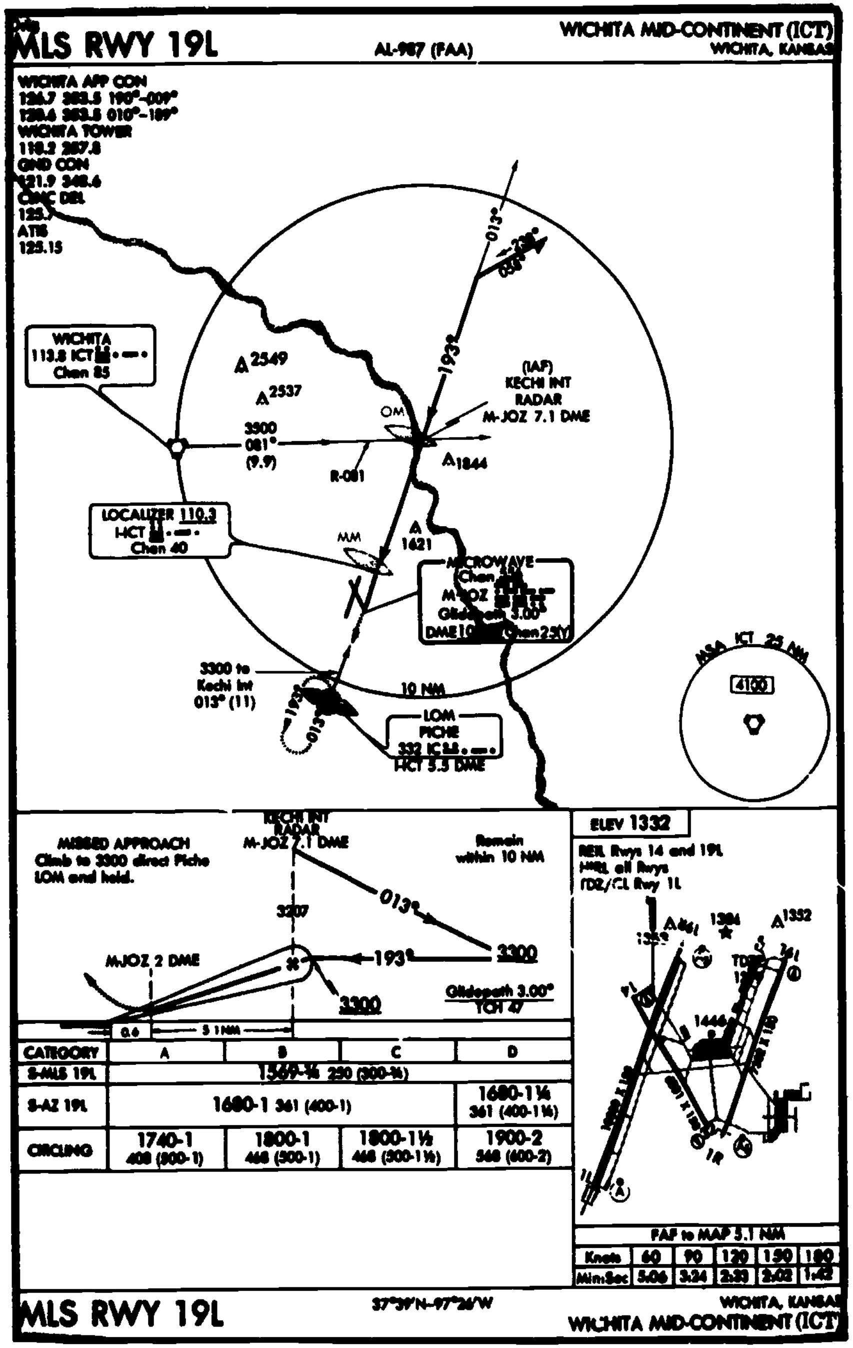


MARYLAND

§ **SALISBURY-WICOMICO CO REGIONAL** (SBY) 4.3 SE UTC-5(-4DT) WASHINGTON
38°20'26"N 75°30'38"W H-4J, 6H, L-22H, 24H, 27B, 28E
52 B S4 FUEL 100LL, JET A CFR Index A IAP
RWY 14-32: H5500X150 (ASPH-CONC-PFC) S-34, D-54, DT-95 MIRL
RWY 14: REIL. VASI(V4L)—GA 3.0°TCH 54'. Trees. RWY 32: MALSR. Trees.
RWY 05-23: H5000X150 (ASPH) S-30, D-50 MIRL
RWY 05: REIL. VASI(V4L)—GA 3.0°TCH 39'. Trees. RWY 23: REIL. VASI(V4L)—GA 3.0°TCH 39'. Trees.
AIRPORT REMARKS: Attended 1100-0300Z‡. CAUTION: Birds on and in vicinity of arpt. Numerous military activities on and in vicinity of arpt Airport CLOSED to unscheduled air carrier ops with more then 30 passenger seats except 1 hour PPR call arpt manager 301-548-4827. Rwy 14 VASI unmonitored, key 123.6 5 times on and 3 times off. Rwy 14-32 middle third wire combed outer thirds PFC. Deer on airport. Numerous military activities on and in vicinity of arpt.
COMMUNICATIONS: CTAF 123.6 UNICOM 122.95
SALISBURY FSS (SBY) on arpt. 123.6 LC 742-8710. (1100-0300Z‡). NOTAM FILE SBY.
LEESBURG FSS (DCA) Toll free call dial 1-800-WX-BRIEF. (0300-1100Z‡).
SALISBURY RCO 122.1R 114.5T (NEWPORT NEWS)
SALISBURY RCO 122.3 122.2 (LEESBURG FSS)
Ⓡ PATUXENT APP/DEP CON 127.95 (1200-0400Z‡) CLNC DEL 118 55
Ⓡ WASHINGTON CENTER APP/DEP CON 127.7 (0400-1200Z‡)
RADIO AIDS TO NAVIGATION: NOTAM FILE SBY. VHF/DF ctc LEESBURG FSS
(L) VORTAC 111.2 SBY Chan 49 38°20'42"N 75°30'39"W at fld. 50/08W. VOR portion unusable 290°-320° beyond 10 NM below 3000'.
COLBE NDB (LOM) 278 SB 38°16'43"N 75°24'22"W 316° 5.7 NM to fld.
ILS 108.7 I-SBY Rwy 32 LOM COLBE NDB. BC unusable beyond 13 NM below 3500'.

NAME	ALTERNATE MINIMUMS
SALISBURY-WICOMICO COUNTY REGIONAL, MD	VOR Rwy 14* LOC (BC) Rwy 14* VOR Rwy 23** *Category C, 800-2¼, Category D, 800-2½ **Category D, 800-2¼

FIGURE 27.—LOC BC RWY 14 (SBY) and Excerpt from A/FD.



KANSAS

§ WICHITA MID-CONTINENT (ICT) 5 SW UTC-6(-5DT) 37°39'00"N 97°25'58"W — WICHITA H-2J, 4F, L-8B IAP

1332 B S4 FUEL 100LL, JET A MOGAS OX 1, 2, 3, 4 LRA CFR Index C

RWY 01L-19R: H10,300X150 (CONC-GRVD) S-100, D-150, DT-250 HIRL CL

RWY 01L: ALSF2, TDZ. Antenna. RWY 19R: MALSR. Rgt tfc.

RWY 01R-19L: H7302X150 (CONC-GRVD) S-100, D-175, DT-300 HIRL

RWY 01R: MALSR. Rgt tfc. RWY 19L: REIL. VASI(V4L)—GA 3.0°TCH 55'. Antenna.

RWY 14-32: H6301X150 (CONC) S-100, D-150, DT-250 HIRL

RWY 14: REIL. VASI(V4L)—GA 3.0°TCH 52.5'. RWY 32: VASI(V4L)—GA 3.0°TCH 52'.

AIRPORT REMARKS: Attended continuously. Acft carrying hazardous or explosive cargo prohibited. Flight Notification Service (ADCUS) available.

WEATHER DATA SOURCES: LLWAS.

COMMUNICATIONS: ATIS 125.15 UNICOM 122.95

WICHITA FSS (ICT) on arpt 122.65, 122.2, 122.1R LC 942-4131. NOTAM FILE ICT.

(R) APP CON 120.6 (010°–189°4500' and below W IAB 010°–189°) 126.7 (190°–009°) 134.8 (E IAB 010°–189° 4500' and below) 134.45 (010°–189° above 4500')

TOWER 118.2 GND CON 121.9 CLNC DEL 125.7

(R) DEP CON 120.6 (010°–189° 4500' and below) 126.7 (190°–009°) 134.45 (010°–189° above 4500') 124.75

ARSA ctc APP CON.

RADIO AIDS TO NAVIGATION: NOTAM FILE ICT.

(H) VORTACW 113.8 ICT Chan 85 37°44'43"N 97°35'01"W 121°9.1 NM to fld. 1470/7E

PICHE NDB (H-SAB/LOM) 332 IC 37°34'42"N 97°27'20"W 012°4.1 NM to fld

ILS/DME 110.3 I-ICT Chan 40 Rwy 01R LOM PICHE NDB.

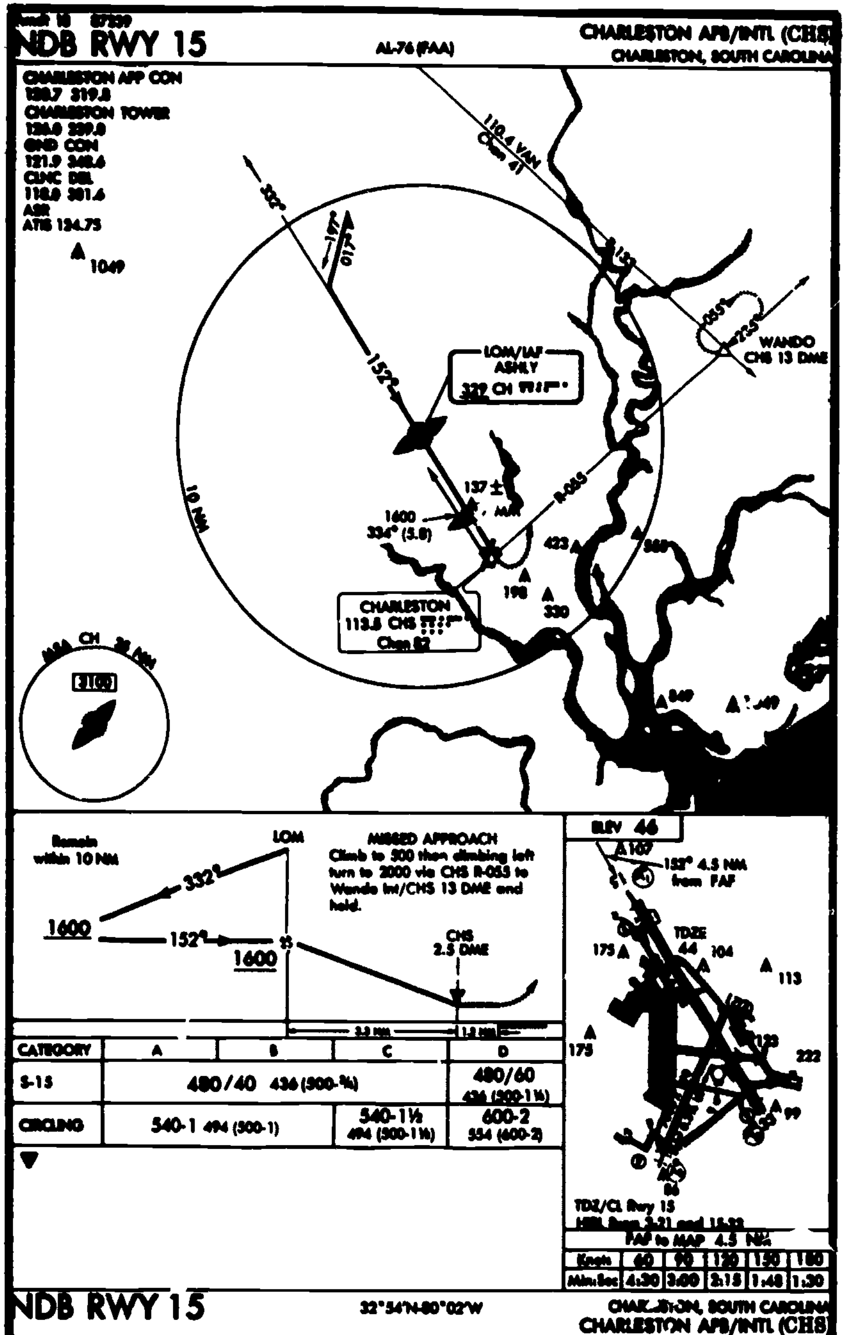
ILS 109.1 I-TWI Rwy 01L

ILS 110.5 I-HOV Rwy 19R.

MLS Chan 25Y Rwy 19L

COMM/NAVAID REMARKS: Emerg frequency 121.5 not avbl at FSS.

FIGURE 28.—MLS RWY 19L (ICT) and Excerpt from A/FD.



CATEGORY	A	B	C	D
S-15	480/40 436 (500-¾)			480/60 436 (500-1¼)
CIRCLING	540-1 494 (500-1)		540-1½ 494 (500-1½)	600-2 554 (600-2)

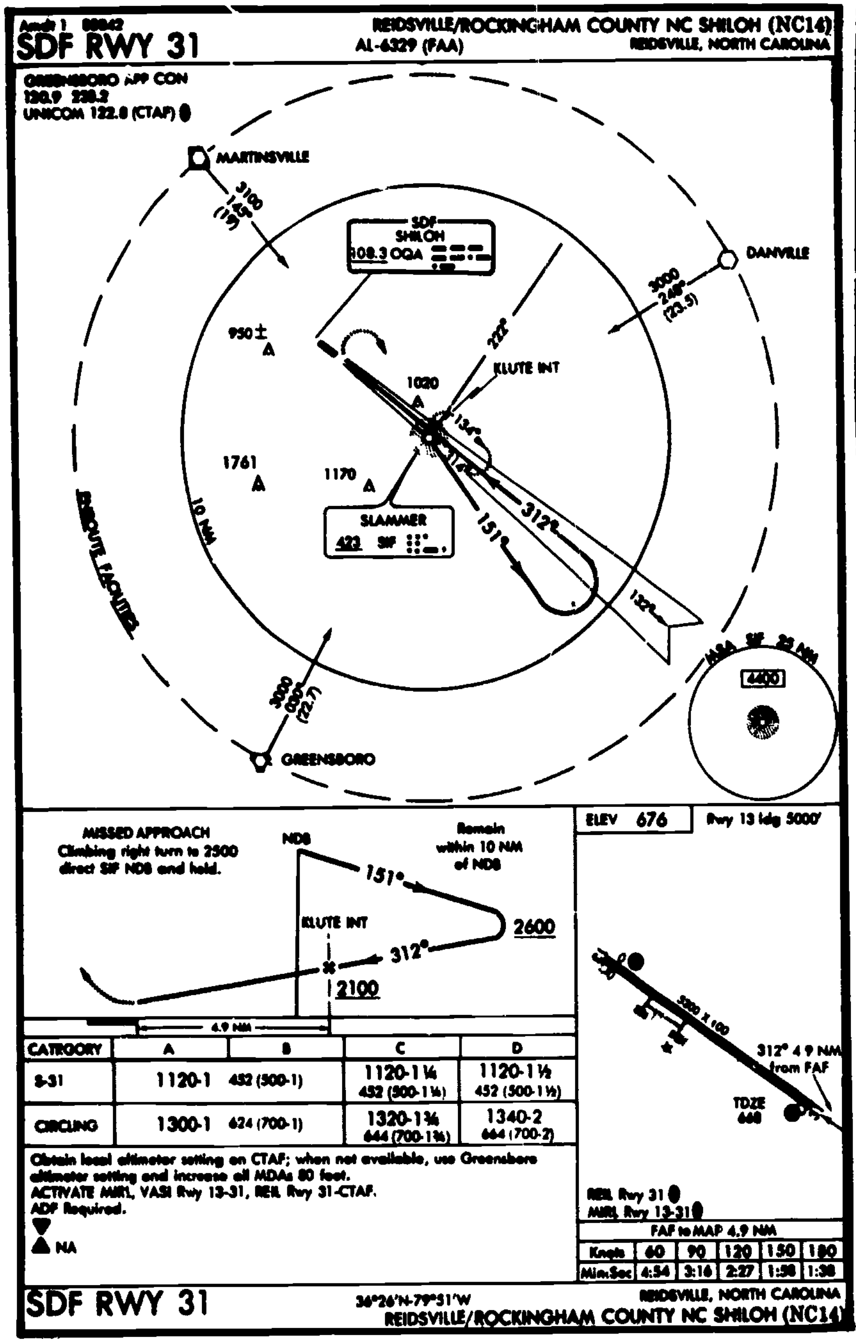
Knots	60	90	120	150	180
Min:Sec	4:30	3:00	2:15	1:48	1:30

SOUTH CAROLINA

CHARLESTON

§ CHARLESTON AFB/INTL (CHS) 8.7 NW UTC-5(-4DT) 32°53'56"N 80°02'27"W — CHARLOTTE
46 B S4 FUEL 100, JET A1+ OX 1 LRA CFR Index C — H-6F, 4I, L-20A, 21A
RWY 15-33: H9001X200 (ASPH-CONC) S-125, D-275, DT-380, DDT-775 HIRL, CL — IAP
RWY 15: ALSF1. TDZ. VASI(V12)—GA 3.0° TCH 53'. Trees. Arresting device.
RWY 33: VASI(V12)—GA 3.0° TCH 51'. Trees. Arresting device
RWY 03-21: H7000X150 (ASPH-CONC) S-125, D-275, DT-380, DDT-775 HIRL
RWY 03: SSALR, VASI(V12)—TCH 56'. Trees. RWY 21: VASI(V12)—TCH 46'. Trees.
AIRPORT REMARKS: Attended continuously. Rwy 15-33 CLOSED last Fri of each month 1230–2200Z‡ No student solo touch and go ldgs. Rwy braking action poor when wet due to rubber build–up. Taxiway 2 condition poor, surface rough and wavy. Flight Notification Service (ADCUS) available.
WEATHER DATA SOURCES: LLWAS.
COMMUNICATIONS: ATIS 124.75 UNICOM 122.95
CHARLESTON FSS (CHS) on arpt 122.5, 122.2, 122.1R 803-747-5293. NOTAM FILE CHS.
Ⓡ APP CON 120.7 (151°-330°) 135.8 (331°-150°) 119.3 Ⓡ DEP CON 120.7 (151°-330°) 135.8 (331°-150°)
TOWER 126.0 GND CON 121.9 CLNC DEL 118.0
ARSA ctc APP CON
RADIO AIDS TO NAVIGATION: NOTAM FILE CHS. VHF/DF Charleston FSS
(H) VORTAC 113.5 CHS Chan 82 32°53'39"N 80°02'17"W at fld. 40/05W
VOR unusable 001°–080° byd 20 NM blo 5000' 201°–216° byd 25 NM blo 8000'.
ASHLY NDB (MHW/LOM) 329 CH 32°58'34"N 80°05'52"W 152° 4.5 NM to fld
ILS 109.7 I-CHS Rwy 15. LOM ASHLY NDB
ILS 109.9 I-CCI Rwy 33
ASR

FIGURE 29.—NDB RWY 15 (CHS) and Excerpt from A/FD.



NORTH CAROLINA

REIDSVILLE

ROCKINGHAM CO NC SHILOH (NC14) 7.8 NW UTC-5(-4DT) 36°26'09"N 79°50'58"W CINCINNATI
676 B S4 FUEL 100LL, JET A1 OX 3 H-6B, 4I, L-23B
RWY 13-31: H5200X100 (ASPH) S-12.5 MIRL IAP
RWY 13: VASI(V2L)—GA 3.75°TCH 31.1'. Thld dsplcd 200'. Trees.
RWY 31: REIL. VASI(V2L)—GA 3.75°TCH 34'. Barn.
AIRPORT REMARKS: Attended Mon-Sat 1230Z‡-dusk, Sun 1800Z‡-dusk. Emergency repairs (919) 685-4423. For MIRL Rwy 13-31, VASI Rwys 13, 31 and REIL Rwy 31 key 122.8 3 times
COMMUNICATIONS: CTAF/UNICOM 122.8
RALEIGH FSS (RDU) Toll free call dial 1-800-662-7272. NOTAM FILE RDU.
GREENSBORO RCO 123.65, 122.2, 122.1R 116.2T (RALEIGH FSS)
Ⓡ GREENSBORO APP/DEP CON 120.9
RADIO AIDS TO NAVIGATION: NOTAM FILE RDU.
GREENSBORO (H) VORTAC 116.2 GSO Chan 109 36°02'44"N 79°58'36"W 018°24.2 NM to fld. 880/03W. NOTAM FILE GSO.
SLAMMER NDB (MHW) 423 SIF 36°22'56"N 79°45'49"W 315°5 NM to fld.
SDF 108.3 OQA Rwy 31

FIGURE 30.—SDF RWY 31 (NC14) and Excerpt from A/FD.

87229

CIVIL RADAR INSTRUMENT APPROACH MINIMUMS

ASHEVILLE REGIONAL NC Amdt. 5, MAR 17, 1983 ELEV 2165
RADAR—125.8 226.8

	RWY	GS/TCH/RPI	CAT	DH/ MDA-VIS	HAT/ HAA	CEIL-VIS	CAT	DH/ MDA-VIS	HAT/ HAA	CEIL-VIS
ASR	34		AB	2800—½	660	(700—½)	C	2800—1¼	660	(700—1¼)
			D	2800—1½	660	(700—1½)				
	16		A	3000—1	836	(900—1)	B	3000—1¼	835	(900—1¼)
			C	3000—2½	835	(900—2½)	D	3000—2¾	835	(900—2¾)
CIRCLING			A	3000—1	835	(900—1)	B	3000—1¼	835	(900—1¼)
			C	3000—2½	835	(900—2½)	D	3000—2¾	835	(900—2¾)

Circling not authorized west of Rwy 16—34. Night circling not authorized. ▼▲

ATLANTA/DEKALB-PEACHTREE GA Amdt. 1, MAY 8, 1986 ELEV 1002
RADAR—119.3 381.6

	RWY	GS/TCH/RPI	CAT	DH/ MDA-VIS	HAT/ HAA	CEIL-VIS	CAT	DH/ MDA-VIS	HAT/ HAA	CEIL-VIS
ASR	20L		A	1520—¾	529	(600—¾)	B	1520—1¼	529	(600—1¼)
			C	1520—1½	529	(600—1½)	D	1520—2	529	(600—2)
CIRCLING			A	1520—1	518	(600—1)	B	1520—1¼	518	(600—1¼)
			C	1520—1½	518	(600—1½)	D	1560—2	558	(600—2)

When control zone not in effect: 1. Use Fulton County Airport—Brown Field altimeter setting: 2. Increase all MDA's 40 feet: 3. ACTIVATE MALSF Rwy 20L—120.0. Inoperative table applies only to Category A.
CAUTION: Numerous antennae to heights of 2000 feet + MSL in sector south of airport. ▼▲

ATLANTA/FULTON COUNTY AIRPORT-BROWN FIELD GA Amdt. 16, FEB 2, 1984 ELEV 840
RADAR—121.0 385.5

	RWY	GS/TCH/RPI	CAT	DH/ MDA-VIS	HAT/ HAA	CEIL-VIS	CAT	DH/ MDA-VIS	HAT/ HAA	CEIL-VIS
ASR	8R		AB	1540—¾	736	(700—¾)	C	1540—1½	736	(700—1½)
			D	1540—1¾	736	(700—1¾)				
	26L		AB	1520—1	706	(700—1)	C	1520—2	706	(700—2)
			D	1520—2¼	706	(700—2¼)				
CIRCLING			AB	1540—1	700	(700—1)	C	1540—2	700	(700—2)
			D	1580—2¼	740	(800—2¼)				

Categories A, B S—8R visibility increased ¼ mile for inoperative MALSR.
CAUTION: Building and numerous trees between 1900 and 2600 feet from threshold Rwy 8R penetrate approach light plane as much as 20 feet. ▼▲

ATLANTA/THE WILLIAM B. HARTSFIELD ATLANTA INTL GA Amdt. 30, NOV 20, 1986 ELEV 1026
RADAR—127.9 379.9

	RWY	GS/TCH/RPI	CAT	DH/ MDA-VIS	HAT/ HAA	CEIL-VIS	CAT	DH/ MDA-VIS	HAT/ HAA	CEIL-VIS
ASR	26R		AB	1400/24	410	(400—½)	C	1400/40	410	(400—¾)
			D	1400/50	410	(400—1)				
	27L		ABC	1420/40	421	(400—¾)	D	1420/50	421	(400—1)
	9R		AB	1400/24	454	(500—½)	C	1400/40	454	(500—¾)
			D	1400/50	454	(500—1)				
	8L		AB	1400/24	465	(500—½)	C	1400/40	465	(500—¾)
			D	1400/50	465	(500—1)				

Categories D ASR S—26R and S—27L visibility increased to RVR 6000 for inoperative MALSR.

SE-2

CIVIL RADAR INSTRUMENT APPROACH MINIMUMS

FIGURE 31.—Civil Radar Instrument Approach Minimums.

LOADING CONDITIONS	WT-1	WT-2	WT-3	WT-4	WT-5
PASSENGERS					
FORWARD COMPT	18	23	12	28	26
AFT COMPT	95	112	75	122	103
CARGO					
FORWARD HOLD	1,500	2,500	3,500	850	1,400
AFT HOLD	2,500	3,500	4,200	1,500	2,200
FUEL					
TANKS 1 AND 3 (EACH)	10,500	11,000	FULL	10,000	11,500
TANK 2	28,000	27,000	24,250	26,200	25,200

FIGURE 32.—B-727 Loading.

LOADING CONDITIONS	WT-6	WT-7	WT-8	WT-9	WT-10
PASSENGERS					
FORWARD COMPT	10	27	6	29	21
AFT COMPT	132	83	98	133	127
CARGO					
FORWARD HOLD	5,000	4,500	1,300	975	2,300
AFT HOLD	6,000	5,500	3,300	1,250	2,400
FUEL					
TANKS 1 AND 3 (EACH)	9,500	9,000	FULL	11,000	10,500
TANK 2	21,700	19,800	12,000	29,300	22,700

FIGURE 33.—B-727 Loading.

LOADING CONDITIONS	WT-11	WT-12	WT-13	WT-14	WT-15
PASSENGERS					
FORWARD COMPT	11	28	22	17	3
AFT COMPT	99	105	76	124	130
CARGO					
FORWARD HOLD	3,100	4,200	1,600	3,800	1,800
AFT HOLD	5,500	4,400	5,700	4,800	3,800
FUEL					
TANKS 1 AND 3 (EACH)	8,500	11,500	12,000	11,000	10,500
TANK 2	19,600	27,800	29,100	25,400	21,900

FIGURE 34.—B-727 Loading.

AIRPLANE DATUM CONSTANTS

MAC	180.9 inches
L.E. of MAC	860.5 inches
Basic Operating Index	$\frac{92,837.0}{1,000}$

OPERATING LIMITATIONS

Maximum Takeoff Slope	± 2%
Maximum Takeoff/Landing Crosswind Component	32 knots
Maximum Takeoff/Landing Tailwind Component	12 knots

WEIGHT LIMITATIONS

Basic Operating Weight	105,500 pounds
Maximum Zero Fuel Weight	138,500 pounds
Maximum Taxi Weight	185,700 pounds
Maximum Takeoff Weight (Brake Release)	184,700 pounds
Maximum Inflight Weight (Flaps 30)	155,500 pounds
(Flaps 40)	144,000 pounds
Maximum Landing Weight (Flaps 30)	155,000 pounds
(Flaps 40)	143,000 pounds

FIGURE 35.—Table of Weights and Limits.

PASSENGER LOADING TABLE

Number of Pass.	Weight Lbs.	Moment / 1000
FORWARD COMPARTMENT CENTROID—582.0		
5	850	495
10	1,700	989
15	2,550	1,484
20	3,400	1,979
25	4,250	2,473
29	4,930	2,869
AFT COMPARTMENT CENTROID—1028.0		
10	1,700	1,748
20	3,400	3,495
30	5,100	5,243
40	6,800	6,990
50	8,500	8,738
60	10,200	10,486
70	11,900	12,233
80	13,600	13,980
90	15,300	15,728
100	17,000	17,476
110	18,700	19,223
120	20,400	20,971
133	22,610	23,243

CARGO LOADING TABLE

Moment / 1000

Weight Lbs.	Forward Hold Arm 680.0	Aft Hold Arm 1166.0
6,000		6,996
5,000	3,400	5,830
4,000	2,720	4,664
3,000	2,040	3,498
2,000	1,360	2,332
1,000	680	1,166
900	612	1,049
800	544	933
700	476	816
600	408	700
500	340	583
400	272	466
300	204	350
200	136	233
100	68	117

NOTE: THESE COMPUTATIONS ARE TO BE USED FOR TESTING PURPOSES ONLY.

FUEL LOADING TABLE

TANKS 1 & 3 (EACH)			TANK 2 (3 CELL)					
Weight Lbs.	Arm	Moment / 1000	Weight Lbs.	Arm	Moment / 1000	Weight Lbs.	Arm	Moment / 1000
8,500	992.1	8,433	8,500	917.5	7,799	22,500	914.5	20,576
9,000	993.0	8,937	9,000	917.2	8,255	23,000	914.5	21,034
9,500	993.9	9,442	9,500	917.0	8,711	23,500	914.4	21,488
10,000	994.7	9,947	10,000	916.8	9,168	24,000	914.3	21,943
10,500	995.4	10,451	10,500	916.6	9,624	24,500	914.3	22,400
11,000	996.1	10,957	11,000	916.5	10,082	25,000	914.2	22,855
11,500	996.8	11,463	11,500	916.3	10,537	25,500	914.2	23,312
12,000	997.5	11,970	12,000	916.1	10,993	26,000	914.1	23,767
FULL CAPACITY			**(See note at lower left)			26,500	914.1	24,244
			18,500	915.1	16,929	27,000	914.0	24,678
			19,000	915.0	17,385	27,500	913.9	25,132
			19,500	914.9	17,841	28,000	913.9	25,589
			20,000	914.9	18,298	28,500	913.8	26.043
			20,500	014.8	18,753	29,000	913.7	26,497
			21,000	914.7	19,209	29,500	913.7	26,954
			21,500	914.6	19,664	30,000	913.6	27,408
			22,000	914.6	20,121	FULL CAPACITY		

**Note: Computations for Tank 2 weights for 12,500 lbs. to 18,000 lbs. have been purposely omitted.

FIGURE 36.—Loading Tables.

LOADING CONDITIONS	WS-1	WS-2	WS-3	WS-4	WS-5
LOADED WEIGHT	90,000	85,000	84,500	81,700	88,300
LOADED CG (% MAC)	22.5%	28.4%	19.8%	30.3%	25.5%
WEIGHT CHANGE (POUNDS)	2,500	1,800	3,000	2,100	3,300
FWD COMPT CENTROID - STA 352.1 AND -227.9 INDEX ARM AFT COMPT CENTROID - STA 724.9 AND +144.9 INDEX ARM MAC - 141.5 INCHES, LEMAC - STA 549.13, AND -30.87 INDEX ARM					

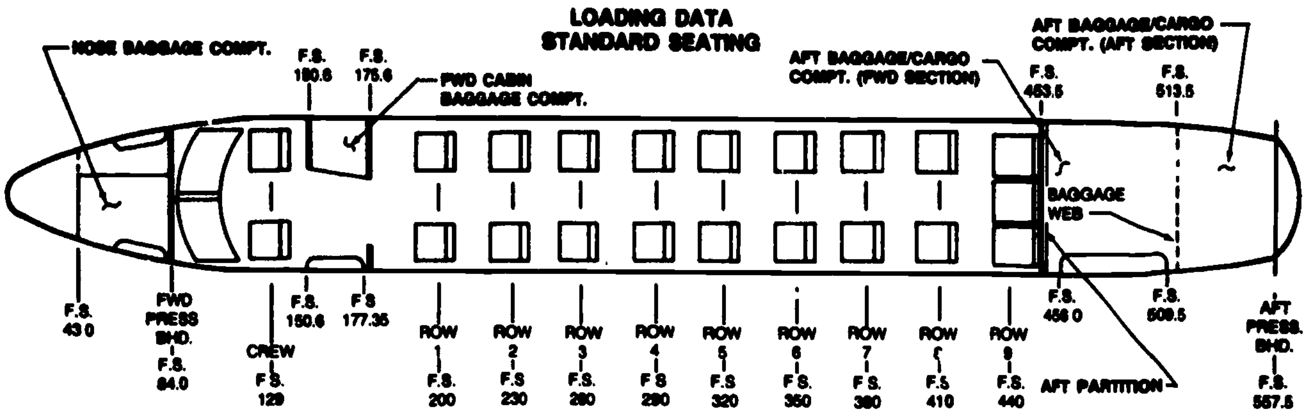
FIGURE 37.—DC-9 Weight Shift.

LOADING CONDITIONS	BE-1	BE-2	BE-3	BE-4	BE-5
CREW	360	340	350	340	360
PASSENGERS					
ROW 1	350	300	120	-	-
ROW 2	260	250	340	370	-
ROW 3	200	190	350	400	170
ROW 4	340	170	300	290	200
ROW 5	120	190	170	200	290
ROW 6	400	340	-	170	400
ROW 7	120	190	-	210	370
ROW 8	250	-	-	190	340
ROW 9	-	-	-	420	430
BAGGAGE					
NOSE	60	-	80	-	100
FWD CABIN	250	100	120	-	200
AFT (FWD SEC)	500	200	250	800	-
AFT (AFT SEC)	-	600	500	-	-
FUEL					
GAL	370	390	400	290	340
TYPE	JET B	JET A	JET B	JET A	JET B
TEMP	+5° C	+15° C	-15° C	+10° C	+25° C

FIGURE 38.—Beech 1900 Loading Passenger Configuration.

LOADING CONDITIONS	BE-6	BE-7	BE-8	BE-9	BE-10
CREW	360	340	350	370	420
CARGO SECTION A	500	-	600	600	350
B	500	400	200	600	450
C	550	450	400	600	450
D	550	600	400	600	550
E	600	600	200	550	550
F	600	600	200	350	600
G	450	500	200	250	600
H	-	-	200	250	-
J	350	-	300	150	-
K	-	-	260	200	-
L	-	-	100	100	-
FUEL GAL	340	370	390	290	400
TYPE	JET B	JET B	JET A	JET A	JET B
TEMP	+25° C	+5° C	+15° C	+10° C	-15° C
BASIC OPERATING WEIGHT - 9,005 POUNDS, 25,934 MOM/100					

FIGURE 39.—Beech 1900 Loading Cargo Configuration.



BAGGAGE/CARGO LOCATION	CAPACITY - POUNDS	CENTROID (FUSELAGE STATION)
NOSE BAGGAGE COMPARTMENT	150	65.5
FORWARD CABIN BAGGAGE COMPARTMENT (INCLUDES UP TO 100 POUNDS WHICH MAY BE SUSPENDED FROM CLOTHES ROD)	250	163.6
AFT BAGGAGE/CARGO COMPARTMENT - FWD SECTION	880	483.5
- AFT SECTION	630	533.0

NOTE:

1. For compartment loadings which result in only partial utilization of total compartment volume, load items must be distributed or secured in a manner to preclude shifting under normally anticipated operating conditions.

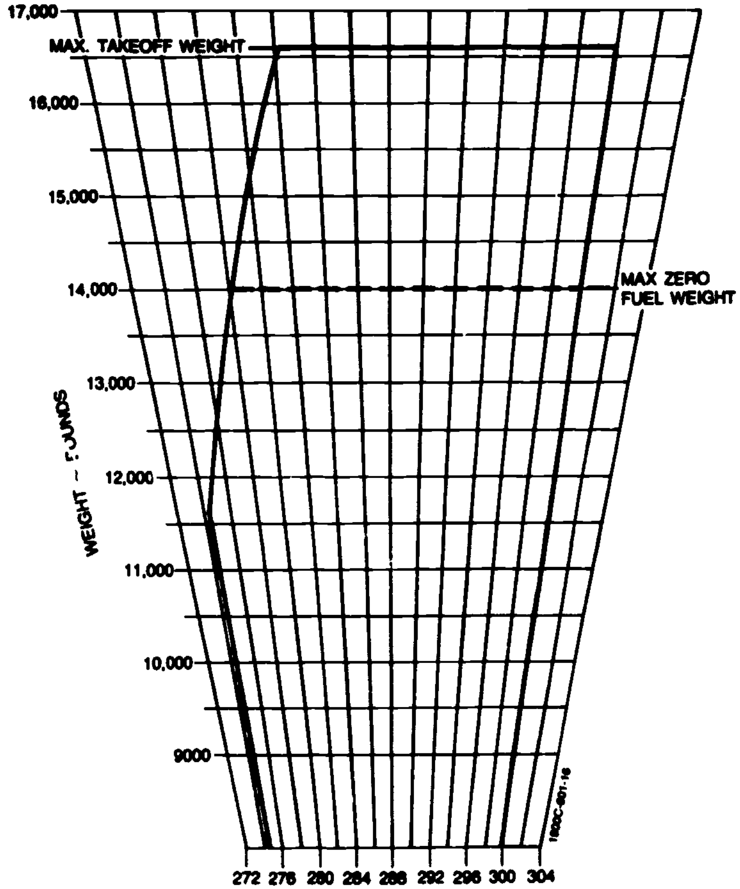
BASIC EMPTY WEIGHT 9,226 LB.

BASIC MOMENT/100 25823

FIGURE 40.—Airplane - Loading Data.

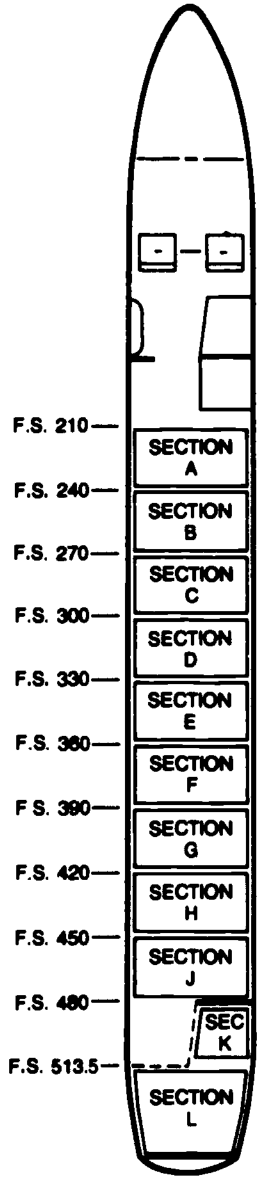
228

WEIGHT AND BALANCE DIAGRAM



MAX TAKEOFF WEIGHT -- 16,000 lb
MAX LANDING WEIGHT -- 16,000 lb
MAX ZERO FUEL WEIGHT -- 16,000 lb

LOADING DATA
CARGO CONFIGURATION



SECTION	MAXIMUM STRUCTURAL CAPACITY	CENTROID ARM
A	600	F.S. 225
B	600	F.S. 255
C	600	F.S. 285
D	600	F.S. 315
E	600	F.S. 345
F	600	F.S. 375
G	600	F.S. 405
H	600	F.S. 435
J	600	F.S. 465
K	250	F.S. 499.5
L	565	F.S. 533

NOTES:

1. ALL CARGO IN SECTIONS A THROUGH J MUST BE SUPPORTED ON THE SEAT TRACKS AND SECURED TO THE SEAT TRACKS AND SIDE SEAT RAILS BY AN FAA APPROVED SYSTEM.
2. CONCENTRATED CARGO LOADS IN SECTIONS A THROUGH L MUST NOT EXCEED 100 LBS. PER SQUARE FOOT.
3. CARGO IN SECTIONS K AND L MUST BE RETAINED BY BAGGAGE WEBS AND PARTITIONS PROVIDED AS PART OF STANDARD AIRPLANE.
4. ANY EXCEPTIONS TO THE ABOVE PROCEDURES WILL REQUIRE APPROVAL BY A LOCAL FAA OFFICE.

1900-003-00

FIGURE 41.—CG Envelope and Cargo Loading Data.

USEFUL LOAD WEIGHTS AND MOMENTS

BAGGAGE

WEIGHT	NOSE BAGGAGE COMPARTMENT F.S. 65.5	FORWARD CABIN BAGGAGE COMPARTMENT F.S. 163.6	AFT BAGGAGE/ CARGO COMPARTMENT (FORWARD SECTION) F.S. 483.5	AFT BAGGAGE/ CARGO COMPARTMENT (AFT SECTION) F.S. 533.0
	MOMENT/100			
10	7	16	48	53
20	13	33	97	107
30	20	49	145	160
40	26	65	193	213
50	33	82	242	266
60	39	98	290	320
70	46	115	338	373
80	52	131	387	426
90	59	147	435	480
100	66	164	484	533
150	98	245	725	800
200		327	967	1066
250		409	1209	1332
300			1450	1599
350			1692	1866
400			1934	2132
450			2176	2398
500			2418	2665
550			2659	2932
600			2901	3198
630			3046	3358
650			3143	
700			3384	
750			3626	
800			3868	
850			4110	
880			4255	

FIGURE 42.—Airplane - Weights and Moments - Baggage.

USEFUL LOAD WEIGHTS AND MOMENTS

OCCUPANTS

WEIGHT	CREW	CABIN SEATS								
	F.S. 129	F.S. 200	F.S. 230	F.S. 260	F.S. 290	F.S. 320	F.S. 350	F.S. 380	F.S. 410	F.S. 440
	MOMENT/100									
80	103	160	184	208	232	256	280	304	328	352
90	116	180	207	234	261	288	315	342	369	396
100	129	200	230	260	290	320	350	380	410	440
110	142	220	253	286	319	352	385	418	451	484
120	155	240	276	312	348	384	420	456	492	528
130	168	260	299	338	377	416	455	494	533	572
140	181	280	322	364	406	448	490	532	574	616
150	194	300	345	390	435	480	525	570	615	660
160	206	320	368	416	464	512	560	608	656	704
170	219	340	391	442	493	544	595	646	697	748
180	232	360	414	468	522	576	630	684	738	792
190	[illegible]5	380	437	494	551	608	665	722	779	836
200	258	400	460	520	580	640	700	760	820	880
210	271	420	483	546	609	672	735	798	861	924
220	284	440	506	572	638	704	770	836	902	968
230	297	460	529	598	667	736	805	874	943	1012
240	310	480	552	624	696	768	840	912	984	1056
250	323	500	575	650	725	800	875	950	1025	1100

Note: Weights reflected in above table represent weight per seat.

FIGURE 43.—Airplane - Weights and Moments - Occupants.

DENSITY VARIATION OF AVIATION FUEL

BASED ON AVERAGE SPECIFIC GRAVITY

FUEL	AVERAGE SPECIFIC GRAVITY AT 15°C (59°F)
AVIATION KEROSENE JET A AND JET A1	.812
JET B (JP-4)	.785
AV GAS GRADE 100/130	.703

NOTE: The Fuel Quantity Indicator is calibrated for correct indication when using Aviation Kerosene Jet A and Jet A1. When using other fuels, multiply the indicated fuel quantity in pounds by .99 for Jet B (JP-4) or by .98 for Aviation Gasoline (100/130) to obtain actual fuel quantity in pounds.

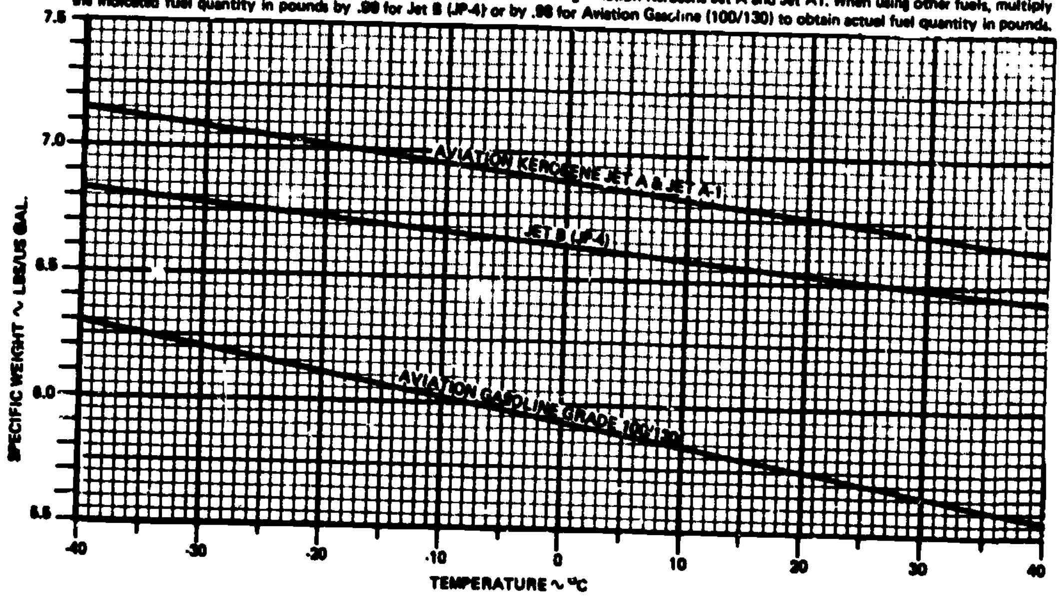


FIGURE 44.—Density Variation of Aviation Fuel.

USEFUL LOAD WEIGHTS AND MOMENTS

USABLE FUEL

GALLONS	6.5 LB/GAL WEIGHT	6.5 LB/GAL MOMENT/100	6.6 LB/GAL WEIGHT	6.6 LB/GAL MOMENT/100	6.7 LB/GAL WEIGHT	6.7 LB/GAL MOMENT/100	6.8 LB/GAL WEIGHT	6.8 LB/GAL MOMENT/100
10	65	197	66	200	67	203	68	206
20	130	394	132	401	134	407	136	413
30	195	592	198	601	201	610	204	619
40	260	789	264	802	268	814	272	826
50	325	987	330	1002	335	1018	340	1033
60	390	1185	396	1203	402	1222	408	1240
70	455	1383	462	1404	469	1426	476	1447
80	520	1581	528	1605	536	1630	544	1654
90	585	1779	594	1806	603	1834	612	1861
100	650	1977	660	2007	670	2038	680	2068
110	715	[illegible]	726	2208	737	2242	748	2275
120	780	[illegible]	792	2409	804	2445	816	2482
130	845	2569	858	2608	871	2648	884	2687
140	910	2765	924	2808	938	2850	952	2893
150	975	2962	990	3007	1005	3053	1020	3099
160	1040	3157	1056	3205	1072	3254	1088	3303
170	1105	3351	1122	3403	1139	3454	1156	3506
180	1170	3545	1188	3600	1206	3654	1224	3709
190	1235	3739	1254	3797	1273	3854	1292	3912
200	1300	3932	1320	3992	1340	4053	1360	4113
210	1365	4124	1386	4187	1407	4250	1428	4314
220	1430	4315	1452	4382	1474	4448	1496	4514
230	1495	4507	1518	4576	1541	4646	1564	4715
240	1560	4698	1584	4770	1608	4843	1632	4915
250	1625	4889	1650	4964	1675	5040	1700	5115
260	1690	5080	1716	5158	1742	5236	1768	5315
270	1755	5271	1782	5352	1809	5433	1836	5514
280	1820	5462	1848	5546	1876	5630	1904	5714
290	1885	5651	1914	5738	1943	5825	1972	5912
300	1950	5842	1980	5932	2010	6022	2040	6112
310	2015	6032	2046	6125	2077	6218	2108	6311
320	2080	6225	2112	6321	2144	6416	2176	6512
330	2145	6417	2178	6516	2211	6615	2244	6713
340	2210	6610	2244	6711	2278	6813	2312	6915
350	2275	6802	2310	6907	2345	7011	2380	7116
360	2340	6995	2376	7103	2412	7210	2448	7318
370	2405	7188	2442	7299	2479	7409	2516	7520
380	2470	7381	2508	7495	2546	7609	2584	7722
390	2535	7575	2574	7691	2613	7808	2652	7924
400	2600	7768	2640	7888	2680	8007	2720	8127
410	2665	7962	2706	8085	2747	8207	2788	8330
420	2730	8156	2772	8282	2814	8407	2856	8532
425	2763	8259	2805	8386	2848	8513	2890	8640

FIGURE 45.—Airplane - Weights and Moments - Usable Fuel.

OPERATING CONDITIONS	BE-11	BE-12	BE-13	BE-14	BE-15
BASIC EMPTY WT					
WEIGHT	9,225	9,100	9,000	8,910	[illegible] 150
MOM/100	25,820	24,990	24,710	24,570	[illegible],240
CREW WEIGHT	340	380	360	400	370
PASS AND BAG					
WEIGHT	4,200	4,530	4,630	4,690	4,500
MOM/100	15,025	16,480	16,743	13,724	13,561
FUEL (6.8 LB/GAL)					
RAMP LOAD - GAL	360	320	340	310	410
USED START AND TAXI	20	20	10	20	30
REMAIN AT LDG	100	160	140	100	120

FIGURE 46.—Beech 1900 Loading Limitations.

OPERATING CONDITIONS	BL-1	BL-2	BL-3	BL-4	BL-5
CREW WEIGHT	340	400	360	380	370
PASSENGER WT					
ROW 1	700	620	-	180	680
ROW 2	830	700	750	800	950
ROW 3	800	680	810	720	850
ROW 4	-	400	650	200	500
BAGGAGE					
CENTER	500	550	300	200	450
LEFT AND RIGHT	200	250	-	100	-
FUEL					
GALLONS	300	250	360	400	260
TYPE	JET A	JET B	JET A	JET B	JET A

FIGURE 47.—Bell 214 ST Loading.

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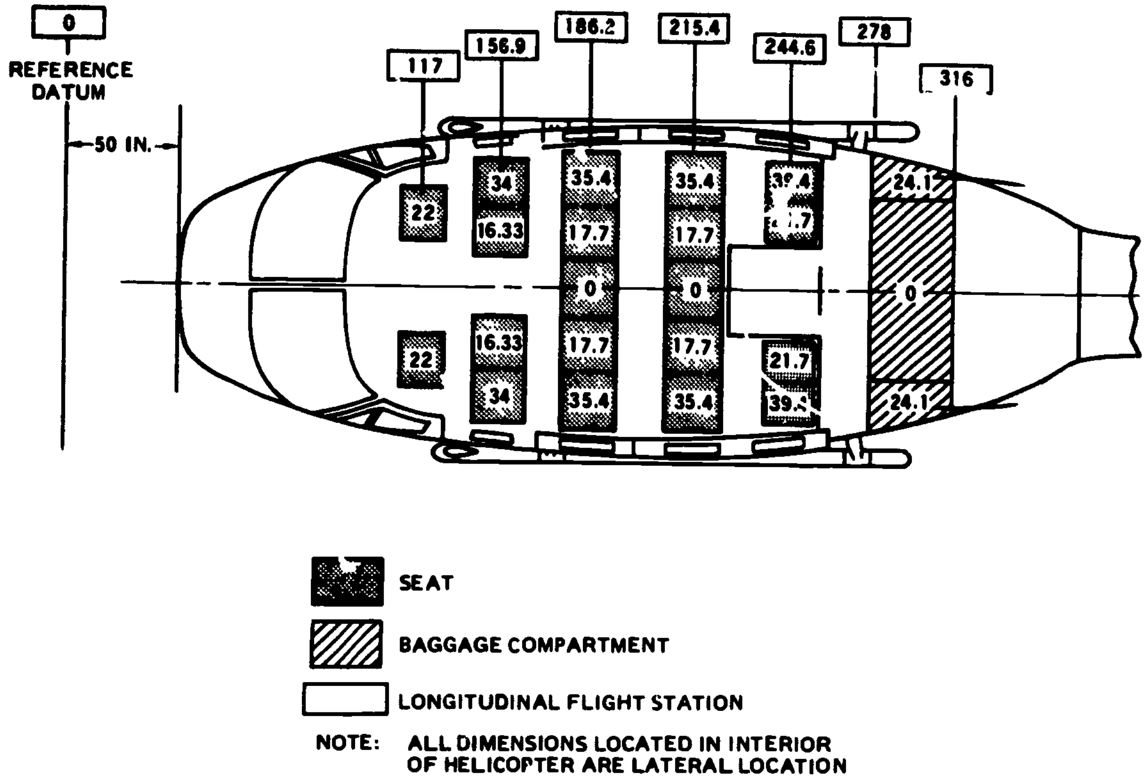
LOADING CONDITIONS	BL-6	BL-7	BL-8	BL-9	BL-10
BASIC WEIGHT	10,225	9,450	9,000	9,510	9,375
BASIC MOM/100	25562.5	23236.0	22020.5	23499.9	23296.8
CREW WEIGHT	340	380	410	360	400
PASSENGER WEIGHT	3,280	2,880	3,150	2,040	2,400
PASSENGER MOM/100	6722.5	5418.6	6425.8	4732.2	4560.7
BAGGAGE (CENTER)	700	600	300	550	650
FUEL LOAD (6.8 LB/GAL)	435	290	220	435	380
TRIP FUEL BURN (GAL)	355	190	190	325	330
LATERAL CG IS ON LONGITUDINAL AXIS					

FIGURE 48.—Bell 214 ST Weight Shift and Limits.



Helicopter station diagram

	WEIGHT	CG	MOMENT
WEIGHT EMPTY	9387.5	247.89	2327105

FIGURE 49.—Helicopter - Loading Data.

Crew and Passenger Table of Moments

WEIGHT LBS	CREW SEATS F.S. 117	AIRLINE PASSENGER SEATS: FIRST ROW (FOUR PASSENGER) SEATS F.S. 156.9	SECOND ROW (FIVE PASSENGER) SEATS F.S. 186.2	THIRD ROW (FIVE PASSENGER) SEATS F.S. 215.4	FOURTH ROW (FOUR PASSENGER) SEATS F.S. 244.6
	CREW AND PASSENGER TABLE OF MOMENTS (IN-LB)				
100	11700	15690	18620	21540	24460
110	12870	17259	20482	23694	26906
120	14040	18828	22344	25848	29352
130	15210	20397	24206	28002	31798
140	16380	21966	26068	30156	34244
150	17550	23535	27930	32310	36690
160	18720	25104	29792	34464	39136
170	19890	26673	31654	36618	41582
180	21060	28242	33516	38772	44028
190	22230	29811	35378	40926	46474
200	23400	31380	37240	43080	48920
210	24570	32949	39102	45234	51366
220	25740	34518	40964	47388	53812

Baggage Compartment Loading Table

BAGGAGE COMPARTMENT LOADING TABLE (IN. LB. ÷ 100)

BAGGAGE WEIGHT LBS	LEFT AND RIGHT BAGGAGE COMPARTMENT STA. 278.0 TO 316.0 F.S. 295.2	CENTER BAGGAGE COMPARTMENT STA. 278.0 TO 316.0 F.S. 297.0
50	147.6	148.5
100	295.2	297.0
150	442.8	445.5
200	590.4	594.0
250	738.0	742.5
300	885.6	891.0
350	1033.2	1039.5
400	1180.8	1188.0
450	1328.4	1336.5
500	1476.0	1485.0
530	1564.6	1574.1
550		1633.5
600		1782.0
650		1930.5
700		2079.0
740		2197.8

FIGURE 50.—Helicopter - Weights and Moments - Crew, Passengers, and Baggage.

Usable Fuel Loading Table

USABLE FUEL LOADING TABLE (ENGLISH)

JET A, JET A-1, JP-5 (6.8 LBS/GAL)

U.S. GAL	WEIGHT LBS	C.G.	MOMENT IN. LB. ÷ 100	U.S. GAL	WEIGHT LBS	C.G.	MOMENT IN. LB. ÷ 100
10	68	244.3	166	220	1496	246.9	3694
20	136	244.3	332	230	1564	244.3	3820
30	204	244.4	499	240	1632	241.8	3947
**37.1	252	244.4	616	250	1700	239.6	4073
40	272	242.8	660	260	1768	237.6	4200
50	340	237.8	808	270	1836	235.6	4326
60	408	234.6	957	280	1904	233.9	4453
70	476	232.1	1105	290	1972	232.2	4579
80	544	230.9	1256	**291.4	1982	232.0	4597
90	612	229.2	1403	300	2040	233.1	4754
*99.7	678	228.2	1546	310	2108	234.0	4934
*109.2	743	228.2	1695	320	2176	235.1	5115
110	748	228.5	1709	330	2244	236.0	5296
120	816	231.7	1890	340	2312	236.9	5477
130	884	234.4	2072	350	2380	237.7	5658
140	952	236.7	2253	360	2448	238.5	5839
150	1020	238.6	2434	370	2516	239.3	6021
160	1088	240.4	2615	380	2584	240.0	6202
170	1156	242.0	2798	390	2652	240.7	6383
180	1224	243.3	2978	400	2720	241.3	6564
190	1292	244.5	3159	410	2788	241.9	6745
200	1360	245.6	3340	420	2856	242.5	6927
210	1428	246.6	3521	430	2924	243.1	7108
*218.4	1484	247.3	3673	435.0	2958	243.4	7199

JET B, JP-4 (6.5 LBS/GAL)

U.S. GAL	WEIGHT LBS	C.G.	MOMENT IN. LB. ÷ 100	U.S. GAL	WEIGHT LBS	C.G.	MOMENT IN. LB. ÷ 100
10	65	244.3	159	220	1430	246.9	3531
20	130	244.3	318	230	1495	244.3	3652
30	195	244.5	477	240	1560	241.8	3772
**37.1	241	244.4	589	250	1625	239.6	3894
40	260	242.8	631	260	1690	237.6	4015
50	325	237.8	773	270	1755	235.6	4135
60	390	234.5	915	280	1820	233.9	4257
70	455	232.1	1056	290	1885	232.2	4377
80	520	230.9	1201	**291.4	1894	232.0	4394
90	585	229.2	1341	300	1950	233.1	4545
*99.7	648	228.2	1479	310	2015	234.0	4715
*109.2	710	228.2	1620	320	2080	235.1	4890
110	715	228.5	1634	330	2145	236.0	5062
120	780	231.7	1807	340	2210	236.9	5235
130	845	234.4	1981	350	2275	237.7	5408
140	910	236.7	2154	360	2340	238.5	5581
150	975	238.6	2326	370	2405	239.3	5755
160	1040	240.4	2500	380	2470	240.5	5928
170	1105	242.0	2674	390	2535	240.7	6102
180	1170	243.3	2847	400	2600	241.3	6274
190	1235	244.5	3020	410	2665	241.9	6447
200	1300	245.6	3193	420	2730	242.5	6620
210	1365	246.6	3366	430	2795	243.1	6795
*218.4	1420	247.3	3612	435	2827.5	243.4	6882

* Extreme limits of fuel C.G.

** Point of C.G. direction change.

Weights given are nominal weights at 15°C.

FIGURE 51.—Helicopter - Weights and Moments - Usable Fuel.

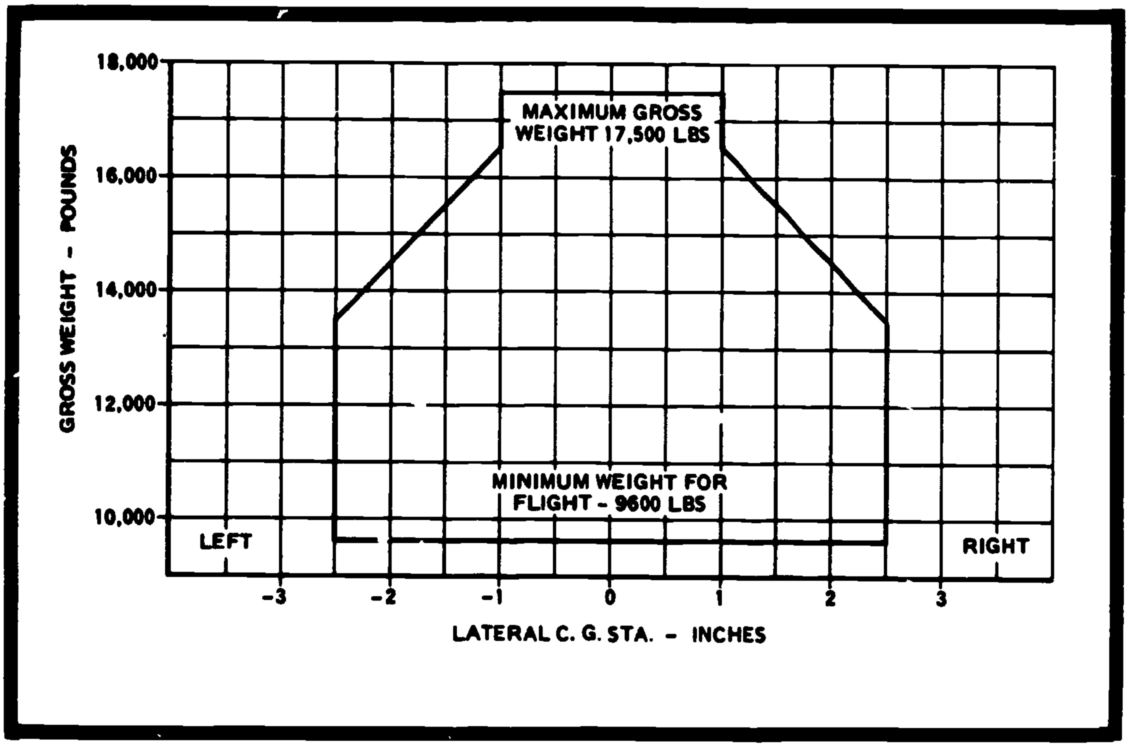


FIGURE 52.—Helicopter - Lateral CG Envelope.

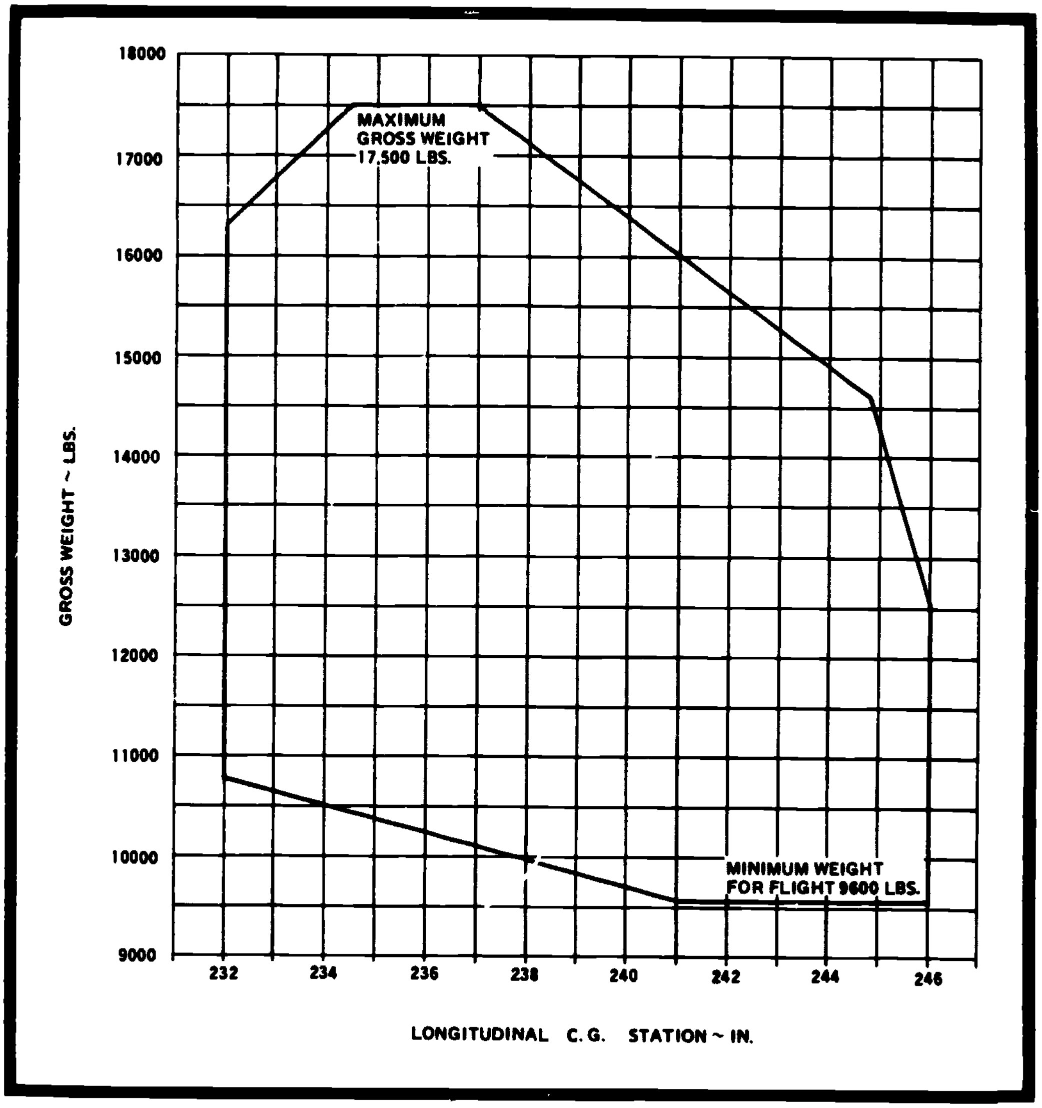


FIGURE 53.—Helicopter - Longitudinal CG Envelope.

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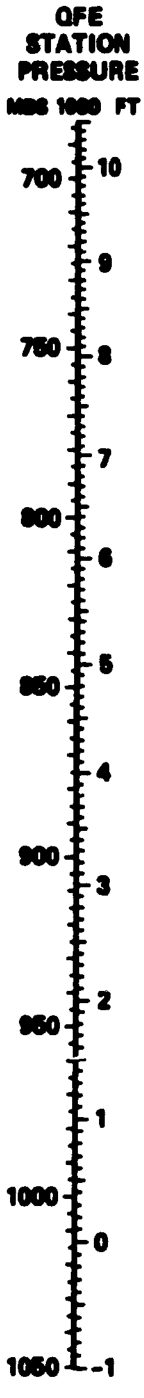
ALTIMETER SETTING TO STATION PRESSURE



QNH TO PRESSURE ALTITUDE

QNH IN. HG.	CORRECTION TO ELEVATION FOR PRESS. ALT FT	QNH MILLIBARS
28.81 to 28.91	1000	976 to 979
28.91 to 29.02	900	979 to 983
29.02 to 29.12	800	983 to 986
29.12 to 29.23	700	986 to 990
29.23 to 29.34	600	990 to 994
29.34 to 29.44	500	994 to 99/
29.44 to 29.55	400	997 to 1001
29.55 to 29.66	300	1001 to 1004
29.66 to 29.76	200	1004 to 1008
29.76 to 29.87	100	1008 to 1012
29.87 to 29.97	0	1012 to 1015
29.97 to 30.08	-100	1015 to 1019
30.08 to 30.19	-200	1019 to 1022
30.19 to 30.30	-300	1022 to 1026
30.30 to 30.41	-400	1026 to 1030
30.41 to 30.52	-500	1030 to 1034
30.52 to 30.63	-600	1034 to 1037
30.63 to 30.74	-700	1037 to 1041
30.74 to 30.85	-800	1041 to 1045
30.85 to 30.96	-900	1045 to 1048
30.96 to 31.07	-1000	1048 to 1052

EXAMPLE: ELEVATION = 2500FT
QNH = 29.48 IN.HG
CORRECTION = 400 FT.
PRESS ALT = 2900 FT

FIGURE 54.—Altimeter Setting to Pressure Altitude.

OPERATING CONDITIONS	A-1	A-2	A-3	A-4	A-5
FIELD ELEVATION	2,500	600	4,200	5,100	2,100
ALTIMETER SETTING	29.40"	30.50"	1020 mb	29.35"	1035 mb
AMBIENT TEMPERATURE	+10° F	+80° F	0° C	+30° F	+20° C
WEIGHT (X1000)	75	85	90	80	65
FLAP POSITION	20°	20°	20°	20°	20°
RUNWAY SLOPE %	+1%	-1.5%	0	+1.5%	-2%
WIND COMPONENT	10 HW	10 TW	15 HW	5 TW	20 HW
ICE PROTECTION	BOTH	NONE	BOTH	ENGINE	NONE
CG STATION	590.2	-	580.3	-	594.4
CG INDEX ARM	-	-3.1	-	+5.9	-

INDEX ARM REF - STA 580.0, LEMAC - STA 549.13, AND -30.87 INDEX, MAC 141.5
CG % MAC = STAB TRIM SETTING

FIGURE 55.—DC-9 Takeoff.

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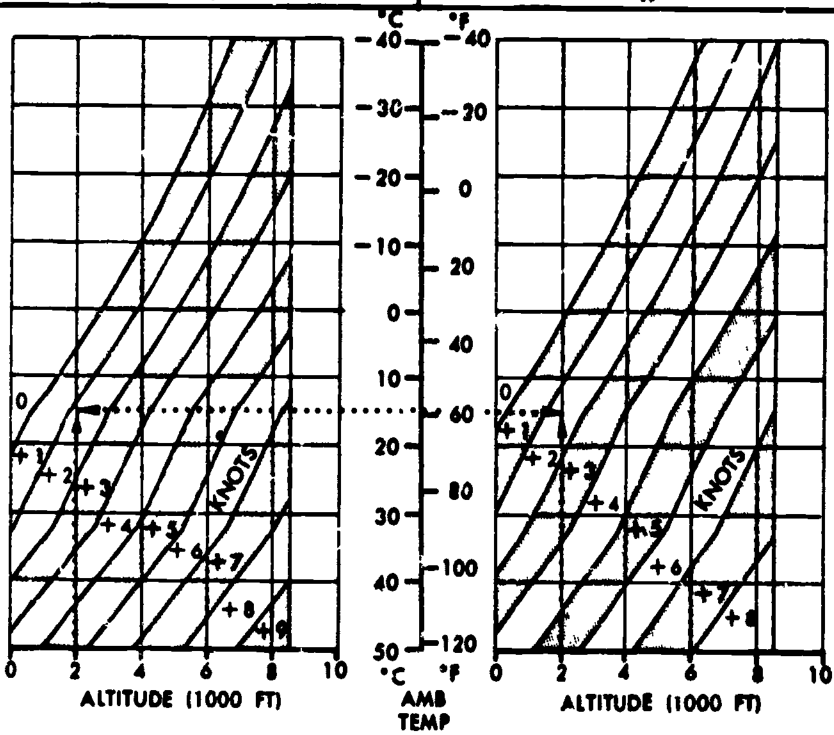
MODEL DC-9
TAKEOFF SPEEDS
JT8D-1 ENGINES

TAKEOFF SPEED — 20° FLAPS EITHER NO ICE PROTECTION OR ENGINE ICE PROTECTION ONLY								
TAKEOFF WEIGHT (1000 LB)	60	65	70	75	80	85	90	95
V_1 (KNOTS, IAS)	104.0	110.0	115.0	120.5	125.0	129.5	133.5	136.0
V_R (KNOTS, IAS)	106.5	112.5	118.0	123.5	129.0	134.0	139.0	143.5
V_2 (KNOTS, IAS)	117.0	121.5	126.5	130.5	135.0	139.0	143.0	147.0

CORRECTION TO SPEEDS



		V_1	V_R	V_2
AMBIENT TEMPERATURE AND AIRPORT PRESSURE ALTITUDE		(chart)	(chart)	0
SLOPE PER 1%	UPHILL	+ 1.5* KNOTS	+0.9 KNOTS	0
	DOWNHILL	-1.5 KNOTS	−0.9 KNOTS	
WIND PER 10 KN	HEADWIND	+0.30* KNOTS	0 KNOTS	0
	TAILWIND	−0.8 KNOTS		
ENGINE AND AIRPLANE ICE PROTECTION		+0.8 KNOTS	+0.8 KNOTS	0

* IF V_1 EXCEEDS V_R, SET V_1 EQUAL TO V_R

FIGURE 56.—Takeoff Speeds.

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OPERATING CONDITIONS	G-1	G-2	G-3	G-4	G-5
FIELD ELEVATION FT	1,050	2,000	4,350	3,050	2,150
ALTIMETER SETTING	29.36"	1016 mb	30.10"	1010 mb	29.54"
TEMPERATURE	+23° F	+10° C	+68° F	-5° C	+5° F
AIR COND ENGS 1 AND 3	OFF	ON	ON	ON	ON
ANTI-ICE ENG 2	ON	OFF	OFF	ON	ON
GROSS WEIGHT (X1000)	140	190	180	160	120
6TH STAGE BLEED	OFF	ON	ON	OFF	OFF
FLAP POSITION	15°	5°	25°	15°	5°
CG STATION	911.2	882.2	914.8	932.9	925.6
LEMAC - STA 860.5, MAC 180.9"					

FIGURE 57.—B-727 Takeoff.

TAKEOFF EPR, SPEEDS AND STAB TRIM SETTING

MAX TAKEOFF EPR

0 - 6[illegible]

, 3 AIRBLEED ON
NO AIRBLEED

PRESS ALT FT	ENG	OAT °F / °C: -67 TO -9 / -55 TO -23	-4 / -20	5 / -15	14 / -10	23 / -5	32 / 0	41 / 5	50 / 10	59 / 15	68 / 20	77 / 25	30	95 / 35	104 / 40	113 / 45	120 / 49
-1000	1 & 3	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.04	2.03	1.99	1.94	1.91
	2	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.05	2.00	1.96	1.92
S.L.	1 & 3	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.08	2.03	1.99	1.94	1.91
	2	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.11	2.10	2.05	2.00	1.96	1.92
1000	1 & 3	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.13	2.12	2.12	2.11	2.08	2.03	1.99	1.94	1.91
	2	2.16	2.16	2.16	2.16	2.16	2.16	2.16	2.15	2.13	2.13	2.12	2.10	2.05	2.00	1.96	1.92
2000	1 & 3	2.21	2.21	2.21	2.21	2.21	2.20	2.17	2.14	2.14	2.14	2.11	2.08	2.03	1.99	1.94	1.91
	2	2.22	2.22	2.22	2.22	2.22	2.21	2.18	2.16	2.16	2.15	2.12	2.10	2.05	2.00	1.96	1.92
3000	1 & 3	2.26	2.26	2.26	2.25	2.23	2.20	2.17	2.14	2.14	2.14	2.11	2.08	2.03	1.99	1.94	1.91
	2	2.28	2.28	2.28	2.27	2.24	2.21	2.18	2.16	2.16	2.15	2.12	2.10	2.05	2.00	1.96	1.92
3856 & ABOVE	1 & 3	2.31	2.29	2.27	2.25	2.23	2.20	2.17	2.14	2.14	2.14	2.11	2.08	2.03	1.99	1.94	1.91
	2	2.32	2.31	2.29	2.27	2.24	2.21	2.18	2.16	2.16	2.15	2.12	2.10	2.05	2.00	1.96	1.92

EPR BLEED CORRECTIONS	ENG 1 & 3	ENG 2
AIR CONDITIONING	OFF+.04	-
ENGINE ANTI-ICE ON	-	-.03

REDUCE ENG 2 EPR BY .06 WITH 6TH STAGE BLEED ON (IF INSTALLED) FOR 10°C (50°F) OAT & WARMER

V_1, V_R, V_2

ANTI-SKID OPERATIVE

PRESSURE ALT - 1000 FT		OAT			
9 TO 11	°F / °C	(ABOVE CERTIFIED ALTITUDE)		-65 TO 25 / -54 TO -4	26 TO 87 / -3 TO 31
7 TO 9	°F / °C		-65 TO 9 / -54 TO -13	10 TO 75 / -12 TO 24	76 TO 104 / 25 TO 40
5 TO 7	°F / °C	-65 TO -10 / -54 TO -23	-8 TO 42 / -22 TO 5	43 TO 97 / 6 TO 36	98 TO 111 / 37 TO 44
3 TO 5	°F / °C	-65 TO 32 / -54 TO 0	33 TO 90 / 1 TO 32	91 TO 113 / 33 TO 45	114 TO 130 / 46 TO 49
1 TO 3	°F / °C	-65 TO 83 / -54 TO 28	84 TO 106 / 29 TO 41	107 TO 120 / 42 TO 49	
-1 TO 1	°F / °C	-65 TO 99 / -54 TO 37	100 TO 120 / 38 TO 49		

FLAPS	GROSS WEIGHT 1000 LB	$V_1=V_R$	V_2	$V_1=V_R$	V_2	$V_1=V_R$	V_2	$V_1=V_R$	V_2
5	210	165	175	166	175				
	200	160	171	162	171				
	190	155	167	157	167	158	167		
	180	150	163	152	163	154	163		
	170	144	159	147	159	[illegible]	159	150	158
	160	140	154	141	153	143	153	145	153
	150	135	149	136	149	138	149	140	148
	140	129	145	130	145	132	144	134	144
	130	124	140	125	139	126	138	128	138
	120	119	135	120	134	120	134	121	133
15	210	156	166	157	166				
	200	151	162	153	162				
	190	146	158	148	158	149	158		
	180	141	154	143	154	145	154		
	170	136	150	138	150	140	150	141	149
	160	132	146	133	145	135	145	137	145
	150	127	141	128	141	130	141	132	140
	140	122	137	123	137	124	136	126	136
	130	117	133	118	132	118	131	120	131
	120	112	128	113	127	113	127	115	126
20	210	151	161	152	161				
	200	146	157	148	157				
	190	141	153	143	153	144	153		
	180	136	150	138	150	140	149		
	170	132	146	133	146	135	145	136	145
	160	128	142	129	141	[illegible]	141	133	141
	150	123	137	124	137	[illegible]	136	128	136
	140	118	133	119	133	[illegible]	132	122	132
	130	113	129	114	128	[illegible]	127	116	127
	120	109	124	109	123	109	123	111	122
25	210	146	157	147	157				
	200	141	153	143	153				
	190	137	149	138	149	139	149		
	180	132	145	134	145	136	145		
	170	127	141	129	141	131	141	132	140
	160	123	137	124	137	126	137	128	136
	150	119	133	120	133	122	133	124	132
	140	114	129	115	129	116	128	118	128
	130	109	125	110	124	110	124	112	123
	120	105	120	106	120	106	119	108	118

STAB TRIM SETTING

CG%	FLAPS 5	FLAPS 15/20	FLAPS 25
	UNITS AIRPLANE NOSE UP		
10	6 3/4	7 1/2	8 1/4
12	6 1/2	7 1/4	8
14	6 1/4	7	7 3/4
16	6	6 3/4	7 1/2
18	5 3/4	6 1/2	7
20	5 1/2	6	6 1/2
22	5	5 3/4	6 1/4
24	4 3/4	5 1/4	5 3/4
26	4 1/2	4 3/4	5 1/4
28	4	4 1/2	4 3/4
30	3 3/4	4	4 1/4
32	3 1/2	3 3/4	4
34	3 1/4	3 1/4	3 1/2
36	2 3/4	3	3
38	2 1/2	2 1/2	2 1/2
40	2 1/2	2 1/2	2 1/2
42	2 1/2	2 1/2	2 1/2

FLAP RETRACTION/ MANEUVERING SPEEDS

GROSS WEIGHT LB	FLAP POSITION 15	5	2	0
154500 & BELOW	150	160	190	200
154501 TO 176000	160	170	200	210
176001 TO 191000	170	180	210	220
ABOVE 191000	180	190	225	235

FOR MANEUVERS IMMEDIATELY AFTER TAKEOFF EXCEEDING 15° BANK MAINTAIN AT LEAST V_2+10 AT TAKEOFF FLAPS

FIGURE 58.—Takeoff Performance.

OPERATING CONDITIONS	R-1	R-2	R-3	R-4	R-5
FIELD ELEVATION	100	4,000	950	2,000	50
ALTIMETER SETTING	29.50"	1032 mb	29.40"	1017 mb	30.15"
TEMPERATURE (OAT)	+50° F	-15° C	+59° F	0° C	+95° F
WEIGHT (X1000)	90	110	100	85	95
FLAP POSITION	15°	5°	5°	1°	1°
WIND COMPONENT (KTS)	5 HW	5 TW	20 HW	10 TW	7 HW
RUNWAY SLOPE %	1% UP	1% DN	1% UP	2% DN	1.5% UP
AIR CONDITIONING	ON	ON	OFF	ON	OFF
ENGINE ANTI-ICE	OFF	ON	OFF	ON	OFF
CG STATION	635.7	643.8	665.2	657.2	638.4
LEMAC STA 625.0, MAC 134.0					

FIGURE 59.—B-737 Takeoff.

OPERATING CONDITIONS	V-1	V-2	V-3	V-4	V-5
BRK REL WEIGHT (X1000)	110	95	85	105	75
CRUISE PRESS ALT	33,000	27,000	35,000	22,000	31,000
AIRPORT ELEVATION	2,000	3,000	2,000	4,000	2,000
ISA TEMPERATURE	+10°	ISA	ISA	+10°	+10°
AVG WIND COMP (KTS)	20 HW	20 TW	30 HW	10 TW	40 HW

FIGURE 60.—B-737 En Route Climb.

TAKEOFF EPR

0 TO 60 KTS

A/C ON

EPR BLEED CORRECTIONS	Δ EPR
AIR CONDITIONING OFF	+.03
ENGINE ANTI-ICE	ZERO

OAT °F	-65	-49	-40	-31	-22	-13	- 4	5	14	23	32	41	50	59	68	77	86	95	104	120
OAT °C	-54	-45	-40	-35	-30	-25	-20	-15	-10	- 5	0	5	10	15	20	25	30	35	40	49
TEMP LIMIT EPR	2.31	2.31	2.31	2.29	2.27	2.24	2.22	2.19	2.17	2.14	2.11	2.07	2.04	2.01	2.01	2.01	2.00	1.95	1.91	1.82

PRESS LIMIT EPR

EPR	2.31	2.22	2.16	2.11	2.06	2.01	1.96
ALT	5660 AND ABOVE	4000	3000	2000	1000	S.L.	-1000

1. FIND TEMP LIMIT EPR
2. FIND PRESS LIMIT EPR
3. USE THE SMALLER OF THE TWO LIMITS

V_1, V_R, V_2

ANTI-SKID ON

PRESSURE ALTITUDE 1000 FT		OAT					
9 to 10	F°			-65 to -19	-18 to 18	19 to 45	46 to 86
	C°			-54 to -28	-27 to - 8	- 7 to 7	8 to 30
7 to 9	F°		-65 to -21	-20 to 10	11 to 39	40 to 87	88 to 101
	C°		-54 to -29	-28 to -23	-22 to 4	5 to 31	32 to 38
5 to 7	F°	-65 to -15	-14 to 15	16 to 40	41 to 87	88 to 105	106 to 109
	C°	-54 to -26	-27 to - 9	- 8 to 4	5 to 31	32 to 40	41 to 43
3 to 5	F°	-65 to 20	21 to 42	43 to 88	89 to 103	104 to 116	
	C°	-54 to - 8	-7 to 6	7 to 31	32 to 39	40 to 46	
1 to 3	F°	-65 to 46	47 to 89	90 to 104	105 to 120		
	C°	-54 to 8	9 to 32	33 to 40	41 to 49		
-1 to 1	F°	-65 to 91	92 to 105	105 to 120			
	C°	-54 to 33	34 to 40	41 to 49			

FLAPS	GROSS WT -1000 LB	V_1	V_R	V_2	V_1	V_R	V_2	V_1	V_R	V_2	V_1	V_R	V_2	V_1	V_R	V_2	V_1	V_R	V_2
1	120	159	161	164	160	162	164												
	110	150	152	155	151	153	155	152	154	155									
	100	141	143	147	142	143	147	142	144	147	143	145	147	144	146	147			
	90	131	133	138	132	134	138	133	135	138	133	136	138	134	136	138	135	137	138
	80	122	124	130	122	125	130	123	126	130	124	126	130	125	127	130	125	128	130
	70	112	116	123	113	117	123	113	117	122	114	118	122	115	119	122	116	119	122
5	120	153	155	158	154	156	158												
	110	144	146	150	145	147	150												
	100	135	137	142	136	138	142	137	139	142	138	140	142						
	90	126	128	133	127	129	133	128	130	133	129	131	133	130	132	133			
	80	116	118	125	117	119	125	118	121	125	119	122	125	120	123	125	121	124	125
	70	106	109	118	107	110	118	108	111	117	109	112	117	110	113	117	112	114	117
15	100	130	130	135	131	131	135	132	132	135									
	90	120	121	128	121	122	128	123	123	128	124	124	128	125	125	128	126	126	128
	80	111	112	119	112	113	119	113	114	119	114	115	119	115	116	119	117	117	119
	70	[illegible]	[illegible]	112	101	103	112	102	105	112	103	106	112	105	107	112	106	108	112
25	100	124	126	132	126	127	132												
	90	115	117	124	116	118	124	117	119	124	118	120	124						
	80	105	108	116	107	109	116	108	110	116	109	111	116	110	112	116	111	113	116
	70	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	101	101	[illegible]	99	102	108	100	103	108	101	104	108

SHADED AREA INDICATES PERFORMANCE AFFECTED BY MINIMUM CONTROL SPEED, MINIMUM FIELD LENGTH FOR LIGHTEST WEIGHT ABOVE SHADED AREA IS REQUIRED.

V_1 ADJUSTMENTS*	
WIND	SLOPE
ADD 1 KT PER 20 KTS HEADWIND	ADD 1 KT PER 1% UP SLOPE
SUBSTRACT 1 KT PER 5 KTS TAILWIND	SUBTRACT 1 KT PER 1% DOWN SLOPE

*V_1 MUST NOT EXCEED V_R

SPEEDS NOT VALID WHEN WEIGHTS ARE PREDICATED ON USE OF CLEARWAY, STOPWAY, IMPROVED CLIMB OR ARE LIMITED BY BRAKE ENERGY

FLAP RETRACTION/ MANEUVERING SPEED

FLAP POS	KTS IAS
0	210
1	190
2	180
5	170
10	160
15	150
25	140

FOR MANEUVERS IMMEDIATELY AFTER TAKE-OFF EXCEEDING 15° BANK, MAINTAIN AT LEAST V2 + 15 AT TAKE-OFF FLAPS

STAB. TRIM SETTING - UNITS AIRPLANE NOSE UP

CG	FLAPS ALL
6	8
8	7-3/4
10	7-1/2
12	7
14	6-3/4
16	6-1/4
18	5-3/4
20	5-1/2
22	5
24	4-1/2
26	4
28	3-1/2
30	3
32	2-1/2

FIGURE 61.—Takeoff Performance.

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ENROUTE CLIMB 280/.70 ISA

PRESSURE ALTITUDE -FT	UNITS MIN/LB NM/KNOTS	BRAKE RELEASE WEIGHT - LB										
		120000	115000	110000	105000	100000	95000	90000	85000	60000	75000	65000
37000	TIME/FUEL DIST./TAS		41/ 5700 251/387	32/ 4700 192/384	27/ 4100 162/382	24/ 3700 140/380	21/ 3400 124/379	19/ 3100 111/378	17/ 2800 100/377	16/ 2500 90/376	14/ 2300 82/375	12/ 1900 67/374
36000	TIME/FUEL DIST./TAS	41/ 5900 246/386	33/ 4900 194/383	28/ 4300 164/381	25/ 3900 143/379	22/ 3500 127/378	20/ 3200 114/377	18/ 2900 103/376	16/ 2700 93/375	15/ 2500 84/374	14/ 2300 77/374	11/ 1900 63/373
35000	TIME/FUEL DIST./TAS	33/ 5100 197/382	29/ 4500 168/380	25/ 4100 147/378	23/ 3700 131/377	21/ 3400 117/376	19/ 3100 106/375	17/ 2800 96/374	16/ 2600 87/373	14/ 2400 80/373	13/ 2200 73/372	11/ 1800 60/371
34000	TIME/FUEL DIST./TAS	29/ 4700 171/379	26/ 4300 150/377	23/ 3900 134/376	21/ 3500 120/375	19/ 3200 109/374	18/ 3000 99/373	16/ 2700 90/372	15/ 2500 82/372	14/ 2300 75/371	12/ 2100 69/371	10/ 1800 57/370
33000	TIME/FUEL DIST./TAS	27/ 4400 153/376	24/ 4000 137/375	22/ 3700 123/374	20/ 3400 112/373	18/ 3100 102/372	17/ 2900 93/371	15/ 2700 85/370	14/ 2500 78/370	13/ 2300 71/369	12/ 2100 65/369	10/ 1700 54/368
32000	TIME/FUEL DIST./TAS	25/ 4200 139/374	23/ 3900 126/372	21/ 3600 114/371	19/ 3300 104/370	17/ 3000 95/370	16/ 2800 87/369	15/ 2600 80/368	14/ 2400 74/368	12/ 2200 67/367	11/ 2000 62/367	10/ 1700 51/366
31000	TIME/FUEL DIST./TAS	23/ 4000 128/371	21/ 3700 117/370	19/ 3400 107/369	18/ 3200 98/368	16/ 2900 90/367	15/ 2700 82/367	14/ 2500 76/366	13/ 2300 70/366	12/ 2100 64/365	11/ 2000 59/365	9/ 1700 49/364
30000	TIME/FUEL DIST./TAS	22/ 3900 119/368	20/ 3600 109/367	18/ 3300 100/366	17/ 3100 92/365	16/ 2800 84/365	15/ 2600 78/364	13/ 2400 72/364	12/ 2300 66/363	11/ 2100 61/363	11/ 1900 56/363	9/ 1600 47/362
29000	TIME/FUEL DIST./TAS	21/ 3700 111/365	19/ 3400 102/364	18/ 3200 93/363	16/ 3000 86/363	15/ 2700 79/362	14/ 2500 73/362	13/ 2400 68/361	12/ 2200 62/361	11/ 2000 57/361	10/ 1900 53/360	9/ 1600 44/360
28000	TIME/FUEL DIST./TAS	19/ 3600 103/362	18/ 3300 95/361	17/ 3100 88/360	15/ 2900 81/360	14/ 2700 75/359	13/ 2500 69/359	12/ 2300 64/359	11/ 2100 59/358	11/ 2000 54/358	10/ 1800 50/358	8/ 1500 42/357
27000	TIME/FUEL DIST./TAS	19/ 3400 96/358	17/ 3200 89/358	16/ 3000 82/357	15/ 2800 76/357	14/ 2600 71/356	13/ 2400 65/356	12/ 2200 60/356	11/ 2100 56/356	10/ 1900 52/355	9/ 1800 47/355	8/ 1500 40/355
26000	TIME/FUEL DIST./TAS	17/ 3300 88/354	16/ 3000 82/354	15/ 2800 76/353	14/ 2600 70/353	13/ 2500 65/352	12/ 2300 60/352	11/ 2100 56/352	10/ 2000 52/352	10/ 1800 48/351	9/ 1700 44/351	7/ 1400 37/351
25000	TIME/FUEL DIST./TAS	16/ 3100 81/350	15/ 2900 75/350	14/ 2700 70/349	13/ 2500 65/349	12/ 2400 60/349	11/ 2200 56/348	11/ 2000 52/348	10/ 1900 48/348	9/ 1800 45/348	8/ 1600 41/348	7/ 1400 35/347
24000	TIME/FUEL DIST./TAS	15/ 3000 75/346	14/ 2800 69/346	13/ 2600 65/345	12/ 2400 60/345	12/ 2300 56/345	11/ 2100 52/345	10/ 2000 48/345	9/ 1800 45/344	9/ 1700 41/344	8/ 1600 38/344	7/ 1300 32/344
23000	TIME/FUEL DIST./TAS	14/ 2800 69/342	13/ 2700 64/342	13/ 2500 60/342	13/ 2300 56/342	11/ 2200 52/342	10/ 2000 48/341	9/ 1900 45/341	9/ 1800 41/341	8/ 1600 38/341	8/ 1500 35/341	6/ 1300 30/341
22000	TIME/FUEL DIST./TAS	14/ 2700 63/339	13/ 2500 59/339	12/ 2400 55/338	11/ 2200 51/338	10/ 2100 48/338	10/ 1900 45/338	9/ 1800 41/338	8/ 1700 38/338	8/ 1600 36/338	7/ 1400 33/338	6/ 1200 28/337
21000	TIME/FUEL DIST./TAS	13/ 2600 58/335	12/ 2400 54/335	11/ 2300 51/335	10/ 2100 47/335	10/ 2000 44/335	9/ 1900 41/335	9/ 1700 38/335	8/ 1600 36/335	7/ 1500 [illegible]334	7/ 1400 30/334	6/ 1200 26/334
20000	TIME/FUEL DIST./TAS	12/ 2500 54/332	11/ 2300 50/332	11/ 2200 47/332	10/ 2000 44/332	9/ 1900 41/332	9/ 1800 38/332	8/ 1700 35/332	7/ 1500 33/331	7/ 1400 30/331	6/ 1300 28/331	5/ 1100 24/331
19000	TIME/FUEL DIST./TAS	11/ 2400 49/329	11/ 2200 46/329	10/ 2100 43/329	9/ 1900 40/329	9/ 1800 37/329	8/ 1700 35/329	8/ 1600 33/328	7/ 1500 30/328	7/ 1400 28/328	6/ 1300 26/328	5/ 1100 22/328
18000	TIME/FUEL DIST./TAS	11/ 2200 45/326	10/ 2100 42/326	9/ 2000 39/326	9/ 1900 37/326	8/ 1700 34/326	8/ 1600 32/326	7/ 1500 30/326	7/ 1400 28/325	6/ 1300 26/325	6/ 1200 24/325	5/ 1000 20/325
17000	TIME/FUEL DIST./TAS	10/ 2100 41/323	9/ 2000 38/323	9/ 1900 36/323	8/ 1800 34/323	8/ 1700 32/323	7/ 1500 29/323	7/ 1400 27/323	6/ 1300 26/323	6/ 1200 24/323	5/ 1200 22/323	5/ 1000 19/322
16000	TIME/FUEL DIST./TAS	9/ 2000 37/320	9/ 1900 35/320	8/ 1800 33/320	8/ 1700 31/320	7/ 1600 29/320	7/ 1500 27/320	6/ 1400 25/320	6/ 1300 23/320	5/ 1200 22/320	5/ 1100 20/320	4/ 900 17/320
15000	TIME/FUEL DIST./TAS	9/ 1900 34/318	6/ 1800 32/317	8/ 1700 30/317	7/ 1600 28/317	7/ 1500 26/317	6/ 1400 24/317	6/ 1300 23/317	6/ 1200 21/317	5/ 1100 20/317	5/ 1000 18/317	4/ 900 15/317
14000	TIME/FUEL DIST./TAS	8/ 1800 31/315	8/ 1700 29/315	7/ 1600 27/315	7/ 1500 25/315	6/ 1400 24/315	6/ 1300 22/315	6/ 1200 21/315	5/ 1100 19/315	5/ 1100 18/314	4/ 1000 17/314	4/ 800 14/314
13000	TIME/FUEL DIST./TAS	8/ 1700 27/312	7/ 1600 26/312	7/ 1500 24/312	6/ 1400 23/312	6/ 1300 21/312	6/ 1200 20/312	5/ 1200 19/312	5/ 1100 17/312	5/ 1000 16/312	4/ 900 15/312	4/ 800 13/312
12000	TIME/FUEL DIST./TAS	7/ 1600 24/310	7/ 1500 23/310	6/ 1400 22/310	6/ 1300 20/310	6/ 1300 19/309	5/ 1200 18/309	5/ 1100 17/309	5/ 1000 15/309	4/ 1000 14/309	4/ 900 13/309	3/ 800 11/309
11000	TIME/FUEL DIST./TAS	7/ 1500 22/307	6/ 1400 20/307	6/ 1300 19/307	5/ 1300 18/307	5/ 1200 17/307	5/ 1100 16/307	5/ 1000 15/307	4/ 1000 14/307	4/ 900 13/307	4/ 800 12/307	3/ 700 10/307
10000	TIME/FUEL DIST./TAS	6/ 1400 19/305	6/ 1300 18/305	5/ 1200 17/305	5/ 1200 16/305	5/ 1100 15/305	4/ 1000 14/305	4/ 1000 13/305	4/ 900 12/305	4/ 800 11/304	3/ 800 10/304	3/ 700 9/304
8000	TIME/FUEL DIST./TAS	5/ 1200 14/300	5/ 1100 13/300	5/ 1100 12/300	4/ 1000 11/300	4/ 900 11/300	4/ 900 10/300	4/ 800 9/300	3/ 800 9/300	3/ 700 8/300	3/ 700 8/300	2/ 600 6/300
6000	TIME/FUEL DIST./TAS	4/ 1000 9/295	4/ 1000 9/295	4/ 900 8/295	4/ 800 8/295	3/ 800 7/295	3/ 700 7/295	3/ 700 6/295	3/ 700 6/295	3/ 600 5/295	2/ 600 5/295	2/ 500 4/295
1500	TIME/FUEL	2/ 600	2/ 600	2/ 500	2/ 500	2/ 500	2/ 400	2/ 400	2/ 400	1/ 400	1/ 300	1/ 300

FUEL ADJUSTMENT FOR HIGH ELEVATION AIRPORTS	AIRPORT ELEVATION	2000	4000	6000	8000	10000	12000
EFFECT ON TIME AND DISTANCE IS NEGLIGIBLE	FUEL ADJUSTMENT	-100	-200	-400	-500	-600	-700

FIGURE 62.—En Route Climb 280/.70 ISA.

ENROUTE CLIMB 280/.70 ISA+10° C

PRESSURE ALTITUDE -FT	UNITS MIN/LB NM/KNOTS	BRAKE RELEASE WEIGHT - LB										
		120000	115000	110000	105000	100000	95000	90000	85000	80000	75000	65000
37000	TIME/FUEL DIST./TAS			42/ 5700 263/395	34/ 4700 206/391	29/ 4100 174/389	25/ 3700 151/388	23/ 3300 133/386	20/ 3000 119/385	18/ 2700 107/384	16/ 2500 96/384	13/ 2100 78/382
36000	TIME/FUEL DIST./TAS		43/ 5900 266/394	35/ 5000 211/391	30/ 4400 179/389	26/ 3900 156/387	23/ 3500 138/385	21/ 3200 123/384	19/ 2900 111/383	17/ 2700 100/383	16/ 2400 90/382	13/ 2000 74/381
35000	TIME/FUEL DIST./TAS	45/ 5200 275/394	36/ 5300 219/390	31/ 4600 186/388	27/ 4100 162/386	24/ 3700 143/385	22/ 3400 128/384	20/ 3100 115/383	18/ 2800 104/382	16/ 2600 94/381	15/ 2400 85/380	12/ 2000 70/379
34000	TIME/FUEL DIST./TAS	38/ 5600 228/390	32/ 4900 193/387	28/ 4400 168/386	25/ 3900 149/384	23/ 3600 133/383	21/ 3300 120/382	19/ 3000 108/381	17/ 2700 98/380	16/ 2500 89/379	14/ 2300 81/379	12/ 1900 67/378
33000	TIME/FUEL DIST./TAS	34/ 5100 200/387	30/ 4600 174/385	26/ 4100 154/383	24/ 3800 138/382	22/ 3400 124/381	20/ 3100 113/380	18/ 2900 102/379	16/ 2600 93/378	15/ 2400 85/378	14/ 2200 77/377	11/ 1900 64/376
32000	TIME/FUEL DIST./TAS	31/ 4800 188/384	28/ 4400 160/382	25/ 4000 143/381	23/ 3600 129/379	21/ 3300 116/378	19/ 3000 106/378	17/ 2800 96/377	16/ 2600 88/376	14/ 2400 [illegible]/376	13/ 2200 73/375	11/ 1800 61/374
31000	TIME/FUEL DIST./TAS	29/ 4600 165/381	26/ 4200 147/379	23/ 3800 133/378	21/ 3500 120/377	20/ 3200 109/376	18/ 2900 100/375	16/ 2700 91/375	15/ 2500 83/374	14/ 2300 76/374	13/ 2100 70/373	11/ 1800 58/372
30000	TIME/FUEL DIST./TAS	27/ 4400 152/378	24/ 4000 137/376	22/ 3700 124/375	20/ 3400 113/374	19/ 3100 103/374	17/ 2900 94/373	16/ 2600 86/372	14/ 2400 79/372	13/ 2200 72/371	12/ 2100 66/371	10/ 1700 55/370
29000	TIME/FUEL DIST./TAS	25/ 4200 141/375	23/ 3800 128/374	21/ 3500 116/373	19/ 3200 106/372	18/ 3000 97/371	16/ 2800 89/370	15/ 2600 82/370	14/ 2400 75/369	13/ 2200 69/369	12/ 2000 63/369	10/ 1700 52/368
28000	TIME/FUEL DIST./TAS	24/ 6000 131/371	22/ 3700 119/370	20/ 3400 109/369	18/ 3100 100/369	17/ 2900 91/368	16/ 2700 84/368	14/ 2500 77/367	13/ 2300 71/367	12/ 2100 65/366	11/ 1900 60/366	9/ 1600 50/365
27000	TIME/FUEL DIST./TAS	22/ 3800 121/368	21/ 3500 111/367	19/ 3300 102/366	18/ 3000 93/366	16/ 2800 86/365	15/ 2600 79/364	14/ 2400 73/364	13/ 2200 67/364	12/ 2000 61/363	11/ 1900 56/363	9/ 1600 47/363
26000	TIME/FUEL DIST./TAS	21/ 3600 118/363	19/ 3400 101/362	18/ 3100 93/362	16/ 2900 86/361	15/ 2700 79/361	14/ 2500 73/360	13/ 2300 67/360	12/ 2100 62/360	11/ 2000 57/359	10/ 1800 52/359	9/ 1500 44/359
25000	TIME/FUEL DIST./TAS	19/ 3400 101/358	18/ 3200 93/358	17/ 3000 85/357	15/ 2800 79/357	14/ 2600 73/357	13/ 2400 67/356	12/ 2200 62/356	11/ 2000 57/356	10/ 1900 53/356	10/ 1700 48/355	8/ 1500 41/355
24000	TIME/FUEL DIST./TAS	18/ 3300 92/354	17/ 3000 85/354	16/ 2800 78/353	15/ 2600 72/353	13/ 2400 67/353	12/ [illegible] [illegible]/352	12/ 2100 57/352	11/ 1900 53/352	10/ 1800 49/352	9/ 1700 45/352	8/ 1400 38/351
23000	TIME/FUEL DIST./TAS	17/ 3100 84/350	16/ 2900 78/350	15/ 2700 72/350	14/ 2500 67/349	13/ 2300 62/349	12/ 2200 57/349	11/ 2000 53/349	10/ 1900 49/348	9/ 1700 45/348	9/ 1600 42/348	7/ 1300 35/348
22000	TIME/FUEL DIST./TAS	16/ 3000 77/346	15/ 2800 71/346	14/ 2600 66/346	13/ 2400 61/346	12/ 2200 57/345	11/ 2100 53/345	10/ 1900 49/345	10/ 1800 45/345	9/ 1700 42/345	8/ 1500 38/345	7/ 1300 32/344
21000	TIME/FUEL DIST./TAS	15/ 2800 70/343	14/ 2600 65/343	13/ 2400 61/342	12/ 2300 56/342	11/ 2100 52/342	10/ 2000 49/342	10/ 1800 45/342	9/ 1700 42/342	8/ 1600 39/341	8/ 1500 36/341	6/ 1200 30/341
20000	TIME/FUEL DIST./TAS	14/ 2700 64/339	13/ 2500 60/339	12/ 2300 56/339	11/ 2200 52/339	11/ 2000 48/339	10/ 1900 45/338	9/ 1800 41/338	8/ 1600 38/338	8/ 1500 36/338	7/ 1400 33/338	6/ 1200 28/338
19000	TIME/FUEL DIST./TAS	13/ 2300 59/336	12/ 2400 55/336	11/ 2200 51/336	11/ 2100 47/335	10/ 1900 44/335	9/ 1800 41/335	9/ 1700 38/335	8/ 1600 35/335	7/ 1400 33/335	7/ 1300 30/335	6/ 1100 25/335
18000	TIME/FUEL DIST./TAS	12/ 2400 53/333	11/ 2300 50/333	11/ 2100 46/332	10/ 2000 43/332	9/ 1800 40/332	9/ 1700 38/332	8/ 1600 35/332	8/ 1500 32/332	7/ 1400 30/332	6/ 1300 28/332	5/ 1100 23/332
17000	TIME/FUEL DIST./TAS	11/ 2300 49/330	11/ 2100 45/329	10/ 2000 42/329	9/ 1900 39/329	9/ 1700 37/329	8/ 1600 34/329	8/ 1500 32/329	7/ 1400 30/329	7/ 1300 27/329	6/ 1200 25/329	5/ 1000 21/329
16000	TIME/FUEL DIST./TAS	11/ 2200 44/327	10/ 2000 41/326	9/ 1900 38/326	9/ 1800 36/326	8/ 1700 33/326	8/ 1500 31/326	7/ 1400 29/326	7/ 1300 27/326	6/ 1200 25/326	6/ 1200 23/326	5/ 1000 19/326
15000	TIME/FUEL DIST./TAS	10/ 2000 40/324	9/ 1900 37/324	9/ 1800 35/323	8/ 1700 33/323	8/ 1600 30/323	7/ 1500 28/323	7/ 1400 26/323	6/ 1300 24/323	6/ 1200 23/323	5/ 1100 21/323	5/ 900 18/323
14000	TIME/FUEL DIST./TAS	9/ 1900 36/321	9/ 1800 34/321	8/ 1700 31/321	8/ 1600 29/321	7/ 1500 27/321	7/ 1400 26/321	6/ 1300 24/320	6/ 1200 22/320	5/ 1100 20/320	5/ 1000 19/320	4/ 900 16/320
13000	TIME/FUEL DIST./TAS	9/ 1800 34/318	8/ 1700 30/318	8/ 1600 28/318	7/ 1500 26/318	7/ 1400 25/318	6/ 1300 23/318	6/ 1200 21/318	5/ 1100 20/318	5/ 1100 18/318	5/ 1000 17/318	4/ 800 14/318
12000	TIME/FUEL DIST./TAS	8/ 1700 29/315	8/ 1600 27/315	7/ 1500 25/315	7/ 1400 23/315	6/ 1300 22/315	6/ 1200 20/315	5/ 1100 19/315	5/ 1100 18/315	5/ 1000 16/315	4/ 900 15/315	4/ 800 13/315
11000	TIME/FUEL DIST./TAS	7/ 1600 25/313	7/ 1500 24/313	7/ 1400 22/313	6/ 1300 21/313	6/ 1200 19/313	5/ 1200 18/313	5/ 1100 17/313	5/ 1000 16/313	4/ 900 15/313	4/ 900 13/313	3/ 700 11/313
10000	TIME/FUEL DIST./TAS	7/ 1500 22/310	6/ 1400 20/310	6/ 1300 19/310	6/ 1200 18/310	5/ 1200 17/310	5/ 1100 16/310	5/ 1000 15/310	4/ 900 14/310	4/ 900 13/310	4/ 800 12/310	3/ 700 10/310
8000	TIME/FUEL DIST./TAS	6/ 1300 16/305	5/ 1200 15/305	5/ 1100 14/305	5/ 1100 13/305	4/ 1000 12/305	4/ 900 11/305	4/ 900 11/305	4/ 800 10/305	3/ 800 9/305	3/ 700 9/305	3/ 600 7/305
6000	TIME/FUEL DIST./TAS	5/ 1100 10/301	4/ 1000 10/301	4/ 900 9/301	4/ 900 9/301	4/ 800 8/301	3/ 800 8/301	3/ 700 7/301	3/ 700 7/301	3/ 600 6/301	3/ 600 6/301	2/ 500 5/301
1500	TIME/FUEL	3/ 800	2/ 600	2/ 500	2/ 500	2/ 500	2/ 500	2/ 400	2/ 400	2/ 400	1/ 300	1/ 300

FUEL ADJUSTMENT FOR HIGH ELEVATION AIRPORTS	AIRPORT ELEVATION	2000	4000	6000	8000	10000	12000
EFFECT ON TIME AND DISTANCE IS NEGLIGIBLE	FUEL ADJUSTMENT	-100	-200	-400	-500	-600	-800

FIGURE 63.—En Route Climb 280/.70 ISA +10° C.

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OPERATING CONDITIONS	T-1	T-2	T-3	T-4	T-5
TOTAL AIR TEMP (TAT)	+10° C	0° C	-15° C	-30° C	+15° C
ALTITUDE	10,000	5,000	25,000	35,000	18,000
ENGINE ANTI-ICE	ON	ON	ON	ON	OFF
WING ANTI-ICE	OFF	2 ON	2 ON	1 ON	OFF
AIR CONDITIONING	ON	OFF	ON	ON	OFF

FIGURE 64.—B-737 Climb and Cruise Power.

OPERATING CONDITIONS	W-1	W-2	W-3	W-4	W-5
CLIMB SCHEDULE	LR	HS	LR	HS	HS
INITIAL WEIGHT (X1000)	84	86	78	88	92
CRUISE PRESS ALTITUDE	34,000	28,000	32,000	22,000	24,000
ISA TEMPERATURE	ISA	ISA	ISA	ISA	ISA
AVG WIND COMP (KTS)	20 HW	30 HW	10 TW	20 TW	40 HW

FIGURE 65.—DC-9 En Route Climb.

EN ROUTE

MAX CLIMB & MAX CONTINUOUS EPR

A/C AIRBLEED ON

MAX. CLIMB	MAX. CONT.	TAT °C -40	-35	-30	-25	-20	-15	-10	- 5	0	5	10	15	20	25	30	35	40	45	50
S.L TO 30000	S.L TO 1500 20000 TO 30000	2.25	2.23	2.21	2.18	2.15	2.12	2.09	2.04	1.99	1.94	1.90	1.86	1.82	1.79	1.76	1.73	1.70	1.67	1.64
	1500 TO 20000	2.30	2.28	2.26	2.24	2.21	2.19	2.16	2.13	2.10	2.07	2.04	2.00	1.95	1.91	1.86	1.81	1.75	1.71	1.66
	35000 & 37000	2.24	2.22	2.20	2.17	2.14	2.11	2.07	2.02	1.97	1.92									

2.30	2.20	2.14	2.09	2.04	1.98
5660 AND ABOVE	4000	3000	2000	1000	S.L.

TEMP
PRESS
LIMIT EPR

1. FIND TEMP LIMIT EPR
2. FIND PRESS LIMIT EPR
3. USE THE SMALLER OF THE TWO LIMITS

MAX CRUISE EPR

A/C AIRBLEED ON

TAT °C		-50	-45	-40	-35	-30	-25	-20	-15	-10	- 5	0	5	10	15	20	25	30	35	40
PRESS ALT 1000 FT	6 TO 30	2.18	2.16	2.14	2.12	2.10	2.07	2.05	2.02	1.99	1.95	1.91	1.85	1.79	1.73	1.68	1.64	1.61	1.57	1.54
	35 & 37	2.28	2.26	2.24	2.22	2.20	2.17	2.14	2.11	2.07	2.02	1.97	1.92	1.87	1.84	1.80				

ANTI-ICE BLEED CORRECTIONS		Δ EPR
ENGINE ANTI-ICE		- .08
WING ANTI-ICE		2 ENG -.04
		1 ENG -.06

AIR COND-BLEED CORRECTIONS Δ EPR	A/C OFF
S. L TO 37000	+ .04

BLEED CORRECTIONS APPLY TO MAX CLIMB, MAX CONTINUOUS, AND MAX CRUISE EPR SETTINGS

FIGURE 66.—Climb and Cruise Power.

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TIME, FUEL, AND DISTANCE TO CLIMB
JT8D-1 ENGINES — NORMAL BLEED
DC-9 SERIES 10 — HIGH SPEED CLIMB SCHEDULE
CLIMB AT 320 KNOTS IAS TO 23500 FT ALTITUDE THEN CLIMB AT M .74

INITIAL WEIGHT = 86000. POUNDS

PRES. ALT. FEET	TIME MIN.	FUEL BURNED LB.	DIST. N. MI.
0.	0.	0.	0.
2000.	0.5	133.	2.8
4000.	1.1	267.	5.9
6000.	1.7	403.	9.3
8000.	2.3	541.	13.0
10000.	3.0	684.	17.2
12000.	3.8	830.	21.3
14000.	4.6	982.	27.0
16000.	5.5	1141.	32.9
18000.	6.4	1309.	39.6
20000.	7.6	1489.	47.4
22000.	8.8	1684.	56.6
23500.	9.9	1845.	64.7
23500.	9.9	1845.	64.7
24000.	10.2	1886.	66.8
26000.	11.4	2052.	75.9
28000.	12.8	2225.	85.8
30000.	14.3	2410.	97.1
32000.	16.2	2613.	110.3
34000.	18.4	2844.	126.3
36000.	21.4	3136.	147.8

INITIAL WEIGHT = 90000. POUNDS

PRES. ALT. FEET	TIME MIN.	FUEL BURNED LB.	DIST. N. MI.
0.	0.	0.	0.
2000.	0.6	140.	3.0
4000.	1.1	282.	6.3
6000	1.8	426.	9.8
8000.	2.5	573.	13.8
10000.	3.2	724.	18.2
12000.	4.0	879.	23.1
14000.	4.8	1041.	28.6
16000.	5.8	1211.	34.9
18000.	6.9	1390.	42.1
20000.	8.0	1583.	50.4
22000	9.4	1793.	60.3
23500.	10.6	1968.	69.1
23500.	10.6	1968.	69.1
24000.	10.9	2013.	71.5
26000.	12.3	2196.	81.5
28000.	13.8	2389.	92.6
30000.	15.5	2598.	105.4
32000.	17.6	2833.	120.6
34000.	20.3	3110.	139.8
36000.	24.3	3494.	168.0

INITIAL WEIGHT = 88000. POUNDS

PRES. ALT. FEET	TIME MIN.	FUEL BURNED LB.	DIST. N. MI.
0.	0.	0.	0.
2000.	0.5	136.	2.9
4000.	1.1	274.	6.1
6000.	1.7	414.	9.6
8000.	2.4	557.	13.4
10000.	3.1	703.	17.7
12000.	3.9	855.	22.5
14000.	4.7	1012.	27.8
16000.	5.6	1176.	33.9
18000.	6.6	1349.	40.8
20000.	7.8	1535.	48.9
22000.	9.1	1738.	58.4
23500.	10.3	1906.	66.9
23500.	10.3	1906.	66.9
24000.	10.6	1949.	69.1
26000.	11.9	2123.	78.6
28000.	13.3	2306.	89.1
30000.	14.9	2502.	101.2
32000.	16.9	2720.	115.3
34000.	19.3	2973.	132.8
36000.	22.7	3304.	157.2

INITIAL WEIGHT = 92000. POUNDS

PRES. ALT. FEET	TIME MIN.	FUEL BURNED LB.	DIST. N. MI.
0.	0.	0.	0.
2000.	0.6	144.	3.1
4000.	1.2	290.	6.4
6000.	1.8	438.	10.1
8000.	2.5	589.	14.2
10000.	3.3	744.	18.7
12000.	4.1	905.	23.8
14000.	5.0	1072.	29.5
16000.	6.0	1247.	36.0
18000.	7.1	1432.	43.4
20000.	8.3	1631.	52.0
22000.	9.7	1850.	62.3
23500.	11.0	2032.	71.5
23500.	11.0	2032.	71.5
24000.	11.3	2079.	73.9
26000.	12.7	2272.	84.4
28000.	14.3	2476.	98.2
30000.	16.2	2693.	109.8
32000.	18.4	2951.	126.2
34000.	21.4	3258.	147.4
36000.	26.1	3713.	181.0

FIGURE 67.—High-Speed Climb Schedule.

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TIME, FUEL AND DISTANCE TO CLIMB

JT8D-1 ENGINES NORMAL BLEED

DC-9 SERIES 10 – LONG RANGE CLIMB SCHEDULE

CLIMB AT 290 KNOTS IAS TO 26860 FT ALTITUDE THEN CLIMB AT M .72

INITIAL WEIGHT = 78000. POUNDS

PRES. ALT. FEET	TIME MIN.	FUEL BURNED LB.	DIST. N. MI.
0.	0.	0.	0.
2000.	0.5	113.	2.2
4000.	0.9	227.	4.6
6000.	1.5	342.	7.3
8000.	2.0	457.	10.2
10000.	2.6	574.	13.3
12000.	3.2	693.	16.8
14000.	3.9	815.	20.7
16000.	4.6	941.	25.0
18000.	5.4	1070.	29.9
20000.	6.3	1205.	35.4
22000.	7.2	1347.	41.7
24000.	8.3	1498.	49.0
26000.	9.5	1661.	57.6
26860.	10.1	1736.	61.8
26860.	10.1	1736.	61.8
28000.	10.7	1813.	66.2
30000.	11.9	1953.	74.6
32000.	13.3	2102.	84.2
34000.	14.9	2267.	95.4
36000.	16.9	2456.	109.2

INITIAL WEIGHT = 82000. POUNDS

PRES. ALT. FEET	TIME MIN.	FUEL BURNED LB.	DIST. N. MI.
0.	0.	0.	0.
2000.	0.5	120.	2.4
4000.	1.0	241.	4.9
6000.	1.5	363.	7.7
8000.	2.1	486.	10.8
10000.	2.7	610.	14.2
12000.	3.4	737.	17.9
14000.	4.1	868.	22.1
16000.	4.9	1002.	26.7
18000.	5.7	1141.	31.9
20000.	6.7	1286.	37.9
22000.	7.7	1439.	44.6
24000.	8.9	1602.	52.5
26000.	10.2	1780.	61.9
26860.	10.9	1863.	66.5
26860.	10.9	1863.	66.5
28000.	11.6	1948.	71.4
30000.	12.9	2104.	80.8
32000.	14.4	2274.	91.7
34000.	16.3	2464.	104.6
36000.	18.7	2693.	121.3

INITIAL WEIGHT = 80000. POUNDS

PRES. ALT. FEET	TIME MIN.	FUEL BURNED LB.	DIST. N. MI.
0.	0.	0.	0.
2000.	0.5	117.	2.3
4000.	1.0	234.	4.8
6000.	1.5	352.	7.5
8000.	2.1	471.	10.5
10000.	2.7	592.	13.7
12000.	3.3	715.	17.4
14000.	4.0	841.	21.4
16000.	4.7	971.	25.9
18000.	5.6	1105.	30.9
20000.	6.5	1245.	36.6
22000.	7.5	1392.	43.2
24000.	8.6	1549.	50.7
26000.	9.9	1719.	59.7
26860.	10.5	1798.	64.1
26860.	10.5	1798.	64.1
28000.	11.1	1879.	68.7
30000.	12.4	2027	77.7
32000.	13.8	2186.	87.8
34000.	15.6	2362.	99.8
36000.	17.7	2570.	114.9

INITIAL WEIGHT = 84000. POUNDS

PRES. ALT. FEET	TIME MIN.	FUEL BURNED LB.	DIST. N. MI.
0.	0.	0.	0.
2000.	0.5	124.	2.4
4000.	1.0	248.	5.1
6000.	1.6	374.	8.0
8000.	2.2	500.	11.1
10000.	2.8	629.	14.6
12000.	3.5	760.	18.5
14000	4.2	894.	22.8
16000.	5.1	1033.	27.6
18000.	5.9	1177.	33.0
20000.	6.9	1327.	39.1
22000.	8.0	1486.	46.2
24000.	9.2	1656.	54.4
26000.	10.6	1841.	64.1
26860.	11.3	1928.	69.0
26860.	11.3	1928.	69.0
28000	12.0	2018	74.1
30000	13.4	2183	84.1
32000.	15.0	2364	95.7
34000.	17.1	2570.	109.7
36000.	19.7	2826.	128.3

FIGURE 68.—Long-Range Climb Schedule.

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OPERATING CONDITIONS	X-1	X-2	X-3	X-4	X-5
DISTANCE (NM)	2,000	2,400	1,800	2,800	1,200
WIND COMPONENT (KTS)	50 TW	50 HW	20 HW	50 TW	30 HW
CRUISE PRESS ALTITUDE	27,000	35,000	20,000	29,000	37,000
ISA TEMPERATURE	+10°	ISA	+20°	-10°	+10°
LANDING WEIGHT (X1000)	70	75	75	65	90

FIGURE 69.—Flight Planning at .78 Mach Cruise.

OPERATING CONDITIONS	Q-1	Q-2	Q-3	Q-4	Q-5
WEIGHT (X1000)	110	70	90	80	100
PRESSURE ALTITUDE	30,000	25,000	35,000	20,000	10,000
TOTAL AIR TEMP (TAT)	-8° C	-23° C	-16° C	+4° C	-6° C

FIGURE 70.—Turbulent Air RPM.

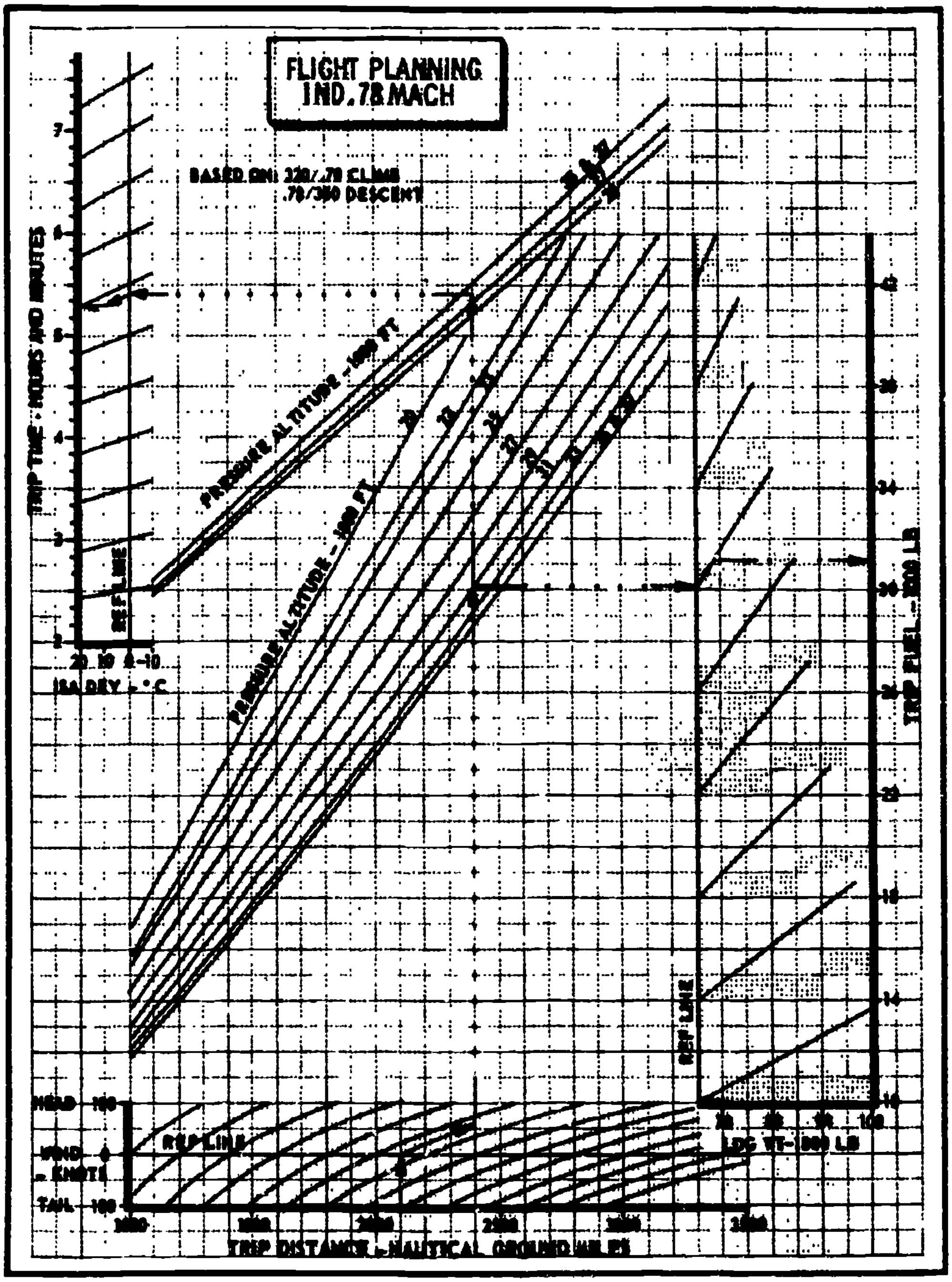

FIGURE 71.—Flight Planning .78 Mach Indicated.

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OPERATING CONDITIONS	Z-1	Z-2	Z-3	Z-4	Z-5
DISTANCE (NM)	340	650	900	290	400
AVG WIND COMP (KTS)	25 TW	45 HW	35 TW	25 HW	60 HW

FIGURE 72.—Flight Planning at .74 Mach Cruise.

TURBULENT AIR PENETRATION

TARGET SPEED IAS/MACH	PRESS ALT -1000 FT	GROSS WEIGHT - 1000 LB					ISA TAT -°C	% N1 ADJUSTMENT PER 10°C VARIATION FROM TABLE TAT COLDER - WARMER +
		70	80	90	100	110		
		APPROXIMATE POWER SETTING -%N1 RPM						
280/.70	35	77.1	79.0	81.0	83.4		-36	1.6
	30	77.2	78.2	79.4	81.1	82.4	-23	1.6
	25	76.7	77.5	78.3	79.2	80.1	-13	1.5
	20	74.7	75.4	76.1	77.0	77.9	- 6	1.4
	15	72.7	73.5	74.2	74.8	75.7	1	1.2
	10	70.5	71.3	72.1	72.9	73.9	9	1.3

FIGURE 73.—Turbulent Air Penetration.

ABBREVIATED FLIGHT PLANNING
.280/.70 CLIMB
.74/320/340 DESCENT
250 KTS CRUISE BELOW 10000 FT.
320 KTS CRUISE 10000 THRU 23000 FT.
.74 MACH CRUISE 24000 FT. AND ABOVE

DIST. N. MI.	REC. ALT.	TAS KTS	AIR TIME MINS.	FUEL LBS.
50	6000-7000	279	16	1800
60	6000-7000	279	18	1950
70	10000-11000	373	19	2000
80	10000-11000	373	20	2150
90	10000-11000	373	21	2250
100	10000-11000	373	23	2400
110	11000-12000	380	24	2550
120	12000-13000	386	25	2750
130	13000-14000	391	27	2900
140	14000-15000	396	28	3050
150	16000-17000	407	30	3200
160	17000-18000	414	31	3350
170	18000-19000	420	32	3500
180	19000-20000	426	33	3650
190	20000-21000	432	35	3800
200	21000-22000	439	36	3950
210	21000-22000	439	37	4050
220	22000-23000	446	39	4200
230	23000-24000	450	40	4300
240	24000-25000	450	41	4400
250	25000-26000	449	43	4500
260	26000-27000	447	44	4600
270	26000-27000	447	45	4750
280	27000-28000	445	47	4850
290	28000-29000	443	48	4950
300	28000-29000	443	49	5100
310	28000-29000	443	51	5200
320	29000-31000	441	52	5300
330	29000-31000	441	53	5400
340	31000-33000	438	55	5550
350	31000-33000	438	56	5650
400	33000-35000	433	62	6250
450	33000-35000	433	69	6850
500	33000-35000	433	76	7500
550	33000-35000	433	82	8100
600	33000-35000	433	89	8700
650	33000-35000	433	96	9300
700	33000-35000	433	102	9900
750	33000-35000	433	109	10500
800	33000-35000	433	115	11100
850	33000-35000	433	122	11700
900	33000-35000	433	129	12300
950	33000-35000	433	135	12900
1000	33000-35000	433	142	13500

TIME AND FUEL CORRECTION FOR WIND
Δ TIME = TIME X WIND COMPONENT ÷ TAS
Δ FUEL = FUEL X WIND COMPONENT ÷ TAS
EXAMPLE: DIST. = 250
STILL AIR TIME = 43 MIN.
STILL AIR FUEL = 4500 LBS.
WIND COMPONENT = 20 KTS.

Δ TIME = 43 X 20 ÷ 449 = MIN.
Δ FUEL = 4500 X 20 ÷ 449 = 200 LBS.
ADD Δ TIME AND Δ FUEL FOR HEADWIND; SUBTRACT FOR TAILWIND

FIGURE 74.—Abbreviated Flight Planning.

OPERATING CONDITIONS	L-1	L-2	L-3	L-4	L-5
WEIGHT (START TO ALT)	85,000	70,000	86,000	76,000	82,000
DISTANCE (NAM)	110	190	330	50	240
WIND COMPONENT (KTS)	15 HW	40 TW	50 HW	20 TW	45 HW
HOLDING TIME AT ALT (MIN)	15	15	15	15	15

FIGURE 75.—DC-9 Alternate Planning.

OPERATING CONDITIONS	H-1	H-2	H-3	H-4	H-5
ALTITUDE	24,000	17,000	8,000	18,000	22,000
WEIGHT (X1000)	195	185	155	135	175
ENGINES OPERATING	3	3	3	3	3
HOLDING TIME (MIN)	15	30	45	25	35

FIGURE 76.—B-727 Holding.

OPERATING CONDITIONS	O-1	O-2	O-3	O-4	O-5
ALTITUDE	31,000	23,000	17,000	8,000	4,000
WEIGHT (X1000)	102	93	104	113	109
ENGINES OPERATING	2	2	2	2	2
HOLDING TIME (MIN)	20	40	35	15	25

FIGURE 77.—B-737 Holding.

ALTERNATE PLANNING CHART

DIST. - NAM	20	30	40	50	60	70	80	90	100	110	120	130	140
OPTM. ALT.	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000	13000	14000
TIME:	:16	:17	:19	:20	:22	:23	:25	:26	:28	:29	:30	:32	:33
FUEL	2500	2600	2700	2800	2900	3000	3100	3200	3300	3400	3500	3600	3700
TAS	275	280	283	286	289	292	296	300	303	306	309	312	315
DIST. - NAM	**150**	**160**	**170**	**180**	**190**	**200**	**210**	**220**	**230**	**240**	**250**	**260**	**270**
OPTM. ALT.	15000	16000	17000	18000	19000	20000	21000	22000	23000	24000	25000	26000	27000
TIME	:35	:36	:38	:39	:40	:42	:43	:45	:46	:48	:49	:50	:52
FUEL	3800	3900	4000	4100	4200	4300	4400	4500	4600	4700	4800	4900	5000
TAS	319	323	326	330	334	338	341	345	349	353	357	361	365
DIST. - NAM	**280**	**290**	**300**	**310**	**320**	**330**	**340**	**350**	**360**	**370**	**380**	**390**	**400**
OPTM. ALT.	27000	28000	28000	29000	29000	30000	30000	31000	31000	31000	31000	31000	31000
TIME	:53	:55	:56	:58	:59	1:00	1:02	1:03	1:04	1:05	1:07	1:08	1:10
FUEL	5150	5250	5350	5450	5600	5700	5800	5900	6050	6150	6250	6350	6500
TAS	368	372	376	380	385	388	392	397	397	397	397	397	397

NOTES:

1. Fuel includes ½ climb distance enroute credit, fuel to cruise remaining distance at LRC schedule, 15 minutes holding at alternate, and 800 lbs. for descent.
2. Time includes ½ climb distance credit, time to cruise distance shown at LRC schedule and 8 minutes for descent. 15 minutes holding is not included in time.

FIGURE 78.—Alternate Planning Chart.

HOLDING **B–727**

EPR
IAS - KTS
FF PER ENG - LB/HR

PRESSURE ALTITUDE FT	GROSS WEIGHT - 1000 LB 200	190	180	170	160	150	140	130	120
25000	1.85 268 3600	1.81 261 3400	1.77 253 3210	1.73 246 3030	1.69 238 2860	1.64 230 2680	1.60 222 2510	1.55 213 2340	1.51 205 2180
20000	1.69 265 3630	1.66 258 3450	1.62 251 3280	1.59 244 3110	1.55 236 2940	1.51 228 2770	1.48 220 2600	1.44 212 2440	1.40 204 2270
15000	1.56 263 3670	1.53 256 3500	1.50 249 3340	1.47 242 3170	1.44 235 3000	1.41 227 2850	1.38 219 2680	1.35 211 2520	1.32 203 2350
10000	1.45 262 3800	1.43 255 3640	1.40 248 3460	1.38 241 3310	1.35 234 3140	1.33 226 2970	1.30 218 2810	1.28 210 2640	1.25 202 2480
5000	1.36 260 3890	1.34 254 3720	1.32 247 3550	1.30 240 3380	1.28 233 3220	1.26 225 3060	1.24 218 2890	1.22 210 2730	1.20 201 2560

FIGURE 79.—Holding Performance Chart.

HOLDING

EPR
IAS KNOTS
FF PER ENGINE LB/HR

FLIGHT LEVEL	GROSS WEIGHT 1000 LB										
	115	110	105	100	95	90	85	80	75	70	65
350	2.13 234 2830	2.07 228 2810	2.01 223 2630	1.95 217 2460	1.90 211 2290	1.85 210 2180	1.80 210 2070	1.76 210 1960	1.71 210 1870	1.67 210 1780	1.64 210 1700
300	1.86 231 2740	1.82 226 2600	1.79 220 2470	1.75 215 2370	1.71 210 2250	1.67 210 2140	1.64 210 2050	1.60 210 1960	1.57 210 1880	1.54 210 1790	1.51 210 1720
250	1.69 229 2710	1.66 224 2610	1.63 218 2490	1.60 213 2370	1.57 210 2260	1.54 210 2180	1.51 210 2080	1.48 210 1980	1.45 210 1920	1.43 210 1840	1.41 210 1780
200	1.56 227 2716	1.53 222 2590	1.50 217 2490	1.48 211 2390	1.45 210 2310	1.43 210 2230	1.40 210 2130	1.38 210 2060	1.36 210 2000	1.34 210 1920	1.32 210 1860
150	1.45 226 2790	1.43 221 2680	1.40 216 2570	1.38 210 2470	1.36 210 2380	1.34 210 2290	1.32 210 2220	1.31 210 2140	1.29 210 2070	1.27 210 2000	1.26 210 1990
100	1.36 225 2860	1.34 220 2780	1.33 215 2670	1.31 210 2560	1.29 210 2470	1.28 210 2390	1.26 210 2310	1.25 210 2240	1.24 210 2170	1.22 210 2100	1.21 210 2030
050	1.29 224 2960	1.28 219 2870	1.27 214 2770	1.25 210 2670	1.24 210 2580	1.23 210 2500	1.21 210 2420	1.20 210 2350	1.19 210 2290	1.18 210 2230	1.17 210 2150
015	1.25 224 3050	1.24 219 2950	1.23 214 2850	1.22 210 2790	1.21 210 2670	1.20 210 2590	1.19 210 2510	1.18 210 2430	1.17 210 2370	1.16 210 2300	1.15 210 2240

FIGURE 80.—Holding Performance Chart.

INITIAL FUEL WEIGHT 1000 LB	ENDING FUEL WEIGHT - 1000 LB															
	10	14	18	22	26	30	34	38	42	46	50	54	58	62	66	70
70	28	27	25	23	22	20	18	17	15	13	12	10	8	5	3	0
66	26	25	23	21	20	18	16	15	13	11	10	8	5	3	0	
62	23	23	20	18	17	15	13	12	10	8	7	5	3	0		
58	21	20	18	16	15	13	11	10	8	6	5	3	0			
54	18	16	15	13	12	10	8	7	5	3	2	0				
50	16	15	13	12	10	8	7	5	3	2	0					
46	15	13	12	10	8	7	5	3	2	0						
42	13	12	10	8	7	5	3	2	0							
38	12	10	8	7	5	3	2	0								
34	10	8	7	5	3	2	0									
30	8	7	5	3	2	0										
26	7	5	3	2	0											
22	5	3	2	0												
18	3	2	0													
14	2	0														
10	0															

FUEL DUMP TIME

FUEL JETTISON TIME-MINUTES

FIGURE 81.—Fuel Dump Time.

OPERATING CONDITIONS	D-1	D-2	D-3	D-4	D-5
WT AT ENG FAIL (X1000)	100	110	90	80	120
ENGINE ANTI-ICE	ON	OFF	ON	ON	ON
WING ANTI-ICE	OFF	OFF	ON	ON	OFF
ISA TEMPERATURE	ISA	+10°	-10°	-10°	+20°
AIR CONDITIONING	OFF	OFF	OFF	OFF	OFF

FIGURE 82.—B-737 Drift-Down.

OPERATING CONDITIONS	S-1	S-2	S-3	S-4	S-5
FLIGHT LEVEL	370	350	410	390	330
LANDING WEIGHT (X1000)	130	150	135	155	125
DESCENT TYPE	.80M/ 250	.80M/ 280/250	.80M/ 320/250	.85M/ 350/250	.80M/ 320/250

FIGURE 83.—Descent Performance.

1 ENGINE INOP

ENGINE A/I OFF

GROSS WEIGHT 1000 LB		OPTIMUM DRIFTDOWN SPEED KIAS	ISA DEV °C			
AT ENGINE FAILURE	AT LEVEL OFF (APPROX)		-10	0	10	20
			APPROX GROSS LEVEL OFF PRESS ALT FT			
80	77	184	27900	26800	25400	22800
90	86	195	25000	23800	21700	20000
100	96	206	22000	20500	20000	18500
110	105	216	20000	19100	17500	15400
120	114	224	18200	16600	14700	12200

ENGINE A/I ON

GROSS WEIGHT 1000 LB		OPTIMUM DRIFTDOWN SPEED KIAS	ISA DEV °C			
AT ENGINE FAILURE	AT LEVEL OFF (APPROX)		-10	0	10	20
			APPROX GROSS LEVEL OFF PRESS ALT FT			
80	77	184	25500	24600	22800	20000
90	86	195	23000	21400	20000	19400
100	96	206	20000	19400	18700	15600
110	105	216	18100	16600	14700	12200
120	114	224	15500	13800	11800	8800

ENGINE AND WING A/I ON

GROSS WEIGHT 1000 LB		OPTIMUM DRIFTDOWN SPEED KIAS	ISA DEV °C			
AT ENGINE FAILURE	AT LEVEL OFF (APPROX)		-10	0	10	20
			APPROX GROSS LEVEL OFF PRESS ALT FT			
80	77	184	24400	23400	21400	20000
90	86	195	21600	20100	19800	18000
100	96	206	19600	18000	16400	14200
110	105	216	16800	15100	13300	10700
120	114	224	14000	12200	10300	7200

NOTE:

WHEN ENGINE BLEED FOR AIR CONDITIONING IS OFF BELOW 17,000 FT., INCREASE LEVEL-OFF ALTITUDE BY 800 FT.

FIGURE 84.—Drift-Down Performance Chart.

.80M/250 KIAS

FLIGHT LEVEL	TIME MIN	FUEL LB	DISTANCE NAM AT LANDING WEIGHTS 120,000 LB	140,000 LB	160,000 LB
410	27	1610	133	137	138
390	27	1600	130	134	136
370	26	1570	123	128	129
350	25	1540	116	120	122
330	24	1510	110	113	115
310	23	1480	103	107	108
290	22	1450	97	100	101
270	21	1420	90	93	95
250	20	1390	84	87	88
230	19	1360	78	80	81
210	18	1320	72	74	75
190	17	1280	66	68	68
170	16	1240	60	62	62
150	14	1190	54	56	56
100	11	1050	39	40	40
050	8	870	24	24	24
015	5	700	12	12	12

.80M/280/250 KIAS

FLIGHT LEVEL	TIME MIN	FUEL LB	DISTANCE NAM AT LANDING WEIGHTS 120,000 LB	140,000 LB	160,000 LB
410	25	1550	123	129	132
390	24	1540	121	127	130
370	24	1520	115	121	125
350	23	1500	111	117	120
330	23	1480	106	111	115
310	22	1450	100	105	108
290	21	1430	94	99	102
270	20	1400	88	93	95
250	19	1370	83	87	89
230	18	1350	77	81	83
210	17	1310	72	75	76
190	16	1280	66	69	70
170	15	1240	61	63	64
150	14	1200	55	57	58
100	12	1080	42	42	42
050	8	870	24	24	24
015	5	700	12	12	12

.80M/320/250 KIAS

FLIGHT LEVEL	TIME MIN	FUEL LB	DISTANCE NAM AT LANDING WEIGHTS 120,000 LB	140,000 LB	160,000 LB
410	22	1490	113	120	123
390	22	1480	111	117	121
370	21	1460	105	112	116
350	21	1440	101	107	111
330	20	1420	96	103	107
310	20	1400	92	98	102
290	19	1390	89	94	98
270	19	1370	85	90	94
250	18	1350	80	85	88
230	17	1330	75	79	82
210	17	1300	71	74	77
190	16	1270	66	69	71
170	15	1240	61	64	65
150	14	1210	56	59	60
100	12	1110	45	46	46
050	8	870	24	24	24
015	5	700	12	12	12

.85M/350/250 KIAS

FLIGHT LEVEL	TIME MIN	FUEL LB	DISTANCE NAM AT LANDING WEIGHTS 120,000 LB	140,000 LB	160,000 LB
410	21	1440	106	112	116
390	21	1430	103	110	114
370	20	1420	99	106	110
350	20	1400	95	101	106
330	19	1390	91	98	102
310	19	1380	88	94	98
290	18	1360	85	90	95
270	18	1350	82	87	91
250	17	1330	78	83	87
230	17	1310	74	78	81
210	16	1290	70	74	76
190	16	1270	65	69	71
170	15	1240	61	64	66
150	14	1210	57	60	61
100	13	1130	47	48	49
050	8	870	24	24	24
015	5	700	12	12	12

NOTE: FUEL FOR A STRAIGHT-IN APPROACH IS INCLUDED.

FIGURE 85.—Descent Performance Chart.

OPERATING CONDITIONS	L-1	L-2	L-3	L-4	L-5
TEMPERATURE	+15° C TAT	+27° F OAT	-8° C OAT	-10° C TAT	+55° F OAT
PRESSURE ALTITUDE	500	3,100	2,500	2,100	1,200
AIR CONDITIONING	OFF	ON	ON	ON	ON
WING ANTI-ICE	OFF	2 ON	1 ON	2 ON	OFF
WEIGHT (X1000)	100	95	90	105	85
FLAP SETTING	30°	25°	15°	40°	30°
RUNWAY ASSIGNED	35	04	27	34	09
SURFACE WIND	300/20	350/15	310/20	030/10	130/15

FIGURE 86.—B-727 Landing.

LANDING

GO AROUND EPR

A/C BLEED ON

EPR BLEED CORRECTIONS	1 ENG	2 ENG
AIR CONDITIONING OFF	+.03	+.03
ENGINE ANTI-ICE ON	ZERO	ZERO
WING ANTI-ICE ON (FLT)	- .06	- .04

REPORTED OAT °F	-61	-52	-43	-35	-25	-17	-10	0	10	18	27	38	47	55	64	73	83	91	100	119
REPORTED OAT °C	-52	-47	-42	-37	-32	-27	-23	-18	-13	- 8	- 3	3	8	13	18	23	28	33	38	48
TAT °C	-50	-45	-40	-35	-30	-25	-20	-15	-10	- 5	0	5	10	15	20	25	30	35	40	50
TEMP LIMIT EPR	2.30	2.30	2.30	2.29	2.26	2.24	2.21	2.19	2.16	2.13	2.10	2.07	2.04	2.00	1.98	1.98	1.98	1.94	1.90	1.80

PRESS LIMIT EPR							
Pressure altitude	5660 AND ABOVE	4000	3000	2000	1000	S.L.	-1000
EPR	2.30	2.20	2.15	2.09	2.04	1.98	1.93

1. FIND TEMP LIMIT EPR
2. FIND PRESS LIMIT EPR
3. USE THE SMALLER OF THE TWO LIMITS

LANDING SPEED

GROSS WT -1000 LB	REFERENCE SPEED AT FLAP POSITION 40	30	25	15
110	138	142	153	158
105	134	138	149	154
100	130	135	144	150
95	127	131	140	145
90	123	127	136	141
85	119	124	132	136
80	115	120	127	132
75	113	116	123	127
70	109	112	119	123

ADD WIND FACTOR OF: 1/2 HEADWIND COMPONENT + GUST (MAX: 20 KTS)

FLAP EXTENSION/ MANEUVERING SPEED

NORMAL MANEUVER AND FLAP EXTENSION SPEEDS

FLAP POS	NORMAL MANEUVER	SELECT FLAP
0	210	1
1	190	5
5	170	10/15
10	160	15
15	150	25/30/40
25	140	30/40
30	V_{REF}	—
40	V_{REF}	—

FIGURE 87.—Landing Performance Chart.

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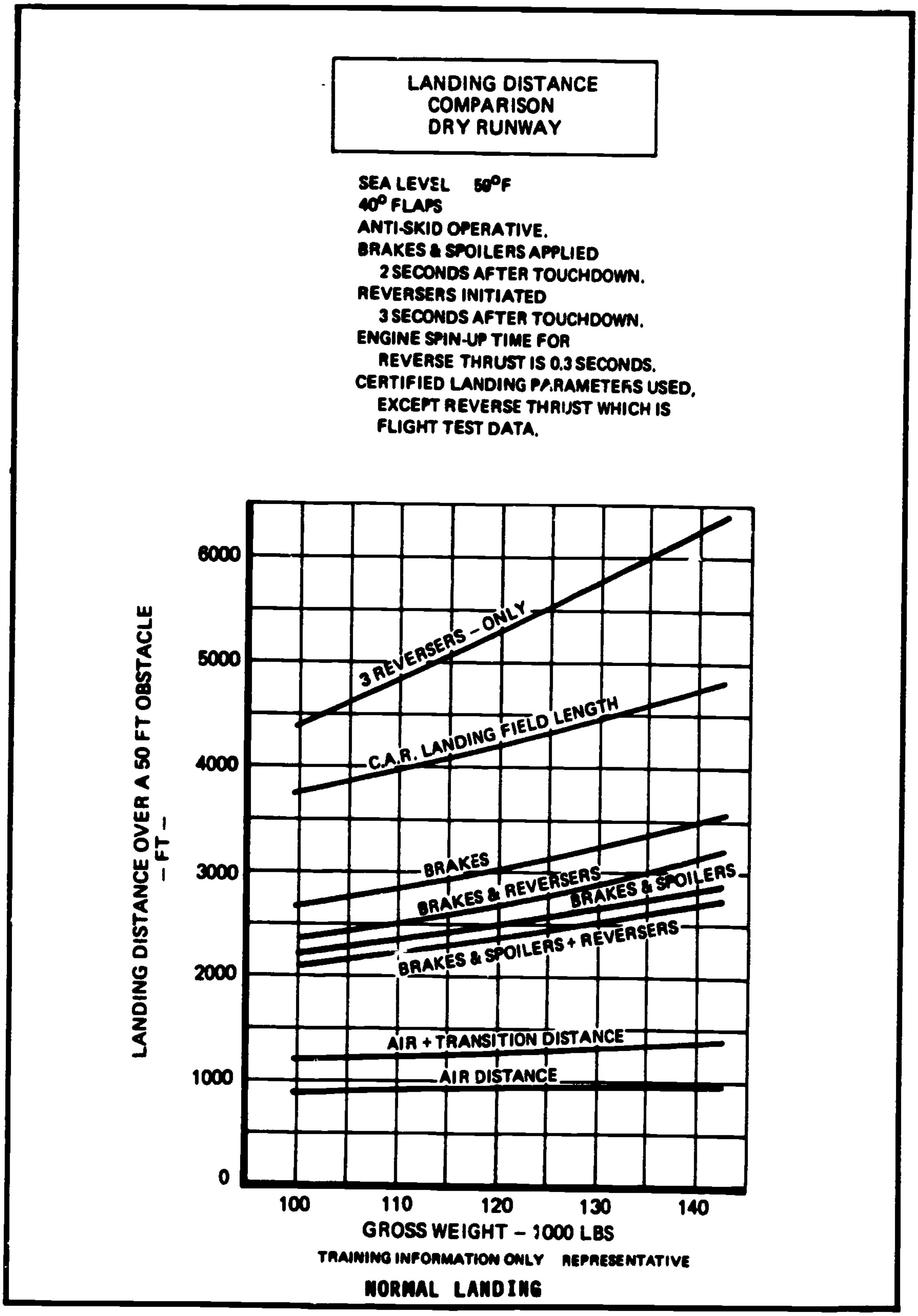
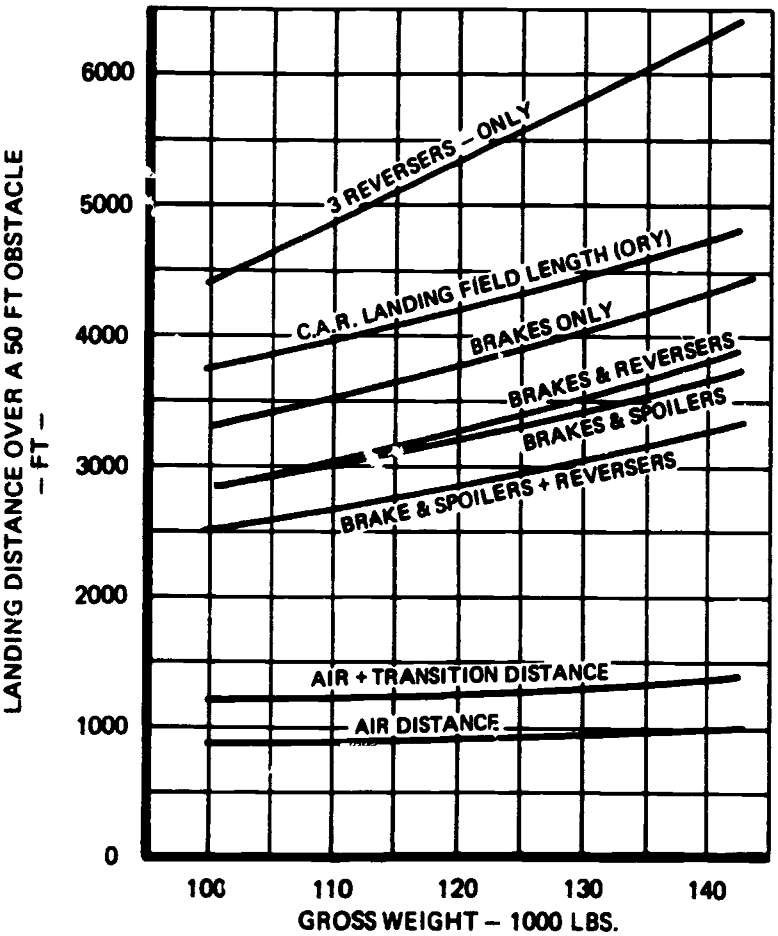


FIGURE 82 —Normal Landing - Dry Runway.

LANDING DISTANCE COMPARISON

WET RUNWAY

SEA LEVEL 59°F
40° FLAPS
ANTI-SKID OPERATIVES.
BRAKES & SPOILERS APPLIED
2 SECONDS AFTER TOUCHDOWN.
REVERSERS INITIATED
3 SECONDS AFTER TOUCHDOWN.
ENGINE SPIN-UP TIME FOR
REVERSE THRUST IS 6.3 SECONDS.
CERTITIED LANDING PARAMETERS USED,
EXCEPT REVERSE THRUST WHICH IS
RIGHT
FLIGHT TEST DATA.



TRAINING INFORMATION ONLY REPRESENTATIVE

NORMAL LANDING

FIGURE 89.—Normal Landing – We' Runway.

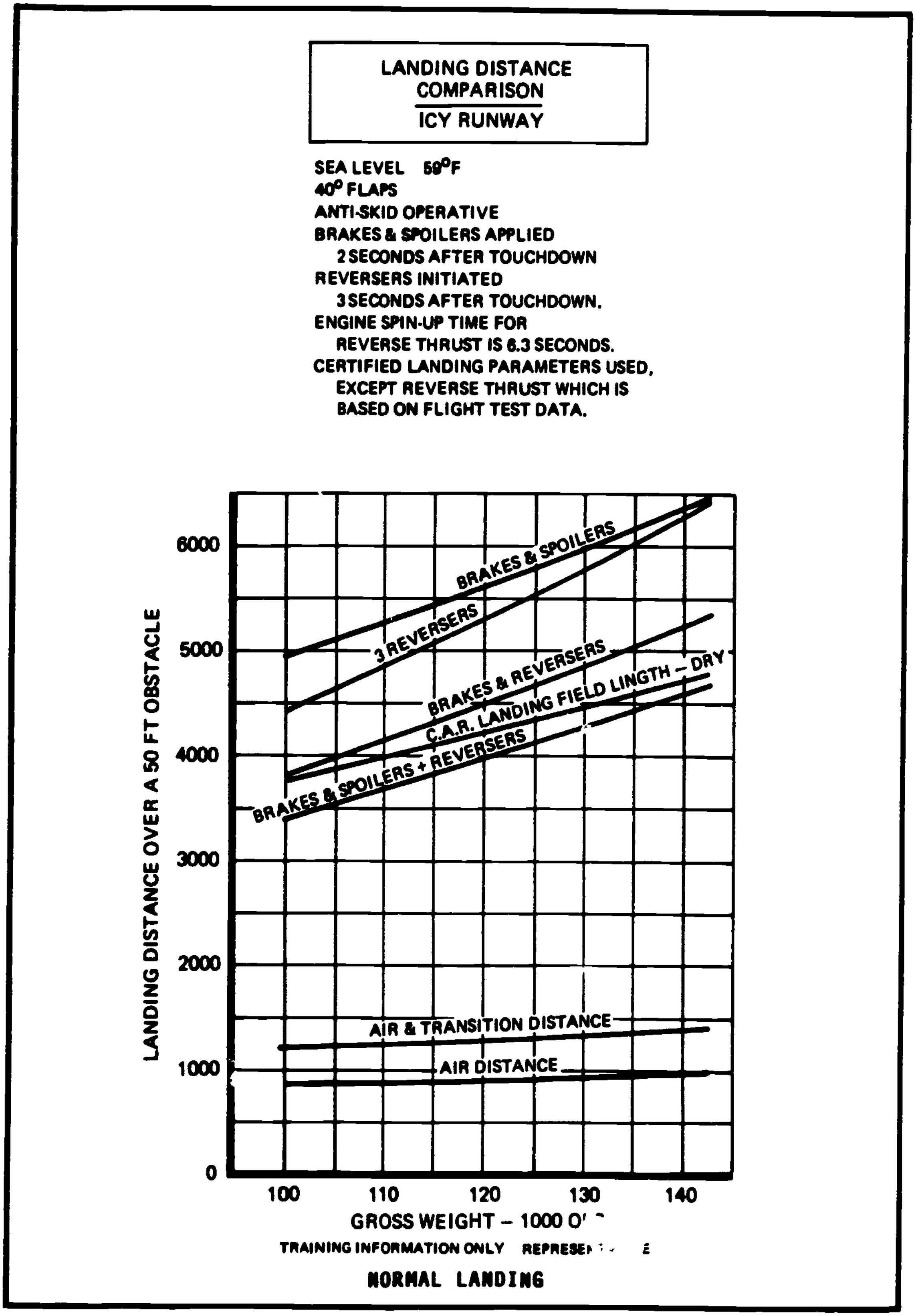
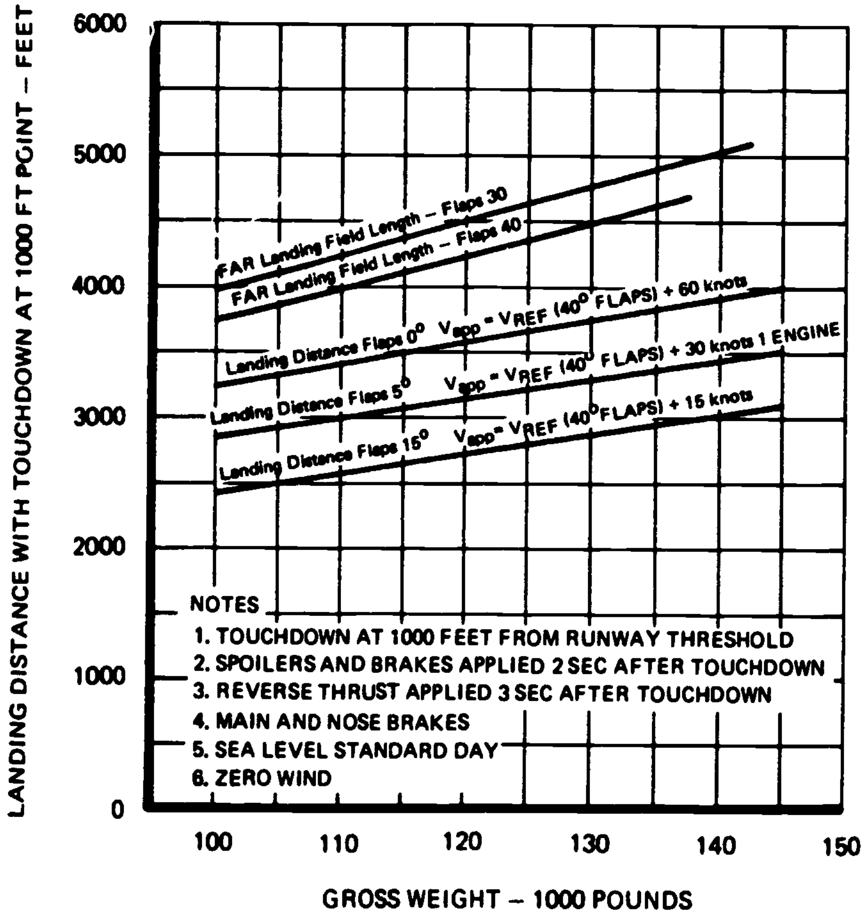


FIGURE 90.—Normal Landing - Icy Runway.

LANDING DISTANCE COMPARISON
FLAPS 0
FLAPS 5
FLAPS 15

TOUCHDOWN AT 1000 FEET FROM RUNWAY THRESHOLD
SPOILERS AND BRAKES APPLIED 2 SECONDS AFTER TOUCHDOWN
REVERSE THRUST APPLIED 3 SECONDS AFTER TOUCHDOWN
MAIN AND NOSE BRAKES
SEA LEVEL, STANDARD DAY
ZERO WIND, DRY RUNWAY
ANTI-SKID OPERATIVE



TRAINING INFORMATION ONLY REPRESENTATIVE

NORMAL LANDING

FIGURE 91.—Normal Landing Distance Comparison.

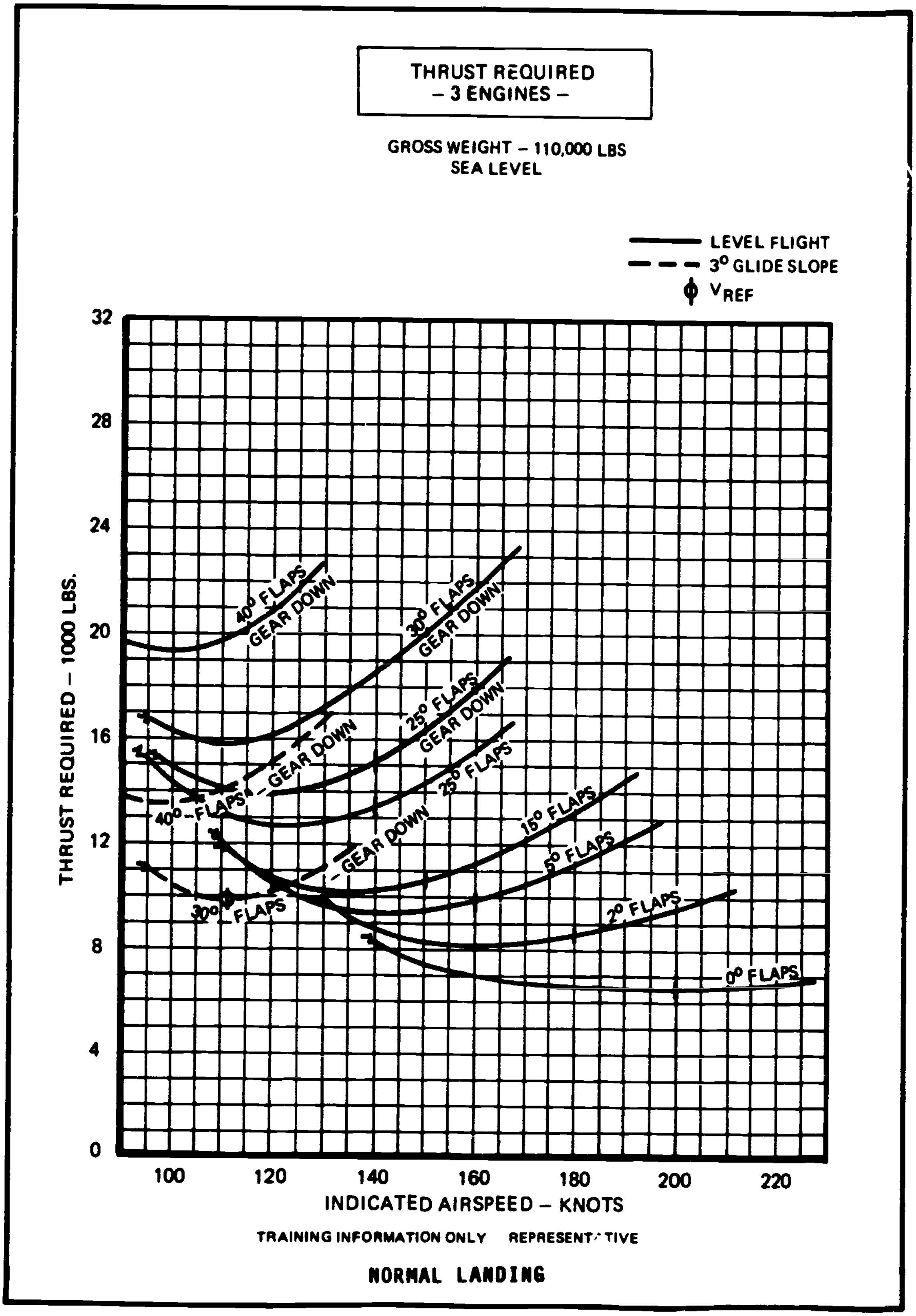


FIGURE 92.—Landing Thrust – 110,000 Pounds.

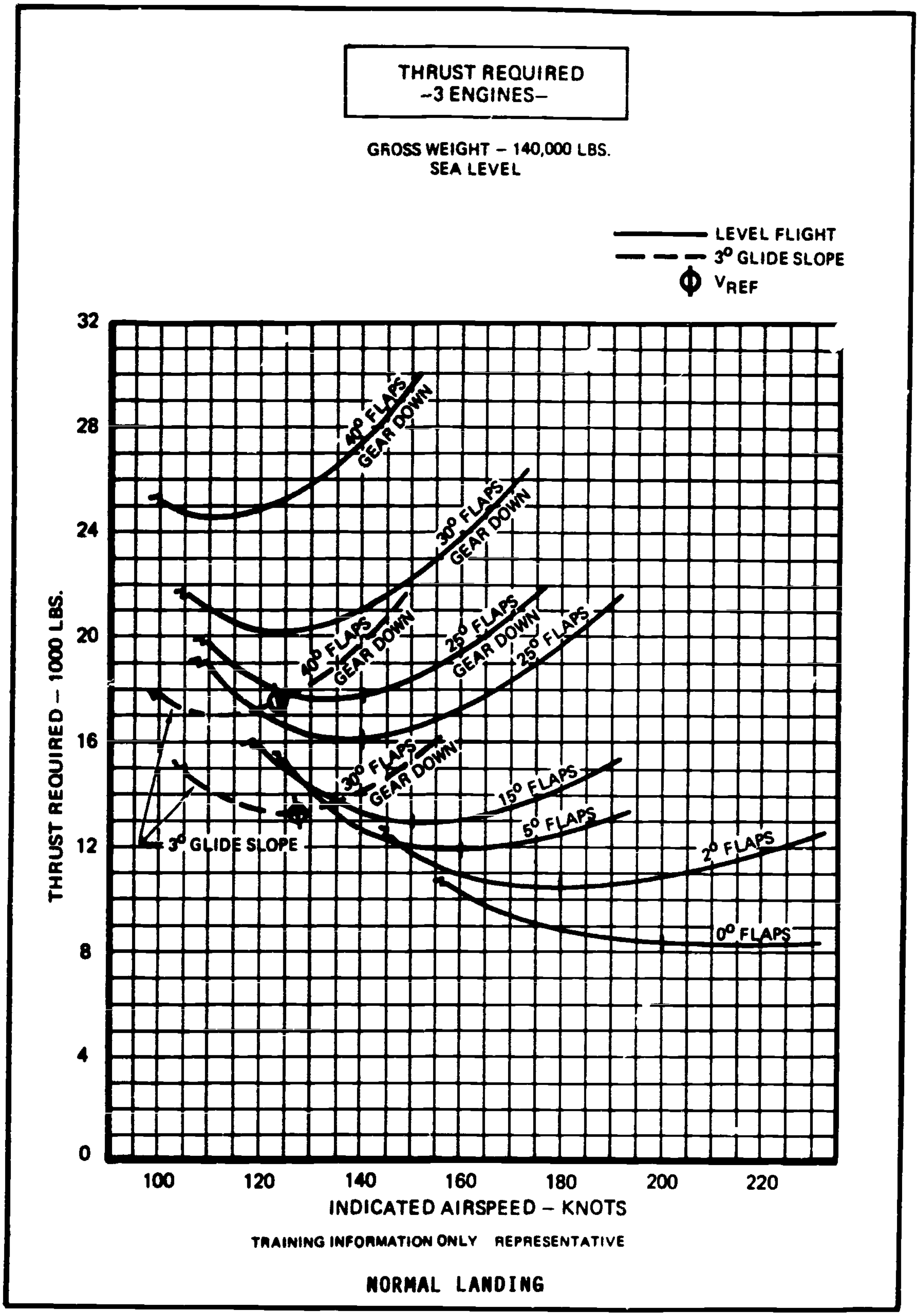


FIGURE 93.—Landing Thrust – 140,000 Pounds.

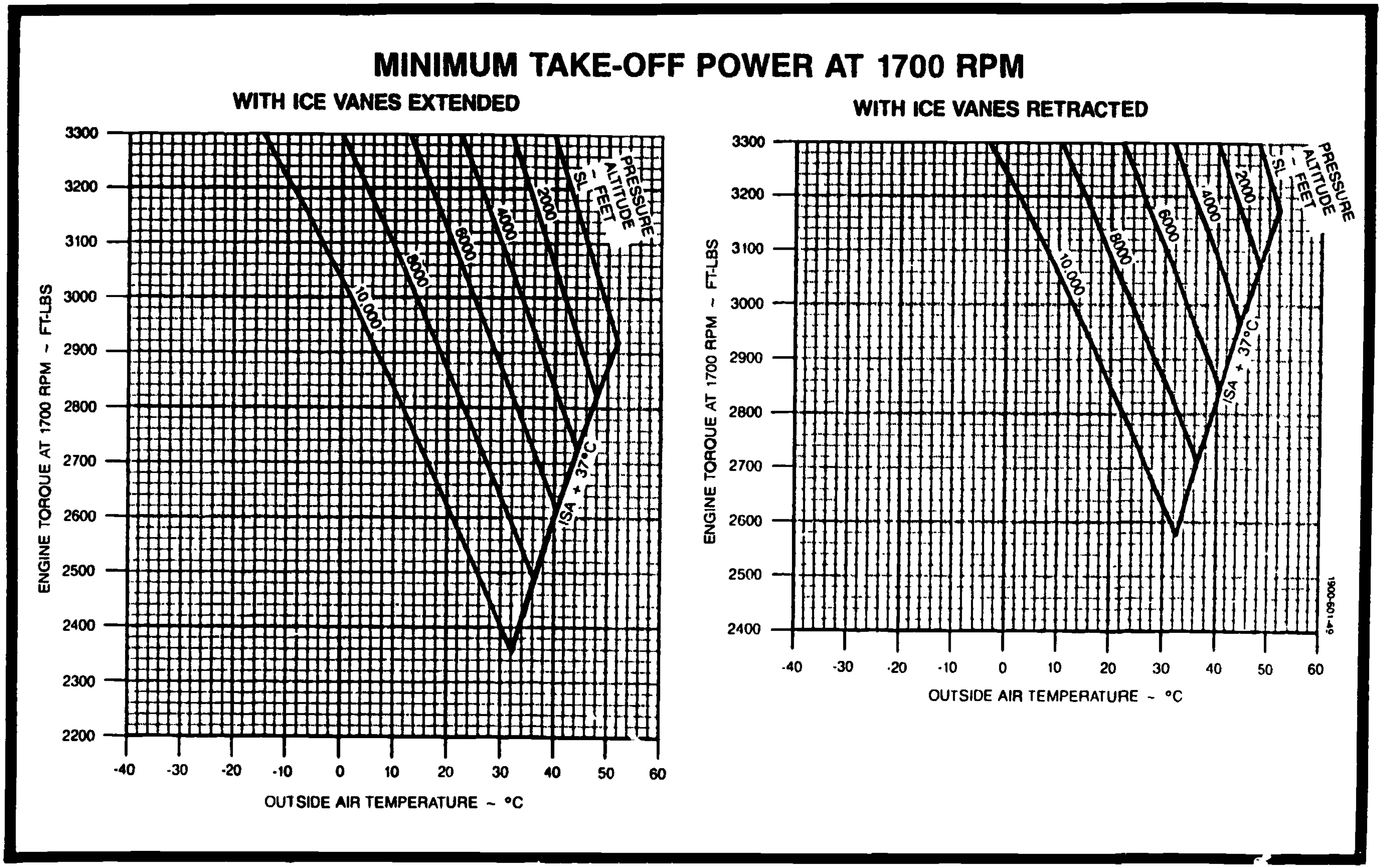


FIGURE 94.—Minimum Takeoff Power at 1700 RPM.

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Appendix 3

TAKE-OFF DISTANCE — FLAPS TAKEOFF

ASSOCIATED CONDITIONS:

POWER .... TAKE-OFF POWER SET BEFORE BRAKE RELEASE
LANDING GEAR ... RETRACT AFTER LIFT-OFF
RUNWAY .... PAVED, LEVEL, DRY SURFACE

WEIGHT ~ POUNDS	TAKE-OFF SPEED ~ KNOTS	
	V_1	V_2
16,600	108	115
16,000	107	114
14,000	102	112
12,000	102	112
10,000	102	112

NOTE: FOR OPERATION WITH ICE VANES EXTENDED ADD 5°C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.

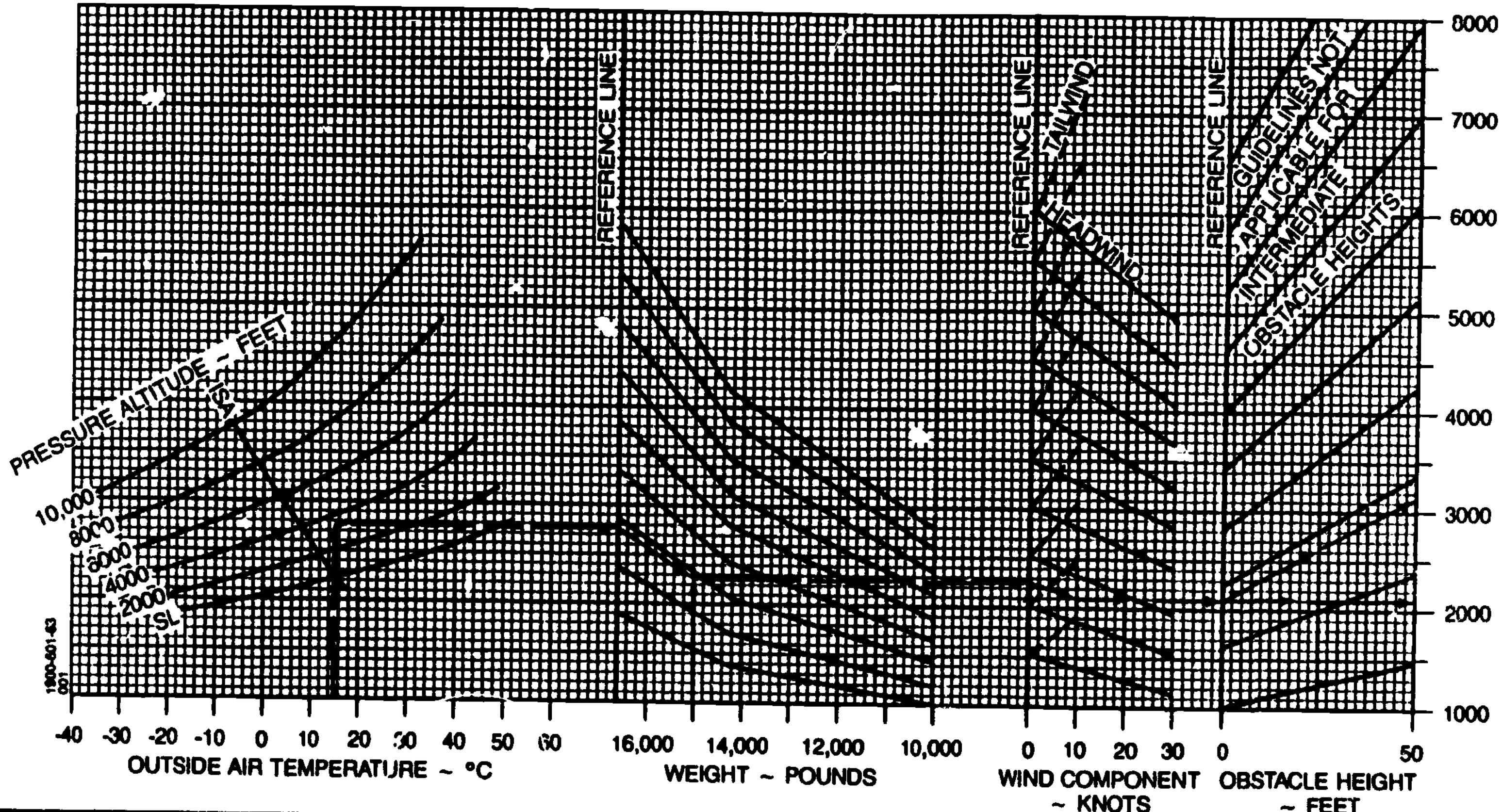

FIGURE 95.—Takeoff Distance - Flaps Takeoff.

ACCELERATE-STOP — FLAPS TAKEOFF

ASSOCIATED CONDITIONS:

POWER .... 1. TAKE-OFF POWER SET BEFORE BRAKE RELEASE
2. BOTH ENGINES IDLE AT V_1 SPEED

AUTOFEATHER ... ARMED

BRAKING .... MAXIMUM

RUNWAY.......... PAVED, LEVEL, DRY SURFACE

WEIGHT ~ POUNDS	V_1 ~ KNOTS
16,600	108
16,000	107
14,000	102
12,000	102
10,000	102

NOTE: FOR OPERATION WITH ICE VANES EXTENDED, ADD 3°C TO THE ACTUAL OAT BEFORE ENTERING GRAPH.

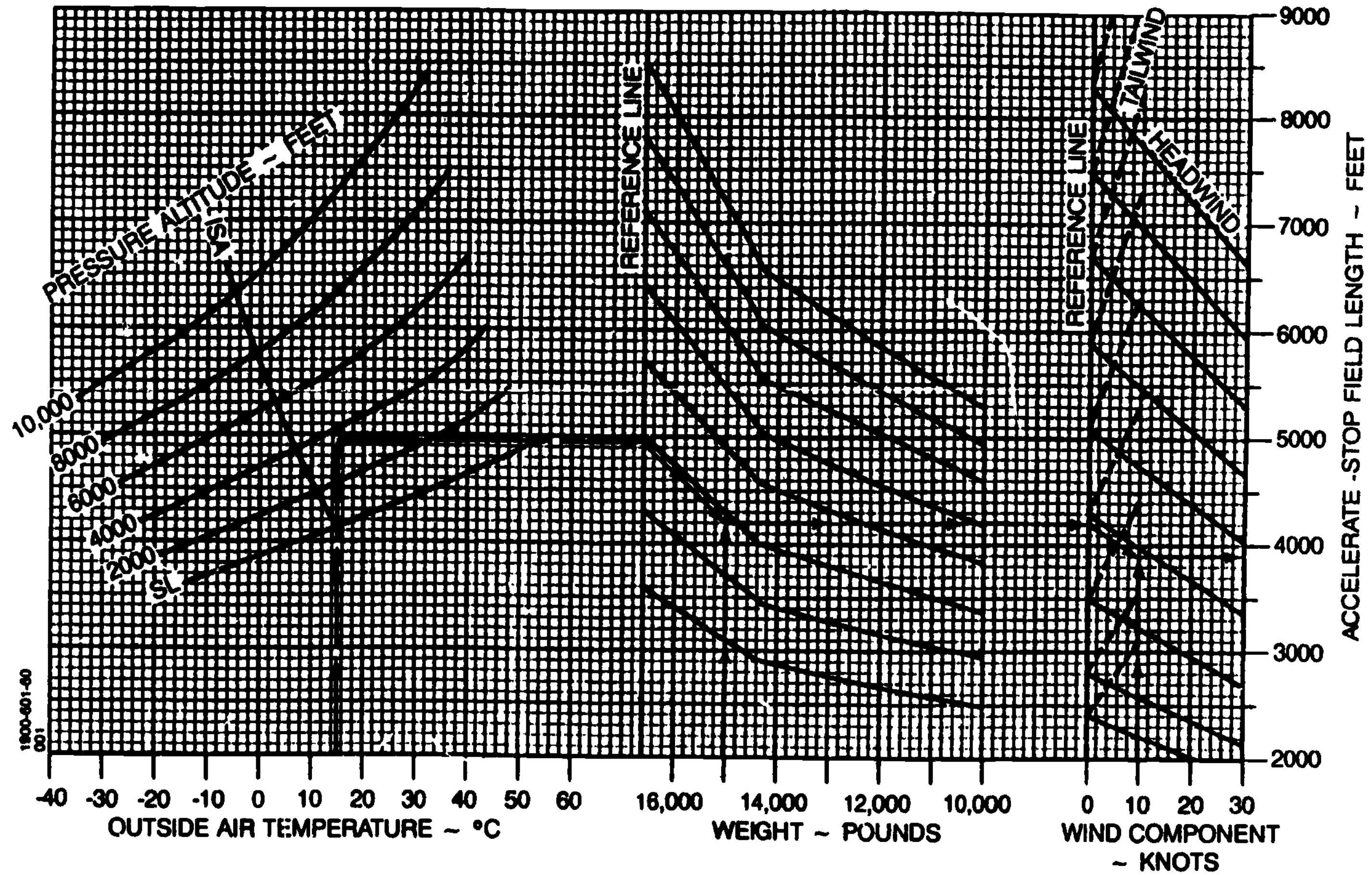

FIGURE 96.—Accelerate-Stop - Flaps Takeoff.

Appendix 3

OPERATING CONDITIONS	BE-21	BE-22	BE-23	BE-24	BE-25
OAT AT TAKEOFF	+10° C	0° C	+20° C	+25° C	-10° C
OAT AT CRUISE	-20° C	-25° C	ISA	0° C	-40° C
AIRPORT PRESS ALTITUDE	2,000	1,000	3,000	4,000	5,000
CRUISE ALTITUDE	16,000	18,000	20,000	14,000	22,000
INITIAL CLIMB WEIGHT	16,600	14,000	15,000	16,000	14,000
ICE VANES	RETRACT	EXTEND	RETRACT	RETRACT	EXTEND

FIGURE 97.—Beech 1900 Climb.

CLIMB — TWO ENGINES — FLAPS UP

ASSOCIATED CONDITIONS:

POWER.......... MAXIMUM CONTINUOUS
FLAPS........... UP
LANDING GEAR... UP

WEIGHT ~ POUNDS	CLIMB SPEED ~ KNOTS
16,600	135
16,000	134
14,000	130
12,000	125
10,000	121

EXAMPLE:

OAT .... -4°C
PRESSURE ALTITUDE ... 8000 FT
WEIGHT .... 14,500 LBS

RATE OF CLIMB .... 2460 FT/MIN
CLIMB GRADIENT ...... 14.7 %
CLIMB SPEED.......... 131 KTS

NOTE: DURING OPERATION WITH ICE VANES EXTENDED, RATE OF CLIMB WILL BE REDUCED APPROXIMATELY 240 FEET PER MINUTE.

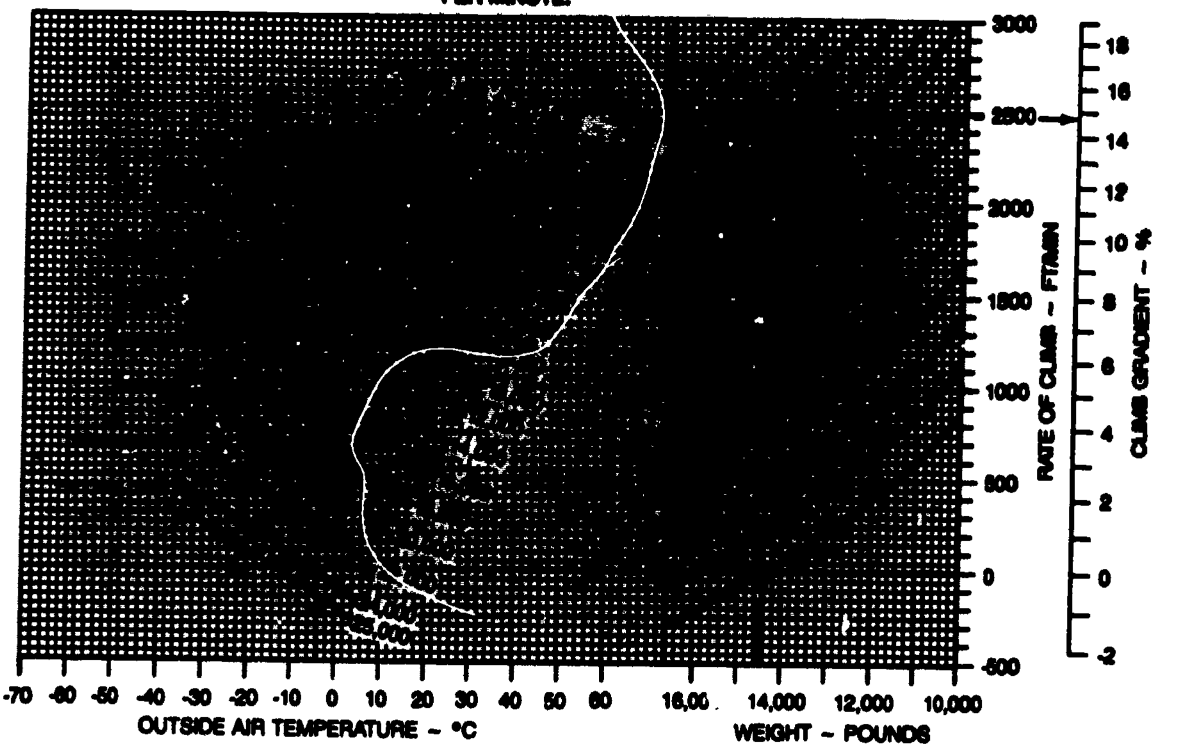

FIGURE 98.—Climb - Two Engines - Flaps Up.

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CLIMB — ONE ENGINE INOPERATIVE

BLEED AIR ON

ASSOCIATED CONDITIONS:
POWER .... MAXIMUM CONTINUOUS
FLAPS .... UP
LANDING GEAR .... UP
INOPERATIVE PROPELLER ... FEATHERED

WEIGHT ~ POUNDS	CLIMB SPEED ~ KNOTS
16,600	125
16,000	124
14,000	119
12,000	116
10,000	112

NOTE: DURING OPERATION WITH ICE VANES EXTENDED, RATE OF CLIMB WILL BE REDUCED APPROXIMATELY 115 FEET PER MINUTE.

EXAMPLE:
OAT .... -4°C
PRESSURE ALTITUDE ... 9000 FT
WEIGHT.................. 14,500 LBS

RATE OF CLIMB .... 450 FT/MIN
CLIMB GRADIENT....... 3.1 %
CLIMB SPEED.......... 120 KTS

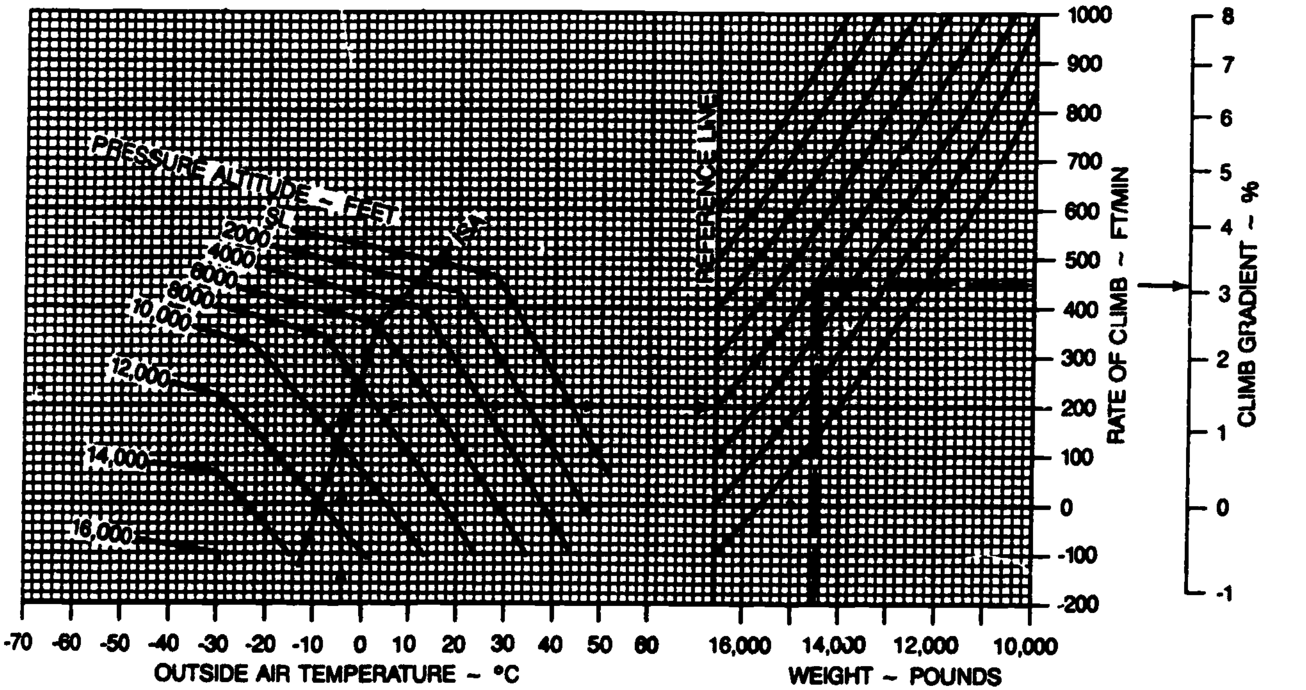

FIGURE 99.—Climb - One Engine Inoperative.

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Appendix 3

TIME, FUEL, AND DISTANCE TO CRUISE CLIMB

ASSOCIATED CONDITIONS:

PROPELLER SPEED . . . 1550 RPM
POWER:
ITT . . . . 750°C
OR TORQUE . . . . 3400 FT-LBS

ALTITUDE ~ FEET	CLIMB SPEED ~ KNOTS
SL TO 10,000	160
10,000 TO 15,000	150
15,000 TO 20,000	140
20,000 TO 25,000	130

EXAMPLE:

OAT AT TAKEOFF . . . . 15°C
OAT AT CRUISE . . . . -10°C
AIRPORT PRESSURE ALTITUDE . . . 3499 FT
CRUISE ALTITUDE . . . . 11,000 FT
INITIAL CLIMB WEIGHT . . . . 15,000 LBS

TIME TO CLIMB (5.8-1.8) . . . . 4 MIN
FUEL TO CLIMB (103-35) . . . . 68 LBS
DISTANCE TO CLIMB (16-5) . . . . 11 NM

NOTES: 1. ADD 110 LBS FUEL FOR START, TAXI, AND TAKEOFF
2. FOR OPERATION WITH ICE VANES EXTENDED, ADD 10°C TO THE ACTUAL OAT BEFORE ENTERING THE GRAPH

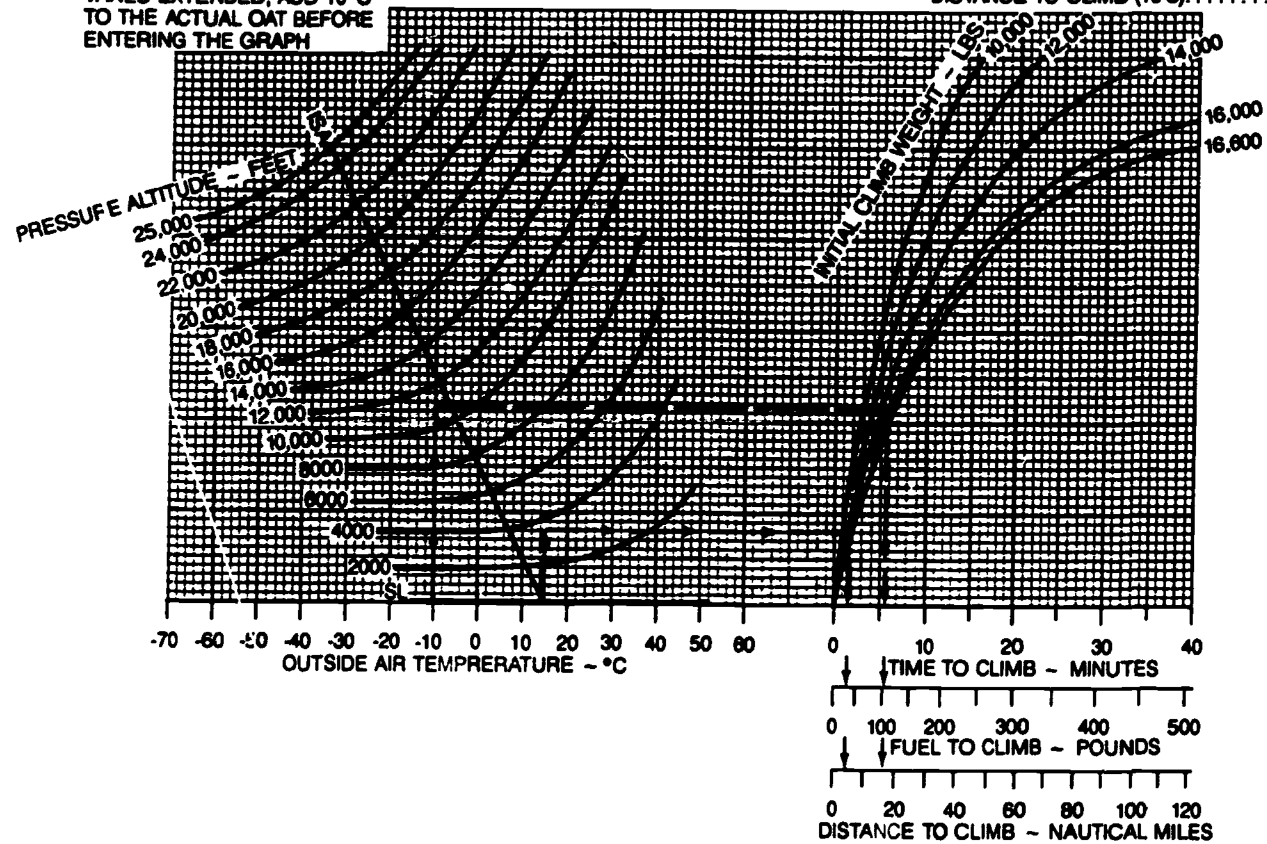

FIGURE 100.—Time, Fuel, and Distance to Cruise Climb.

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OPERATING CONDITIONS	BE-26	BE-27	BE-28	BE-29	BE-30
OAT AT MEA	-8° C	+30° C	+5° C	+18° C	+22° C
WEIGHT	15,500	16,600	16,000	16,300	14,500
ROUTE SEGMENT MEA	6,000	5,500	9,000	7,000	9,500
BLEED AIR	ON	ON	OFF	ON	OFF

FIGURE 101.—Beech 1900 Service Ceiling.

OPERATING CONDITIONS	BE-31	BE-32	BE-33	BE-34	BE-35
WEIGHT	15,000	14,000	13,000	16,000	11,000
PRESSURE ALTITUDE	22,000	17,000	20,000	23,000	14,000
TEMPERATURE (OAT)	-19° C	-19° C	-35° C	-31° C	-3° C
TRUE COURSE	110	270	185	020	305
WIND	180/30	020/35	135/45	340/25	040/50
CRUISE DISTANCE	280	320	400	230	300

FIGURE 102.—Beech 1900 Cruise.

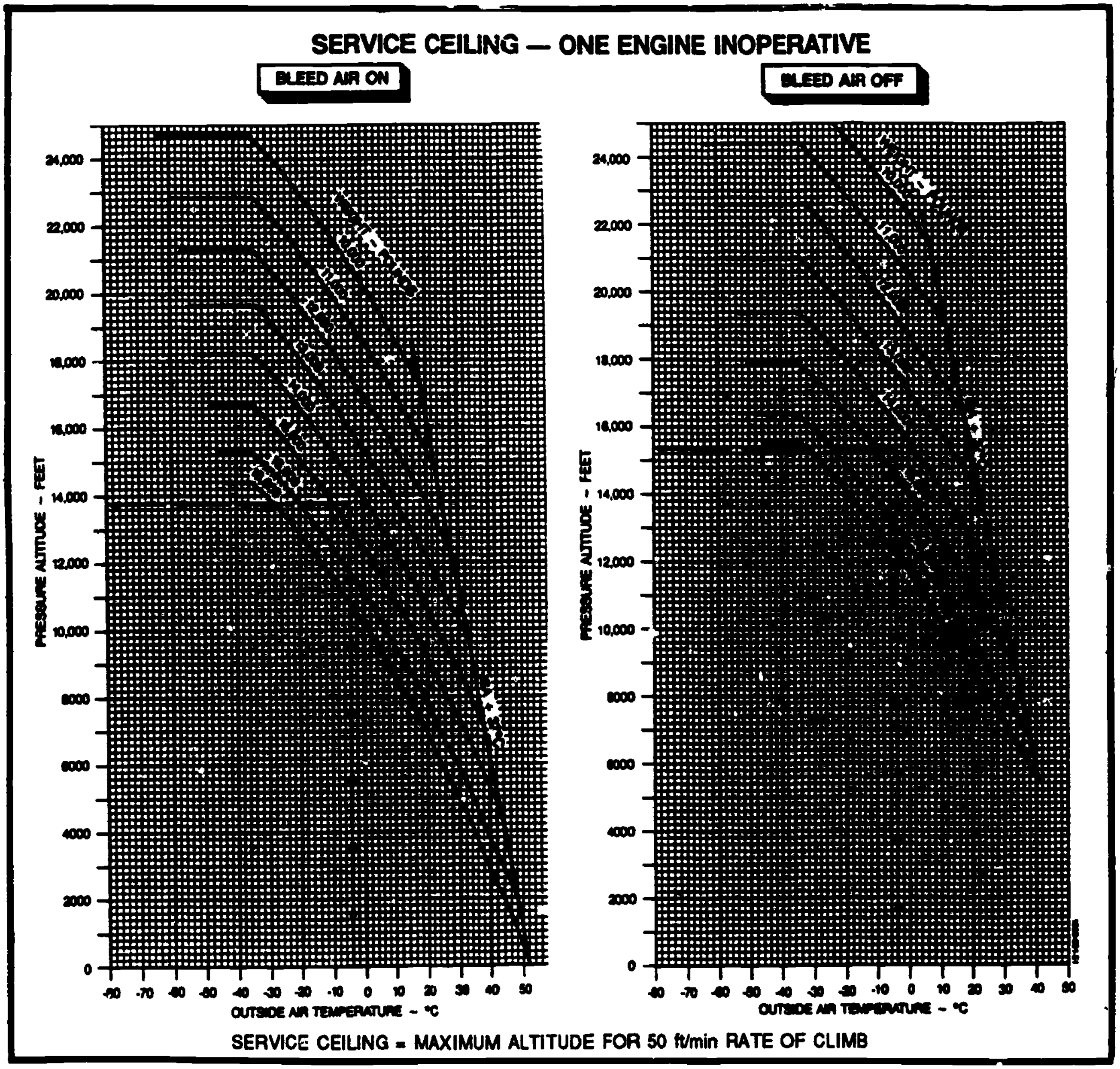

FIGURE 103.—Service Ceiling - One Engine Inoperative.

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RECOMMENDED CRUISE POWER

1550 RPM

ISA +10°C

WEIGHT →			16,000 POUNDS					14,000 POUNDS					12,000 POUNDS					10,000 POUNDS				
PRESSURE ALTITUDE	IOAT	OAT	TORQUE PER ENG	FUEL FLOW PER ENG	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENG	FUEL FLOW PER ENG	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENG	FUEL FLOW PER ENG	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENG	FUEL FLOW PER ENG	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	FT-LBS	LBS/HR	LBS/HR	KTS	KTS	FT-LBS	LBS/HR	LBS/HR	KTS	KTS	FT-LBS	LBS/HR	LBS/HR	KTS	KTS	FT-LBS	LBS/HR	LBS/HR	KTS	KTS
SL	30	25	3294	577	1154	232	239	3301	577	1154	235	241	3307	577	1154	237	243	3312	577	1154	238	245
2000	26	21	3191	551	1102	227	240	3198	551	1102	230	243	3204	552	1104	232	245	3209	552	1104	233	247
4000	22	17	3092	527	1054	222	242	3100	528	1056	224	244	3106	528	1056	227	247	3111	528	1056	228	249
6000	19	13	2992	504	1008	216	243	3000	505	1010	219	246	3006	505	1010	222	249	3012	505	1010	224	251
8000	15	9	2886	481	962	211	244	2896	482	964	214	247	2903	482	964	216	250	2909	482	964	219	253
10,000	11	5	2778	458	916	205	244	2789	458	916	208	248	2797	459	918	211	252	2804	459	918	213	254
12,000	7	1	2636	432	864	198	243	2648	433	866	202	248	2657	433	866	205	252	2664	434	868	207	255
14,000	3	-3	2495	408	816	190	241	2508	409	818	195	247	2518	409	818	198	251	2525	409	818	201	255
16,000	-1	-7	2352	384	768	182	239	2367	385	770	188	246	2378	385	770	192	251	2386	386	772	195	255
18,000	-6	-11	2208	361	722	174	235	2226	362	724	180	243	2239	363	726	185	250	2248	363	726	188	254
20,000	-10	-15	2063	338	676	164	229	2085	340	680	172	240	2100	341	682	177	248	2111	341	682	181	253
22,000	-14	-19	1911	316	632	153	221	1939	317	634	163	235	1957	319	638	169	245	1969	319	638	174	252
24,000	-19	-23	1749	292	584	137	206	1790	295	590	152	229	1812	297	594	161	241	1827	298	596	167	249
25,000	-21	-25	1649	279	558	122	187	1714	284	568	147	224	1739	286	572	156	238	1756	287	574	163	248

FIGURE 104.—Recommended Cruise Power - ISA +10° C.

RECOMMENDED CRUISE POWER

1500 RPM

ISA

WEIGHT — 16,000 POUNDS

PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENG FT-LBS	FUEL FLOW PER ENG LBS/HR	TOTAL FUEL FLOW LBS/HR	IAS KTS	TAS KTS
SL	20	15	3400	586	1172	237	239
2000	17	11	3400	573	1146	234	244
4000	13	7	3400	560	1120	232	248
6000	9	3	3397	548	1096	229	252
8000	5	-1	3253	521	1042	223	253
10,000	1	-5	3092	494	988	216	252
12,000	-3	-9	2929	466	932	208	251
14,000	-7	-13	2772	440	880	201	250
16,000	-11	-17	2606	414	828	193	248
18,000	-15	-21	2435	388	776	184	244
20,000	-19	-25	2263	363	726	175	239
22,000	-24	-29	2094	338	676	164	233
24,000	-28	-33	1931	315	630	152	223
25,000	-30	-35	1846	303	606	145	216

WEIGHT — 14,000 POUNDS

PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENG FT-LBS	FUEL FLOW PER ENG LBS/HR	TOTAL FUEL FLOW LBS/HR	IAS KTS	TAS KTS
SL	20	15	3400	585	1170	239	241
2000	17	11	3400	573	1146	236	246
4000	13	7	3400	559	1118	234	250
6000	9	3	3400	548	1096	231	255
8000	5	-1	3260	522	1044	225	256
10,000	1	-5	3100	494	988	219	256
12,000	-3	-9	2937	467	934	212	255
14,000	-7	-13	2781	441	882	205	255
16,000	-11	-17	2618	414	828	197	253
18,000	-15	-21	2449	389	778	189	251
20,000	-19	-25	2282	364	728	181	248
22,000	-24	-29	2118	340	680	172	244
24,000	-28	-33	1960	317	634	163	238
25,000	-30	-35	1880	305	610	157	235

WEIGHT — 12,000 POUNDS

PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENG FT-LBS	FUEL FLOW PER ENG LBS/HR	TOTAL FUEL FLOW LBS/HR	IAS KTS	TAS KTS
SL	20	15	3400	585	1170	241	243
2000	17	11	3400	572	1144	238	248
4000	13	7	3400	559	1118	236	252
6000	9	3	3400	547	1094	233	257
8000	5	-1	3265	522	1044	228	258
10,000	1	-5	3107	495	990	221	258
12,000	-3	-9	2945	467	934	214	258
14,000	-7	-13	2789	441	882	208	258
16,000	-11	-17	2626	415	830	201	258
18,000	-15	-21	2459	389	778	193	256
20,000	-19	-25	2294	365	730	186	254
22,000	-24	-29	2133	341	682	178	251
24,000	-28	-33	1979	318	636	169	248
25,000	-30	-35	1901	307	614	165	246

WEIGHT — 10,000 POUNDS

PRESSURE ALTITUDE FEET	IOAT °C	OAT °C	TORQUE PER ENG FT-LBS	FUEL FLOW PER ENG LBS/HR	TOTAL FUEL FLOW LBS/HR	IAS KTS	TAS KTS
SL	20	15	3400	585	1170	242	244
2000	17	11	3400	572	1144	240	249
4000	13	7	3400	559	1118	237	254
6000	9	3	3400	547	1094	235	259
8000	5	-1	3270	522	1044	229	260
10,000	1	-5	3112	495	990	223	261
12,000	-3	-9	2950	467	934	217	261
14,000	-7	-13	2795	442	884	210	261
16,000	-11	-17	2633	415	830	203	261
18,000	-15	-21	2467	390	780	196	260
20,000	-19	-25	2302	365	730	189	259
22,000	-24	-29	2144	342	684	182	257
24,000	-28	-33	1991	319	638	174	255
25,000	-30	-35	1915	308	616	170	253

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FIGURE 105.—Recommended Cruise Power - ISA.

RECOMMENDED CRUISE POWER

1550 RPM

ISA -10° C

WEIGHT —			16,000 POUNDS					14,000 POUNDS					12,000 POUNDS					10,000 POUNDS				
PRESSURE-ALTITUDE	IOAT	OAT	TORQUE PER ENG	FUEL FLOW PER ENG	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENG	FUEL FLOW PER ENG	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENG	FUEL FLOW PER ENG	TOTAL FUEL FLOW	IAS	TAS	TORQUE PER ENG	FUEL FLOW PER ENG	TOTAL FUEL FLOW	IAS	TAS
FEET	°C	°C	FT-LBS	LBS/HR	LBS/HR	KTS	KTS	FT-LBS	LBS/HR	LBS/HR	KTS	KTS	FT-LBS	LBS/HR	LBS/HR	KTS	KTS	FT-LBS	LBS/HR	LBS/HR	KTS	KTS
SL	10	5	3400	582	1164	238	237	3400	582	1164	240	239	3400	581	1162	242	240	3400	581	1162	243	242
2000	6	1	3400	569	1138	236	241	3400	569	1138	238	243	3400	568	1136	240	245	3400	568	1136	241	246
4000	3	-3	3400	558	1116	233	245	3400	557	1114	236	248	3400	557	1114	237	249	3400	557	1114	239	251
6000	-1	-7	3400	548	1096	231	250	3400	547	1094	233	252	3400	547	1094	235	254	3400	546	1092	236	256
8000	-5	-11	3400	538	1076	228	254	3400	538	1076	231	257	3400	538	1076	232	259	3400	537	1074	234	261
10,000	-9	-15	3400	530	1060	226	259	3400	530	1060	228	262	3400	530	1060	230	264	3400	529	1058	232	266
12,000	-13	-19	3200	499	998	218	258	3208	500	1000	221	261	3215	500	1000	223	264	3220	501	1002	225	266
14,000	-17	-23	3010	470	940	210	256	3019	471	942	213	260	3026	471	942	216	263	3032	472	944	218	266
16,000	-21	-27	2823	442	884	202	254	2833	442	884	205	258	2841	443	886	209	262	2848	443	886	211	265
18,000	-25	-31	2641	414	828	193	251	2652	415	830	198	256	2661	416	832	201	261	2668	416	832	204	264
20,000	-29	-35	2456	387	774	184	247	2471	388	776	189	254	2481	389	778	193	259	2489	390	780	196	263
22,000	-33	-39	2277	361	722	174	242	2296	363	726	181	250	2308	363	726	185	256	2318	364	728	189	261
24,000	-37	-43	2105	336	672	163	234	2128	338	676	172	246	2144	339	678	177	254	2155	340	680	181	260
25,000	-40	-45	2017	324	648	157	230	2044	326	652	167	243	2061	327	654	173	252	2073	328	656	177	258

FIGURE 106.—Recommended Cruise Power - ISA -10° C.

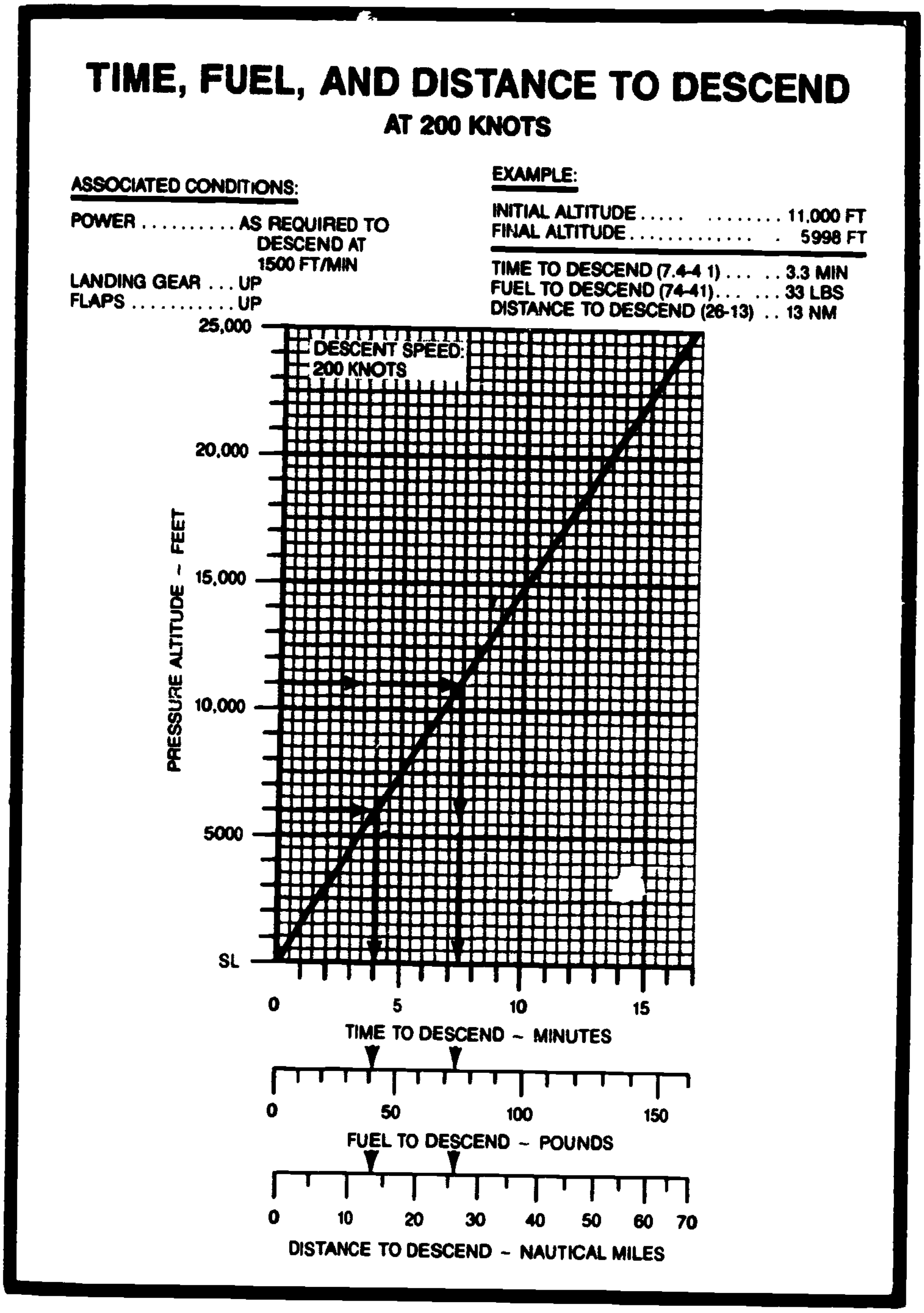

FIGURE 107.—Time, Fuel, and Distance to Descend.

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OPERATING CONDITIONS	B-36	B-37	B-38	B-39	B-40
PRESSURE ALTITUDE	SL	1,000	2,000	4,000	5,000
TEMPERATURE (OAT)	+30° C	+16° C	0° C	+20° C	ISA
WEIGHT	16,000	14,500	13,500	15,000	12,500
WIND COMPONENT (KTS)	20 HW	10 TW	15 HW	5 TW	25 HW
RUNWAY LENGTH (FT)	4,000	4,500	3,800	5,000	4,000

FIGURE 108.—Beech 1900 Landing.

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NORMAL LANDING DISTANCE — FLAPS LANDING

ANTI-SKID ON

ASSOCIATED CONDITIONS:

POWER .... RETARD TO MAINTAIN 800 FT/MIN ON FINAL APPROACH
RUNWAY .... PAVED, LEVEL, DRY SURFACE
APPROACH SPEED... IAS AS TABULATED
BRAKING........... MAXIMUM

WEIGHT ~ POUNDS	APPROACH SPEED ~ KNOTS
16,100	113
14,000	107
12,000	101
10,000	93

EXAMPLE:

OAT........................... 25°C
PRESSURE ALTITUDE.......... 5998 FT
LANDING WEIGHT............. 14,182 LBS
HEADWIND COMPONENT....... 10 KTS

GROUND ROLL .... 1150 FT
TOTAL OVER 50-FT OBSTACLE... 2195 FT
APPROACH SPEED .... 108 KTS

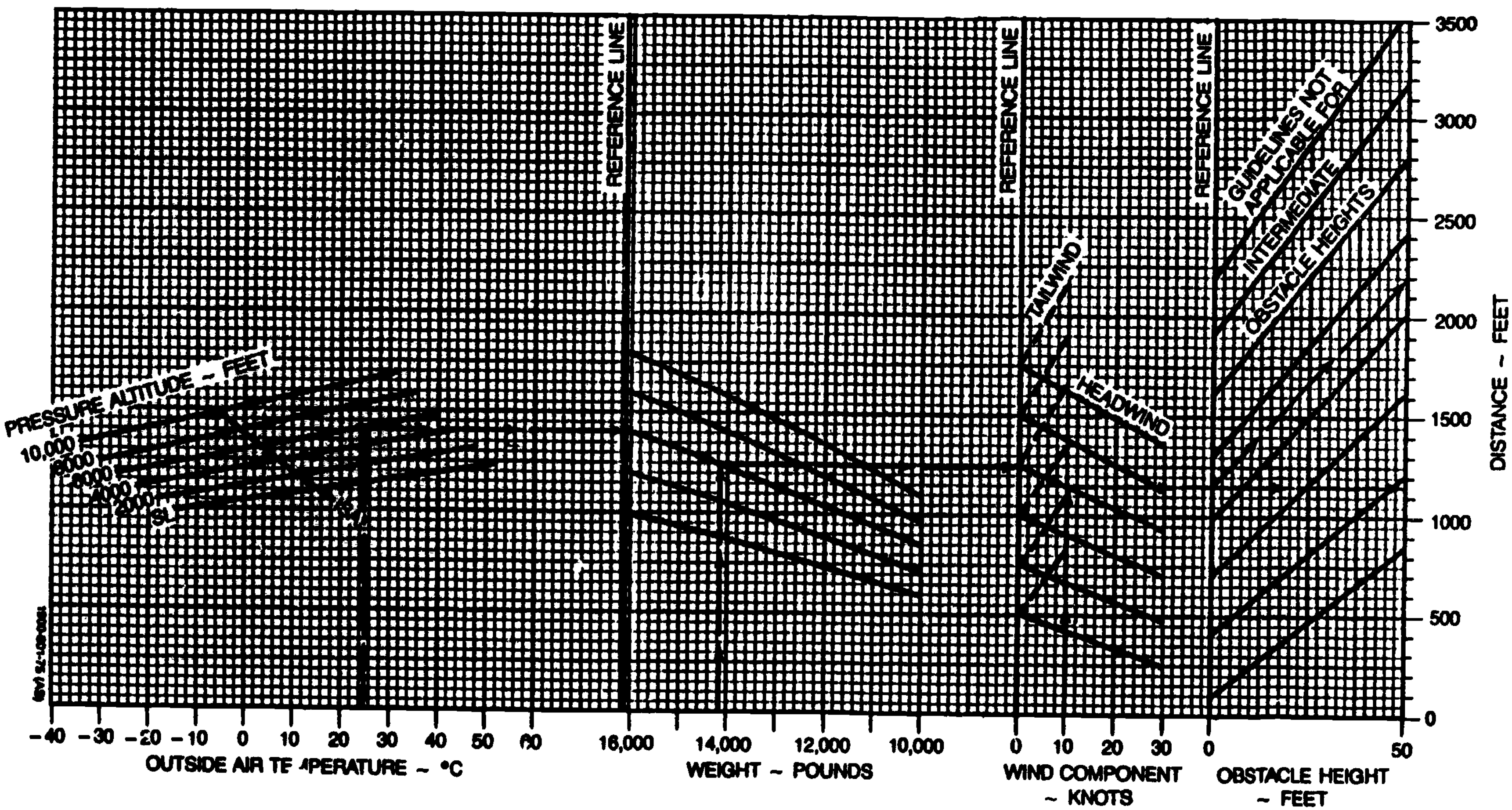


FIGURE 109.—Normal Landing Distance - Flaps Landing.

MODEL 214ST
POWER ASSURANCE CHECK
GROUND OPERATION
GENERAL ELECTRIC CT-7-2A ENGINE

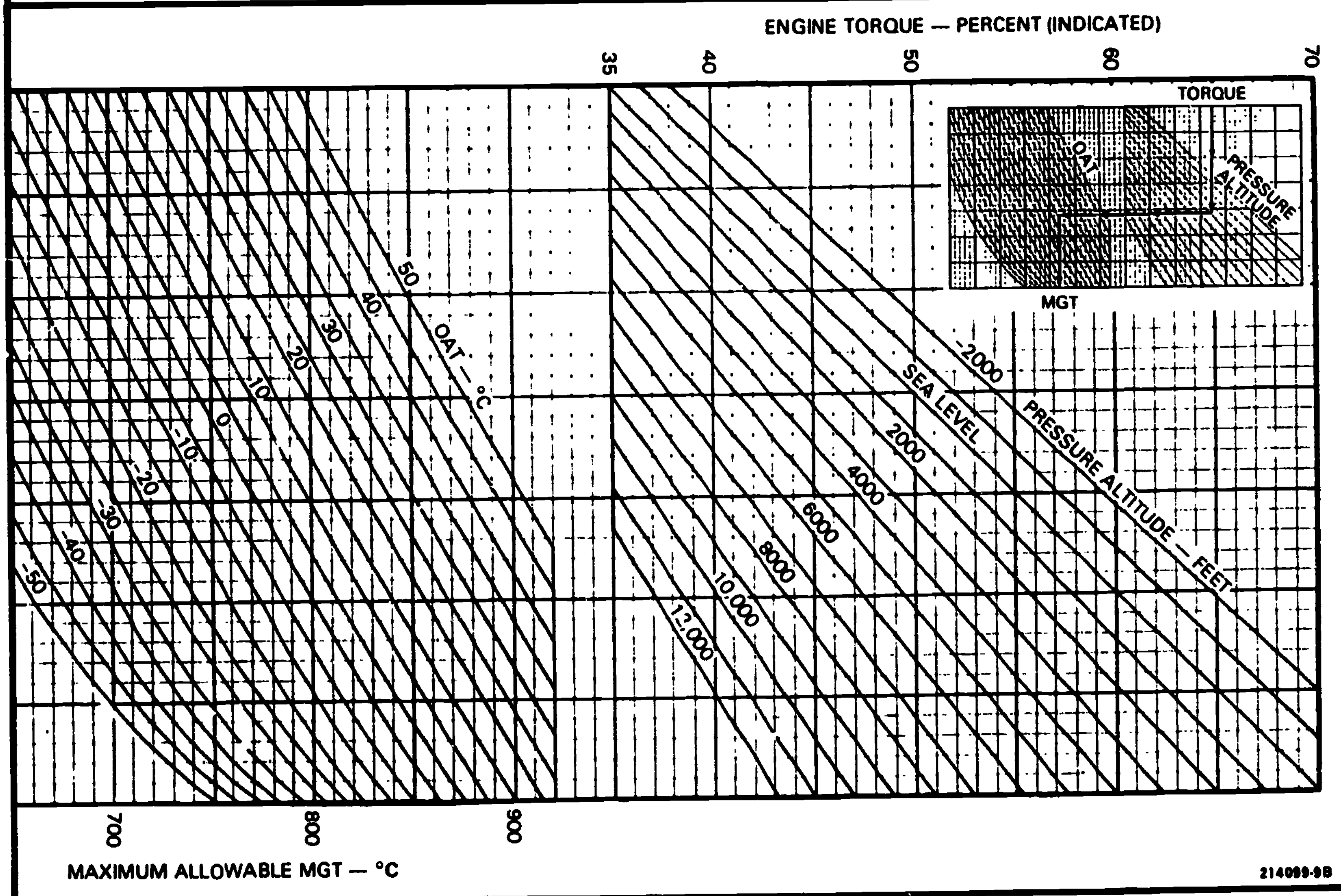


FIGURE 110.—Power Assurance Check.

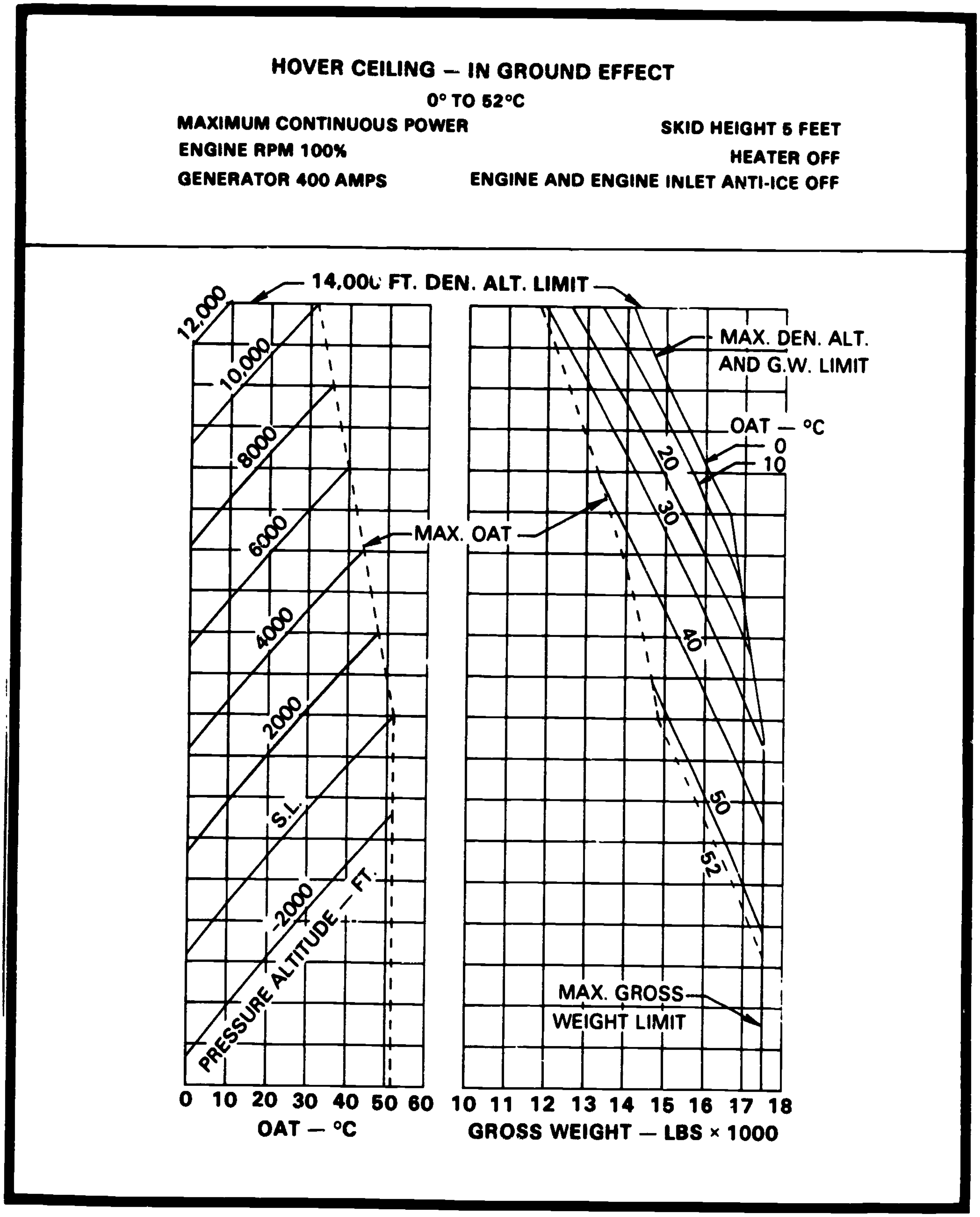


FIGURE 111.—Hovering Ceiling - In Ground Effect.

HOVER CEILING — OUT OF GROUND EFFECT

0° TO 52°C

MAXIMUM CONTINUOUS POWER | **SKID HEIGHT 100 FEET**
ENGINE RPM 100% | **HEATER OFF**
GENERATOR 400 AMPS | **ENGINE AND ENGINE INLET ANTI-ICE OFF**

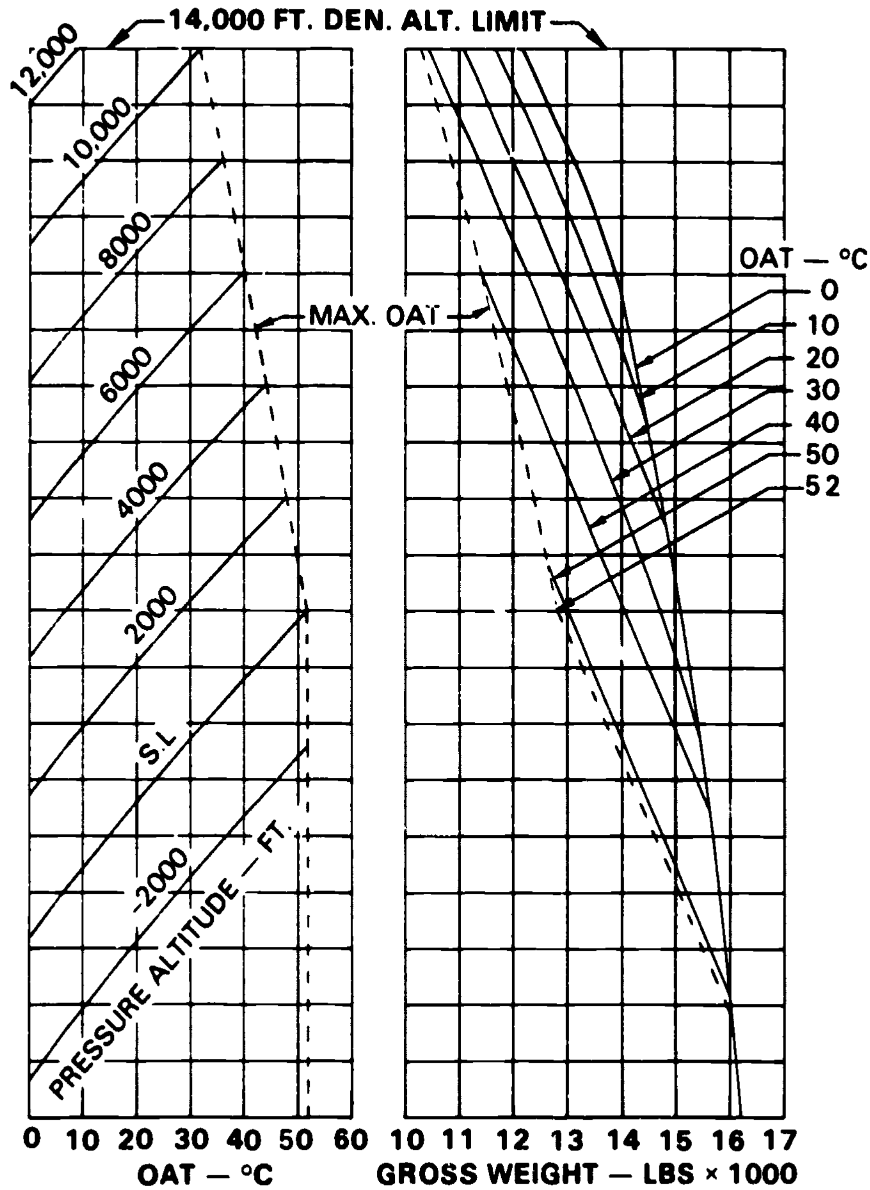


FIGURE 112.—Hovering Ceiling - Out of Ground Effect.

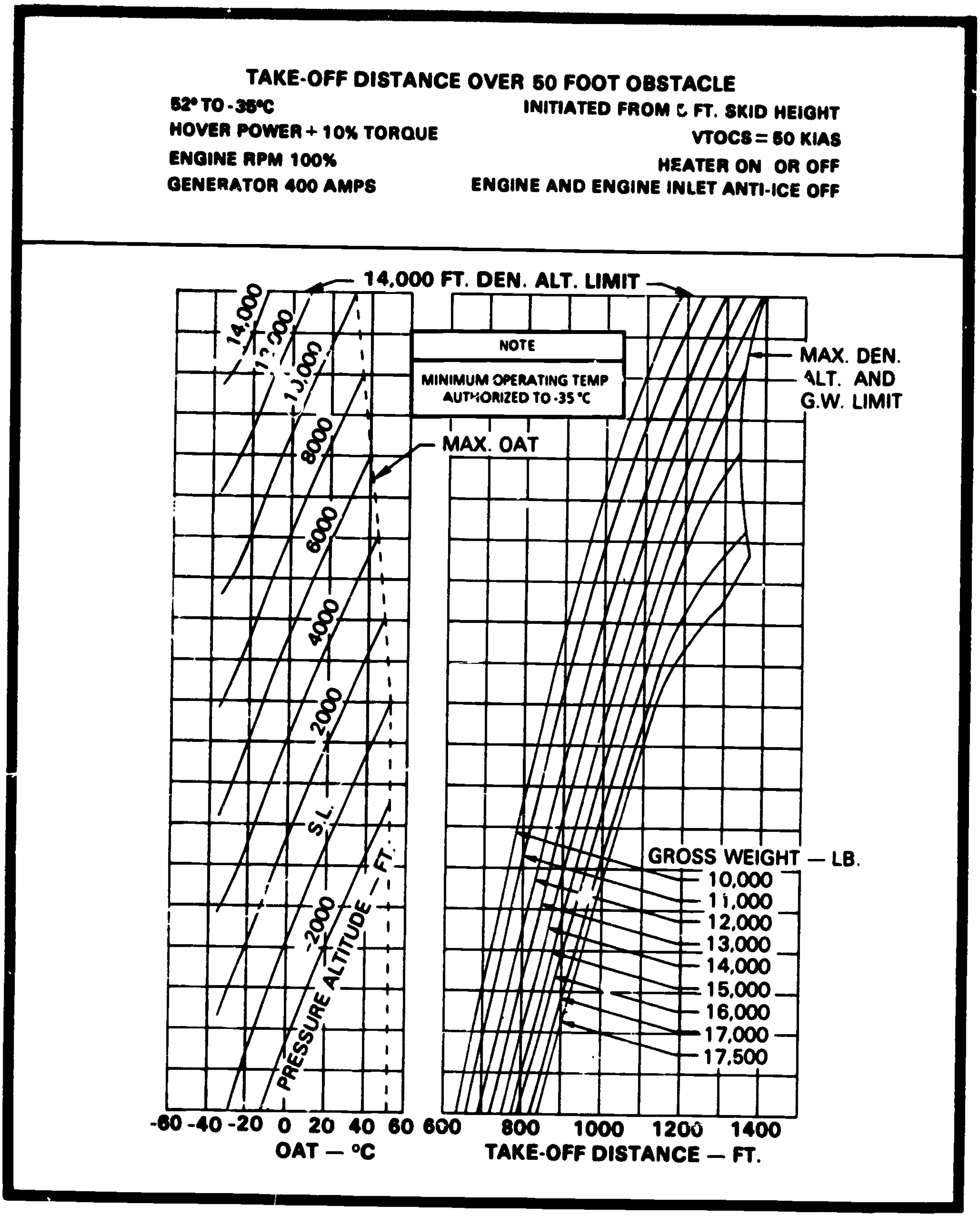


FIGURE 113.—Takeoff Distance Over 50-Foot Obstacle.

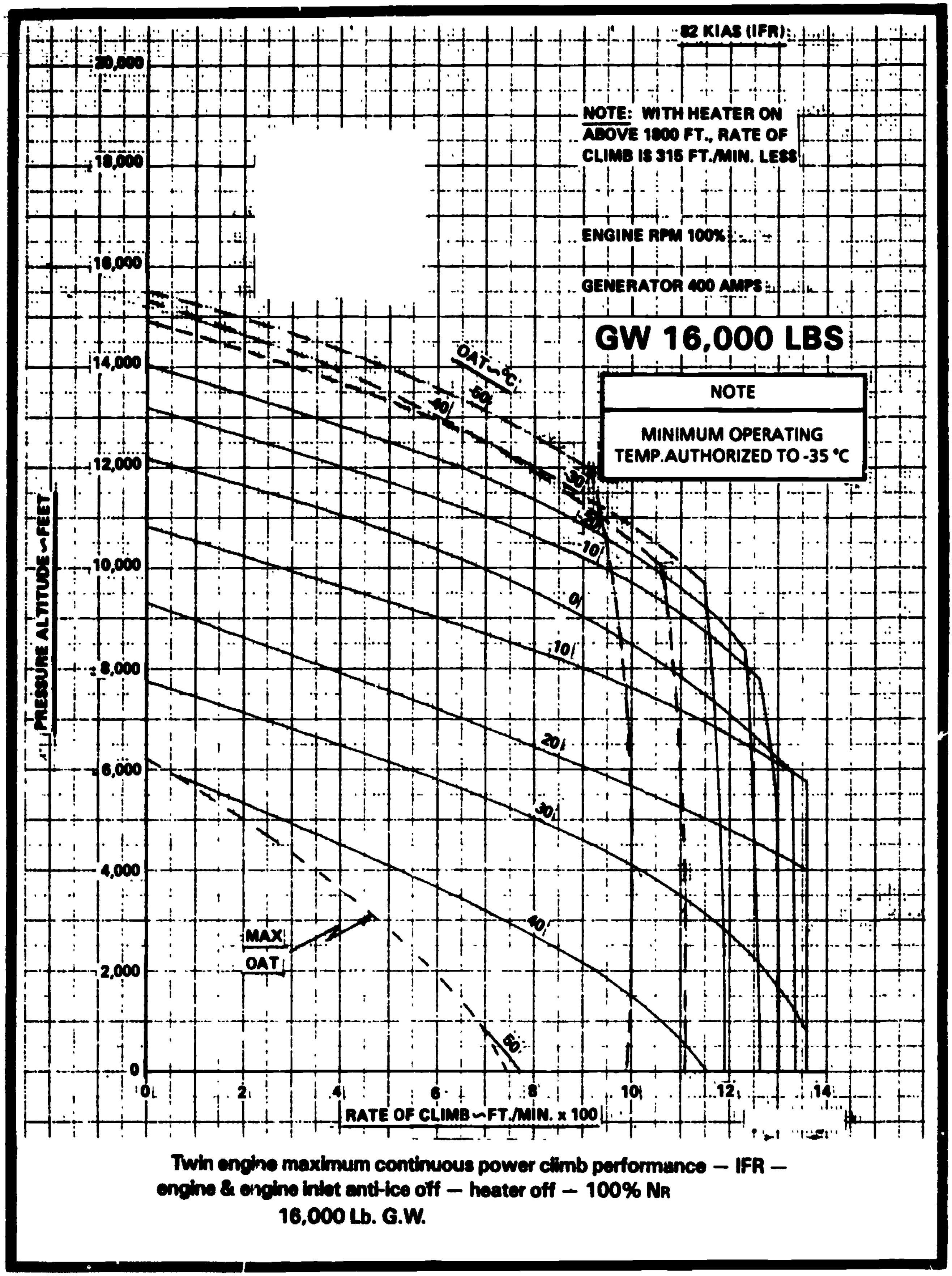
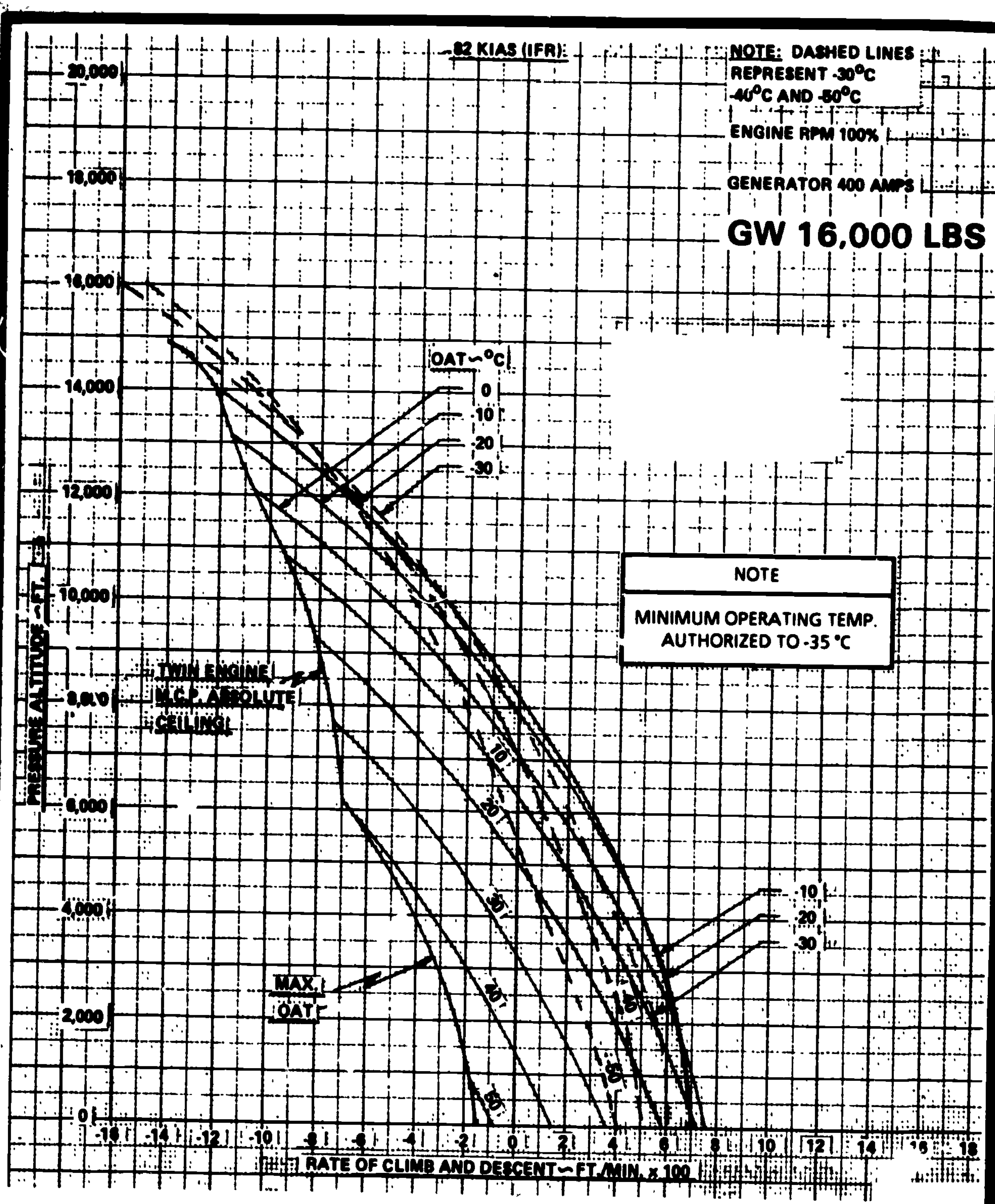


FIGURE 114.—Twin-Engine Climb Performance.



Single-engine maximum-continuous (OEI) power climb and descent — IFR — performance — engine & engine inlet anti-ice off — 100% NR 16,000 Lb. G.W.

FIGURE 115.—Single-Engine Climb Performance.

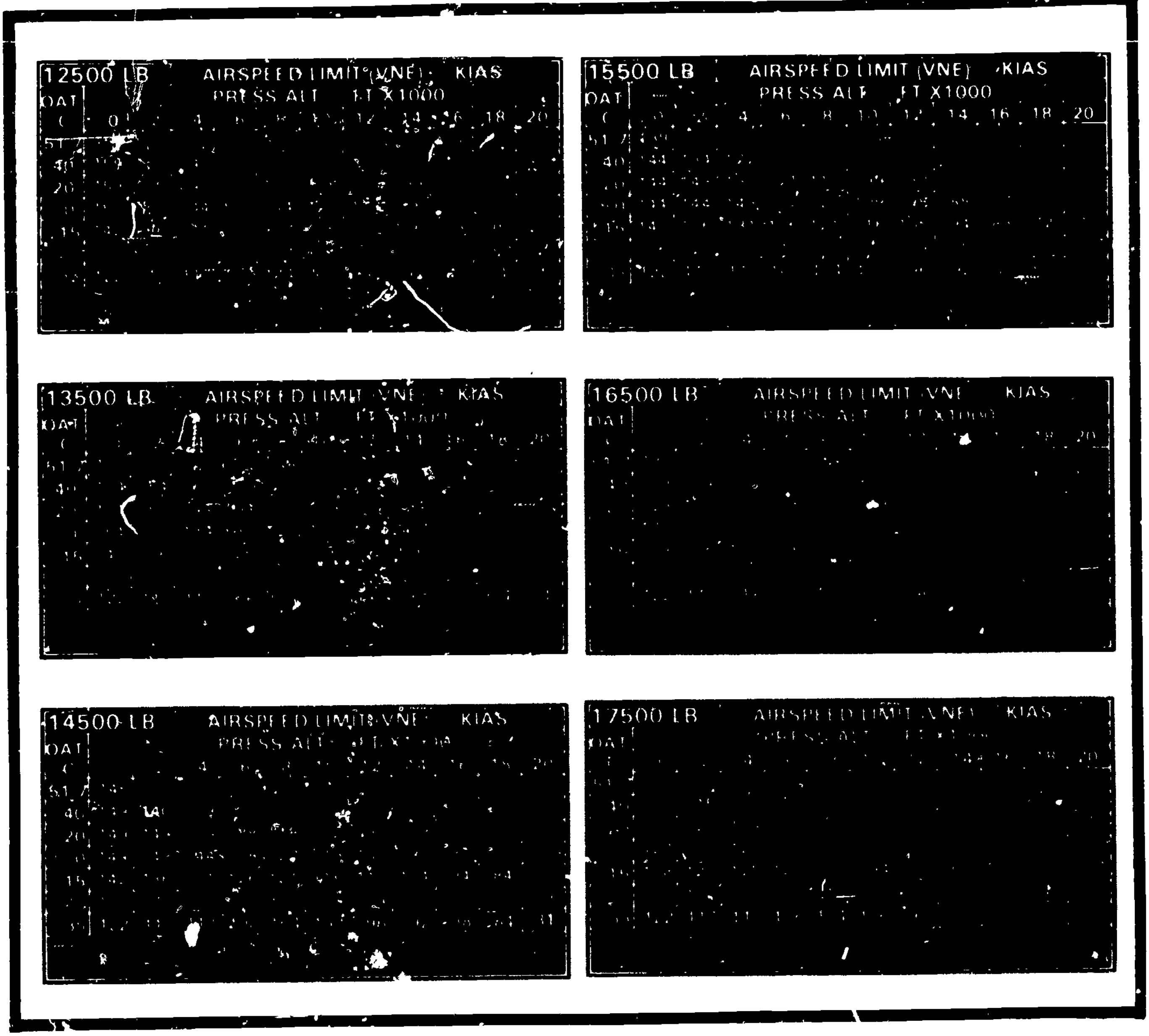


FIGURE 116 —Airspeed Limit

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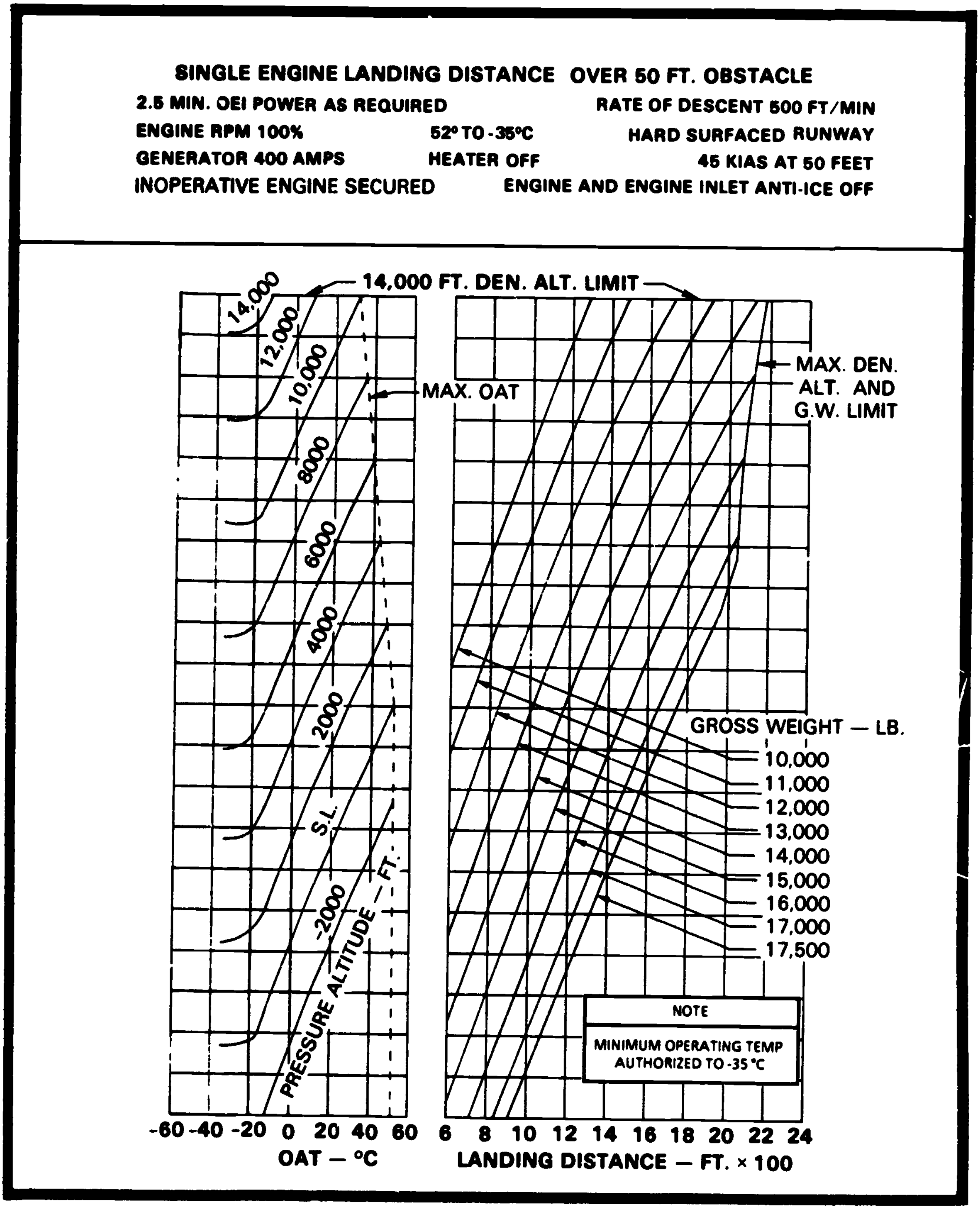

FIGURE 117.—Single-Engine Landing Distance Over 50-Foot Obstacle.

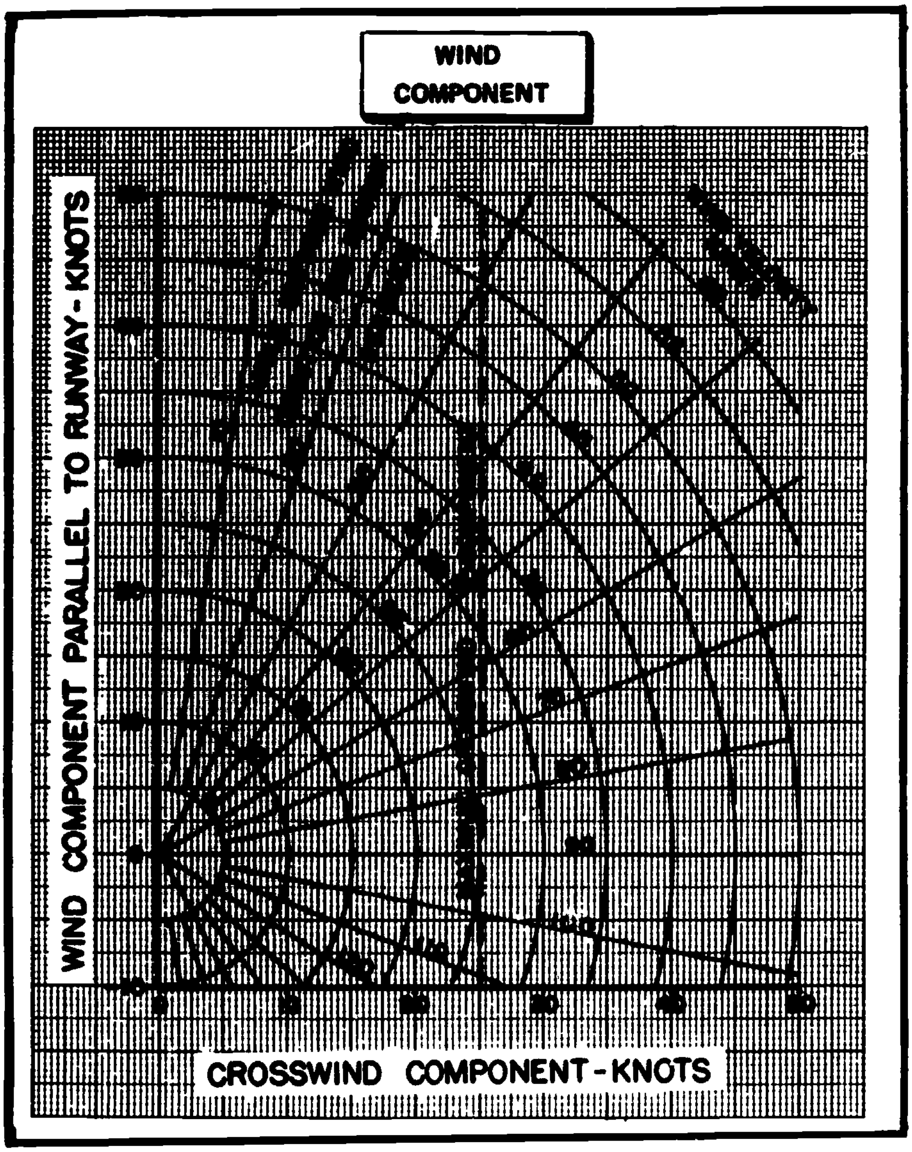

FIGURE 118.—Wind Component Chart.

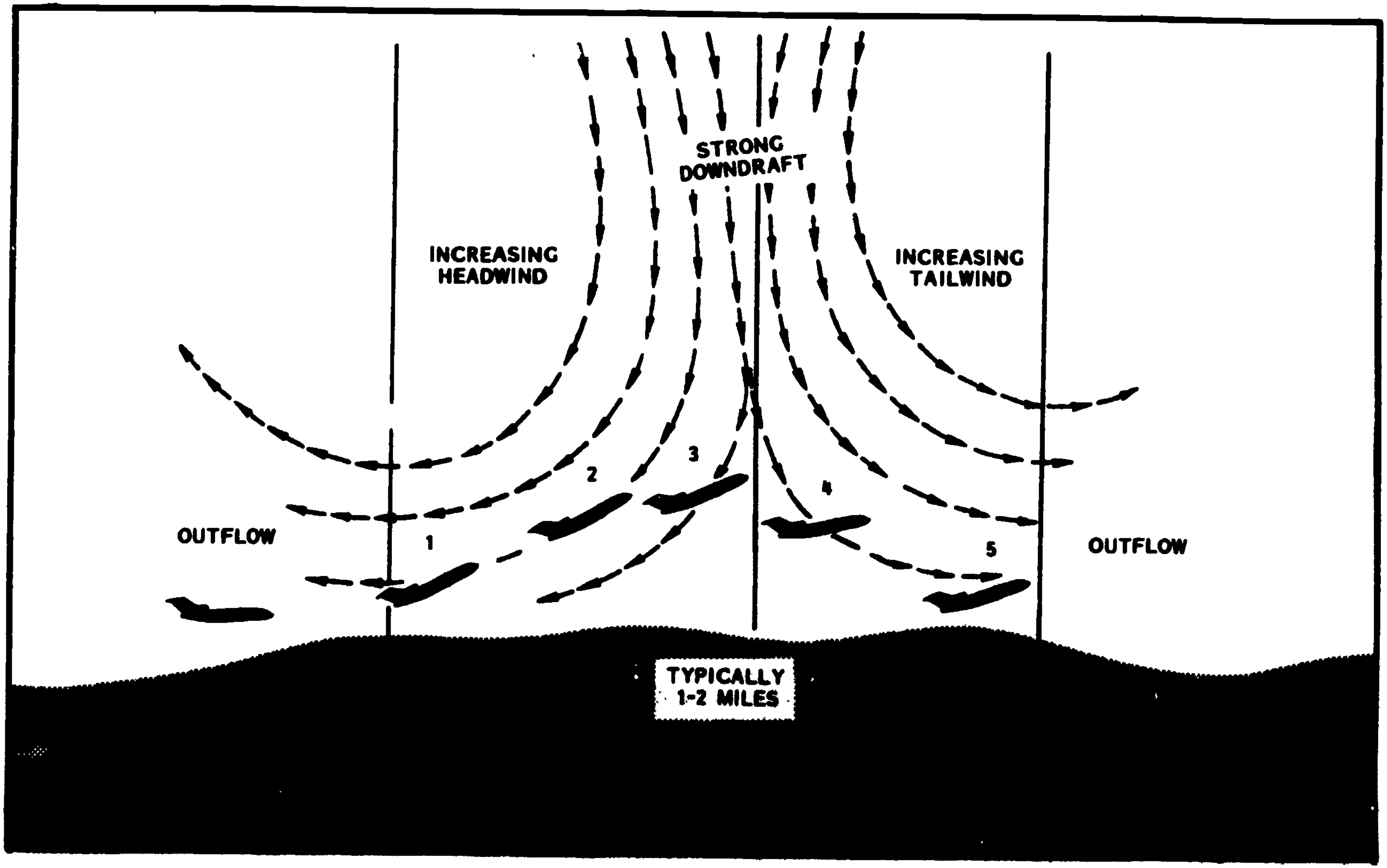

FIGURE 119.—Microburst Section Chart.

SURFACE AVIATION WEATHER REPORT

AUS SA 1753 4Ø SCT E25Ø BKN 8 17Ø/87/69/1911G17/ØØ6
BPT SA 1755 3Ø SCT E25Ø BKN 7 183/93/74/17Ø4/ØØ7
BRO SA 1755 34 SCT 25Ø -OVC 6H 163/93/74/1415/ØØ1
CDS SA 1758 E18 OVC 7RW- 183/73/69/1113/Ø12/RW+ E-S BINOVC
RB2Ø
CLL SA 1749 3Ø SCT 25Ø -BKN 7 181/93/69/2111/ØØ8
COT SA 1749 4Ø SCT 2ØØ SCT 1Ø 16Ø/87/7Ø/131Ø/ØØ2
CRP SA 1753 28 SCT E25Ø BKN 1Ø 169/9Ø/75/1616/ØØ3
DAL SA 1755 23 SCT E1ØØ OVC 7 87/71/16Ø5/ØØ7/HLYR
DFW SA 18ØØ 35 SCT E12Ø OVC 1Ø 174/85/68/17Ø7/ØØ8
DHT RS 1756 E25 BKN 15 2ØØ/72/59/Ø414/Ø26
DRT SA 1756 2Ø SCT E1ØØ BKN 25Ø OVC 1Ø 145/82/72/1212/ØØØ
ELP SA 1755 7Ø SCT 25Ø SCT 6Ø 131/84/56/Ø9Ø7/Ø15
FTW SA 175Ø 25 -SCT E1ØØ OVC 7 84/68/18Ø7/ØØ8
FTW UA /OV DFW 18ØØØ5/TM 18Ø3/FLØ95/TP PA3Ø/SK Ø36 OVC Ø6Ø/Ø7Ø OVC Ø75/OVC ABV
GGG SA 1745 25Ø SCT 15 89/69/15Ø8/Ø11
GLS SA 1755 25 SCT E2ØØ BKN 7 92/71
GLS SP 1811 AMOS 86/74/17Ø5/ØØ7/ØØØ
HOU SA 1752 3Ø SCT E25Ø OVC 7 89/7Ø/15Ø6/ØØ8
HRL SA 1753 E25Ø OVC 7 93/72/1415/ØØ2/ FEW CU E
IAH SA 1755 33 SCT E25Ø BKN 1Ø 181/87/73/12Ø7/ØØ7
INK SA 1755 E3Ø BKN 6Ø BKN 25Ø BKN 2Ø 144/81/61/Ø4Ø6/Ø88
LBB SA 175Ø E12 BKN 3Ø BKN 1ØØ BKN 12 164/7Ø/67/Ø4'3/Ø15/ RB15E4Ø
LBB SP 1818 15 SCT E3Ø BKN 1ØØ BKN 12 Ø412/Ø15
LBB UA /OV LBB Ø45ØØ2/TM 1821/FLØ6Ø/TP B727/SK Ø45 BKN Ø53 TOPS RGD
LFK SA 1756 3ØØ -BKN 7 182/91/66/24Ø7/ØØ8
MAF SA 1756 M25 BKN 25Ø OVC 12 142/8Ø/64/Ø22Ø/ØØ9 RWU E-S
MFE SA 1756 25Ø -BKN 7 151/92/66/1315/998
MRF SA 1752 AMOS E3Ø BKN 6Ø 125/81/57/Ø912/ØØØ/ PK WND 2Ø
MRF SP 1811 AMOS 83/58/Ø8Ø9/ØØØ PK WND 2Ø

FIGURE 120.—Surface Aviation Weather Report.

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SURFACE AVIATION WEATHER REPORT

MWL SA 1756 E11 BKN 5Ø OVC 1Ø E169/77/73/1311/ØØ6
PSX SA 1755 18 SCT E2ØØ OVC 7 183/87/76/2Ø1Ø/ØØ7
PVW SA 175Ø 12 SCT E3Ø OVC 1Ø 185/85/68/Ø5Ø6/Ø11/ BINOVC NE
SAT SA 1756 28 SCT E25Ø OVC 7 164/85/69/1518/ØØ5/ UA /OV SAT TM 1739/FL UNKN/TP UNKN/SK TOPS Ø4Ø
SJT SA 1755 E18 BKN 7Ø OVC 7 17Ø/77/72/2212/ØØ2
SPS RS 1757 9 SCT M25 OVC 6R- 185/75/71/Ø914/Ø11
SPS SP 182Ø M15 OVC 6R- 1Ø1Ø/Ø11
SPS UA /OV SPS/TM 1815/FLØ9Ø/TP C4Ø2/SK OVC Ø5Ø-Ø6Ø
TPL SA 1751 15 SCT 1ØØ SCT 25Ø -OVC 15 89/69/1715/ØØ7
VCT SA 1755 3Ø SCT E25Ø OVC 7 179/88/73/1713/ØØ5

AR

ELD SA 1755 25Ø -BKN 6H 19Ø/88/7Ø/Ø6Ø5/Ø1Ø
FSM SA 1756 E8Ø BKN 12Ø OVC 2Ø 191/86/69/28Ø5/Ø11
FSM UA /OV HRO-FSM/TM 1825/FL29Ø/TP B737/RM SCT TOPS 29Ø
FYV SA 1755 35 SCT E8Ø BKN 25Ø OVC 15 2Ø2/83/7Ø/17Ø5/Ø16/ RWU SE
HOT SA 1751 4Ø SCT E15Ø OVC 15 91/62/34Ø6/Ø1Ø
HRO RS 1755 2Ø SCT E35 BKN 13T 195/84/72/3ØØ7/Ø15/ TB3Ø S-SSW MOVG E FQT THDR
HRO SP 1825 E15 BKN 35 BKN 13TRW- 181ØG2Ø/Ø16/ T SE-W MOVG NE LTGICG RB25
LIT SA 1754 3Ø SCT E25Ø BKN 1Ø 182/93/69/Ø7Ø4/ØØ7
PBF SA 1753 4Ø SCT E1ØØ BKN 5H E183/95/68/29Ø7/ØØ7
TXK SA 1753 1ØØ SCT 2ØØ -BKN 7 92/66/25Ø3/Ø1Ø

FIGURE 121.—Surface Aviation Weather Report.

TERMINAL FORECAST

TX

ALI FT Ø31515 C12 BKN 6H 1415. 17Z C3Ø BKN 1515G25. 19Z 4Ø SCT C25Ø BKN 1515G25 SLGT CHC C2Ø BKN 3TRW. Ø1Z 15Ø SCT 1315. Ø7Z C8 BKN. Ø9Z IFR CIG. 14Z MVFR CIG..
AMA FT Ø31515 C1Ø BKN 8Ø BKN Ø512 OCNL C1Ø OVC 2TRW+. 18Z C2Ø BKN 8Ø OVC Ø315 OCNL C1Ø OVC 2TRW+. 14Z C1Ø OVC 5R-F Ø312. Ø9Z IFR CIG R F..
AUS FT COR Ø31615 1545 C25 BKN 1ØØ OVC 171Ø. 18Z C3Ø BKN 1ØØ OVC 171Ø CHC C1Ø OVC 1TRW. Ø4Z C14 BKN CHC C1Ø OVC 1TRW. Ø9Z MVFR CIG TRW..
BPT FT Ø31515 25 SCT 6H. 17Z 3Ø SCT 25Ø SCT 181Ø. Ø1Z 25Ø SCT. Ø9Z VFR. 1ØZ MVFR FK..
CRP FT Ø31515 2Ø SCT C25Ø BKN 1515G25. 18Z 3Ø SCT C25Ø BKN 1615G25 SLGT CHC TRW. Ø1Z 15Ø SCT 1615. Ø9Z VFR..
DAL FT Ø31515 3Ø SCT C1ØØ BKN. 17Z C3Ø BKN 1ØØ OVC CHC C1Ø OVC 2TRW. Ø1Z C2Ø BKN CHC 3TRW. Ø9Z MVFR CIG TRW..
DRT FT AMD 1 Ø31515 152ØZ C14 OVC 141Ø. 16Z C2Ø BKN 1ØØ OVC 141Ø CHC 3TRW. 19Z C3Ø BKN 1ØØ BKN 1412 CHC C2Ø BKN 3TRW. Ø2Z 35 SCT C8Ø BKN CHC C2Ø BKN 3TRW. Ø9Z MVFR CIG TRW..
ELP FT Ø31515 7Ø SCT 1ØØ SCT. 17Z 7Ø SCT C12Ø BKN Ø812 CHC C5Ø BKN 5TRW G35. Ø8Z C7Ø BKN Ø712 SLGT CHC RW-. Ø9Z MVFR CIG..
HOU FT Ø31515 2Ø SCT 6H. 17Z 35 SCT 25Ø SCT 181Ø. Ø1Z 25Ø SCT. Ø9Z VFR. 11Z MVFR FK..
IAH FT Ø31515 2Ø SCT 6H. 17Z 35 SCT 25Ø SCT 181Ø. Ø1Z 25Ø SCT. Ø9Z VFR. 11Z MVFR FK..
INK FT Ø31515 2Ø SCT 1ØØ SCT 1Ø1Ø. 16Z C25 BKN 8Ø BKN Ø813 CHC C1Ø OVC 1TRW+A G35. Ø4Z C2Ø BKN 5Ø OVC Ø513 OCNL C1Ø OVC 1TRW+. Ø9Z MVFR CIG R F. 11Z IFR CIG R F..
LBB FT Ø31515 C1Ø BKN 5Ø OVC Ø612 CHC 1Ø SCT C2Ø OVC 3TRW. 17Z C2Ø BKN 6Ø OVC Ø415 OCNL C1Ø OVC 1TRW+. Ø4Z C1Ø OVC 4R-F OCNL 1TRW+. Ø9Z IFR CIG R F..
SAT FT Ø31515 C16 BKN 6H 171Ø. 17Z C25 BKN 1715. 19Z C3Ø BKN 25Ø OVC 1715 CHC C2Ø BKN 3TRW. Ø5Z C14 BKN CHC 3TRW. Ø9Z MVFR CIG TRW..
SJT FT Ø31515 C15 BKN 5Ø OVC 121Ø OCNL C8 OVC 4TRW. 2ØZ C25 BKN 7Ø OVC Ø912 OCNL C8 OVC 1TRW+. Ø9Z IFR CIG R F..
SPS FT Ø31515 3Ø SCT C8Ø BKN Ø712 CHC C1Ø OVC 2TRW. Ø9Z MVFR CIG TRW..

FIGURE 122.—Terminal Forecast.

AREA FORECAST

DFWH FA Ø31Ø4Ø
HAZARDS VALID UNTIL Ø323ØØ
OK TX AR LA TN MS AL AND CSTL WTRS
FLT PRCTNS...IFR...OK TX
...MTN OBSCN...TN AL
...TSTMS...OK AR TN AL

TSTMS IMPLY PSBL SVR OR GTR TURBC SVR ICG AND LLWS
NON MSL HGTS NOTED BY AGL OR CIG
THIS FA ISSUANCE INCORPORATES THE FOLLOWING AIRMETS STILL IN EFFECT...NONE
...
DFWS FA Ø31Ø4Ø
SYNOPSIS VALID UNTIL Ø4Ø5ØØ
AT 11Z STNRY FNT ALG LOU MEM ABI MRF LN. LGT MOIST NELY LOW LVL FLOW N OF FNT. S OF FNT MDT SELY LOW LVL FLOW FM GLF OVR TX AND LGT WNDS ELSW. LTL CHG IN SYNOPTIC PATTERN THRU PD.
...
DFWI FA Ø31Ø4Ø
ICING AND FRZLVL VALID UNTIL Ø323ØØ
NO SGFNT ICING EXPCD OUTSIDE CNVTV ACTVTY.
FRZLVL 13Ø N PTN TO 16Ø S PTN OF AREA.
...
DFWT FA Ø31Ø4Ø
TURBC VALID UNTIL Ø323ØØ
NO SGFNT TURBC EXPCD OUTSIDE CNVTV ACTVTY.
...
DFWC FA Ø31Ø4Ø SGFNT CLOUD AND WX VALID UNTIL Ø323ØØ...OTLK Ø323ØØ-Ø4Ø5ØØ
IFR...TX OK
FM LAR TO OSW TO SAT TO MAF TO LAR
CIGS BLO 1Ø VSBYS AOB 3F. CONDS IMPVG AFT 19Z.
MTN OBSCN...TN AL
FM BML TO AGS TO BMH TO LOZ TO BML
MTNS ERN TN AND NERN AL OCNLY OBSCD IN CLDS AND PCPN.
TX OK N OF ROW MAF SAT OSW LN
CIGS BLO 1Ø VSBYS AOB 3F WITH MEGG LYRS TO ABV 24Ø. WDLY SCT LGT RAIN. CONDS BCMG BY 19Z CIGS 15-25 BKN-OVC AND MEGG LYRS TO ABV 24Ø WITH SCT LGT RAIN AND WDLY SCT EMBDD RSHWRS. RSHWRS BCMG TSHWRS 17Z-23Z. CB TOPS TO 35Ø. OTLK...MVFR CIGS F TRW BCMG IFR CIG BY Ø5Z.
.
RMNDR TX
VSBYS 3-5H ERN PTN AND OCNL CIGS 1Ø-3Ø OVC 5Ø MSTLY CNTRL PTN. AFT 17Z CONDS BCMG CU 3Ø-4Ø SCT-BKN 1ØØ. OTLK...MVFR CIG TRW.
RMNDR OK AR EXTRM WRN TN
GNLY 9Ø OVC WITH MEGG LYRS TO 16Ø EXCP OCNL CIGS 15-25 OVC IN SCT TRW-. CB TOPS TO 35Ø. OTLK...MVFR CIG TRW.

FIGURE 123.—Area Forecast.

CONVECTIVE SIGMET

MKCC WST Ø31755
CONVECTIVE SIGMET 42C
VALID UNTIL 1955Z
TX OK
FROM 5W MLC–PEQ–SJT–5W MLC
AREA SCT EMBDD TSTMS MOVG LTL. TOPS 3ØØ.

CONVECTIVE SIGMET 43C
VALID UNTIL 1955Z
CO KS OK
FROM AKO–OSW–3ØWNW OKC–AKO
AREA SCT TSTMS OCNLY EMBDD MOVG FROM 322Ø. TOPS 38Ø.

CONVECTIVE SIGMET 44C
VALID UNTIL 1955Z
50NE MEM
ISOLD INTSD LVL5 TSTM DIAM 1Ø MOVG FROM 2625. TOP ABV 45Ø.

OUTLOOK VALID UNTIL 2355Z
TSTMS OVR TX AND SE OK WL MOV SEWD 15 KTS.
TSTMS OVR CO, KS, AND N OK WL CONT MOVG SEWD 2Ø KTS.
TSTM OVR TN WL CONT MOVG EWD 25 KTS.

FIGURE 124.—Convective Sigmet.

WINDS AND TEMPERATURES ALOFT FORECAST

DATA BASED ON Ø312ØØZ
VALID Ø4ØØØØZ FOR USE 18ØØ-Ø3ØØZ. TEMPS NEG ABV 24ØØØ

FT	3ØØØ	6ØØØ	9ØØØ	12ØØØ	18ØØØ	24ØØØ	3ØØØØ	34ØØØ	39ØØØ
ABI		13Ø6+16	16Ø7+11	18Ø7+Ø6	21Ø8-Ø7	22Ø8-18	24Ø833	25Ø942	3ØØ753
ABO			Ø81Ø+14	Ø511+Ø8	3415-Ø6	322Ø-18	312333	312543	3Ø2554
AMA		Ø614	Ø814+1Ø	Ø7Ø9+Ø5	321Ø-Ø7	2914-19	281934	282243	292554
ATL	Ø9Ø6	99ØØ+17	99ØØ+12	Ø2Ø5+Ø7	35Ø7-Ø7	33Ø5-19	29Ø534	28Ø543	99ØØ54
BNA	99ØØ	99ØØ+17	32Ø5+12	31Ø9+Ø7	3Ø18-Ø7	2918-19	272134	262444	262855
BRO	151Ø	1614+2Ø	1611+14	17Ø8+Ø8	99ØØ-Ø7	99ØØ-19	99ØØ34	99ØØ43	99ØØ55
DAL	Ø91Ø	17Ø6+17	2ØØ9+11	2Ø11+Ø6	2Ø15-Ø8	2214-19	231333	241342	271153
DEN			99ØØ+Ø9	99ØØ+Ø4	3Ø2Ø-1Ø	3Ø29-21	3Ø3636	3Ø4145	294756
DSM	3615	3315+Ø7	3118+Ø4	3Ø22+ØØ	2835-12	2748-24	276438	277348	277957
ELP		Ø61Ø	Ø614+13	Ø615+Ø8	Ø113-Ø5	3614-17	361433	361442	251354
GCK		Ø611+11	Ø8Ø9+Ø8	99ØØ+Ø3	2817-Ø9	2823-2Ø	273135	273644	284155
HLC		Ø4Ø9+Ø9	Ø4Ø5+Ø7	31Ø6+Ø2	2822-1Ø	273Ø-21	273936	274545	275256
HOU	Ø9Ø9	16Ø7+19	16Ø6+13	16Ø6+Ø7	16Ø5-Ø8	99ØØ-2Ø	99ØØ34	99ØØ43	99ØØ54
ICT	Ø516	Ø613+12	Ø6Ø7+Ø8	99ØØ+Ø4	2718-Ø9	2626-2Ø	263635	264144	274655
IND	3611	32Ø7+12	2912+Ø8	2818+Ø3	2733-Ø9	2643-21	265635	265944	256255
INK		Ø6Ø9+16	Ø7Ø9+12	Ø6Ø8+Ø7	Ø1Ø7-Ø6	36Ø7-18	35Ø833	34Ø842	35Ø855
JAN	3612	3613+18	3611+13	36Ø9+Ø7	Ø1Ø5-Ø8	99ØØ-19	99ØØ34	99ØØ43	23Ø854
LIT	Ø31Ø	36Ø8+16	32Ø6+11	28Ø8+Ø6	2517-Ø8	2518-19	252Ø34	252243	262454
LOU	Ø1Ø5	99ØØ+15	29Ø8+1Ø	2913+Ø5	2825-Ø8	2731-2Ø	263834	264143	254454
MEM	Ø1Ø9	Ø1Ø8+17	34Ø8+12	311Ø+Ø6	2916-Ø7	2717-19	261934	262144	262555
MKC	Ø316	Ø211+11	34Ø9+Ø7	3Ø13+Ø3	2728-1Ø	2638-21	265Ø36	265645	276356
MSY	Ø315	Ø216+19	Ø315+13	Ø414+Ø7	Ø51Ø-Ø8	Ø6Ø5-2Ø	99ØØ34	99ØØ43	21Ø854
OKC	Ø715	Ø81Ø+14	11Ø6+1Ø	99ØØ+Ø5	2414-Ø8	2419-19	252534	252743	272754
SAT	11Ø7	1713+18	1813+13	1911+Ø7	2ØØ6-Ø7	19Ø6-19	18Ø734	17Ø743	99ØØ54
SGF	Ø414	Ø41Ø+14	36Ø5+Ø9	29Ø8+Ø4	2624-Ø9	2632-2Ø	254135	264444	264655
SHV	Ø5Ø9	99ØØ+18	99ØØ+12	21Ø6+Ø6	2Ø12-Ø8	21Ø9-19	22Ø734	24Ø743	26Ø754
STL	Ø314	Ø11Ø+12	321Ø+Ø8	2915+Ø3	273Ø-Ø9	2741-21	265435	265744	266Ø55
TUS		Ø8Ø7+23	Ø814+16	Ø814+1Ø	Ø81Ø-Ø5	Ø5Ø5-17	33Ø533	31Ø842	29Ø954

FIGURE 125.—Winds and Temperatures Aloft Forecast.

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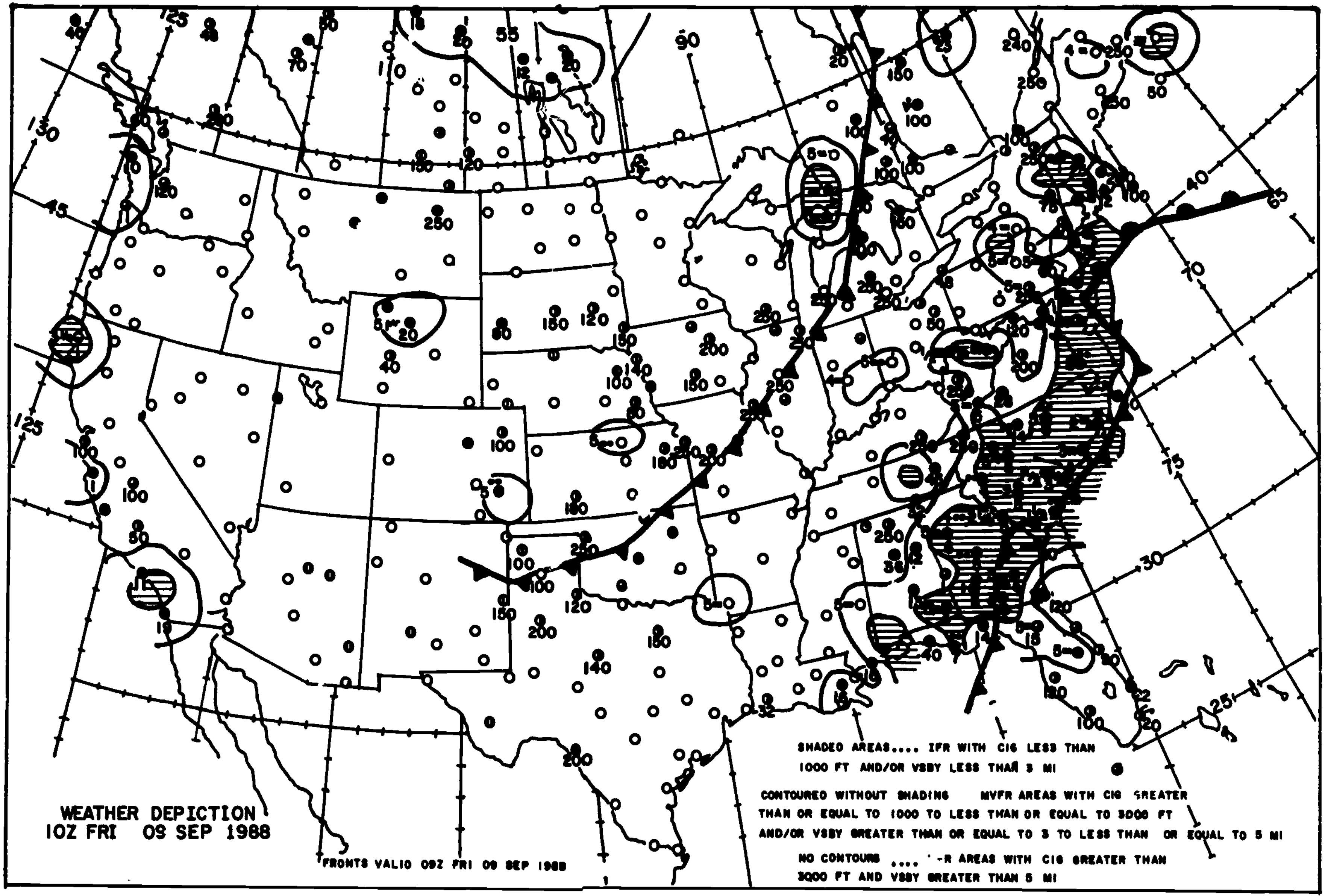

FIGURE 126.—Weather Depiction Chart.

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Appendix 3

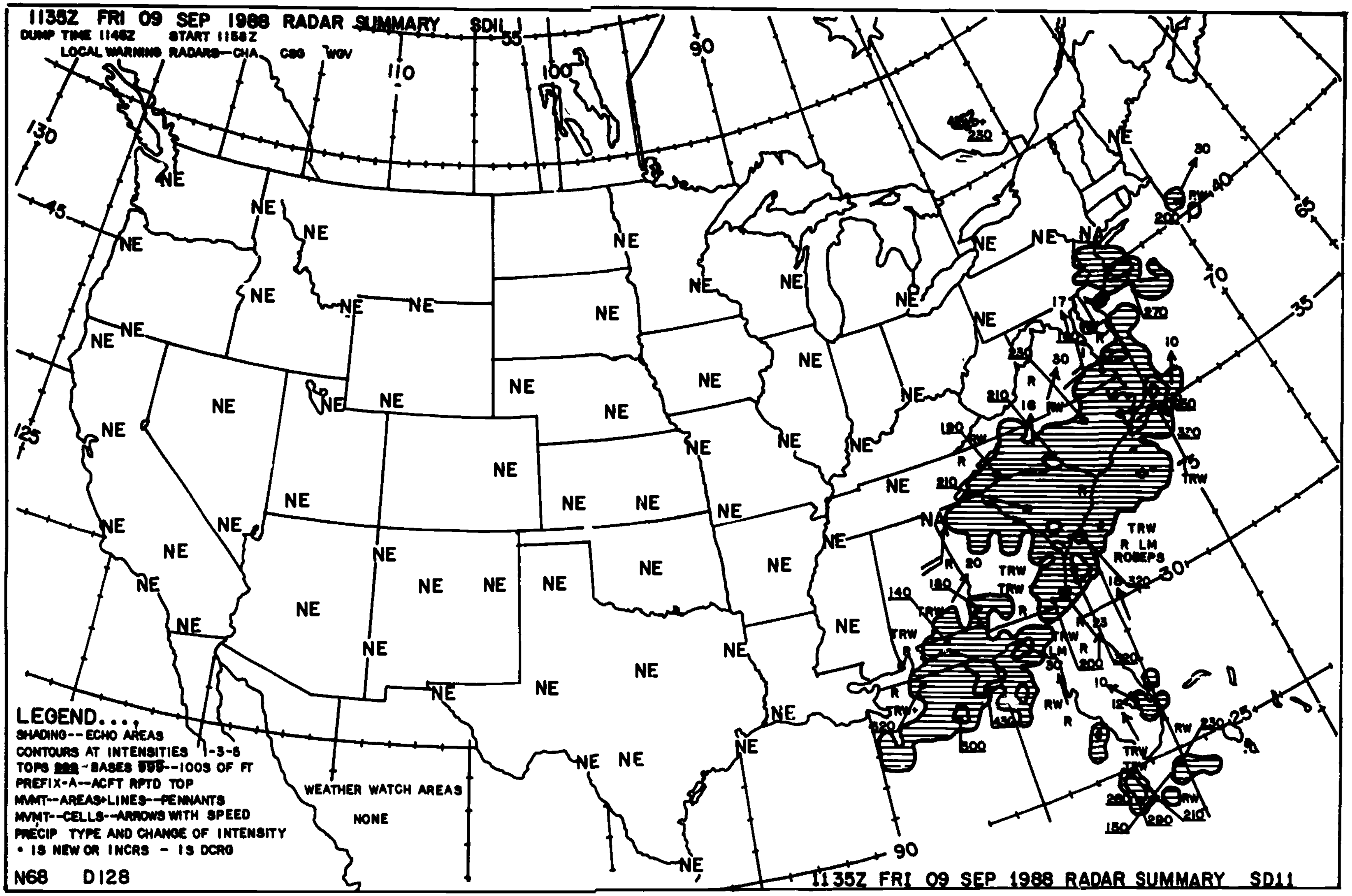


FIGURE 127.—Radar Summary Chart.

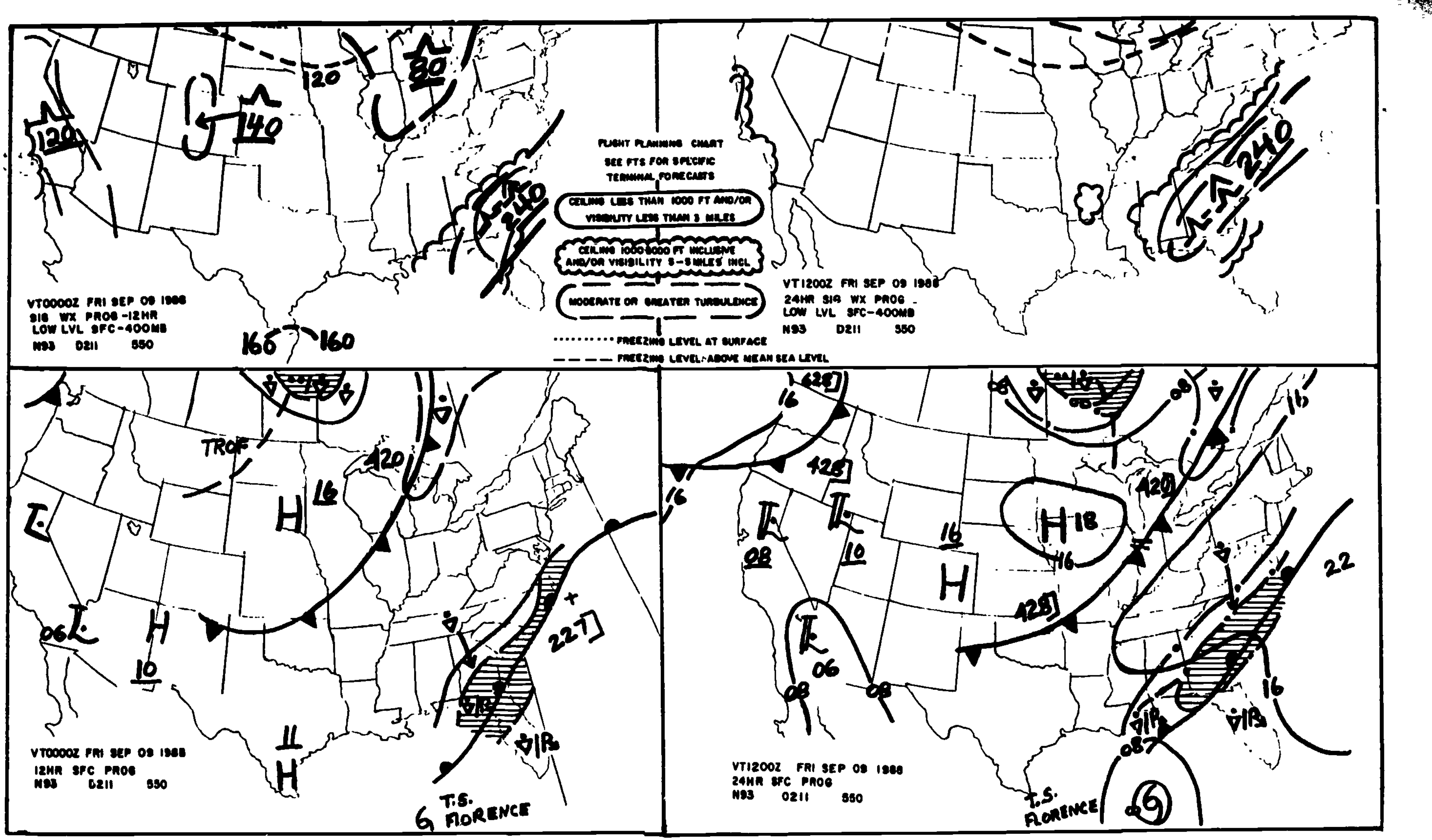


FIGURE 128.—Significant Weather Prognostic Chart.

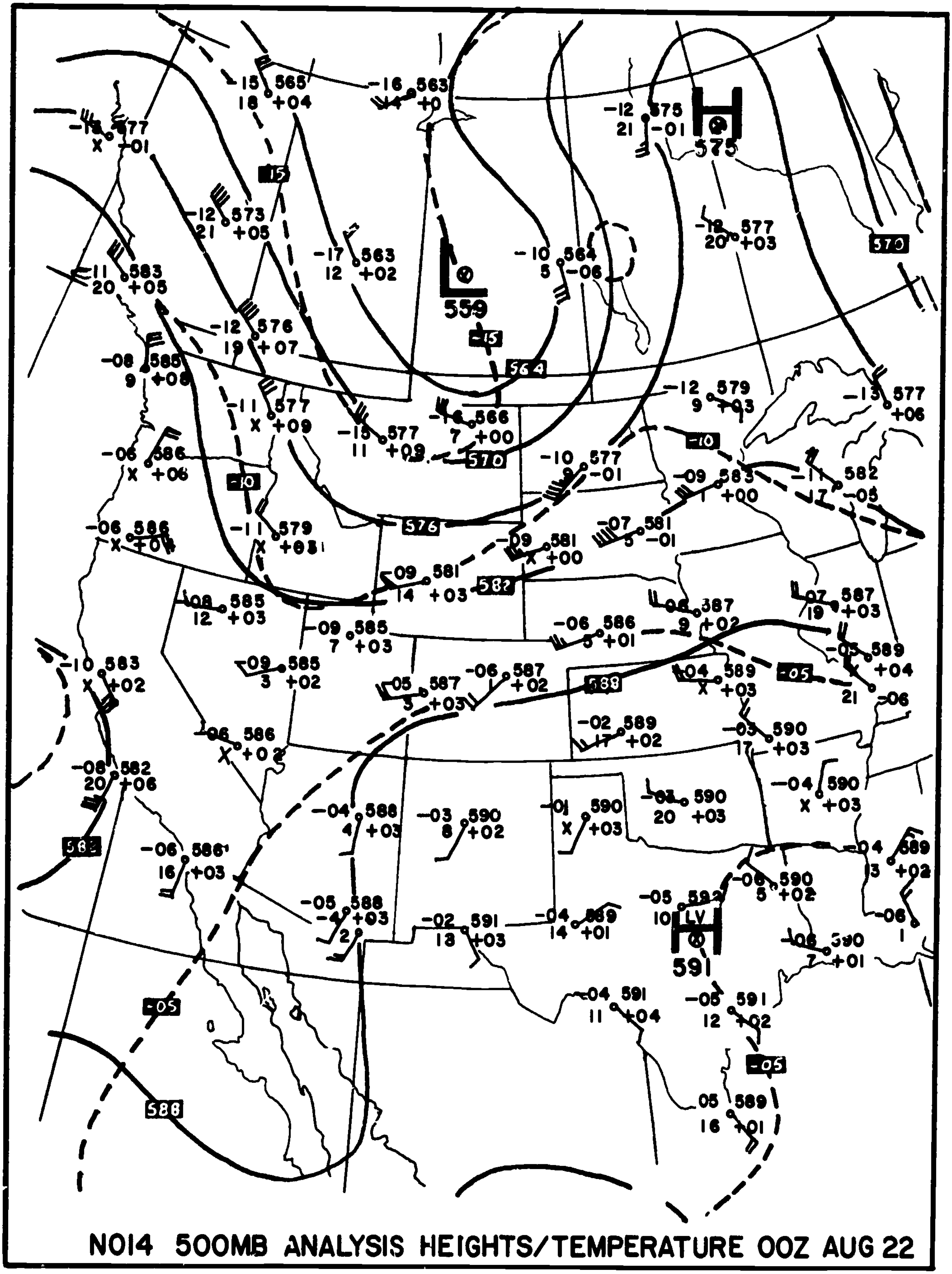


FIGURE 129.—500 MB Analysis Heights/Temperature Chart.

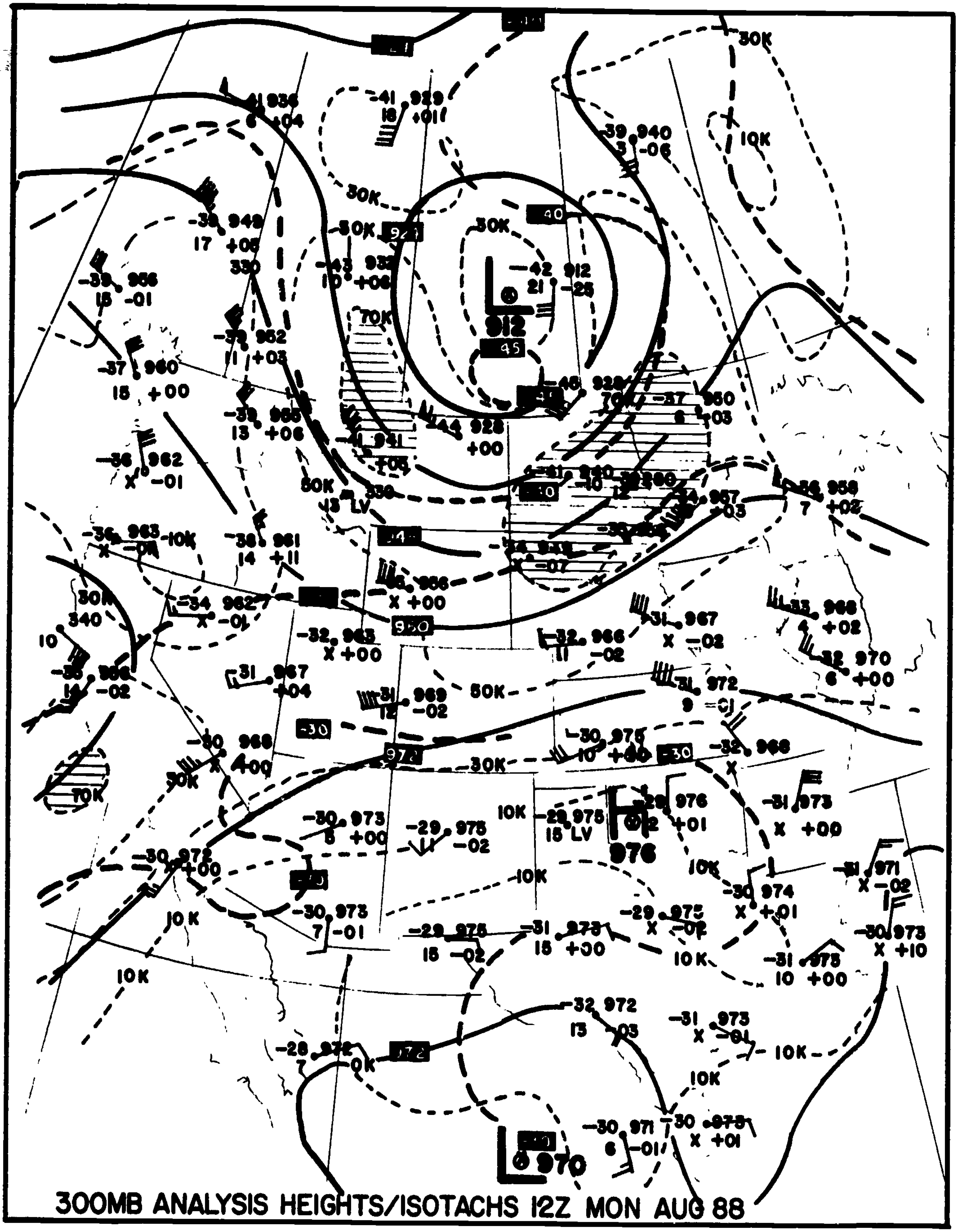


FIGURE 130.—300 MB Analysis Heights/Isotachs Chart.

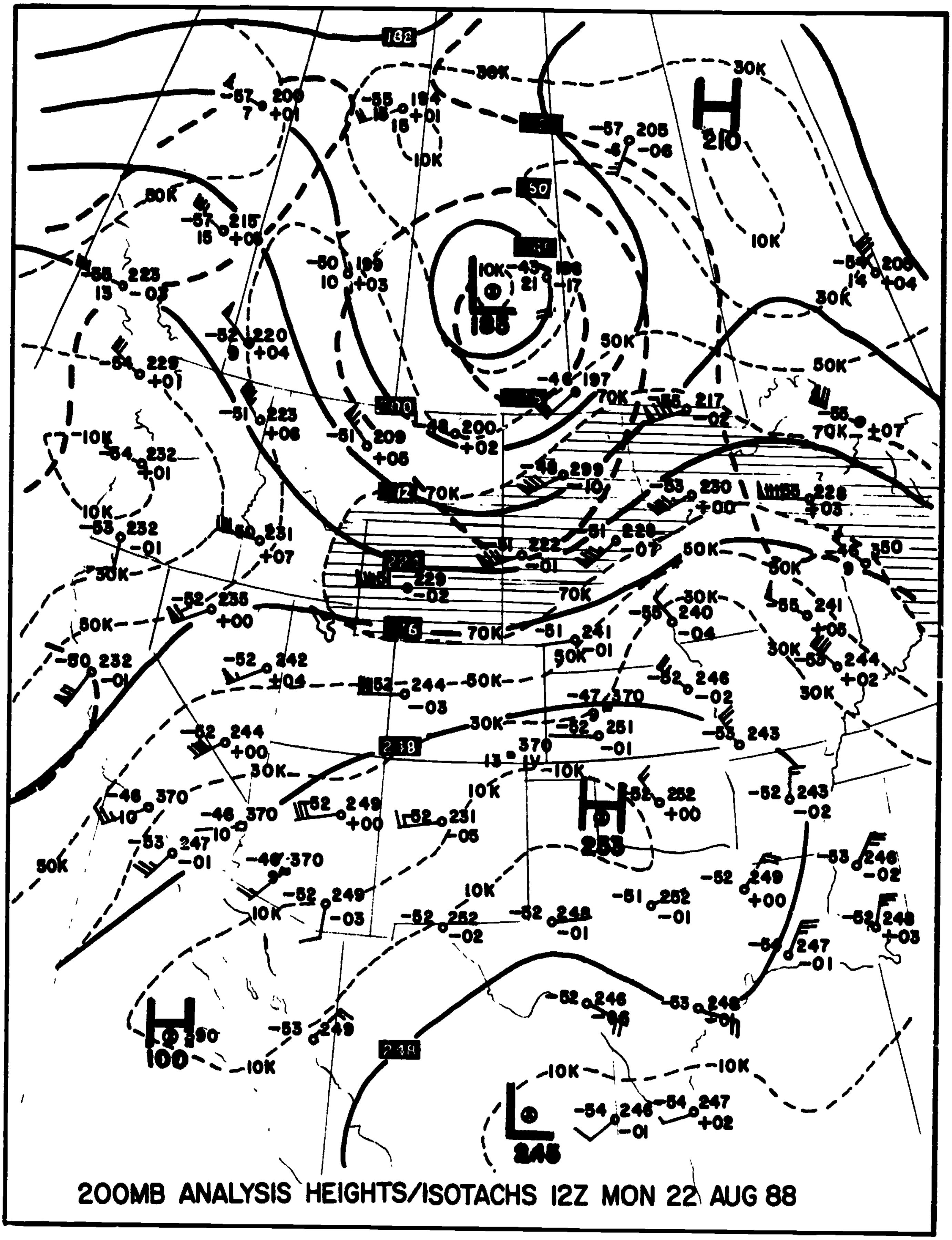


FIGURE 131.—200 MB Analysis Heights/Isotachs Chart.

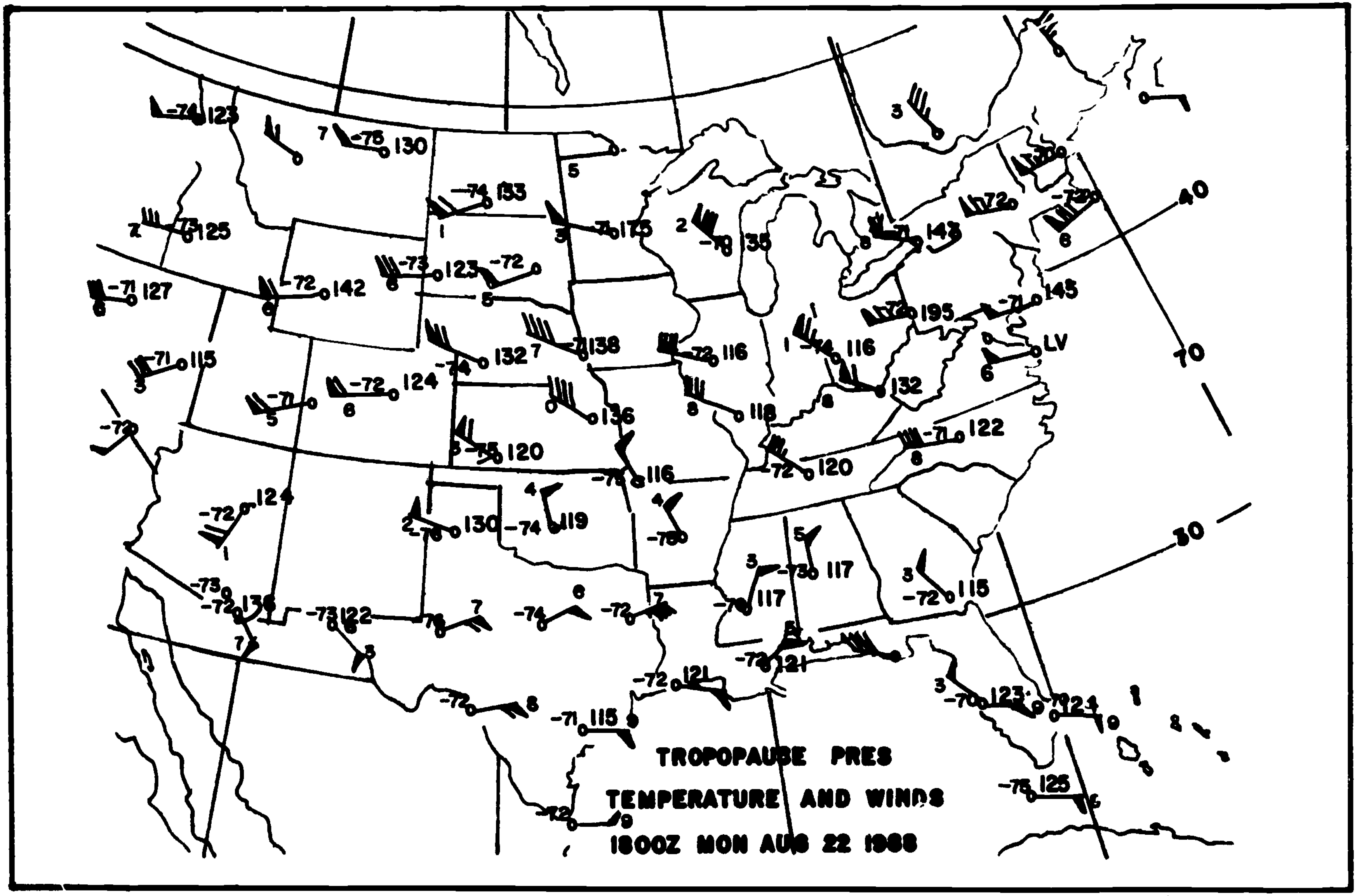


FIGURE 132A.—Tropopause Pressure.

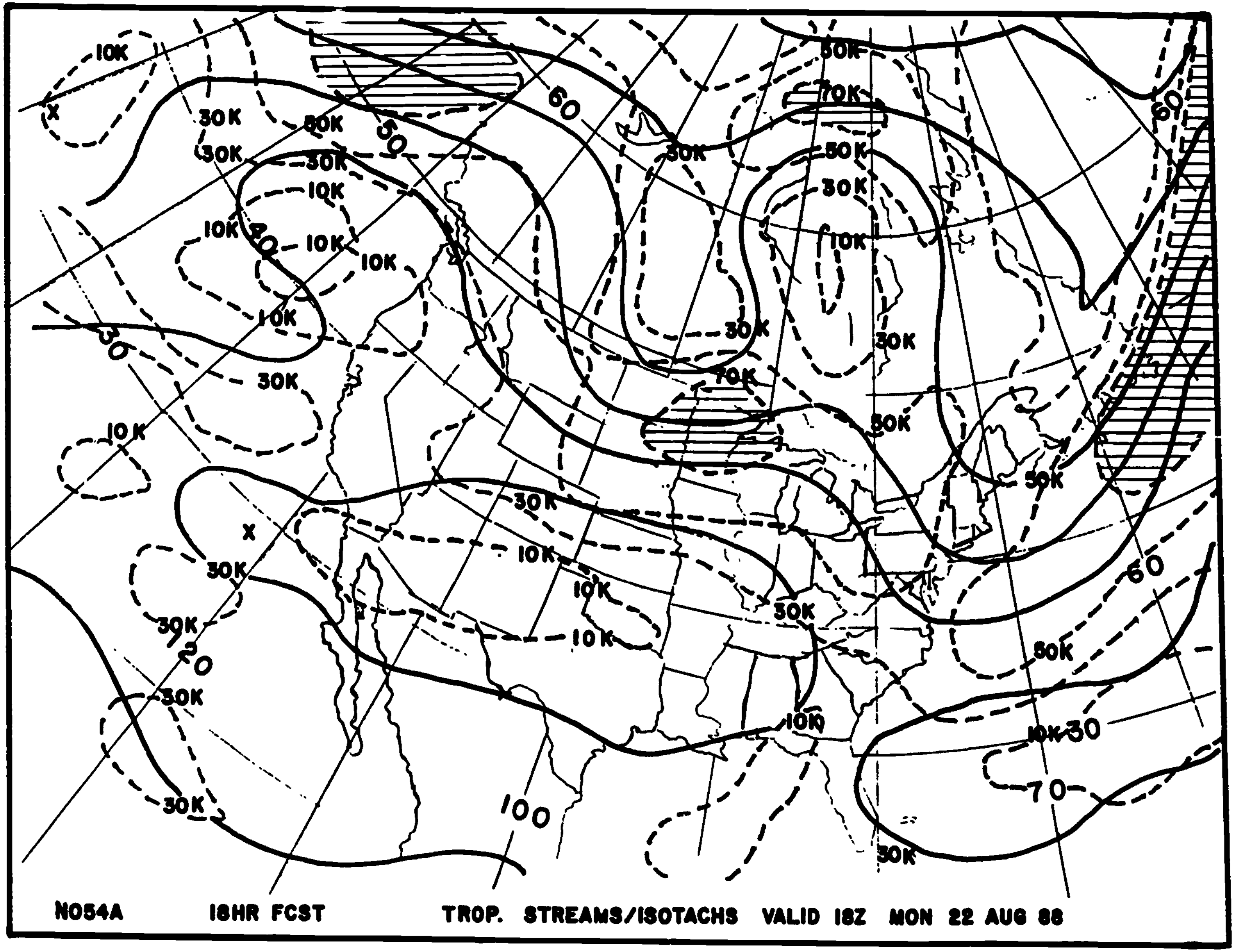


FIGURE 132B.—Tropopause/Streams Isotachs.

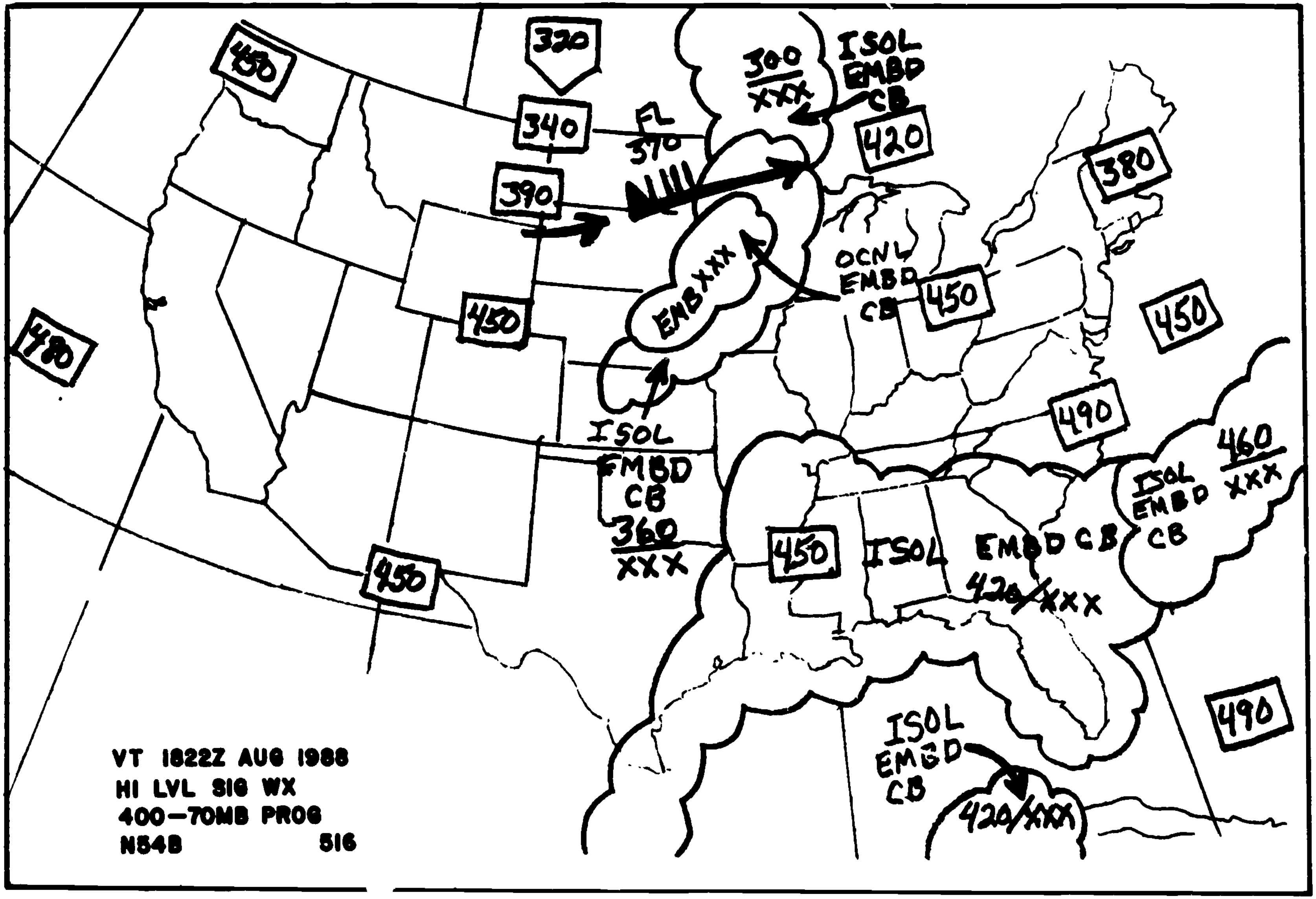
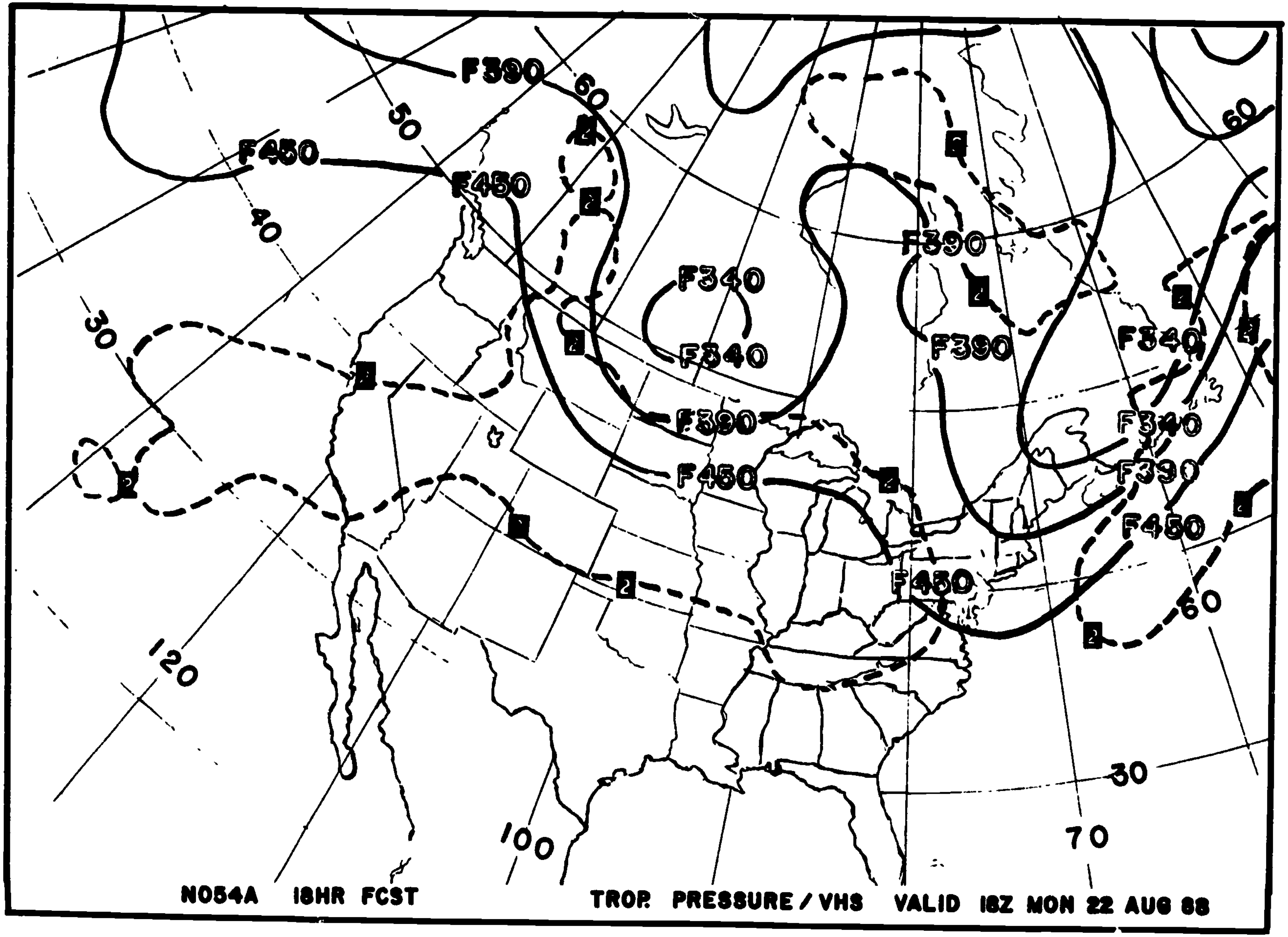


FIGURE 132C.—High-Level Significant Weather Chart.



328 329

FIGURE 132D.—Tropopause Pressure/VHS.

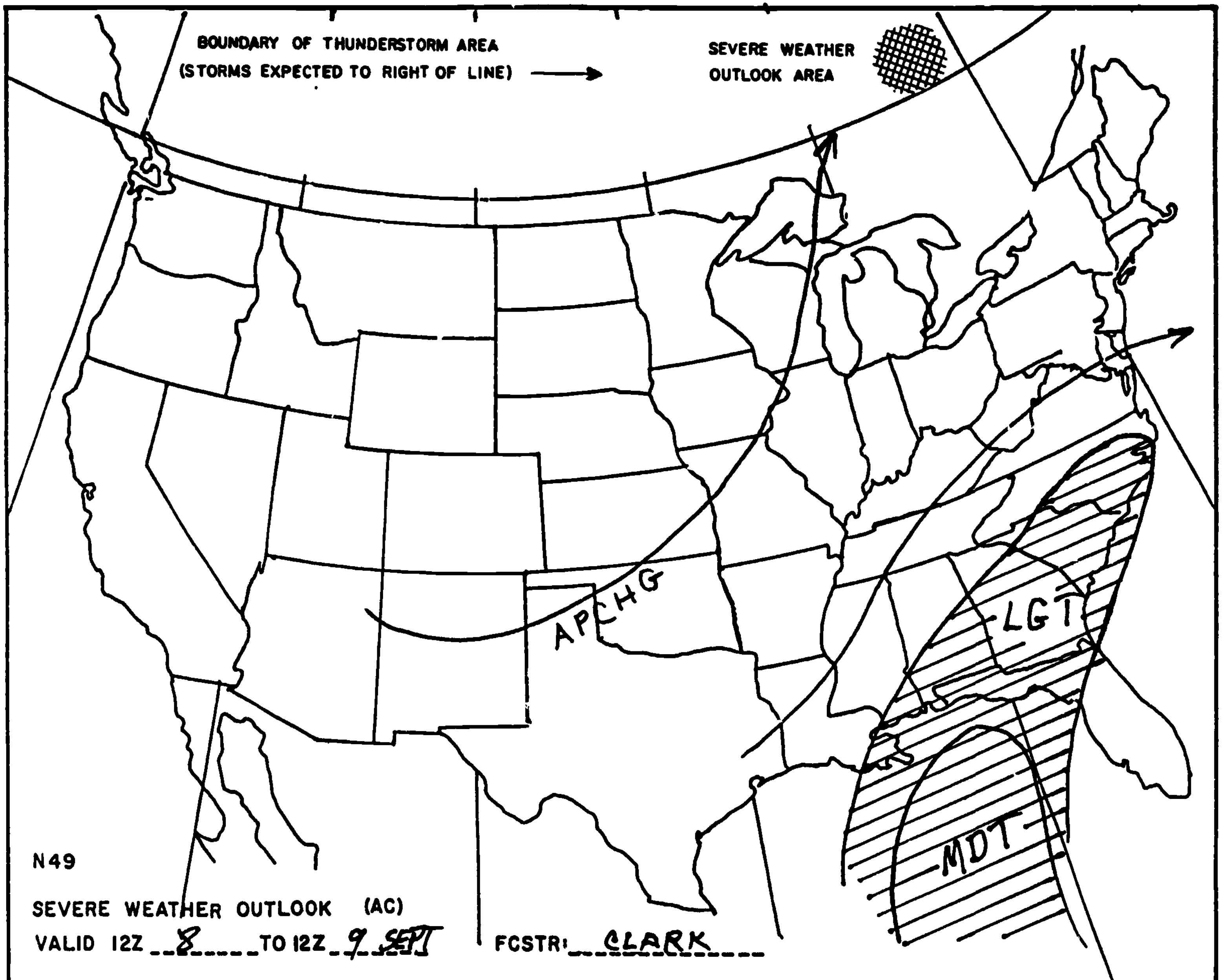


FIGURE 133A.--Severe Weather Outlook (AC).

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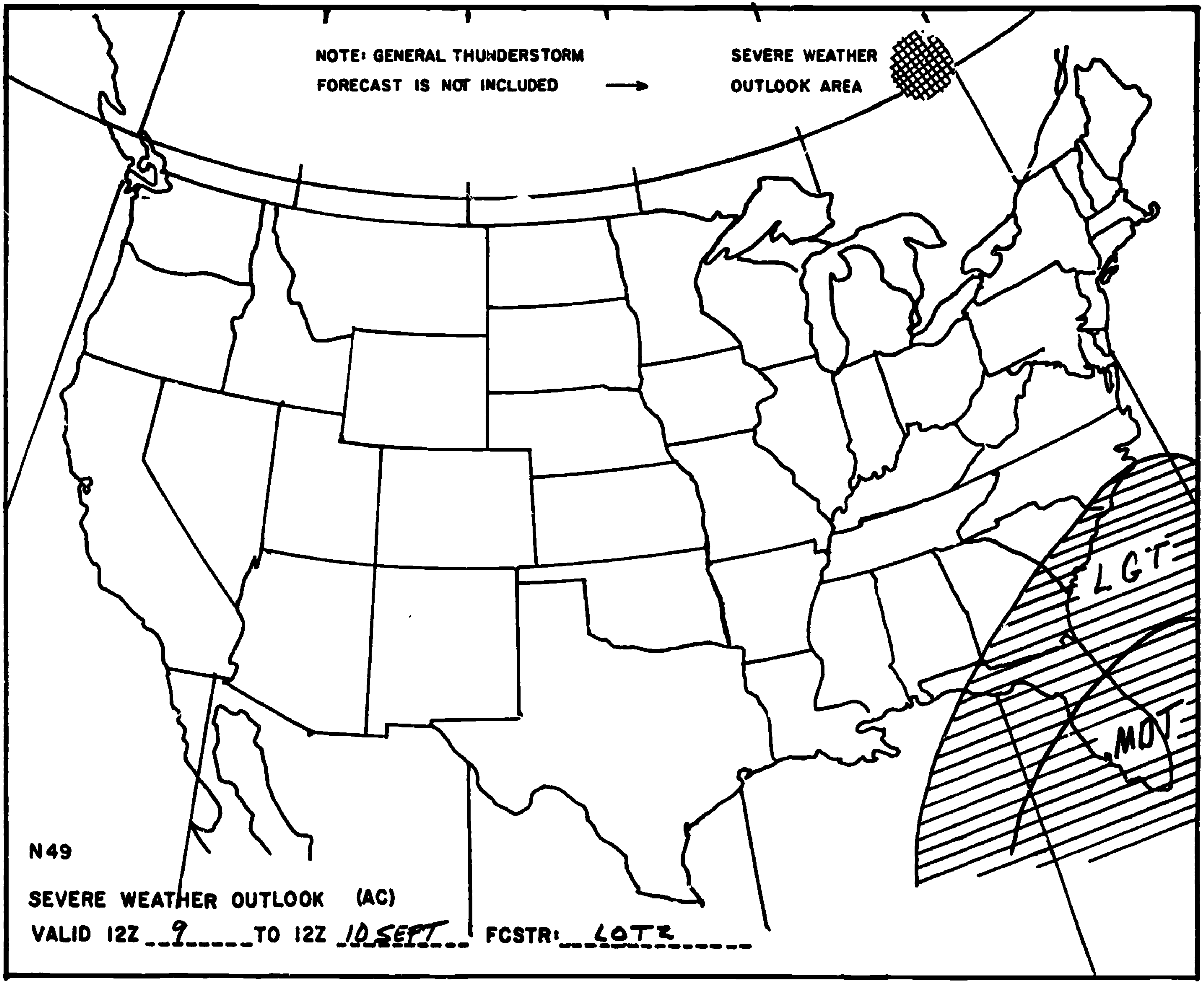

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FIGURE 133B.—Severe Weather Outlook (AC).

STARS, JULY—DEC., 1978

No.	Name		Mag.	S.H.A. ° ′	Dec. ° ′
7*	*Acamar*		3·1	315 38	S. 40 23
5*	*Achernar*		0·6	335 46	S. 57 21
30*	*Acrux*		1·1	173 39.	S. 62 59
19	*Adhara*	†	1·6	255 33	S. 28 57
10*	*Aldebaran*	†	1·1	291 19	N. 16 28
32*	*Alioth*		1·7	166 44	N. 56 05
34*	*Alkaid*		1·9	153 20	N. 49 25
55	*Al Na'ir*		2·2	28 16	S. 47 04
15	*Alnilam*	†	1·8	276 13	S. 1 13
25*	*Alphard*	†	2·2	218 22	S. 8 34
41*	*Alphecca*	†	2·3	126 33	N. 26 47
1*	*Alpheratz*	†	2·2	358 10	N. 28 58
51*	*Altair*	†	0·9	62 34	N. 8 40
2	*Ankaa*		2·4	353 41	S. 42 25
42*	*Antares*	†	1·2	112 59	S. 26 23
37*	*Arcturus*	†	0·2	146 20	N. 19 18
43	*Atria*		1·9	108 24	S. 68 59
22	*Avior*		1·7	234 29	S. 59 26
13	*Bellatrix*	†	1·7	279 00	N. 6 20
16*	*Betelgeuse*	†	0·1-1·2	271 30	N. 7 24
17*	*Canopus*		−0·9	264 08	S. 52 41
12*	*Capella*		0·2	281 13	N. 45 58
53*	*Deneb*		1·3	49 49	N. 45 13
28*	*Denebola*	†	2·2	183 01	N. 14 42
4*	*Diphda*	†	2·2	349 22	S. 18 06
27*	*Dubhe*		2·0	194 24	N. 61 52
14	*Elnath*	†	1·8	278 46	N. 28 35
47	*Eltanin*		2·4	90 58	N. 51 30
54*	*Enif*	†	2·5	34 13	N. 9 47
56*	*Fomalhaut*	†	1·3	15 53	S. 29 44
31	*Gacrux*		1·6	172 30	S. 57 00
29*	*Gienah*	†	2·8	176 20	S. 17 25
35	*Hadar*		0·9	149 25	S. 60 16
6*	*Hamal*	†	2·2	328 30	N. 23 22
48	*Kaus Aust.*		2·0	84 19	S. 34 24
40*	*Kochab*		2·2	137 20	N. 74 15
57	*Markab*	†	2·6	14 04	N. 15 06
8*	*Menkar*	†	2·8	314 42	N. 4 00
36	*Menkent*		2·3	148 39	S. 36 16
24*	*Miaplacidus*		1·8	221 45	S. 69 38
9*	*Mirfak*		1·9	309 18	N. 49 47
50*	*Nunki*	†	2·1	76 31	S. 26 19
52*	*Peacock*		2·1	54 00	S. 56 48
21*	*Pollux*	†	1·2	244 00	N. 28 05
20*	*Procyon*	†	0·5	245 27	N. 5 17
46*	*Rasalhague*	†	[illegible]	96 31	N. 12 35
26*	*Regulus*	†	1·3	208 12	N. 12 04
11*	*Rigel*	†	0·3	281 37	S. 8 14
38*	*Rigil Kent.*		0·1	140 28	S. 60 45
44	*Sabik*	†	2·6	102 43	S. 15 42
3*	*Schedar*		2·5	350 10	N. 56 25
45*	*Shaula*		1·7	96 58	S. 37 05
18*	*Sirius*	†	−1·6	258 57	S. 16 41
33*	*Spica*	†	1·2	158 59	S. 11 03
23*	*Suhail*		2·2	223 12	S. 45 21
49*	*Vega*		0·1	80 57	N. 38 46
39	*Zuben'ubi*	†	2·9	137 35	S. 15 57

INTERPOLATION OF G.H.A.

Increment to be added for intervals of G.M.T. to G.H.A. of: Sun, Aries (♈) and planets; Moon

SUN, etc. m s	° ′	MOON m s
00 00		00 00
	0 00	
01		00 02
	0 01	
05		00 06
	0 02	
09		00 10
	0 03	
13		00 14
	0 04	
17		00 18
	0 05	
21		00 22
	0 06	
25		00 26
	0 07	
29		00 31
	0 08	
33		00 35
	0 09	
37		00 39
	0 10	
41		00 43
	0 11	
45		00 47
	0 12	
49		00 51
	0 13	
53		00 55
	0 14	
00 57		01 00
	0 15	
01 01		01 04
	0 16	
05		01 08
	0 17	
09		01 12
	0 18	
13		01 16
	0 19	
17		01 20
	0 20	
21		01 24
	0 21	
25		01 29
	0 22	
29		01 33
	0 23	
33		01 37
	0 24	
37		01 41
	0 25	
41		01 45
	0 26	
45		01 49
	0 27	
49		01 53
	0 28	
53		01 58
	0 29	
01 57		02 02
	0 30	
02 01		02 06
	0 31	
05		02 10
	0 32	
09		02 14
	0 33	
13		02 18
	0 34	
17		02 22
	0 35	
21		02 27
	0 36	
25		02 31
	0 37	
29		02 35
	0 38	
33		02 39
	0 39	
37		02 43
	0 40	
41		02 47
	0 41	
45		02 51
	0 42	
49		02 56
	0 43	
53		03 00
	0 44	
02 57		03 04
	0 45	
03 01		03 08
	0 46	
05		03 12
	0 47	
09		03 16
	0 48	
13		03 20
	0 49	
17		03 25
	0 50	
03 21		03 29

SUN, etc. m s	° ′	MOON m s
03 17		03 25
	0 50	
21		03 29
	0 51	
25		03 33
	0 52	
29		03 37
	0 53	
33		03 41
	0 54	
37		03 45
	0 55	
41		03 49
	0 56	
45		03 54
	0 57	
49		03 58
	0 58	
53		04 02
	0 59	
03 57		04 06
	1 00	
04 01		04 10
	1 01	
05		04 14
	1 02	
09		04 19
	1 03	
13		04 23
	1 04	
17		04 27
	1 05	
21		04 31
	1 06	
25		04 35
	1 07	
29		04 39
	1 08	
33		04 43
	1 09	
37		04 48
	1 10	
41		04 52
	1 11	
45		04 56
	1 12	
49		05 00
	1 13	
53		05 04
	1 14	
04 57		05 08
	1 15	
05 01		05 12
	1 16	
05		05 17
	1 17	
09		05 21
	1 18	
13		05 25
	1 19	
17		05 29
	1 20	
21		05 33
	1 21	
25		05 37
	1 22	
29		05 41
	1 23	
33		05 46
	1 24	
37		05 50
	1 25	
41		05 54
	1 26	
45		05 58
	1 27	
49		06 02
	1 28	
53		06 06
	1 29	
05 57		06 10
	1 30	
06 01		06 15
	1 31	
05		06 19
	1 32	
09		06 23
	1 33	
13		06 37
	1 34	
17		06 31
	1 35	
21		06 35
	1 36	
25		06 39
	1 37	
29		06 44
	1 38	
33		06 48
	1 39	
37		06 52
	1 40	
06 41		06 56

SUN, etc. m s	° ′	MOON m s
06 37		06 52
	1 40	
41		06 56
	1 41	
45		07 00
	1 42	
49		07 04
	1 43	
53		07 08
	1 44	
06 57		07 13
	1 45	
07 01		07 17
	1 46	
05		07 21
	1 47	
09		07 25
	1 48	
13		07 29
	1 49	
17		07 33
	1 50	
21		07 37
	1 51	
25		07 42
	1 52	
29		07 46
	1 53	
33		07 50
	1 54	
37		07 54
	1 55	
41		07 58
	1 56	
45		08 02
	1 57	
49		08 06
	1 58	
53		08 11
	1 59	
07 57		08 15
	2 00	
08 01		08 19
	2 01	
05		08 23
	2 02	
09		08 27
	2 03	
13		08 31
	2 04	
17		08 35
	2 05	
21		08 40
	2 06	
25		08 44
	2 07	
29		08 48
	2 08	
33		08 52
	2 09	
37		08 56
	2 10	
41		09 00
	2 11	
45		09 04
	2 12	
49		09 09
	2 13	
53		09 13
	2 14	
08 57		09 17
	2 15	
09 01		09 21
	2 16	
05		09 25
	2 17	
09		09 29
	2 18	
13		09 33
	2 19	
17		09 38
	2 20	
21		09 42
	2 21	
25		09 46
	2 22	
29		09 50
	2 23	
33		09 54
	2 24	
37		09 58
	2 25	
41		10 00
	2 26	
45		
	2 27	
49		
	2 28	
53		
	2 29	
09 57		
	2 30	
10 00		

*Stars used in H.O. 249 (A.P. 3270) Vol. 1.
†Stars that may be used with Vols. 2 and 3.

FIGURE 134.—STARS, July – December.

(DAY 262) GREENWICH P. M. 1978 SEPTEMBER 19 (TUESDAY)

GMT	☉ SUN GHA	SUN Dec	ARIES GHA ♈	VENUS –4.2 GHA	VENUS Dec	JUPITER –1.5 GHA	JUPITER Dec.	SATURN 1.0 GHA	SATURN Dec.	◯ MOON GHA	MOON Dec.
h m	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
12 00	1 31.8	N 1 30.8	178 02.2	321 44	S19 07	53 07	N19 51	18 54	N10 23	147 51	N 9 07
10	4 01.8	30.6	180 32.7	324 14		55 37		21 25		150 16	08
20	6 31.9	30.4	183 03.1	326 44		58 08		23 55		152 41	10
30	9 01.9	· 30.3	185 33.5	329 14	·	60 38	·	26 25	·	155 06	· 11
40	11 31.9	30.1	188 03.9	331 44		63 08		28 56		157 30	13
50	14 02.0	30.0	190 34.3	334 14		65 39		31 26		159 55	14
13 00	16 32.0	N 1 29.8	193 04.7	336 45	S19 08	68 09	N19 51	33 56	N10 23	162 20	N 9 16
10	19 02.1	29.6	195 35.1	339 15		70 39		36 27		164 45	17
20	21 32.1	29.5	198 05.5	341 45		73 10		38 57		167 10	19
30	24 02.1	· 29.3	200 35.9	344 15	·	75 40	·	41 27	·	169 35	· 20
40	26 32.2	29.2	203 06.4	346 45		78 10		43 58		172 00	22
50	29 02.2	29.0	205 36.8	349 15		80 41		46 28		174 25	23
14 00	31 32.2	N 1 28.8	208 07.2	351 45	S19 09	83 11	N19 51	48 59	N10 23	176 50	N 9 25
10	34 02.3	28.7	210 37.6	354 15		85 41		51 29		179 15	26
20	36 32.3	28.5	213 08.0	356 45		88 12		53 59		181 40	28
30	39 02.4	· 28.3	215 38.4	359 16	·	90 42	·	56 30	·	184 05	· 29
40	41 32.4	28.2	218 08.8	1 46		93 12		59 00		186 30	31
50	44 02.4	28.0	220 39.2	4 16		95 43		61 30		188 55	32
15 00	46 32.5	N 1 27.9	223 09.6	6 46	S19 10	98 13	N19 51	64 01	N10 23	191 20	N 9 34
10	49 02.5	27.7	225 40.1	9 16		100 43		66 31		193 45	35
20	51 32.5	27.5	228 10.5	11 46		103 14		69 01		196 10	37
30	54 02.6	· 27.4	230 40.9	14 16	·	105 44	·	71 32	·	198 35	· 38
40	56 32.6	27.2	233 11.3	16 46		108 14		74 02		201 00	40
50	59 02.7	27.1	235 41.7	19 16		110 45		76 33		203 25	41
16 00	61 32.7	N 1 26.9	238 12.1	21 47	S19 11	113 15	N19 51	79 03	N10 23	205 49	N 9 43
10	64 02.7	26.7	240 42.5	24 17		115 45		81 33		208 14	44
20	66 32.8	26.6	243 12.9	26 47		118 16		84 04		210 39	46
30	69 02.8	· 26.4	245 43.3	29 17	·	120 46	·	86 34	·	213 04	· 47
40	71 32.8	26.2	248 13.7	31 47		123 16		89 04		215 29	49
50	74 02.9	26.1	250 44.2	34 17		125 47		91 35		217 54	50
17 00	76 32.9	N 1 25.9	253 14.6	36 47	S19 12	128 17	N19 51	94 05	N10 22	220 19	N 9 52
10	79 03.0	25.8	255 45.0	39 17		130 47		96 35		222 44	53
20	81 33.0	25.6	258 15.4	41 47		133 18		99 06		225 09	55
30	84 03.0	· 25.4	260 45.8	44 18	·	135 48	·	101 36	·	227 34	· 56
40	86 33.1	25.3	263 16.2	46 48		138 18		104 06		229 59	58
50	89 03.1	25.1	265 46.6	49 18		140 49		106 37		232 24	9 59
18 00	91 33.1	N 1 25.0	268 17.0	51 48	S19 12	143 19	N19 51	109 07	N10 22	234 49	N10 01
10	94 03.2	24.8	270 47.4	54 18		145 49		111 38		237 14	02
20	96 33.2	24.6	273 17.9	56 48		148 20		114 08		239 39	04
30	99 03.2	· 24.5	275 48.3	59 18	·	150 50	·	116 38	·	242 04	· 05
40	101 33.3	24.3	278 18.7	61 48		153 20		119 09		244 29	06
50	104 03.3	24.1	280 49.1	64 18		155 51		121 39		246 54	08
19 00	106 33.4	N 1 24.0	283 19.5	66 49	S19 13	158 21	N19 51	124 09	N10 22	249 19	N10 09
10	109 03.4	23.8	285 49.9	69 19		160 51		126 40		251 44	11
20	111 33.4	23.7	288 20.3	71 49		163 22		129 10		254 09	12
30	114 03.5	· 23.5	290 50.7	74 19	·	165 52	·	131 41	·	256 34	· 14
40	116 33.5	23.3	293 21.1	76 49		168 22		134 11		258 59	15
50	119 03.5	23.2	295 51.6	79 19		170 53		136 41		261 24	17
20 00	121 33.6	N 1 23.0	298 22.0	81 49	S19 14	173 23	N19 50	139 12	N10 22	263 48	N10 18
10	124 03.6	22.8	300 52.4	84 19		175 53		141 42		266 13	19
20	126 33.7	22.7	303 22.8	86 50		178 24		144 12		268 38	21
30	129 03.7	· 22.5	305 53.2	89 20	·	180 54	·	146 43	·	271 03	· 22
40	131 33.7	22.4	308 23.6	91 50		183 25		149 13		273 28	24
50	134 03.8	22.2	310 54.0	94 20		105 55		151 43		275 53	25
21 00	136 33.8	N 1 22.0	313 24.4	96 50	S19 15	188 25	N19 50	154 14	N10 22	278 18	N10 27
10	139 03.8	21.9	315 54.8	99 20		190 56		156 44		280 43	28
20	141 33.9	21.7	318 25.2	101 50		193 26		159 14		283 08	29
30	144 03.9	· 21.6	320 55.7	104 20	·	195 56	·	161 45	·	285 33	· 31
40	146 34.0	21.4	323 26.1	106 50		198 27		164 15		287 58	32
50	149 04.0	21.2	325 56.5	109 21		200 57		166 46		290 23	34
22 00	151 34.0	N 1 21.1	328 26.9	111 51	S19 16	203 27	N19 50	169 16	N10 22	292 48	N10 35
10	154 04.1	20.9	330 57.3	114 21		205 58		171 46		295 13	37
20	156 34.1	20.7	333 27.7	116 51		208 28		174 17		297 38	38
30	159 04.1	· 20.6	335 58.1	119 21	·	210 58	·	176 47	·	300 03	· 39
40	161 34.2	20.4	338 28.5	121 51		213 29		179 17		302 28	41
50	164 04.2	20.3	340 58.9	124 21		215 59		181 48		304 53	42
23 00	166 34.2	N 1 20.1	343 29.4	126 51	S19 17	218 29	N19 50	184 18	N10 22	307 18	N10 44
10	169 04.3	19.9	345 59.8	129 21		221 00		186 48		309 43	45
20	171 34.3	19.8	348 30.2	131 52		223 30		189 19		312 08	46
30	174 04.4	· 19.6	351 00.6	134 22	·	226 00	·	191 49	·	314 33	· 48
40	176 34.4	19.5	353 31.0	136 52		228 31		194 20		316 58	49
50	179 04.4	19.3	356 01.4	139 22		231 01		196 50		319 23	51
Rate	15 00.2	S0 01.0		15 00.7	S0 00.9	15 02.0	S0 00.1	15 02.2	S0 00.1	14 29.8	N0 08.8

Lat	Moonset	Diff
N	h m	m
72	09 56	55
70	09 42	51
68	09 31	48
66	09 22	45
64	09 15	43
62	09 08	42
60	09 03	40
58	08 58	39
56	08 53	38
54	08 49	37
52	08 46	36
50	08 43	35
45	08 36	34
40	08 30	32
35	08 25	31
30	08 20	30
20	08 13	28
10	08 06	27
0	08 00	25
10	07 54	24
20	07 47	22
30	07 40	21
35	07 35	20
40	07 30	19
45	07 25	17
50	07 18	15
52	07 15	15
54	07 11	14
56	07 08	13
58	07 03	12
60	06 59	11
S		

Moon's P. in A.

Alt. °	Corr. + ′
0	
	57
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Alt. °	Corr. + ′
55	
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	26
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79	
	10
80	

Sun SD 15′.9
Moon SD 16′
Age 17d

FIGURE 135.—Greenwich Day 262.

(DAY 263) GREENWICH A. M. 1978 SEPTEMBER 20 (WEDNESDAY)

GMT	☉ SUN GHA	SUN Dec.	ARIES GHA ♈	VENUS−4.2 GHA	VENUS Dec.	JUPITER−1.5 GHA	JUPITER Dec.	SATURN 1.0 GHA	SATURN Dec.	☽ MOON GHA	MOON Dec.
h m	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
00 00	181 34.5	N 1 19.1	358 31.8	141 52	S19 18	233 31	N19 50	199 20	N10 22	321 48	N10 52
10	184 04.5	19.0	1 02.2	144 22		236 02		201 51		324 13	53
20	186 34.5	18.8	3 32.6	146 52		238 32		204 21		326 38	55
30	189 04.6	18.6	6 03.1	149 22		241 02		206 51		329 03	56
40	191 34.6	18.5	8 33.5	151 52		243 33		209 22		331 28	58
50	194 04.7	18.3	11 03.9	154 23		246 03		211 52		333 53	10 59
01 00	196 34.7	N 1 18.2	13 34.3	156 53	S19 18	248 33	N19 50	214 22	N10 22	336 18	N11 00
10	199 04.7	18.0	16 04.7	159 23		251 04		216 53		338 42	02
20	201 34.8	17.8	18 35.1	161 53		253 34		219 23		341 07	03
30	204 04.8	17.7	21 05.5	164 23		256 04		221 54		343 32	05
40	206 34.8	17.5	23 35.9	166 53		258 35		224 24		345 57	06
50	209 04.9	17.4	26 06.3	169 23		261 05		226 54		348 22	07
02 00	211 34.9	N 1 17.2	28 36.7	171 53	S19 19	263 35	N19 50	229 25	N10 21	350 47	N11 09
10	214 05.0	17.0	31 07.2	174 24		266 06		231 55		353 12	10
20	216 35.0	16.9	33 37.6	176 54		268 36		234 25		355 37	11
30	219 05.0	16.7	36 08.0	179 24		271 06		236 56		358 02	13
40	221 35.1	16.5	38 38.4	181 54		273 37		239 26		0 27	14
50	224 05.1	16.4	41 08.8	184 24		276 07		241 56		2 52	16
03 00	226 35.1	N 1 16.2	43 39.2	186 54	S19 20	278 37	N19 50	244 27	N10 21	5 17	N11 17
10	229 05.2	16.1	46 09.6	189 24		281 08		246 57		7 42	18
20	231 35.2	15.9	48 40.0	191 54		283 38		249 28		10 07	20
30	234 05.3	15.7	51 10.4	194 24		286 08		251 58		12 32	21
40	236 35.3	15.6	53 40.9	196 55		288 39		254 28		14 57	22
50	239 05.3	15.4	56 11.3	199 25		291 09		256 59		17 22	24
04 00	241 35.4	N 1 15.3	58 41.7	201 55	S19 21	293 39	N19 50	259 29	N10 21	19 47	N11 25
10	244 05.4	15.1	61 12.1	204 25		296 10		261 59		22 12	26
20	246 35.4	14.9	63 42.5	206 55		298 40		264 30		24 37	28
30	249 05.5	14.8	66 12.9	209 25		301 10		267 0[illegible]		27 02	29
40	251 35.5	14.6	68 43.3	211 55		303 41		269 [illegible]		29 27	30
50	254 05.5	14.4	71 13.7	214 25		306 11		272 01		31 52	32
05 00	256 35.6	N 1 14.3	73 44.1	216 56	S19 22	308 41	N19 50	274 31	N10 21	34 17	N11 33
10	259 05.6	14.1	76 14.5	219 26		311 12		277 01		36 42	34
20	261 35.7	14.0	78 45.0	221 56		313 42		279 32		39 07	36
30	264 05.7	13.8	81 15.4	224 26		316 12		282 02		41 32	37
40	266 35.7	13.6	83 45.8	226 56		318 43		284 33		43 57	38
50	269 05.8	13.5	86 16.2	229 26		321 13		287 03		46 22	40
06 00	271 35.8	N 1 13.3	88 46.6	231 56	S19 23	323 43	N19 50	289 33	N10 21	48 47	N11 41
10	274 05.8	13.1	91 17.0	234 26		326 14		292 04		51 12	42
20	276 35.9	13.0	93 47.4	236 56		328 44		294 34		53 37	44
30	279 05.9	12.8	96 17.8	239 27		331 14		297 04		56 02	45
40	281 36.0	12.7	98 48.2	241 57		333 45		299 35		58 27	46
50	284 06.0	12.5	101 18.7	244 27		336 15		302 05		60 52	48
07 00	286 36.0	N 1 12.3	103 49.1	246 57	S19 24	338 45	N19 49	304 36	N10 21	63 17	N11 49
10	289 06.1	12.2	106 19.5	249 27		341 16		307 06		65 42	50
20	291 36.1	12.0	108 49.9	251 57		343 46		309 36		68 07	52
30	294 06.1	11.9	111 20.3	254 27		346 16		312 07		70 32	53
40	296 36.2	11.7	113 50.7	256 57		348 47		314 37		72 57	54
50	299 06.2	11.5	116 21.1	259 27		351 17		317 07		75 22	55
08 00	301 36.3	N 1 11.4	118 51.5	261 58	S19 24	353 47	N19 49	319 38	N10 21	77 47	N11 57
10	304 06.3	11.2	121 21.9	264 28		356 18		322 08		80 12	58
20	306 36.3	11.0	123 52.4	266 58		358 48		324 38		82 37	11 59
30	309 06.4	10.9	126 22.8	269 28		1 18		327 09		85 02	12 01
40	311 36.4	10.7	128 53.2	271 58		3 49		329 39		87 27	02
50	314 06.4	10.6	131 23.6	274 28		6 19		332 09		89 52	03
09 00	316 36.5	N 1 10.4	133 54.0	276 58	S19 25	8 49	N19 49	334 40	N10 21	92 17	N12 05
10	319 06.5	10.2	136 24.4	279 28		11 20		337 10		94 42	06
20	321 36.5	10.1	138 54.8	281 59		13 50		339 41		97 07	07
30	324 06.6	09.9	141 25.2	284 29		16 20		342 11		99 32	08
40	326 36.6	09.8	143 55.6	286 59		18 51		344 41		101 57	10
50	329 06.7	09.6	146 26.0	289 29		21 21		347 12		104 22	11
10 00	331 36.7	N 1 09.4	148 56.5	291 59	S19 26	23 51	N19 49	349 42	N10 21	106 47	N12 12
10	334 06.7	09.3	151 26.9	294 29		26 22		352 12		109 12	14
20	336 36.8	09.1	153 57.3	296 59		28 52		354 43		111 37	15
30	339 06.8	08.9	156 27.7	299 29		31 22		357 13		114 02	16
40	341 36.8	08.8	158 58.1	301 59		33 53		359 43		116 27	17
50	344 06.9	08.6	161 28.5	304 30		36 23		2 14		118 52	19
11 00	346 36.9	N 1 08.5	163 58.9	307 00	S19 27	38 54	N19 49	4 44	N10 20	121 17	N12 20
10	349 07.0	08.3	166 29.3	309 30		41 24		7 15		123 41	21
20	351 37.0	08.1	168 59.7	312 00		43 54		9 45		126 06	22
30	354 07.0	08.0	171 30.2	314 30		46 25		12 15		128 31	24
40	356 37.1	07.8	174 00.6	317 00		48 55		14 46		130 56	25
50	359 07.1	07.6	176 31.0	319 30		51 25		17 16		133 21	26
Rate	15 00.2	S0 01.0		15 00.7	S0 00.9	15 02.0	S0 00.1	15 02.2	S0 00.1	14 29.9	N0 08.0

Lat.	Moonrise	Diff
N		
°	h m	m
72	18 07	−02
70	18 31	+03
68	18 49	06
66	19 04	09
64	19 17	11
62	19 27	12
60	19 36	13
58	19 44	14
56	19 51	15
54	19 57	16
52	20 03	17
50	20 08	17
45	20 19	19
40	20 28	20
35	20 36	21
30	20 43	21
20	20 55	23
10	21 06	24
0	21 16	25
10	21 26	26
20	21 37	27
30	21 49	29
35	21 56	29
40	22 05	30
45	22 14	31
50	22 26	33
52	22 31	33
54	22 37	34
56	22 44	34
58	22 52	36
60	23 00	36
S		

Moon's P. in A.

Alt.	Corr.	Alt.	Corr.
°	+ ′	°	+ ′
0		55	
	57		32
7		56	
	56		31
13		57	
	55		30
17		58	
	54		29
20		60	
	53		28
23		61	
	52		27
25		62	
	51		26
27		63	
	50		25
29		64	
	49		24
31		65	
	48		23
33		66	
	47		22
35		67	
	46		21
37		68	
	45		20
38		70	
	44		19
40		71	
	43		18
41		72	
	42		17
43		73	
	41		16
44		74	
	40		15
46		75	
	39		14
47		76	
	38		13
48		77	
	37		12
50		78	
	36		11
51		79	
	35		10
52		80	
	34		
54			
	33		
55			
	32		
56			

Sun SD 16′.0

Moon SD 16′

Age 18d

FIGURE 136.—Greenwich Day 263.

336

(DAY 263) GREENWICH P. M. 1978 SEPTEMBER 20 (WEDNESDAY)

GMT	☉ SUN GHA	SUN Dec.	ARIES GHA ♈	VENUS −4.2 GHA	VENUS Dec.	JUPITER −1.5 GHA	JUPITER Dec	SATURN 1.0 GHA	SATURN Dec	☽ MOON GHA	MOON Dec.
h m	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
12 00	1 37.1	N 1 07.5	179 01.4	322 00	S19 28	53 56	N19 49	19 46	N10 20	135 46	N12 27
10	4 07.2	07.3	181 31.8	324 31		56 26		22 17		138 11	29
20	6 37.2	07.2	184 02.2	327 01		58 56		24 47		140 36	30
30	9 07.3	· 07.0	186 32.6	329 31	· ·	61 27	· ·	27 17	· ·	143 01	· 31
40	11 37.3	06.8	189 03.0	332 01		63 57		29 48		145 26	32
50	14 07.3	06.7	191 33.4	334 31		66 27		32 18		147 51	34
13 00	16 37.4	N 1 06.5	194 03.9	337 01	S19 29	68 58	N19 49	34 49	N10 20	150 16	N12 35
10	19 07.4	06.4	196 34.3	339 31		71 28		37 19		152 41	36
20	21 37.4	06.2	199 04.7	342 01		73 58		39 49		155 06	37
30	24 07.5	· 06.0	201 35.1	344 31	· ·	76 29	· ·	42 20	· ·	157 31	· 39
40	26 37.5	05.9	204 05.5	347 02		78 59		44 50		159 56	40
50	29 07.5	05.7	206 35.9	349 32		81 29		47 20		162 21	41
14 00	31 37.6	N 1 05.5	209 06.3	352 02	S19 29	84 00	N19 49	49 51	N10 20	164 46	N12 42
10	34 07.6	05.4	211 36.7	354 32		86 30		52 21		167 11	44
20	36 37.7	05.2	214 07.1	357 02		89 00		54 51		169 36	45
30	39 07.7	· 05.1	216 37.5	359 32	· ·	91 31	· ·	57 22	· ·	172 01	· 46
40	41 37.7	04.9	219 08.0	2 02		94 01		59 52		174 26	47
50	44 07.8	04.7	221 38.4	4 32		96 31		62 23		176 51	48
15 00	46 37.8	N 1 04.6	224 08.8	7 03	S19 30	99 02	N19 49	64 53	N10 20	179 16	N12 50
10	49 07.8	04.4	226 39.2	9 33		101 32		67 23		181 41	51
20	51 37.9	04.3	229 09.6	12 03		104 02		69 54		184 06	52
30	54 07.9	· 04.1	231 40.0	14 33	· ·	106 33	· ·	72 24	· ·	186 31	· 53
40	56 38.0	03.9	234 10.4	17 03		109 03		74 54		188 56	54
50	59 08.0	03.8	236 40.8	19 33		111 33		77 25		191 21	56
16 00	61 38.0	N 1 03.6	239 11.2	22 03	S19 31	114 04	N19 49	79 55	N10 20	193 46	N12 57
10	64 08.1	03.4	241 41.7	24 33		116 34		82 25		196 11	58
20	66 38.1	03.3	244 12.1	27 04		119 04		84 56		198 36	12 59
30	69 08.1	· 03.1	246 42.5	29 34	· ·	121 35	· ·	87 26	· ·	201 01	13 01
40	71 38.2	03.0	249 12.9	32 04		124 05		89 57		203 26	02
50	74 08.2	02.8	251 43.3	34 34		126 35		92 27		205 51	03
17 00	76 38.3	N 1 02.6	254 13.7	37 04	S19 32	129 06	N19 48	94 57	N10 20	208 16	N13 04
10	79 08.3	02.5	256 44.1	39 34		131 36		97 28		210 41	05
20	81 38.3	02.3	259 14.5	42 04		134 06		99 58		213 06	06
30	84 08.4	· 02.1	261 44.9	44 34	· ·	136 37	· ·	102 28	· ·	215 31	· 08
40	86 38.4	02.0	264 15.3	47 04		139 07		104 59		217 56	09
50	89 08.4	01.8	266 45.8	49 35		141 37		107 29		220 21	10
18 00	91 38.5	N 1 01.7	269 16.2	52 05	S19 33	144 08	N19 48	109 59	N10 20	222 46	N13 11
10	94 08.5	01.5	271 46.6	54 35		146 38		112 30		225 11	12
20	96 38.5	01.3	274 17.0	57 05		149 08		115 00		227 36	14
30	99 08.6	· 01.2	276 47.4	59 35	· ·	151 39	· ·	117 31	· ·	230 01	· 15
40	101 38.6	01.0	279 17.8	62 05		154 09		120 01		232 26	16
50	104 08.7	00.9	281 48.2	64 35		156 39		122 31		234 51	17
19 00	106 38.7	N 1 00.7	284 18.6	67 05	S19 34	159 10	N19 48	125 02	N10 20	237 16	N13 18
10	109 08.7	00.5	286 49.0	69 36		161 40		127 32		239 41	19
20	111 38.8	00.4	289 19.5	72 06		164 10		130 02		242 06	21
30	114 08.8	· 00.2	291 49.9	74 36	· ·	166 41	· ·	132 33	· ·	244 31	· 22
40	116 38.8	1 00.0	294 20.3	77 06		169 11		135 03		246 56	23
50	119 08.9	0 59.9	296 50.7	79 36		171 41		137 33		249 21	24
20 00	121 38.9	N 0 59.7	299 21.1	82 06	S19 34	174 12	N19 48	140 04	N10 19	251 46	N13 25
10	124 09.0	59.6	301 51.5	84 36		176 42		142 34		254 11	26
20	126 39.0	59.4	304 21.9	87 06		179 12		145 05		256 36	27
30	129 09.0	· 59.2	306 52.3	89 36	· ·	181 43	· ·	147 35	· ·	259 01	· 29
40	131 39.1	59.1	309 22.7	92 07		184 13		150 05		261 26	30
50	134 09.1	58.9	311 53.2	94 37		186 43		152 36		263 52	31
21 00	136 39.1	N 0 58.7	314 23.6	97 07	S19 35	189 14	N19 48	155 06	N10 19	266 17	N13 32
10	139 09.2	58.6	316 54.0	99 37		191 44		157 36		268 42	33
20	141 39.2	58.4	319 24.4	102 07		194 14		160 07		271 07	34
30	144 09.2	· 58.3	321 54.8	104 37	· ·	196 45	· ·	162 37	· ·	273 32	· 35
40	146 39.3	58.1	324 25.2	107 07		199 15		165 07		275 57	37
50	149 09.3	57.9	326 55.6	109 37		201 45		167 38		278 22	38
22 00	151 39.4	N 0 57.8	329 26.0	112 08	S19 36	204 16	N19 48	170 08	N10 19	280 47	N13 39
10	154 09.4	57.6	331 56.4	114 38		206 46		172 38		283 12	40
20	156 39.4	57.5	334 26.8	117 08		209 16		175 09		285 37	41
30	159 09.5	· 57.3	336 57.3	119 38	· ·	211 47	· ·	177 39	· ·	288 02	· 42
40	161 39.5	57.1	339 27.7	122 08		214 17		180 10		290 27	43
50	164 09.5	57.0	341 58.1	124 38		216 47		182 40		292 52	44
23 00	166 39.6	N 0 56.8	344 28.5	127 08	S19 37	219 13	N19 48	185 10	N10 19	295 17	N13 46
10	169 09.6	56.6	346 58.9	129 38		221 48		187 41		297 42	47
20	171 39.7	56.5	349 29.3	132 09		224 18		190 11		300 07	48
30	174 09.7	· 56.3	351 59.7	134 39	· ·	226 49	· ·	192 41	· ·	302 32	· 49
40	176 39.7	56.2	354 30.1	137 09		229 19		195 12		304 57	50
50	179 09.8	56.0	357 00.5	139 39		231 49		197 42		307 22	51
Rate	15 00.2	S0 01.0		15 00.7	S0 00.8	15 02.0	S0 00.1	15 02.2	S0 00.1	14 30.0	N0 07.1

Lat	Moon-set	Diff
N		
°	h m	m
72	11 45	54
70	11 22	49
68	11 04	45
66	10 50	43
64	10 39	41
62	10 29	39
60	10 21	38
58	10 13	37
56	10 07	36
54	10 01	35
52	09 56	34
50	09 51	33
45	09 41	32
40	09 33	31
35	09 26	30
30	09 19	29
20	09 09	28
10	08 59	26
0	08 50	25
10	08 41	24
20	08 32	23
30	08 21	21
35	08 15	20
40	08 08	19
45	07 59	18
50	07 49	17
52	07 45	16
54	07 40	15
56	07 34	14
58	07 28	14
60	07 21	12
S		

Moon's P in A.

Alt.	Corr	Alt	Corr
°	+ ′	°	+ ′
0		54	
	57		32
3		56	
	56		31
11		57	
	55		30
15		58	
	54		29
19		59	
	53		28
22		60	
	52		27
24		62	
	51		26
26		63	
	50		25
29		64	
	49		24
31		65	
	48		23
32		66	
	47		22
34		67	
	46		21
36		68	
	45		20
38		69	
	44		19
39		70	
	43		18
41		71	
	42		17
42		73	
	41		16
44		74	
	40		15
45		75	
	39		14
47		76	
	38		13
48		77	
	37		12
49		78	
	36		11
51		79	
	35		10
52		80	
	34		
53			
	33		
54			
	32		
56			

Sun SD 16′.0

Moon SD 15′

Age 18d

FIGURE 137.—Greenwich Day 263.

POLARIS (POLE STAR) TABLE, 1978

FOR DETERMINING THE LATITUDE FROM A SEXTANT ALTITUDE

L.H.A.♈	Q	L.H.A.♈	Q	L.H.A.♈	Q	L.H.A.♈	Q	L.H.A.♈	Q	L.H.A.♈	Q	L.H.A.♈	Q	L.H.A.♈	Q
° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′
359 06		81 54		114 52		145 20		188 06		268 21		300 18		331 10	
	-42		-32		- 6		+20		+46		+28		+ 2		-24
1 12		83 23		116 01		146 35		191 03		269 44		301 27		332 28	
	-43		-31		- 5		+21		+47		+27		+ 1		-25
3 26		84 50		117 10		147 51		194 26		271 06		302 36		333 47	
	-44		-30		- 4		+22		+48		+26		0		-26
5 50		86 16		118 19		149 08		198 36		272 27		303 45		335 07	
	-45		-29		- 3		+23		+49		+25		- 1		-27
8 27		87 40		119 28		150 26		204 36		273 46		304 54		336 29	
	-46		-28		- 2		+24		+50		+24		- 2		-28
11 21		89 02		120 37		151 45		220 55		275 05		306 03		337 51	
	-47		-27		- 1		+25		+49		+23		- 3		-29
14 42		90 24		121 46		153 04		226 55		276 23		307 12		339 15	
	-48		-26		0		+26		+48		+22		- 4		-30
18 48		91 44		122 55		154 25		231 05		277 40		308 21		340 41	
	-49		-25		+ 1		+27		+47		+21		- 5		-31
24 43		93 03		124 04		155 47		234 28		278 56		309 30		342 08	
	-50		-24		+ 2		+28		+46		+20		- 6		-32
40 48		94 21		125 13		157 10		237 25		280 11		310 39		343 37	
	-49		-23		+ 3		+29		+45		+19		- 7		-33
46 43		95 38		126 22		158 35		240 04		281 25		311 48		345 08	
	-48		-22		+ 4		+30		+44		+18		- 8		-34
50 49		96 54		127 31		160 01		242 30		282 39		312 58		346 42	
	-47		-21		+ 5		+31		+43		+17		- 9		-35
54 10		98 10		128 40		161 29		244 46		283 53		314 08		348 18	
	-46		-20		+ 6		+32		+42		+16		-10		-36
57 04		99 25		129 49		162 59		246 53		285 05		315 18		349 56	
	-45		-19		+ 7		+33		+41		+15		-11		-37
59 41		100 39		130 59		164 31		248 54		286 18		316 28		351 38	
	-44		-18		+ 8		+34		+40		+14		-12		-38
62 05		101 52		132 09		166 06		250 49		287 29		317 39		353 23	
	-43		-17		+ 9		+35		+39		+13		-13		-39
64 19		103 05		133 19		167 42		252 40		288 41		318 50		355 12	
	-42		-16		+10		+36		+38		+12		-14		-40
66 25		104 18		134 29		169 22		254 26		289 52		320 01		357 06	
	-41		-15		+11		+37		+37		+11		-15		-41
68 25		105 30		135 39		171 05		256 09		291 02		321 13		359 06	
	-40		-14		+12		+38		+36		+10		-16		-42
70 19		106 41		136 50		172 51		257 49		292 12		322 26		1 12	
	-39		-13		+13		+39		+35		+ 9		-17		-43
72 08		107 52		138 02		174 42		259 25		293 22		323 39		3 26	
	-38		-12		+14		+40		+34		+ 8		-18		-44
73 53		109 03		139 13		176 37		261 00		294 32		324 52		5 50	
	-37		-11		+15		+41		+33		+ 7		-19		-45
75 35		110 13		140 26		178 38		262 32		295 42		326 06		8 27	
	-36		-10		+16		+42		+32		+ 6		-20		-46
77 13		111 23		141 38		180 45		264 02		296 51		327 21		11 21	
	-35		- 9		+17		+43		+31		+ 5		-21		-47
78 49		112 33		142 52		183 01		265 30		298 00		328 37		14 42	
	-34		- 8		+18		+44		+30		+ 4		-22		-48
80 23		113 43		144 06		185 27		266 56		299 09		329 53		18 48	
	-33		- 7		+19		+45		+29		+ 3		-23		-49
81 54		114 52		145 20		188 06		268 21		300 18		331 10		24 43	

Q, which does *not* include refraction, is to be applied to the corrected sextant altitude of *Polaris*.
Polaris: Mag. 2·1, S.H.A. 327°14′, Dec. N. 89°10·′0

AZIMUTH OF *POLARIS*

L.H.A. ♈	Latitude 0°	30°	50°	55°	60°	65°	70°	L.H.A. ♈	Latitude 0°	30°	50°	55°	60°	65°	70°
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
0	0·5	0·5	0·7	0·8	0·9	1·1	1·4	180	359·5	359·5	359·3	359·2	359·1	359·0	358·7
10	0·3	0·4	0·5	0·6	0·7	0·8	1·0	190	359·7	359·6	359·5	359·4	359·4	359·3	359·1
20	0·2	0·2	0·3	0·3	0·4	0·4	0·6	200	359·8	359·8	359·7	359·7	359·6	359·6	359·5
30	0·0	0·0	0·1	0·1	0·1	0·1	0·1	210	0·0	0·0	359·9	359·9	359·9	359·9	359·9
40	359·9	359·9	359·8	359·8	359·8	359·7	359·7	220	0·1	0·1	0·2	0·2	0·2	0·2	0·3
50	359·8	359·7	359·6	359·6	359·5	359·4	359·3	230	0·2	0·3	0·4	0·4	0·5	0·6	0·7
60	359·6	359·6	359·4	359·3	359·2	359·1	358·8	240	0·4	0·4	0·6	0·7	0·7	0·9	1·1
70	359·5	359·4	359·2	359·1	359·0	358·8	358·5	250	0·5	0·6	0·8	0·9	1·0	1·2	1·4
80	359·4	359·3	359·0	358·9	358·8	358·5	358·2	260	0·6	0·7	0·9	1·1	1·2	1·4	1·7
90	359·3	359·2	358·9	358·8	358·6	358·3	357·9	270	0·7	0·8	1·1	1·2	1·4	1·6	2·0
100	359·2	359·1	358·8	358·6	358·4	358·2	357·7	280	0·8	0·9	1·2	1·3	1·5	1·8	2·2
110	359·2	359·1	358·7	358·6	358·4	358·1	357·6	290	0·8	0·9	1·3	1·4	1·6	1·9	2·4
120	359·2	359·0	358·7	358·5	358·3	358·0	357·6	300	0·8	1·0	1·3	1·4	1·7	2·0	2·4
130	359·2	359·0	358·7	358·6	358·4	358·1	357·6	310	0·8	1·0	1·3	1·4	1·7	2·0	2·4
140	359·2	359·1	358·8	358·6	358·4	358·1	357·7	320	0·8	0·9	1·2	1·4	1·6	1·9	2·4
150	359·3	359·1	358·9	358·7	358·5	358·3	357·9	330	0·7	0·9	1·2	1·3	1·5	1·8	2·2
160	359·3	359·2	359·0	358·9	358·7	358·5	358·1	340	0·7	0·8	1·0	1·2	1·3	1·6	2·0
170	359·4	359·4	359·1	359·0	358·9	358·7	358·4	350	0·6	0·7	0·9	1·0	1·2	1·4	1·7
180	359·5	359·5	359·3	359·2	359·1	359·0	358·7	360	0·5	0·5	0·7	0·8	0·9	1·1	1·4

When Cassiopeia is left (right), *Polaris* is west (east).

FIGURE 138.—Polaris (Pole Star, able.

CORRECTIONS TO BE APPLIED TO SEXTANT ALTITUDE

REFRACTION

To be subtracted from sextant altitude (referred to as observed altitude in A.P. 3270)

R_o	Height above sea level in units of 1 000 ft. — Sextant Altitude: 0	5	10	15	20	25	30	35	40	45	50	55	R_o	$R = R_o \times f$ — f: 0·9	1·0	1·1	1·2
′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	′	′	′	′	′
	90	90	90	90	90	90	90	90	90	90	90	90					
0													0	0	0	0	0
	63	59	55	51	46	41	36	31	26	20	17	13					
1													1	1	1	1	1
	33	29	26	22	19	16	14	11	9	7	6	4					
2													2	2	2	2	2
	21	19	16	14	12	10	8	7	5	4	2 40	1 40					
3													3	3	3	3	4
	16	14	12	10	8	7	6	5	3 10	2 20	1 30	0 40					
4													4	4	4	4	5
	12	11	9	8	7	5	4 00	3 10	2 10	1 30	0 39	+0 05					
5													5	5	5	5	6
	10	9	7	5 50	4 50	3 50	3 10	2 20	1 30	0 49	+0 11	−0 19					
6													6	5	6	7	7
	8 10	6 50	5 50	4 50	4 00	3 00	2 20	1 50	1 10	0 24	−0 11	−0 38					
7													7	6	7	8	8
	6 30	5 50	5 00	4 00	3 10	2 30	1 50	1 20	0 30	+0 04	−0 28	−0 54					
8													8	7	8	9	10
	6 00	5 10	4 10	3 20	2 40	2 00	1 30	1 00	0 19	−0 13	−0 42	−1 08					
9													9	8	9	10	11
	5 20	4 30	3 40	2 50	2 10	1 40	1 10	0 35	+0 03	−0 27	−0 53	−1 18					
10													10	9	10	11	12
	4 30	3 40	2 50	2 20	1 40	1 10	0 37	+0 11	−0 16	−0 43	−1 08	−1 31					
12													12	11	12	13	14
	3 30	2 50	2 10	1 40	1 10	0 34	+0 09	−0 14	−0 37	−1 00	−1 23	−1 44					
14													14	13	14	15	17
	2 50	2 10	1 40	1 10	0 37	+0 10	−0 13	−0 34	−0 53	−1 14	−1 35	−1 56					
16													16	14	16	18	19
	2 20	1 40	1 20	0 43	+0 15	−0 08	−0 31	−0 52	−1 08	−1 27	−1 46	−2 05					
18													18	16	18	20	22
	1 50	1 20	0 49	+0 23	−0 02	−0 26	−0 46	−1 06	−1 22	−1 39	−1 57	−2 14					
20													20	18	20	22	24
	1 12	0 44	+0 19	−0 06	−0 28	−0 48	−1 09	−1 27	−1 42	−1 58	−2 14	−2 30					
25													25	22	25	28	30
	0 34	+0 10	−0 13	−0 36	−0 55	−1 14	−1 32	−1 51	−2 06	−2 21	−2 34	−2 49					
30													30	27	30	33	36
	+0 06	−0 16	−0 37	−0 59	−1 17	−1 33	−1 51	−2 07	−2 23	−2 37	−2 51	−3 04					
35													35	31	35	38	42
	−0 18	−0 37	−0 58	−1 16	−1 34	−1 49	−2 06	−2 22	−2 35	−2 49	−3 03	−3 16					
40													40	36	40	44	48
		−0 53	−1 14	−1 31	−1 47	−2 03	−2 18	−2 33	−2 47	−2 59	−3 13	−3 25					
45													45	40	45	50	54
		−1 10	−1 28	−1 44	−1 59	−2 15	−2 28	−2 43	−2 56	−3 08	−3 22	−3 33					
50													50	45	50	55	60
			−1 40	−1 53	−2 09	−2 24	−2 38	−2 52	−3 04	−3 17	−3 29	−3 41					
55													55	49	55	60	66
				−2 03	−2 18	−2 33	−2 46	−3 01	−3 12	−3 25	−3 37	−3 48					
60													60	54	60	66	72
							−2 53	−3 07	−3 19	−3 31	−3 42	−3 53					

f	Temperature in °C.: 0	5	10	15	20	25	30	35	40	45	50	55	f
	+47	+36	+27	+18	+10	+ 3	− 5	−13		For these heights no temperature correction is necessary, so use $R = R_o$.			
0·9													0·9
	+26	+16	+ 6	− 4	−13	−22	−31	−40					
1·0													1·0
	+ 5	− 5	−15	−25	−36	−46	−57	−68					
1·1													1·1
	−16	−25	−36	−46	−58	−71	−83	−95					
1·2													1·2
	−37	−45	−56	−67	−81	−95							

Where R_o is less than 10′ or the height greater than 35 000 ft. use $R = R_o$

Choose the column appropriate to height, in units of 1 000 ft., and find the range of altitude in which the sextant altitude lies; the corresponding value of R_o is the refraction, to be subtracted from sextant altitude, unless conditions are extreme. In that case find f from the lower table, with critical argument temperature. Use the table on the right to form the refraction, $R = R_o \times f$.

CORIOLIS (Z) CORRECTION

To be applied by moving the position line a distance Z to starboard (right) of the track in northern latitudes and to port (left) in southern latitudes.

G/S KNOTS	Latitude 0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
	′	′	′	′	′	′	′	′	′	′
150	0	1	1	2	3	3	3	4	4	4
200	0	1	2	3	3	4	5	5	5	5
250	0	1	2	3	4	5	6	6	6	7
300	0	1	3	4	5	6	7	7	8	8
350	0	2	3	5	6	7	8	9	9	9
400	0	2	4	5	7	8	9	10	10	10
450	0	2	4	6	8	9	10	11	12	12
500	0	2	4	7	8	10	11	12	13	13
550	0	3	5	7	9	11	12	14	14	14
600	0	3	5	8	10	12	14	15	16	16
650	0	3	6	9	11	13	15	16	17	17
700	0	3	6	9	12	14	16	17	18	18
750	0	3	7	10	13	15	17	18	19	20
800	0	4	7	10	13	16	18	20	21	21
850	0	4	8	11	14	17	19	21	22	22
900	0	4	8	12	15	18	20	22	23	24

FIGURE 139.—Sextant Altitude Corrections.

LAT 32°N

LHA ♈	*VEGA Hc	Zn	Alphecca Hc	Zn	ARCTURUS Hc	Zn	*SPICA Hc	Zn	REGULUS Hc	Zn	*POLLUX Hc	Zn	Dubhe Hc	Zn
180	13 09	052	43 36	082	57 15	105	42 28	151	57 20	239	35 17	284	58 44	347
181	13 50	053	44 26	082	58 04	105	42 52	153	56 36	240	34 28	284	58 32	346
182	14 30	053	45 16	083	58 53	106	43 15	154	55 52	241	33 39	285	58 19	345
183	15 11	053	46 07	083	59 42	107	43 37	155	55 07	242	32 49	285	58 06	345
184	15 52	054	46 58	084	60 30	108	43 58	156	54 22	243	32 00	285	57 52	344
185	16 33	054	47 48	084	61 19	109	44 17	158	53 36	244	31 11	286	57 38	343
186	17 15	055	48 39	085	62 06	110	44 36	159	52 50	245	30 22	286	57 23	342
187	17 56	055	49 29	085	62 54	111	44 54	160	52 04	246	29 33	286	57 07	342
188	18 38	055	50 20	085	63 41	113	45 10	162	51 17	247	28 45	287	56 50	341
189	19 20	056	51 11	086	64 28	114	45 26	163	50 30	248	27 56	287	56 33	340
190	20 02	056	52 02	086	65 14	115	45 40	164	49 42	249	27 08	288	56 16	339
191	20 44	056	52 52	087	66 00	116	45 53	166	48 55	250	26 19	288	55 58	339
192	21 27	057	53 43	087	66 45	118	46 05	167	48 07	251	25 31	288	55 39	338
193	22 10	057	54 34	088	67 30	119	46 16	169	47 18	252	24 43	289	55 20	338
194	22 52	057	55 25	088	68 14	121	46 25	170	46 30	253	23 54	289	55 00	337

LHA ♈	*Kochab Hc	Zn	VEGA Hc	Zn	Rasalhague Hc	Zn	*ANTARES Hc	Zn	SPICA Hc	Zn	*REGULUS Hc	Zn	Dubhe Hc	Zn
195	45 34	010	23 35	058	24 45	090	13 24	133	46 33	171	45 41	253	54 40	336
196	45 43	010	24 18	058	25 36	091	14 01	134	46 40	173	44 53	254	54 20	336
197	45 51	010	25 02	058	26 27	091	14 37	135	46 46	174	44 04	255	53 59	335
198	46 00	009	25 45	059	27 18	092	15 13	135	46 51	176	43 14	256	53 37	335
199	46 08	009	26 29	059	28 09	092	15 48	136	46 54	177	42 25	256	53 15	334
200	46 16	009	27 13	059	28 59	093	16 23	137	46 56	179	41 36	257	52 53	334
201	46 23	008	27 56	060	29 50	094	16 58	138	46 57	180	40 46	258	52 30	333
202	46 31	008	28 40	060	30 41	094	17 32	138	46 56	181	39 56	258	52 07	333
203	46 38	008	29 25	060	31 32	095	18 05	139	46 54	183	39 06	259	51 44	332
204	46 44	007	30 09	061	32 22	095	18 39	140	46 51	184	38 16	260	51 20	332
205	46 51	007	30 53	061	33 13	096	19 11	141	46 47	186	37 26	260	50 56	332
206	46 57	007	31 38	061	34 04	096	19 43	141	46 41	187	36 36	261	50 32	331
207	47 02	006	32 22	061	34 54	097	20 15	142	46 34	189	35 46	262	50 07	331
208	47 08	006	33 07	062	35 45	098	20 46	143	46 26	190	34 55	262	49 43	331
209	47 12	005	33 52	062	36 35	098	21 16	144	46 16	191	34 05	263	49 17	330

LHA ♈	*Kochab Hc	Zn	VEGA Hc	Zn	Rasalhague Hc	Zn	*ANTARES Hc	Zn	SPICA Hc	Zn	*REGULUS Hc	Zn	Dubhe Hc	Zn
210	47 17	005	34 37	062	37 25	099	21 46	144	46 06	193	33 14	263	48 52	330
211	47 21	005	35 22	062	38 16	100	22 15	145	45 54	194	32 24	264	48 26	330
212	47 25	004	36 07	063	39 06	100	22 44	146	45 41	195	31 33	265	48 00	329
213	47 29	004	36 52	063	39 56	101	23 12	147	45 27	197	30 42	265	47 34	329
214	47 32	003	37 38	063	40 46	102	23 39	148	45 11	198	29 52	266	47 08	329
215	47 35	003	38 23	063	41 35	102	24 06	149	44 55	200	29 01	266	46 42	329
216	47 38	003	39 09	064	42 25	103	24 32	149	44 37	201	28 10	267	46 15	328
217	47 40	002	39 55	064	43 15	104	24 58	150	44 19	202	27 19	267	45 48	328
218	47 42	002	40 40	064	44 04	104	25 23	151	43 59	[illegible]	26 28	268	45 21	328
219	47 43	001	41 26	064	44 53	105	25 47	152	43 38	[illegible]	25 38	268	44 54	328
220	47 44	001	42 12	065	45 42	106	26 10	153	43 16	206	24 47	269	44 27	328
221	47 45	001	42 58	065	46 31	107	26 33	154	42 54	207	23 56	270	43 59	327
222	47 46	000	43 44	065	47 20	107	26 55	155	42 30	208	23 05	270	43 32	327
223	47 46	000	44 30	065	48 08	108	27 16	156	42 05	210	22 14	271	43 04	327
224	47 45	359	45 16	065	48 56	109	27 37	157	41 40	211	21 23	271	42 37	327

LHA ♈	DENEB Hc	Zn	VEGA Hc	Zn	*ALTAIR Hc	Zn	ANTARES Hc	Zn	*SPICA Hc	Zn	Denebola Hc	Zn	*Dubhe Hc	Zn
225	25 14	051	46 03	065	19 30	092	27 57	158	41 13	212	43 06	260	42 09	327
226	25 53	051	46 49	066	20 21	092	28 16	159	40 46	213	42 16	261	41 41	327
227	26 33	051	47 35	066	21 12	093	28 34	160	40 17	214	41 26	261	41 13	327
228	27 13	052	48 22	066	22 03	093	28 51	161	39 48	215	40 36	262	40 45	327
229	27 53	052	49 08	066	22 54	094	29 08	161	39 18	216	39 45	262	40 17	326
230	28 33	052	49 55	066	23 44	094	29 24	162	38 48	218	38 55	263	39 49	326
231	29 13	052	50 41	066	24 35	095	29 38	163	38 16	219	38 04	264	39 21	326
232	29 54	053	51 28	066	25 26	096	29 53	164	37 44	220	37 14	264	38 52	326
233	30 34	053	52 14	066	26 16	096	30 06	165	37 11	221	36 23	265	38 24	326
234	31 15	053	53 01	067	27 07	097	30 18	166	36 38	222	35 32	265	37 56	326
235	31 56	053	53 48	067	27 57	097	30 30	167	36 04	223	34 42	266	37 27	326
236	32 36	054	54 35	067	28 48	098	30 40	168	35 29	224	33 51	267	36 59	326
237	33 17	054	55 21	067	29 38	098	30 50	170	34 53	225	33 00	267	36 31	326
238	33 59	054	56 08	067	30 28	099	30 59	171	34 17	226	32 09	268	36 03	326
239	34 40	054	56 55	067	31 19	100	31 07	172	33 41	227	31 18	268	35 34	326

LHA ♈	*DENEB Hc	Zn	ALTAIR Hc	Zn	Nunki Hc	Zn	*ANTARES Hc	Zn	SPICA Hc	Zn	ARCTURUS Hc	Zn	*Alkaid Hc	Zn
240	35 21	054	32 09	100	18 26	139	31 14	173	33 04	227	63 12	248	59 43	315
241	36 02	055	32 59	101	18 59	140	31 20	174	32 26	228	62 24	249	59 07	314
242	36 44	055	33 49	102	19 32	141	31 25	175	31 48	229	61 37	250	58 30	314
243	37 26	055	34 38	102	20 03	142	31 29	176	31 09	230	60 48	251	57 53	314
244	38 07	055	35 28	103	20 35	142	31 32	177	30 30	231	60 00	252	57 16	313
245	38 49	055	36 18	104	21 05	143	31 35	178	29 50	232	59 12	253	56 39	313
246	39 31	055	37 07	104	21 36	144	31 36	179	29 10	233	58 23	254	56 02	312
247	40 13	055	37 56	105	22 05	145	31 37	180	28 29	233	57 34	255	55 24	312
248	40 54	056	38 45	106	22 34	146	31 36	181	27 48	234	56 44	256	54 46	312
249	41 36	056	39 34	106	23 03	147	31 35	182	27 06	235	55 55	257	54 08	312
250	42 18	056	40 23	107	23 30	147	31 33	183	26 25	236	55 05	258	53 30	311
251	[illegible]	056	41 12	108	23 57	148	31 29	184	25 42	237	54 15	258	52 52	311
252	[illegible]	056	42 00	109	24 24	149	31 25	185	25 00	237	53 26	259	52 14	311
253	44 25	056	42 48	109	24 50	150	31 20	186	24 17	238	52 36	260	51 35	311
254	45 07	056	43 36	110	25 15	151	31 14	187	23 33	239	51 45	261	50 57	311

LHA ♈	*DENEB Hc	Zn	ALTAIR Hc	Zn	Nunki Hc	Zn	*ANTARES Hc	Zn	ARCTURUS Hc	Zn	*Alkaid Hc	Zn	Kochab Hc	Zn
255	45 49	056	44 23	111	25 39	152	31 07	188	50 55	261	50 18	310	44 40	348
256	46 32	056	45 11	112	26 03	153	30 59	189	50 05	262	49 39	310	[illegible]	348
257	47 14	056	45 58	113	26 26	153	30 51	190	49 14	263	49 00	310	44 27	348
258	47 56	056	46 45	114	26 49	154	30 41	191	48 24	263	48 21	310	44 16	347
259	48 38	056	47 31	115	27 10	155	30 31	192	47 33	264	47 43	310	44 05	347
260	49 21	056	48 17	115	27 31	156	30 19	193	46 43	265	47 04	310	43 53	347
261	50 03	056	49 03	116	27 51	157	30 07	194	45 52	265	46 25	310	43 41	347
262	50 45	056	49 48	117	28 11	158	29 54	195	45 01	266	45 46	310	43 29	346
263	51 27	056	50 33	118	28 29	159	29 40	196	44 11	266	45 07	310	43 17	346
264	52 09	056	51 18	119	28 47	160	29 25	197	43 20	267	44 28	310	43 05	346
265	52 52	056	52 02	120	29 04	161	29 09	198	42 29	267	43 49	310	42 52	346
266	53 34	056	52 46	122	29 20	162	28 53	199	41 38	268	43 10	310	42 39	345
267	54 16	056	53 29	123	29 35	163	28 35	200	40 47	269	42 30	310	42 26	345
268	54 58	055	54 11	124	29 50	164	28 17	201	39 56	269	41 51	310	42 13	345
269	55 40	055	54 53	125	30 04	165	27 58	202	39 05	270	41 13	310	42 00	345

LHA ♈	*DENEB Hc	Zn	ALTAIR Hc	Zn	*Nunki Hc	Zn	ANTARES Hc	Zn	ARCTURUS Hc	Zn	*Alkaid Hc	Zn	Kochab Hc	Zn
270	56 21	055	55 35	126	30 16	166	27 39	203	38 15	270	40 34	310	41 46	344
271	57 03	055	56 15	128	30 28	167	27 18	204	37 24	271	39 55	310	41 33	344
272	57 45	055	56 55	129	30 39	168	26 57	205	36 33	271	39 16	310	41 19	344
273	58 26	054	57 34	130	30 49	169	26 35	206	35 42	272	38 37	310	41 05	344
274	59 07	054	58 13	132	30 59	170	26 12	207	34 51	272	37 58	310	40 51	344
275	59 49	054	58 50	133	31 07	171	25 49	208	34 00	273	37 19	311	40 36	344
276	60 30	053	59 27	135	31 14	172	25 25	209	33 09	273	36 41	311	40 22	343
277	61 10	053	60 03	136	31 21	173	25 00	210	32 19	274	36 02	311	40 07	343
278	61 51	053	60 37	138	31 26	174	24 35	210	31 28	274	35 24	311	39 52	343
279	62 31	052	61 11	140	31 31	175	24 09	211	30 37	275	34 45	311	39 38	343
280	63 12	052	61 43	141	31 35	176	23 42	212	29 47	275	34 07	311	39 23	343
281	63 51	051	62 15	143	31 38	177	23 14	213	28 56	276	33 29	311	39 07	343
282	64 31	051	62 44	145	31 40	178	22 46	214	28 05	276	32 51	311	38 52	343
283	65 10	050	63 13	147	31 41	179	22 18	215	27 15	277	32 12	312	38 37	342
284	65 49	049	63 40	149	31 41	181	21 49	215	26 24	277	31 35	312	38 22	342

LHA ♈	*Alpheratz Hc	Zn	Enif Hc	Zn	ALTAIR Hc	Zn	*ANTARES Hc	Zn	ARCTURUS Hc	Zn	*Alkaid Hc	Zn	Kochab Hc	Zn
285	25 12	070	46 17	111	64 06	151	21 19	216	25 34	278	30 57	312	38 06	342
286	26 00	071	47 04	112	64 30	153	20 48	217	24 43	278	30 19	312	37 50	342
287	26 48	071	47 51	113	64 52	155	20 18	218	23 53	279	29 41	312	37 35	342
288	27 36	071	48 37	114	65 13	157	19 46	219	23 03	279	29 04	313	37 19	342
289	28 24	072	49 24	115	65 31	159	19 14	219	22 12	280	28 26	313	37 03	342
290	29 13	072	50 10	116	65 48	162	18 41	220	21 22	280	27 49	313	36 47	342
291	30 01	073	50 55	117	66 03	164	18 08	221	20 32	280	27 12	313	36 31	342
292	30 50	073	51 40	118	66 16	167	17 35	222	19 42	281	26 35	314	36 15	342
293	31 38	073	52 25	119	66 27	169	17 01	222	18 52	281	25 58	314	35 59	342
294	32 27	074	53 10	120	66 36	171	16 26	223	18 03	282	25 22	314	35 43	342
295	33 16	074	53 53	121	66 42	174	15 51	224	17 13	282	24 45	314	35 27	341
296	34 05	075	54 37	122	66 47	176	15 16	224	16 23	283	24 09	315	35 11	341
297	34 54	075	55 19	123	66 49	179	14 40	225	15 34	283	23 33	315	34 55	341
298	35 43	075	56 02	125	66 49	181	14 04	226	14 44	284	22 57	315	34 38	341
299	36 33	076	56 43	126	66 46	184	13 27	227	13 55	284	22 21	315	34 22	341

LHA ♈	*Mirfak Hc	Zn	Alpheratz Hc	Zn	*FOMALHAUT Hc	Zn	ALTAIR Hc	Zn	Rasalhague Hc	Zn	*Alphecca Hc	Zn	Kochab Hc	Zn
300	12 11	038	37 22	076	15 25	141	66 42	186	51 20	248	32 42	283	34 06	341
301	12 42	039	38 11	076	15 56	142	66 35	189	50 32	249	31 52	284	33 49	341
302	13 14	039	39 01	077	16 27	143	66 26	191	49 45	250	31 03	284	33 33	341
303	13 46	039	39 50	077	16 58	143	66 15	194	48 57	251	30 14	285	33 17	341
304	14 19	040	40 40	078	17 28	144	66 02	196	48 08	252	29 24	285	33 01	341
305	14 51	040	41 30	078	17 58	145	65 47	198	47 20	253	28 35	285	32 44	341
306	15 24	040	42 20	078	18 27	146	65 30	201	46 31	253	27 46	286	32 28	341
307	15 57	041	43 09	079	18 55	146	65 11	203	45 42	254	26 57	286	32 12	341
308	16 30	041	43 59	079	19 23	147	64 50	205	44 53	255	26 08	287	31 56	341
309	17 04	041	44 49	079	19 51	148	64 27	[illegible]	44 04	256	25 20	287	31 39	341
310	17 38	042	45 39	080	20 17	149	64 03	209	43 15	256	24 31	287	31 23	341
311	18 12	042	46 29	080	20 43	150	63 38	211	42 25	257	23 43	288	31 07	342
312	18 46	042	47 20	080	21 09	150	63 10	213	41 36	258	22 54	288	30 51	342
313	19 20	043	48 10	081	21 34	151	62 42	215	40 46	258	22 06	289	30 35	342
314	19 55	043	49 00	081	21 58	152	62 12	217	39 56	259	21 18	289	30 19	342

LHA ♈	*Mirfak Hc	Zn	Hamal Hc	Zn	Diphda Hc	Zn	*FOMALHAUT Hc	Zn	ALTAIR Hc	Zn	*VEGA Hc	Zn	Kochab Hc	Zn
315	20 30	043	23 04	076	16 52	125	22 22	153	61 40	219	60 00	293	30 03	342
316	21 05	044	23 53	076	17 34	126	22 45	154	61 08	221	59 21	293	29 47	342
317	21 40	044	24 43	077	18 15	126	23 07	154	60 34	222	58 34	293	29 31	342
318	22 15	044	25 32	077	18 56	127	23 28	155	59 59	224	57 48	293	29 15	342
319	22 51	044	26 22	078	19 37	128	23 49	156	59 23	225	57 01	293	28 59	342
320	23 26	045	27 12	078	20 17	128	24 10	157	58 47	227	56 14	293	28 44	342
321	24 02	045	28 02	079	20 56	129	24 29	158	58 09	228	55 27	293	28 28	342
322	24 38	045	28 52	079	21 36	130	24 48	159	57 31	230	54 41	293	28 13	342
323	25 15	045	29 42	080	22 14	131	25 06	160	56 51	231	53 54	293	27 57	342
324	25 51	046	30 32	080	22 53	131	25 23	161	56 11	233	53 07	293	27 42	342
325	26 27	046	31 22	080	23 31	132	25 39	162	55 31	234	52 21	293	27 27	343
326	27 04	046	32 12	081	24 08	133	25 55	163	54 49	235	51 34	294	27 11	343
327	27 41	046	33 02	081	24 45	134	26 10	163	54 07	236	50 47	294	26 56	343
328	28 18	047	33 53	082	25 22	135	26 24	164	53 25	237	50 01	294	26 41	343
329	28 55	047	34 43	082	25 58	135	26 37	165	52 41	239	49 14	294	26 26	343

LHA ♈	*Mirfak Hc	Zn	Hamal Hc	Zn	Diphda Hc	Zn	*FOMALHAUT Hc	Zn	ALTAIR Hc	Zn	*VEGA Hc	Zn	Kochab Hc	Zn
330	29 32	047	35 33	083	26 33	136	26 50	166	51 58	240	48 28	294	26 12	343
331	30 09	047	36 24	083	27 08	137	27 01	167	51 14	241	47 41	294	25 57	343
332	30 47	047	37 14	084	27 43	138	27 12	168	50 29	242	46 55	294	25 43	343
333	31 24	048	38 05	084	28 16	139	27 22	169	49 44	243	46 09	295	25 28	344
334	32 02	048	38 56	084	28 50	140	27 32	170	48 59	244	45 22	295	25 14	344
335	32 40	048	39 46	085	29 22	141	27 40	171	48 13	245	44 36	295	25 00	344
336	33 18	048	40 37	085	29 54	141	27 47	172	47 27	246	43 50	295	24 46	344
337	33 56	048	41 28	086	30 26	142	27 54	173	46 40	246	43 04	295	24 32	344
338	34 34	048	42 19	086	30 56	143	28 00	174	45 53	247	42 18	295	24 18	344
339	35 12	049	43 09	087	31 27	144	28 05	175	45 06	248	41 32	296	24 04	345
340	35 50	049	44 00	087	31 56	145	28 09	176	44 19	249	40 46	296	23 51	345
341	36 28	049	44 51	088	32 25	146	28 12	177	43 31	250	40 00	296	23 37	345
342	37 07	049	45 42	088	32 53	147	28 14	178	42 43	251	39 15	296	23 24	345
343	37 45	049	46 33	089	33 20	148	28 16	179	41 55	251	38 29	297	23 11	345
344	38 24	049	47 24	089	33 46	149	28 16	180	41 07	252	37 44	297	22 58	345

LHA ♈	*CAPELLA Hc	Zn	ALDEBARAN Hc	Zn	Diphda Hc	Zn	*FOMALHAUT Hc	Zn	ALTAIR Hc	Zn	*VEGA Hc	Zn	Kochab Hc	Zn
345	20 00	048	13 52	[illegible]	34 12	150	28 16	181	40 18	253	36 58	297	22 46	346
346	20 37	048	[illegible]	[illegible]	34 37	151	28 15	182	39 30	254	36 13	297	22 33	346
347	21 15	048	[illegible]	[illegible]	35 01	152	28 13	183	38 41	254	35 28	297	22 20	346
348	21 53	048	[illegible]	[illegible]	35 24	153	28 10	184	37 52	255	34 43	298	22 08	346
349	22 32	049	[illegible]	[illegible]	35 47	154	28 06	185	37 02	256	33 58	298	21 56	346
350	23 10	049	[illegible]	081	36 08	155	28 01	186	36 13	256	33 13	298	21 44	347
351	23 48	049	[illegible]	082	36 29	157	27 56	187	35 23	257	32 28	299	21 32	347
352	24 27	050	[illegible]	082	36 49	158	27 49	188	34 34	258	31 43	299	21 21	347
353	25 06	050	[illegible]	083	37 08	159	27 42	189	33 44	258	30 59	299	21 10	347
354	25 45	050	21 24	083	37 25	160	27 34	190	32 54	259	30 15	299	20 58	347
355	26 24	050	22 15	084	37 42	161	27 25	191	32 04	260	29 30	300	20 47	348
356	27 04	051	23 05	084	37 58	162	27 15	192	31 14	260	28 46	300	20 36	348
357	27 43	051	23 56	085	38 13	163	27 05	193	30 24	261	28 02	300	20 26	348
358	28 23	051	24 47	085	38 27	165	26 53	193	29 33	262	27 18	301	20 15	348
359	29 02	051	25 38	086	38 41	166	26 41	194	28 43	262	26 34	301	20 05	348

FIGURE 140.—LAT 32°N.

LAT 26°N

LHA ♈	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn
	Schedar		•CAPELLA		ALDEBARAN		•Diphda		FOMALHAUT		ALTAIR		•DENEB	
0	58 45	010	25 53	049	25 57	083	44 42	166	32 14	196	28 28	266	46 02	309
1	58 55	009	26 34	049	26 50	084	44 55	167	31 59	197	27 34	266	45 20	309
2	59 03	008	27 15	050	27 44	084	45 07	168	31 42	198	26 40	267	44 38	309
3	59 10	007	27 56	050	28 38	085	45 17	170	31 25	199	25 46	267	43 56	309
4	59 17	006	28 37	050	29 31	085	45 26	171	31 07	200	24 53	268	43 14	309
5	59 22	005	29 18	050	30 25	085	45 34	172	30 48	201	23 59	268	42 32	309
6	59 27	004	30 00	050	31 19	086	45 40	174	30 28	202	23 05	269	41 50	309
7	59 30	003	30 41	050	32 13	086	45 46	175	30 07	203	22 11	269	41 08	308
8	59 33	002	31 22	050	33 06	087	45 50	176	29 46	204	21 17	270	40 25	308
9	59 34	001	32 04	050	34 00	087	45 52	178	29 23	205	20 23	270	39 43	308
10	59 34	000	32 45	050	34 54	087	45 54	179	29 01	206	19 29	270	39 01	308
11	59 34	359	33 27	050	35 48	088	45 54	180	28 37	207	18 35	271	38 19	308
12	59 32	358	34 09	051	36 42	088	45 53	182	28 12	207	17 41	271	37 36	308
13	59 29	357	34 50	051	37 36	089	45 51	183	27 47	208	16 47	272	36 54	308
14	59 25	355	35 32	051	38 30	089	45 47	185	27 21	209	15 53	272	36 12	308
	•CAPELLA		ALDEBARAN		RIGEL		•Diphda		FOMALHAUT		Enif		•DENEB	
15	36 14	051	39 24	090	19 37	110	45 42	186	26 55	210	40 47	260	35 30	308
16	36 55	051	40 18	090	20 27	111	45 36	187	26 27	211	39 54	261	34 47	309
17	37 37	051	41 11	090	21 18	111	45 28	189	25 59	212	39 01	261	34 05	309
18	38 19	051	42 05	091	22 08	112	45 20	190	25 31	212	38 07	262	33 23	309
19	39 00	051	42 59	091	22 58	112	45 10	191	25 02	213	37 14	262	32 41	309
20	39 42	051	43 53	092	23 48	113	44 59	193	24 32	214	36 21	263	31 59	309
21	40 24	051	44 47	092	24 37	113	44 46	194	24 01	215	35 27	263	31 17	309
22	41 05	050	45 41	093	25 27	114	44 33	195	23 30	216	34 33	264	30 35	309
23	41 47	050	46 35	093	26 16	115	44 18	197	22 59	216	33 40	264	29 53	309
24	42 28	050	47 29	094	27 05	115	44 02	198	22 26	217	32 46	265	29 11	309
25	43 10	050	48 22	094	27 53	116	43 45	199	21 54	218	31 52	265	28 29	309
26	43 51	050	49 16	095	28 42	117	43 27	200	21 20	218	30 59	266	27 48	309
27	44 33	050	50 10	095	29 30	117	43 08	202	20 47	219	30 05	266	27 06	310
28	45 14	050	51 04	096	30 17	118	42 47	203	20 12	220	29 11	267	26 25	310
29	45 55	050	51 57	096	31 05	119	42 26	204	19 37	221	28 17	267	25 43	310
	CAPELLA		•ALDEBARAN		RIGEL		•Diphda		Alpheratz		DENEB		•Kochab	
30	46 36	050	52 51	097	31 52	119	42 04	205	64 54	283	25 02	310	10 55	357
31	47 17	049	53 44	098	32 39	120	41 40	206	64 01	283	24 21	310	10 32	357
32	47 58	049	54 38	098	33 25	121	41 16	207	63 09	283	23 39	310	10 29	357
33	48 39	049	55 31	099	34 12	122	40 51	209	62 17	283	22 58	311	10 26	357
34	49 19	049	56 24	099	34 57	122	40 24	210	61 24	283	22 18	311	10 24	358
35	50 00	048	57 17	100	35 43	123	39 57	211	60 32	283	21 37	311	10 22	358
36	50 40	048	58 10	101	36 28	124	39 29	212	59 39	284	20 56	311	10 20	358
37	51 20	048	59 03	102	37 12	125	39 00	213	58 47	284	20 16	311	10 18	358
38	52 00	048	59 56	102	37 56	126	38 31	214	57 54	284	19 35	312	10 17	359
39	52 40	047	60 49	103	38 40	126	38 00	215	57 02	284	18 55	312	10 16	359
40	53 19	047	61 41	104	39 23	127	37 29	216	56 10	284	18 15	312	10 15	359
41	53 58	046	62 33	105	40 06	128	36 57	217	55 17	284	17 35	312	10 15	000
42	54 37	046	63 25	106	40 48	129	36 24	218	54 25	284	16 55	313	10 14	000
43	55 16	046	64 17	107	41 29	130	35 50	219	53 33	284	16 16	313	10 14	000
44	55 54	045	65 09	108	42 10	131	35 16	220	52 40	284	15 36	313	10 14	000
	•CAPELLA		PROCYON		SIRIUS		•RIGEL		Acamar		Diphda		•Alpheratz	
45	56 32	045	20 40	094	20 47	122	42 51	132	23 37	181	34 41	221	51 48	285
46	57 10	044	21 33	095	21 32	122	43 30	133	23 36	181	34 06	222	50 56	285
47	57 47	043	22 27	095	22 18	123	44 09	134	23 34	182	33 30	223	50 04	285
48	58 24	043	23 21	096	23 03	124	44 48	135	23 32	183	32 53	223	49 12	285
49	59 00	042	24 14	096	23 47	124	45 25	136	23 29	184	32 16	224	48 20	285
50	59 36	041	25 08	097	24 32	125	46 02	137	23 25	185	31 38	225	47 28	285
51	60 12	041	26 02	097	25 16	126	46 39	138	23 20	185	30 59	226	46 36	286
52	60 47	040	26 55	098	25 59	126	47 14	140	23 14	186	30 20	227	45 44	286
53	61 21	039	27 48	098	26 43	127	47 48	141	23 08	187	29 41	227	44 52	286
54	61 55	038	28 42	099	27 25	128	48 22	142	23 01	188	29 01	228	44 00	286
55	62 28	037	29 35	099	28 08	129	48 55	143	22 53	189	28 20	229	43 08	286
56	63 00	036	30 28	100	28 50	129	49 27	145	22 44	190	27 40	230	42 17	287
57	63 32	035	31 21	100	29 31	130	49 57	146	22 35	190	26 58	231	41 25	287
58	64 02	034	32 14	101	30 12	131	50 27	147	22 25	191	26 16	231	40 33	287
59	64 32	033	33 07	101	30 53	132	50 56	149	22 14	192	25 34	232	39 42	287
	•Dubhe		PROCYON		SIRIUS		•RIGEL		Diphda		•Hamal		Mirfak	
60	15 40	028	34 00	102	31 33	132	51 23	150	24 51	233	64 02	270	65 09	346
61	16 14	028	34 53	103	32 12	133	51 50	151	24 08	233	63 09	271	64 55	344
62	16 40	029	35 45	103	32 51	134	52 15	153	23 25	234	62 14	271	64 40	343
63	17 05	029	36 38	104	33 30	135	52 39	154	22 41	235	61 20	272	64 23	341
64	17 32	029	37 30	104	34 08	136	53 02	156	21 57	235	60 26	272	64 04	340
65	17 58	029	38 23	105	34 45	137	53 23	157	21 12	236	59 32	272	63 47	339
66	18 24	029	39 15	105	35 22	138	53 43	159	20 28	237	58 38	273	63 27	338
67	18 51	030	40 06	106	35 58	138	54 02	161	19 42	237	57 45	273	63 06	336
68	19 17	030	40 58	107	36 33	139	54 19	162	18 57	238	56 51	273	62 44	335
69	19 44	030	41 50	107	37 08	140	54 35	164	18 11	238	55 57	274	62 21	334
70	20 11	030	42 41	108	37 42	141	54 49	165	17 25	239	55 03	274	61 57	333
71	20 38	030	43 32	109	38 16	142	55 02	167	16 39	240	54 09	274	61 32	332
72	21 05	030	44 23	110	38 48	143	55 13	169	15 52	240	53 16	275	61 06	331
73	21 32	030	45 14	110	39 20	144	55 23	171	15 05	241	52 22	275	60 39	330
74	22 00	031	46 04	111	39 51	145	55 31	172	14 18	241	51 28	276	60 12	329
	•Dubhe		POLLUX		PROCYON		•SIRIUS		RIGEL		•Hamal		Mirfak	
75	22 27	031	53 34	077	46 55	112	40 21	146	55 37	174	50 35	276	59 44	328
76	22 55	031	54 27	077	47 45	113	40 50	148	55 42	176	49 41	276	59 15	327
77	23 22	031	55 20	078	48 34	113	41 19	149	55 45	178	48 47	276	58 46	327
78	23 50	031	56 12	078	49 23	114	41 47	150	55 46	179	47 54	277	58 16	326
79	24 18	031	57 05	078	50 12	115	42 13	151	55 46	181	47 00	277	57 45	325
80	24 46	031	57 58	078	51 01	116	42 39	152	55 44	183	46 07	277	57 14	324
81	25 14	031	58 51	078	51 49	117	43 04	153	55 41	185	45 13	278	56 42	324
82	25 42	031	59 43	078	52 37	118	43 27	154	55 36	186	44 20	278	56 10	323
83	26 10	031	60 36	078	53 24	119	43 50	156	55 29	188	43 26	278	55 37	322
84	26 38	031	61 29	078	54 11	120	44 12	157	55 21	190	42 33	279	55 04	322
85	27 06	032	62 22	079	54 58	121	44 33	158	55 11	192	41 40	279	54 31	321
86	27 34	032	63 15	079	55 44	122	44 52	159	54 59	193	40 47	279	53 57	321
87	28 03	032	64 08	079	56 29	123	45 10	161	54 46	195	39 53	280	53 22	320
88	28 31	032	65 00	079	57 14	125	45 28	162	54 32	197	39 00	280	52 48	320
89	28 59	032	65 53	079	57 58	126	45 44	163	54 15	198	38 07	280	52 13	319

LAT 26°N

LHA ♈	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn	Hc	Zn
	Dubhe		•REGULUS		PROCYON		SIRIUS		•RIGEL		ALDEBARAN		•Mirfak	
90	29 27	032	30 26	091	58 41	127	45 59	165	53 58	200	68 01	249	51 37	319
91	29 56	032	31 20	091	59 24	129	46 12	166	53 39	201	67 11	250	51 02	318
92	30 24	032	32 14	092	60 05	130	46 25	167	53 19	203	66 20	251	50 26	318
93	30 52	032	33 08	092	60 46	131	46 36	169	52 57	204	65 29	252	49 50	318
94	31 21	032	34 02	093	61 26	133	46 46	170	52 34	206	64 37	253	49 13	317
95	31 49	032	34 56	093	62 05	135	46 54	171	52 10	207	63 45	254	48 37	317
96	32 17	032	35 50	094	62 43	136	47 02	173	51 44	209	62 53	255	48 00	317
97	32 45	031	36 43	094	63 20	138	47 08	174	51 18	210	62 01	256	47 23	316
98	33 13	031	37 37	095	63 55	140	47 12	176	50 50	212	61 09	257	46 45	316
99	33 42	031	38 31	095	64 29	142	47 16	177	50 21	213	60 16	257	46 08	316
100	34 10	031	39 25	096	65 02	144	47 18	178	49 51	214	59 24	258	45 30	316
101	34 38	031	40 18	096	65 33	146	47 19	180	49 20	216	58 31	259	44 53	316
102	35 05	031	41 12	097	66 03	148	47 18	181	48 48	217	57 38	260	44 15	315
103	35 33	031	42 05	097	66 31	150	47 16	183	48 15	218	56 45	260	43 37	315
104	36 01	031	42 59	098	66 57	152	47 13	184	47 41	219	55 52	261	42 59	315
	Dubhe		•REGULUS		Alphard		SIRIUS		•RIGEL		ALDEBARAN		•CAPELLA	
105	36 29	031	43 52	098	40 22	129	47 08	186	47 07	221	54 58	262	61 07	321
106	36 56	031	44 45	099	41 04	130	47 03	187	46 31	222	54 05	262	60 33	320
107	37 23	030	45 39	100	41 45	131	46 55	188	45 55	223	53 11	263	59 58	319
108	37 51	030	46 32	100	42 25	132	46 47	190	45 18	224	52 18	263	59 22	318
109	38 18	030	47 25	101	43 05	133	46 37	191	44 40	225	51 24	264	58 46	318
110	38 45	030	48 18	101	43 44	134	46 26	192	44 01	226	50 31	264	58 09	317
111	39 12	030	49 11	102	44 22	135	46 14	194	43 22	227	49 37	265	57 32	316
112	39 38	030	50 03	103	45 00	136	46 00	195	42 42	228	48 43	266	56 55	316
113	40 05	029	50 56	103	45 37	137	45 46	196	42 02	229	47 49	266	56 17	315
114	40 31	029	51 48	104	46 13	138	45 30	198	41 20	230	46 56	267	55 39	315
115	40 57	029	52 40	105	46 48	140	45 13	199	40 39	231	46 02	267	55 01	314
116	41 23	029	53 32	106	47 23	141	44 55	200	39 57	232	45 08	268	54 22	314
117	41 49	028	54 24	106	47 56	142	44 35	202	39 14	233	44 14	268	53 43	313
118	42 14	028	55 16	107	48 29	143	44 15	203	38 31	234	43 20	268	53 04	313
119	42 40	028	56 07	108	49 01	145	43 53	204	37 47	235	42 26	269	52 24	313
	•Dubhe		REGULUS		•Alphard		SIRIUS		RIGEL		•ALDEBARAN		CAPELLA	
120	43 05	027	56 58	109	49 32	146	43 31	205	37 03	235	41 32	269	51 44	312
121	43 30	027	57 49	110	50 01	147	43 07	207	36 18	236	40 38	270	51 04	312
122	43 54	027	58 40	111	50 30	148	42 42	208	35 33	237	39 44	270	50 24	312
123	44 18	027	59 30	112	50 58	150	42 17	209	34 48	238	38 50	271	49 44	311
124	44 42	026	60 20	113	51 24	151	41 50	210	34 02	239	37 57	271	49 03	311
125	45 06	026	61 10	114	51 50	153	41 23	211	33 16	239	37 03	272	48 23	311
126	45 29	025	61 59	115	52 14	154	40 54	212	32 29	240	36 09	272	47 42	311
127	45 52	025	62 47	116	52 37	156	40 25	213	31 42	241	35 15	272	47 01	311
128	46 15	025	63 36	117	52 58	157	39 55	214	30 55	241	34 21	273	46 20	310
129	46 37	024	64 23	119	53 18	159	39 24	215	30 07	242	33 27	273	45 39	310
130	46 59	024	65 10	120	53 37	160	38 52	217	29 19	243	32 33	274	44 58	310
131	47 20	023	65 57	121	53 55	162	38 20	218	28 31	243	31 39	274	44 16	310
132	47 41	023	66 42	123	54 11	164	37 47	219	27 43	244	30 46	274	43 35	310
133	48 02	022	67 27	125	54 25	165	37 13	220	26 54	245	29 52	275	42 53	310
134	48 22	022	68 11	126	54 38	167	36 38	220	26 05	245	28 58	275	42 12	310
	Dubhe		•ARCTURUS		SPICA		Alphard		•SIRIUS		BETELGEUSE		•CAPELLA	
135	48 42	021	18 08	077	15 55	111	54 50	169	36 03	221	42 05	256	41 30	310
136	49 02	021	19 00	077	16 45	112	55 00	170	35 27	222	41 13	256	40 49	309
137	49 21	020	19 53	078	17 35	112	55 08	172	34 50	223	40 20	257	40 07	309
138	49 39	020	20 46	078	18 25	113	55 15	174	34 13	224	39 28	258	39 25	309
139	49 57	019	21 39	078	19 15	113	55 20	175	33 35	225	38 35	258	38 44	309
140	50 15	019	22 31	079	20 04	114	55 23	177	32 57	226	37 42	259	38 02	309
141	50 32	018	23 24	079	20 53	114	55 25	179	32 18	227	36 49	259	37 20	309
142	50 48	017	24 17	079	21 42	115	55 26	181	31 38	227	35 56	260	36 39	309
143	51 04	017	25 10	080	22 31	116	55 24	182	30 58	228	35 03	260	35 57	309
144	51 19	016	26 04	080	23 19	116	55 21	184	30 18	229	34 10	261	35 15	309
145	51 34	016	26 57	081	24 08	117	55 17	186	29 37	230	33 17	261	34 34	309
146	51 48	015	27 50	081	24 56	118	55 10	188	28 55	231	32 23	262	33 52	310
147	52 01	014	28 43	081	25 43	118	55 02	189	28 13	231	31 30	262	33 11	310
148	52 14	013	29 37	082	26 31	119	54 53	191	27 31	232	30 36	263	32 29	310
149	52 27	013	30 30	082	27 18	119	54 42	193	26 48	233	29 43	263	31 47	310
	Dubhe		•ARCTURUS		SPICA		•Alphard		SIRIUS		POLLUX		•CAPELLA	
150	52 38	012	31 23	082	28 05	120	54 29	194	26 05	234	59 46	282	31 06	310
151	52 49	011	32 17	083	28 51	121	54 15	196	25 22	234	58 53	282	30 25	310
152	52 59	011	33 10	083	29 37	122	54 00	198	24 38	235	58 00	282	29 43	310
153	53 09	010	34 04	083	30 23	122	53 43	199	23 53	236	57 07	282	29 02	310
154	53 18	009	34 57	084	31 08	123	53 24	201	23 09	236	56 15	282	28 21	310
155	53 26	008	35 51	084	31 53	124	53 04	202	22 24	237	55 22	282	27 40	310
156	53 34	008	36 45	085	32 38	124	52 43	204	21 38	238	54 29	283	26 59	311
157	53 40	007	37 38	085	33 22	125	52 21	205	20 53	238	53 37	283	26 18	311
158	53 47	006	38 32	085	34 06	126	51 57	207	20 07	239	52 44	283	25 37	311
159	53 52	005	39 26	086	34 50	127	51 32	208	19 20	239	51 52	283	24 56	311
160	53 56	005	40 20	086	35 33	128	51 06	210	18 34	240	50 59	283	24 15	311
161	54 00	004	41 14	086	36 15	128	50 39	211	17 47	241	50 07	283	23 35	311
162	54 03	003	42 07	087	36 57	129	50 10	212	17 00	241	49 14	284	22 54	311
163	54 06	002	43 01	087	37 38	130	49 41	214	16 13	242	48 22	284	22 14	312
164	54 07	001	43 55	088	38 19	131	49 10	215	15 25	242	47 30	284	21 34	312
	•Dubhe		Alkaid		ARCTURUS		•SPICA		Alphard		•PROCYON		POLLUX	
165	54 08	001	50 19	043	44 49	088	39 00	132	48 39	216	37 37	256	46 37	284
166	54 08	000	50 55	042	45 43	088	39 39	133	48 06	218	36 45	256	45 45	284
167	54 08	359	51 32	042	46 37	089	40 19	134	47 33	219	35 52	257	44 53	285
168	54 06	358	52 07	041	47 31	089	40 57	135	46 59	220	35 00	257	44 01	285
169	54 04	357	52 43	041	48 25	090	41 35	136	46 24	221	34 07	258	43 09	285
170	54 01	356	53 18	041	49 19	090	42 12	137	45 48	222	33 14	259	42 17	285
171	53 58	356	53 53	040	50 13	091	42 49	138	45 11	223	32 21	259	41 25	286
172	53 53	355	54 28	040	51 06	091	43 24	139	44 33	225	31 28	260	40 33	286
173	53 48	354	55 02	039	52 00	092	43 59	140	43 55	226	30 35	260	39 41	286
174	53 42	353	55 36	038	52 54	092	44 34	141	43 16	227	29 42	261	38 49	286
175	53 35	353	56 09	038	53 48	093	45 07	142	42 37	228	28 49	261	37 57	286
176	53 28	352	56 42	037	54 42	093	45 39	144	41 57	229	27 55	262	37 06	287
177	53 20	351	57 14	037	55 36	094	46 11	145	41 16	230	27 02	262	36 14	287
178	53 11	350	57 46	036	56 30	094	46 42	146	40 35	231	26 08	263	35 22	287
179	53 02	350	58 17	035	57 23	095	47 11	147	39 53	231	25 15	263	34 31	287

FIGURE 141.—LAT 26°N.

TABLE 5—CORRECTION FOR PRECESSION AND NUTATION

L.H.A. ♈	North latitudes								South latitudes							L.H.A. ♈
	N. 89°	N. 80°	N. 70°	N. 60°	N. 50°	N. 40°	N. 20°	0°	S. 20°	S. 40°	S. 50°	S. 60°	S. 70°	S. 80°	S. 89°	
								1977								
°	′ °	′ °	′ °	′ °	′ °	′ °	′ °	′ °	′ °	′ °	′ °	′ °	′ °	′ °	′ °	°
0	1 170	1 190	1 210	1 230	1 230	2 240	2 250	2 250	2 250	2 240	2 240	1 230	1 220	1 210	1 190	0
30	1 200	1 220	1 230	1 240	2 240	2 240	2 250	2 250	2 250	1 240	1 230	1 220	1 210	1 180	1 160	30
60	1 230	1 240	1 250	2 250	2 250	2 250	2 260	2 250	2 250	1 240	1 230	1 220	1 190	1 150	1 130	60
90	1 260	1 260	1 260	2 260	2 270	2 270	2 270	2 270	1 260	1 260	1 260	0 —	0 —	0 —	1 100	90
120	1 290	1 280	1 280	2 280	2 280	2 280	2 280	2 280	1 280	1 290	1 290	0 —	0 —	1 060	1 070	120
150	1 320	1 310	1 300	2 290	2 290	2 290	2 290	2 290	2 290	1 300	1 310	1 320	1 350	1 020	1 040	150
180	1 350	1 330	1 320	1 310	2 300	2 300	2 290	2 290	2 300	2 300	1 310	1 320	1 330	1 350	1 010	180
210	1 020	1 000	1 330	1 320	1 310	1 300	2 300	2 290	2 290	2 300	2 300	1 300	1 310	1 320	1 340	210
240	1 050	1 030	1 350	1 320	1 310	1 300	2 290	2 290	2 290	2 290	2 290	2 290	1 290	1 300	1 310	240
270	1 080	0 —	0 —	0 —	1 290	1 280	1 280	2 280	2 270	2 280	2 280	2 280	1 280	1 280	1 280	270
300	1 110	1 120	0 —	0 —	1 250	1 250	1 260	2 260	2 260	2 260	2 260	2 260	1 260	1 260	1 250	300
330	1 140	1 160	1 190	1 220	1 230	1 240	2 250	2 250	2 250	2 250	2 250	2 250	1 240	1 230	1 220	330
360	1 170	1 190	1 210	1 230	1 230	2 240	2 250	2 250	2 250	2 240	2 240	1 230	1 220	1 210	1 190	360
								1978								
0	1 160	0 —	1 210	1 220	1 230	1 240	1 240	1 250	1 250	1 240	[illegible] 240	1 240	1 230	1 220	1 200	0
30	1 190	1 210	1 220	1 230	1 240	1 240	1 250	1 250	1 240	1 240	1 230	1 220	1 210	1 190	1 170	30
60	1 220	1 230	1 240	1 250	1 250	1 250	1 250	1 250	1 250	1 240	1 210	0 —	0 —	0 —	1 140	60
90	1 250	1 260	1 260	1 260	1 260	1 260	1 260	1 260	1 260	1 250	0 —	0 —	0 —	0 —	1 110	90
120	1 280	1 280	1 280	1 280	1 280	1 280	1 280	1 280	1 280	1 280	0 —	0 —	0 —	0 —	1 080	120
150	1 310	1 300	1 300	1 290	1 290	1 290	1 290	1 290	1 290	1 300	1 310	0 —	0 —	0 —	1 050	150
180	1 340	1 320	1 310	1 310	1 300	1 300	1 290	1 290	1 300	1 300	1 310	1 320	1 330	0 —	1 020	180
210	1 010	1 350	1 330	1 320	1 310	1 300	1 300	1 290	1 300	1 300	1 300	1 310	1 320	1 330	1 350	210
240	1 040	0 —	0 —	0 —	1 310	1 300	1 290	1 290	1 290	1 290	1 290	1 290	1 300	1 310	1 320	240
270	1 070	0 —	0 —	0 —	0 —	1 290	1 280	1 280	1 280	1 280	1 280	1 280	1 280	1 280	1 290	270
300	1 100	0 —	0 —	0 —	0 —	1 260	1 260	1 270	1 270	1 270	1 270	1 260	1 260	1 260	1 260	300
330	1 130	0 —	0 —	0 —	1 230	1 240	1 250	1 250	1 250	1 250	1 250	1 250	1 250	1 240	1 230	330
360	1 160	0 —	1 210	1 220	1 230	1 240	1 240	1 250	1 250	1 240	1 240	1 240	1 230	1 220	1 200	360
							There is no correction for **1979** or **1980**									
								1981								
0	0 —	0 —	1 050	1 050	1 060	1 060	1 070	1 070	1 060	1 060	1 050	1 040	0 —	0 —	0 —	0
30	0 —	1 060	1 060	1 070	1 070	1 070	1 070	1 070	1 070	1 060	0 —	0 —	0 —	0 —	0 —	30
60	0 —	1 080	1 080	1 080	1 080	1 080	1 080	1 080	1 080	0 —	0 —	0 —	0 —	0 —	0 —	60
90	0 —	1 100	1 100	1 100	1 100	1 100	1 100	1 100	1 100	0 —	0 —	0 —	0 —	0 —	0 —	90
120	0 —	1 120	1 120	1 110	1 110	1 110	1 110	1 110	1 110	1 120	0 —	0 —	0 —	0 —	0 —	120
150	0 —	0 —	1 130	1 130	1 120	1 120	1 110	1 110	1 120	1 120	1 130	1 140	0 —	0 —	0 —	150
180	0 —	0 —	0 —	1 140	1 130	1 120	1 120	1 110	1 110	1 120	1 120	1 130	1 140	0 —	0 —	180
210	0 —	0 —	0 —	0 —	0 —	1 120	1 110	1 110	1 110	1 110	1 110	1 110	1 120	1 130	0 —	210
240	0 —	0 —	0 —	0 —	0 —	0 —	1 100	1 100	1 100	1 100	1 100	1 100	1 100	1 100	0 —	240
270	0 —	0 —	0 —	0 —	0 —	0 —	1 080	1 080	1 090	1 090	1 080	1 080	1 080	1 080	0 —	270
300	0 —	0 —	0 —	0 —	0 —	1 060	1 070	1 070	1 070	1 070	1 070	1 070	1 070	1 060	0 —	300
330	0 —	0 —	0 —	1 040	1 050	1 060	1 070	1 070	1 070	1 060	1 060	1 060	1 050	0 —	0 —	330
360	0 —	0 —	1 050	1 050	1 060	1 060	1 070	1 070	1 060	1 060	1 050	1 040	0 —	0 —	0 —	360

The above table gives the correction to be applied to a position line or a fix, *deduced from the tables in this volume*, for the effects of precession and nutation. Each entry consists of a group of four figures of which the first (in bold type) is the distance, in nautical miles, which the position line or fix is to be moved, and the group of three figures is the direction (true bearing). The table is entered firstly by the year, then by choosing the column nearest the latitude and finally the entry nearest the L.H.A.♈ of observation; no interpolation is necessary.

Example. In 1977 a fix is obtained in latitude N.23° when L.H.A.♈ is 71°. Entering the table with the year 1977, latitude N.20° and L.H.A.♈ 60° gives 2′ 260° which indicates that the fix is to be transferred 2 miles in true bearing 260°.

FIGURE 142.—Precession and Nutation Correction.

TABLE 6—CORRECTION (*Q*) FOR *POLARIS*

L.H.A. ♈	*Q*	L.H.A. ♈	*Q*	L.H.A. ♈	*Q*	L.H.A. ♈	*Q*	L.H.A. ♈	*Q*	L.H.A. ♈	*Q*	L.H.A. ♈	*Q*	L.H.A. ♈	*Q*
° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′	° ′	′
358 16	-41	83 17	-31	116 20	- 5	147 13	+21	192 56	+47	272 28	+25	304 07	- 1	335 51	-27
0 20	-42	84 45	-30	117 29	- 4	148 30	+22	196 40	+48	273 49	+24	305 17	- 2	337 13	-28
2 30	-43	86 12	-29	118 39	- 3	149 48	+23	201 31	+49	275 08	+23	306 26	- 3	338 37	-29
4 49	-44	87 38	-28	119 49	- 2	151 07	+24	224 44	+48	276 27	+22	307 36	- 4	340 03	-30
7 20	-45	89 02	-27	120 58	- 1	152 26	+25	229 35	+47	277 45	+21	308 46	- 5	341 30	-31
10 06	-46	90 24	-26	122 08	0	153 47	+26	233 19	+46	279 02	+20	309 55	- 6	342 58	-32
13 13	-47	91 45	-25	123 18	+ 1	155 09	+27	236 28	+45	280 18	-19	311 05	- 7	344 29	-33
16 54	-48	93 06	-24	124 27	+ 2	156 32	+28	239 16	+44	281 33	+18	312 15	- 8	346 02	-34
21 41	-49	94 25	-23	125 37	+ 3	157 57	+29	241 49	+43	282 48	+17	313 26	- 9	347 37	-35
44 34	-48	95 43	-22	126 47	+ 4	159 23	+30	244 10	+42	284 02	+16	314 36	-10	349 14	-36
49 21	-47	97 00	-21	127 56	+ 5	160 51	+31	246 22	+41	285 16	+15	315 47	-11	350 55	-37
53 02	-46	98 17	-20	129 06	+ 6	162 20	+32	248 27	+40	286 29	+14	316 58	-12	352 39	-38
56 09	-45	99 32	-19	130 16	+ 7	163 52	+33	250 26	+39	287 41	+13	318 10	-13	354 27	-39
58 55	-44	100 47	-18	131 26	+ 8	165 25	+34	252 19	+38	288 53	+12	319 21	-14	356 19	-40
61 26	-43	102 02	-17	132 37	+ 9	167 01	+35	254 08	+37	290 05	+11	320 34	-15	358 16	-41
63 45	-42	103 15	-16	133 48	+10	168 40	+36	255 53	+36	291 16	+10	321 46	-16	0 20	-42
65 55	-41	104 29	-15	134 59	+11	170 22	+37	257 35	+35	292 27	+ 9	323 00	-17	2 30	-43
67 59	-40	105 41	-14	136 10	+12	172 07	+38	259 14	+34	293 38	+ 8	324 13	-18	4 49	-44
69 56	-39	106 54	-13	137 22	+13	173 56	+39	260 50	+33	294 49	+ 7	325 28	-19	7 20	-45
71 48	-38	108 05	-12	138 34	+14	175 49	+40	262 23	+32	295 59	+ 6	326 43	-20	10 06	-46
73 36	-37	109 17	-11	139 46	+15	177 48	+41	263 55	+31	297 09	+ 5	327 58	-21	13 13	-47
75 20	-36	110 28	-10	140 59	+16	179 53	+42	265 24	+30	298 19	+ 4	329 15	-22	16 54	-48
77 01	-35	111 39	- 9	142 13	+17	182 05	+43	266 52	+29	299 28	+ 3	330 32	-23	21 41	-49
78 38	-34	112 49	- 8	143 27	+18	184 26	+44	268 18	+28	300 38	+ 2	331 50	-24	44 34	-48
80 13	-33	114 00	- 7	144 42	+19	186 59	+45	269 43	+27	301 48	+ 1	333 09	-25	49 21	-47
81 46	-32	115 10	- 6	145 57	+20	189 47	+46	271 06	+26	302 57	0	334 30	-26	53 02	-46
83 17		116 20		147 13		192 56		272 28		304 07		335 51		56 09	

The above table, which does *not* include refraction, gives the quantity *Q* to be applied to the corrected sextant altitude of *Polaris* to give the latitude of the observer. In critical cases ascend.

Polaris: Mag. 2·1, S.H.A. 326° 52′, Dec. N.89° 10′·5

TABLE 7—AZIMUTH OF *POLARIS*

L.H.A. ♈	Latitude 0°	30°	50°	55°	60°	65°	70°	L.H.A. ♈	Latitude 0°	30°	50°	55°	60°	65°	70°
°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
0	0·5	0·5	0·7	0·8	0·9	1·1	1·4	180	359·5	359·5	359·3	359·2	359·1	359·0	358·7
10	0·3	0·4	0·5	0·6	0·7	0·8	1·0	190	359·7	359·6	359·5	359·4	359·4	359·3	359·1
20	0·2	0·2	0·3	0·3	0·4	0·5	0·6	200	359·8	359·8	359·7	359·7	359·6	359·6	359·5
30	0·0	0·1	0·1	0·1	0·1	0·1	0·1	210	0·0	359·9	359·9	359·9	359·9	359·9	359·9
40	359·9	359·9	359·8	359·8	359·8	359·8	359·7	220	0·1	0·1	0·2	0·2	0·2	0·2	0·3
50	359·8	359·7	359·6	359·6	359·5	359·4	359·3	230	0·2	0·3	0·4	0·4	0·5	0·5	0·7
60	359·6	359·6	359·4	359·3	359·2	359·1	358·9	240	0·4	0·4	0·6	0·6	0·7	0·9	1·1
70	359·5	359·4	359·2	359·1	359·0	358·8	358·5	250	0·5	0·6	0·8	0·8	1·0	1·1	1·4
80	359·4	359·3	359·1	358·9	358·8	358·5	358·2	260	0·6	0·7	0·9	1·0	1·2	1·4	1·7
90	359·3	359·2	358·9	358·8	358·6	358·3	357·9	270	0·7	0·8	1·1	1·2	1·4	1·6	2·0
100	359·2	359·1	358·8	358·7	358·5	358·2	357·7	280	0·8	0·9	1·2	1·3	1·5	1·8	2·2
110	359·2	359·1	358·7	358·6	358·4	358·1	357·6	290	0·8	0·9	1·2	1·4	1·6	1·9	2·3
120	359·2	359·0	358·7	358·6	358·4	358·0	357·6	300	0·8	1·0	1·3	1·4	1·6	1·9	2·4
130	359·2	359·1	358·7	358·6	358·4	358·1	357·6	310	0·8	0·9	1·3	1·4	1·6	1·9	2·4
140	359·2	359·1	358·8	358·6	358·4	358·1	357·7	320	0·8	0·9	1·2	1·4	1·6	1·9	2·3
150	359·3	359·2	358·9	358·7	358·5	358·3	357·9	330	0·7	0·9	1·2	1·3	1·5	1·8	2·2
160	359·3	359·2	359·0	358·9	358·7	358·5	358·1	340	0·7	0·8	1·0	1·2	1·3	1·6	2·0
170	359·4	359·4	359·1	359·0	358·9	358·7	358·4	350	0·6	0·7	0·9	1·0	1·1	1·4	1·7
180	359·5	359·5	359·3	359·2	359·1	359·0	358·7	360	0·5	0·5	0·7	0·8	0·9	1·1	1·4

When Cassiopeia is left (right), *Polaris* is west (east).

FIGURE 143.—Polaris Correction.

TABLE 8—REFRACTION

TO BE *SUBTRACTED* FROM SEXTANT ALTITUDE

R	(a) Height in thousands of feet												R
	0	5	10	15	20	25	30	35	40	45	50	55	
′	°	°	°	°	°	°	°	°	°	°	°	°	′
	90	90	90	90	90	90	90	90	90	90	90	90	
0													0
	63	59	55	51	46	41	36	31	26	20	17	13	
1													1
	33	29	26	22	19	16	14	11	10	10	10	10	
2													2
	21	19	16	14	12	10	10	10					
3													3
	16	14	12	10	10								
4													4
	12	11	10										
5													5
	10	10											

R	(b) Height in thousands of metres																				R
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
′	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	′
	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	90	
0																					0
	63	61	58	55	53	50	46	43	40	37	33	30	26	23	20	17	15	13	11	10	
1																					1
	33	31	28	26	24	21	19	17	16	14	12	11	10	10	10	10	10	10	10		
2																					2
	21	20	18	16	15	13	12	11	10	10	10	10									
3																					3
	16	14	13	12	11	10	10	10													
4																					4
	12	11	10	10	10																
5																					5
	10	10																			

Choose the column appropriate to height, in units of 1000 feet in table 8(a) or in units of 1000 metres in table 8(b), and find the range of altitude in which the sextant altitude lies; the corresponding value of *R* is the refraction to be subtracted from the sextant altitude.

TABLE 9—CORIOLIS (*Z*) CORRECTION

STANDARD DOME REFRACTION

To be *subtracted* from sextant altitude when using sextant suspension in a perspex dome.

Alt.	Refn.	Alt.	Refn.
°	′	°	′
10	8	50	4
20	7	60	4
30	6	70	3
40	5	80	3

This table must not be used if a calibration table is fitted to the dome, or if a flat glass plate is provided, or for non-standard domes.

Ground speed knots	Latitude 0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	Ground speed knots
	′	′	′	′	′	′	′	′	′	′	
50	0	0	0	1	1	1	1	1	1	1	50
100	0	0	1	1	2	2	2	2	3	3	100
150	0	1	1	2	3	3	3	4	4	4	150
200	0	1	2	3	3	4	5	5	5	5	200
250	0	1	2	3	4	5	6	6	6	7	250
300	0	1	3	4	5	6	7	7	8	8	300
350	0	2	3	5	6	7	8	9	9	9	350
400	0	2	4	5	7	8	9	10	10	10	400
450	0	2	4	6	8	9	10	11	12	12	450
500	0	2	4	7	8	10	11	12	13	13	500
550	0	3	5	7	9	11	12	14	14	14	550
600	0	3	5	8	10	12	14	15	16	16	600
650	0	3	6	9	11	13	15	16	17	17	650
700	0	3	6	9	12	14	16	17	18	18	700
750	0	3	7	10	13	15	17	18	19	20	750
800	0	4	7	10	13	16	18	20	21	21	800
850	0	4	8	11	14	17	19	21	22	22	850
900	0	4	8	12	15	18	20	22	23	24	900

Apply by moving the position line a distance *Z* to starboard (right) of the track in northern latitudes, and to port (left) in southern latitudes.

BUBBLE SEXTANT ERROR

Sextant No.

Alt.	Corr.
°	′

FIGURE 144.—Refraction and Coriolis.

N. Lat. {LHA greater than 180°.......Zn=Z; LHA less than 180°.......Zn=360−Z}

DECLINATION (0°-14°) SAME NAME AS LATITUDE

LAT 25°

LHA	0° Hc	d	Z	1° Hc	d	Z	2° Hc	d	Z	3° Hc	d	Z	4° Hc	d	Z	5° Hc	d	Z	6° Hc	d	Z	7° Hc	d	Z	8° Hc	d	Z	9° Hc	d	Z	10° Hc	d	Z	11° Hc	d	Z	12° Hc	d	Z	13° Hc	d	Z	14° Hc	d	Z	LHA
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	
0	65 00	+60	180	66 00	+60	180	67 00	+60	180	68 00	+60	180	69 00	+60	180	70 00	+60	180	71 00	+60	180	72 00	+60	180	73 00	+60	180	74 00	+60	180	75 00	+60	180	76 00	+60	180	77 00	+60	180	78 00	+60	180	79 00	+60	180	360
1	64 59	60	178	65 59	60	178	66 59	60	177	67 59	60	177	68 59	60	177	69 59	60	177	70 59	60	177	71 59	59	177	72 58	60	177	73 58	60	176	74 58	60	176	75 58	60	176	76 58	60	176	77 58	60	175	78 58	60	175	359
2	64 56	59	175	65 55	59	175	66 55	60	175	67 55	60	174	68 55	60	174	69 55	59	174	70 54	60	174	71 54	59	174	72 54	59	173	73 53	59	173	74 53	59	172	75 52	60	172	76 52	59	171	77 51	59	171	78 50	59	170	358
3	64 50	60	173	65 50	59	173	66 49	60	172	67 49	59	172	68 48	60	172	69 48	59	172	70 47	59	171	71 46	60	170	72 46	59	170	73 45	59	169	74 44	59	169	75 43	59	168	76 42	58	167	77 40	59	166	78 39	58	165	357
4	64 42	60	171	65 42	59	170	66 41	59	170	67 40	59	170	68 39	59	169	69 38	59	169	70 37	59	168	71 36	59	167	72 35	59	167	73 33	59	166	74 32	58	165	75 30	58	164	76 28	57	163	77 25	58	162	78 23	56	160	356
5	64 32	+59	168	65 31	+60	168	66 30	+59	167	67 29	+59	167	68 27	+59	166	69 26	+59	166	70 24	+59	165	71 23	+58	164	72 21	+57	164	73 18	+58	163	74 16	+57	162	75 13	+57	160	76 10	+56	159	77 06	+56	158	78 02	+56	156	355
6	64 20	59	166	65 19	59	166	66 17	59	165	67 15	59	164	68 13	59	164	69 11	59	163	70 09	58	162	71 07	57	161	72 04	57	160	73 01	58	159	73 57	58	158	74 53	56	157	75 49	56	155	76 44	56	154	77 38	56	152	354
7	64 06	59	164	65 04	59	163	66 02	57	163	66 59	58	162	67 57	57	161	68 54	57	160	69 51	57	159	70 48	56	158	71 44	56	157	72 40	56	156	73 36	56	155	74 30	55	153	75 25	55	152	76 18	55	150	77 11	55	148	353
8	63 50	57	162	64 47	57	161	65 44	57	160	66 41	57	159	67 38	57	159	68 35	56	158	69 31	56	157	70 27	55	156	71 22	56	154	72 17	54	153	73 11	55	152	74 05	53	150	74 58	53	148	75 50	56	146	76 40	56	144	352
9	63 32	56	160	64 28	57	159	65 25	56	158	66 21	56	157	67 17	56	156	68 13	55	155	69 08	55	154	70 03	54	153	70 57	54	152	71 51	53	150	72 44	52	149	73 36	52	147	74 28	50	145	75 10	49	143	76 07	48	141	351
10	63 12	+56	157	64 08	+56	157	65 04	+55	156	65 59	+55	155	66 54	+55	154	67 49	+54	153	68 43	+54	152	69 37	+53	150	70 30	+53	149	71 23	+53	148	72 15	+51	146	73 06	+50	144	73 56	+48	142	74 44	+48	140	75 32	+45	138	350
11	62 50	56	155	63 45	56	154	64 40	55	154	65 35	54	153	66 29	54	152	67 23	53	150	68 16	53	149	69 09	52	148	70 01	52	146	70 53	50	145	71 43	50	143	72 33	48	141	73 21	47	139	74 08	46	137	74 54	44	135	349
12	62 26	55	153	63 21	54	152	64 15	54	151	65 09	53	150	66 02	53	149	66 55	53	148	67 48	51	147	68 39	51	146	69 30	50	144	70 20	50	142	71 10	48	141	71 58	47	139	72 45	45	137	73 30	44	135	74 14	43	132	348
13	62 01	54	151	62 55	53	150	63 48	53	149	64 41	53	148	65 34	52	147	66 26	51	146	67 17	51	145	68 08	49	143	68 57	49	142	69 46	48	140	70 34	47	138	71 21	46	136	72 07	44	134	72 51	42	132	73 33	41	130	347
14	61 34	53	150	62 27	53	149	63 20	52	147	64 12	51	146	65 03	51	145	65 54	51	144	66 45	49	143	67 34	49	141	68 23	48	139	69 11	46	138	69 57	46	136	70 43	44	134	71 27	43	132	72 10	41	130	72 51	39	127	346
15	61 06	+52	148	61 58	+52	147	62 50	+51	146	63 41	+51	144	64 32	+50	143	65 22	+49	142	66 11	+48	140	66 59	+48	139	67 47	+46	137	68 33	+46	136	69 19	+44	134	70 03	+43	132	70 46	+41	130	71 27	+40	128	72 07	+38	125	345
16	60 36	51	146	61 27	51	145	62 18	51	144	63 09	49	143	63 58	49	141	64 47	48	140	65 35	48	138	66 23	46	137	67 09	46	135	67 55	44	134	68 39	43	132	69 22	41	130	70 03	40	128	70 43	39	126	71 22	36	123	344
17	60 05	50	144	60 55	50	143	61 45	50	142	62 35	48	141	63 23	48	139	64 11	48	138	64 59	46	137	65 45	45	135	66 30	45	133	67 15	43	132	67 58	42	130	68 40	40	128	69 20	39	126	69 59	37	124	70 36	35	121	343
18	59 32	50	142	60 22	49	141	61 11	49	140	62 00	47	139	62 47	47	138	63 34	47	136	64 21	45	135	65 06	44	133	65 50	43	132	66 33	42	130	67 15	41	128	67 56	39	126	68 35	38	124	69 13	36	122	69 49	34	120	342
19	58 50	49	141	59 47	49	140	60 36	47	139	61 23	47	137	62 10	46	136	62 56	45	135	63 41	46	133	64 26	43	132	65 09	42	130	65 51	41	128	66 32	40	126	67 12	38	125	67 50	36	122	68 26	35	120	69 01	33	118	341
20	58 24	+48	139	59 12	+47	138	59 59	+47	137	60 46	+46	136	61 32	+45	134	62 17	+44	133	63 01	+44	131	63 45	+42	130	64 27	+41	128	65 08	+40	127	65 48	+38	125	66 26	+38	123	67 04	+35	121	67 39	+34	119	68 13	+32	117	340
21	57 48	47	138	58 35	46	137	59 21	46	135	60 07	45	134	60 52	45	133	61 37	43	131	62 20	42	130	63 02	42	128	63 44	40	127	64 24	39	125	65 03	37	123	65 40	37	121	66 17	34	119	66 51	33	117	67 24	31	115	339
22	57 10	47	136	57 57	46	135	58 43	45	134	59 28	44	133	60 12	43	131	60 55	43	130	61 38	41	128	62 19	41	127	63 00	39	125	63 39	38	124	64 17	37	122	64 54	35	120	65 29	34	118	66 03	32	116	66 35	30	114	338
23	56 32	46	135	57 18	44	134	58 03	44	132	58 47	44	131	59 31	42	130	60 13	42	128	60 55	40	127	61 35	40	125	62 15	38	124	62 53	37	122	63 30	36	120	64 06	35	119	64 41	32	117	65 13	30	115	65 45	29	113	337
24	55 53	45	134	56 38	44	132	57 22	44	131	58 06	42	130	58 48	42	128	59 30	41	127	60 11	40	126	60 51	38	124	61 29	38	123	62 07	36	121	62 43	35	119	63 18	34	117	63 52	32	115	64 24	30	114	64 54	29	112	336
25	55 14	+44	132	55 58	+43	131	56 41	+43	130	57 24	+41	128	58 05	+41	127	58 46	+40	126	59 26	+39	124	60 05	+38	123	60 43	+37	121	61 20	+35	120	61 55	+35	118	62 30	+32	116	63 02	+32	114	63 34	+30	112	64 04	+28	110	335
26	54 33	43	131	55 16	43	130	55 59	42	129	56 41	41	127	57 22	40	126	58 02	39	124	58 41	38	123	59 19	37	122	59 56	36	120	60 32	35	118	61 07	33	117	61 40	33	115	62 13	30	113	62 43	29	111	63 12	28	109	334
27	53 51	43	130	54 34	42	129	55 16	41	127	55 57	40	126	56 37	40	125	57 17	38	123	57 55	38	122	58 32	37	120	59 09	36	119	59 44	34	117	60 18	33	116	60 51	31	114	61 22	30	112	61 52	29	110	62 21	27	108	333
28	53 09	42	129	53 51	41	127	54 32	41	126	55 13	39	125	55 52	39	123	56 31	38	122	57 09	36	121	57 45	36	119	58 21	34	118	58 55	34	116	59 29	32	114	60 01	31	113	60 32	29	111	61 01	28	109	61 29	27	107	332
29	52 26	41	127	53 07	41	126	53 48	40	125	54 28	38	124	55 06	38	122	55 44	37	121	56 21	37	120	56 58	35	118	57 33	33	117	58 06	33	115	58 39	32	113	59 11	30	112	59 41	29	110	60 10	27	108	60 37	26	107	331
30	51 43	+40	126	52 23	+40	125	53 03	+39	124	53 42	+38	123	54 20	+38	121	54 58	+36	120	55 34	+35	118	56 09	+35	117	56 44	+33	116	57 17	+32	114	57 49	+31	112	58 20	+30	111	58 50	+28	109	59 18	+27	107	59 45	+25	106	330
31	50 58	40	125	51 38	40	124	52 18	38	123	52 56	37	121	53 33	37	120	54 10	36	119	54 46	35	117	55 21	33	116	55 54	33	115	56 27	32	113	56 59	30	112	57 29	29	110	57 58	28	108	58 26	26	107	58 52	25	105	329
32	50 14	39	124	50 53	39	123	51 32	37	122	52 09	37	120	52 46	36	119	53 22	35	118	53 57	34	116	54 [illegible]	37	115	55 05	32	114	55 37	31	112	56 08	30	111	56 38	28	109	57 06	28	107	57 34	26	106	58 00	24	104	328
33	49 28	39	123	50 07	38	122	50 45	37	121	51 22	36	119	51 58	36	118	52 34	34	117	53 08	34	115	53 42	33	114	54 15	31	113	54 46	31	111	55 17	29	110	55 46	28	108	56 14	27	107	56 41	26	105	57 07	24	103	327
34	48 43	38	122	49 21	37	121	49 58	37	120	50 35	35	118	51 10	35	117	51 45	34	116	52 19	33	115	52 52	32	113	53 24	31	112	53 55	30	110	54 25	29	109	54 54	28	107	55 22	27	106	55 49	25	104	56 14	24	103	326
35	47 56	+38	121	48 34	+37	120	49 11	+35	119	49 46	+36	118	50 22	+34	116	50 56	+34	115	51 30	+32	114	52 02	+32	112	52 34	+30	111	53 04	+30	109	53 34	+28	108	54 02	+28	107	54 30	+26	105	54 56	+25	103	55 21	+23	102	325
36	47 09	37	120	47 46	37	119	48 23	35	118	48 58	35	117	49 33	34	115	50 07	33	114	50 40	32	113	51 12	31	[illegible]	51 43	30	110	52 13	29	109	52 42	28	107	53 10	27	106	53 37	26	104	54 03	24	103	54 27	24	101	324
37	46 22	37	119	46 59	35	118	47 34	35	117	48 09	34	116	48 43	34	115	49 17	32	113	49 49	32	112	50 21	31	111	50 52	29	109	51 21	29	108	51 50	28	107	52 18	26	105	52 44	26	104	53 10	24	102	53 34	27	101	323
38	45 35	38	118	46 10	36	117	46 46	35	116	47 20	34	115	47 54	33	114	48 27	32	112	48 59	31	111	49 30	30	110	50 00	29	109	50 29	29	107	50 58	27	106	51 25	26	104	51 51	25	103	52 16	25	101	52 41	22	100	322
39	44 47	36	118	45 22	35	116	45 57	35	115	46 31	33	114	47 04	32	113	47 36	32	112	48 08	31	110	48 39	29	109	49 08	29	108	49 37	28	106	50 05	27	105	50 32	26	104	50 58	25	102	51 23	24	101	51 47	27	99	321
40	43 58	+35	117	44 33	+34	116	45 07	+34	114	45 41	+33	113	46 14	+32	112	46 46	+31	111	47 17	+30	110	47 47	+29	108	48 16	+29	107	48 45	+28	106	49 13	+26	104	49 39	+26	103	50 05	+25	102	50 30	+23	100	50 53	+23	99	320
41	43 09	35	116	43 44	34	115	44 18	33	114	44 51	32	113	45 23	32	111	45 55	30	110	46 25	30	109	46 55	29	108	47 24	29	106	47 53	27	105	48 20	26	104	48 46	26	102	49 12	24	101	49 36	23	100	49 59	23	98	319
42	42 20	34	115	42 54	34	114	43 28	32	113	44 00	32	112	44 32	31	111	45 03	31	109	45 34	29	108	46 03	29	107	46 32	28	106	47 00	27	104	47 27	26	103	47 53	25	102	48 18	24	100	48 42	24	99	49 06	22	98	318
43	41 31	34	114	42 05	32	113	42 37	32	112	43 10	31	111	43 41	31	110	44 12	30	[illegible]	44 42	29	107	45 11	29	106	45 40	27	105	46 07	27	104	46 34	26	102	47 00	25	101	47 25	24	100	47 49	23	98	48 12	22	97	317
44	40 41	33	114	41 14	33	113	41 47	32	111	42 19	31	110	42 50	30	109	43 20	30	108	43 50	29	107	44 19	28	106	44 47	27	104	45 14	27	103	45 41	26	102	46 06	25	100	46 31	24	99	46 55	23	98	47 18	21	96	316
45	39 51	+33	113	40 24	+32	112	40 56	+32	111	41 28	+30	110	41 58	+30	108	42 28	+30	107	42 58	+28	106	43 26	+28	105	43 54	+27	104	44 21	+26	102	44 47	+26	101	45 13	+24	100	45 37	+24	99	46 01	+22	97	46 23	+22	96	315
46	39 01	33	112	39 34	31	111	40 05	31	110	40 36	31	109	41 07	29	108	41 36	29	107	42 05	29	105	42 34	27	104	43 01	27	103	43 28	26	102	43 54	25	101	44 19	24	99	44 43	24	98	45 07	22	97	45 29	22	95	314
47	38 11	32	112	38 43	31	110	39 14	31	109	39 45	30	108	40 15	29	107	40 44	29	106	41 13	28	105	41 41	27	104	42 08	27	102	42 35	26	101	43 01	24	100	43 25	25	99	43 50	23	97	44 13	22	96	44 35	22	95	313
48	37 20	32	111	37 52	31	110	38 23	30	109	38 53	30	108	39 23	29	106	39 52	28	105	40 20	28	104	40 48	27	103	41 15	26	102	41 41	26	101	42 07	25	99	42 32	24	98	42 56	23	97	43 19	22	96	43 41	21	94	312
49	36 29	31	110	37 00	31	109	37 31	30	108	38 01	30	107	38 31	28	106	38 59	29	105	39 28	27	104	39 55	27	102	40 22	26	101	40 48	25	100	41 13	25	99	41 38	24	98	42 02	23	96	42 25	22	95	42 47	21	94	311
50	35 38	+31	110	36 09	+30	109	36 39	+30	107	37 09	+29	106	37 38	+29	105	38 07	+28	104	38 35	+27	103	39 02	+26	102	39 28	+26	101	39 54	+25	100	40 19	+25	98	40 44	+24	97	41 08	+23	96	41 30	+23	95	41 53	+21	93	310
51	34 47	30	109	35 17	30	108	35 47	30	107	36 17	29	106	36 46	28	105	37 14	28	104	37 42	27	102	38 09	26	101	38 35	26	100	39 01	25	99	39 26	24	98	39 50	23	97	40 13	23	95	40 36	22	94	40 58	21	93	309
52	33 55	30	108	34 25	30	107	34 55	29	106	35 24	29	105	35 53	28	104	36 21	27	103	36 48	27	102	37 15	26	101	37 41	26	100	38 07	25	98	38 32	24	97	38 56	23	96	39 19	23	95	39 42	22	94	40 04	21	93	308
53	33 03	30	108	33 33	30	107	34 03	29	106	34 32	28	105	35 00	28	103	35 28	27	102	35 55	27	101	36 22	26	100	36 48	25	99	37 13	25	98	37 38	24	97	38 02	23	96	38 25	23	94	38 48	22	93	39 10	21	92	307
54	32 11	30	107	32 41	29	106	33 10	29	105	33 39	28	104	34 07	28	103	34 35	27	102	35 02	26	101	35 28	26	100	35 54	25	99	36 19	25	97	36 44	24	96	37 08	23	95	37 31	22	94	37 53	22	93	38 15	21	92	306
55	31 19	+30	107	31 49	+29	106	32 18	+28	104	32 46	+28	103	33 14	+27	102	33 41	+27	101	34 08	+26	100	34 34	+26	99	35 00	+25	98	35 25	+25	97	35 50	+23	96	36 13	+24	95	36 37	+22	94	36 59	+22	92	37 21	+21	91	305
56	30 27	29	106	30 56	29	105	31 25	28	104	31 53	28	103	32 21	27	102	32 48	27	101	33 15	26	100	33 41	25	99	34 06	25	98	34 31	24	96	34 55	24	95	35 19	23	94	35 42	23	93	36 05	21	92	36 26	22	91	304
57	29 35	29	105	30 04	28	104	30 32	28	103	31 00	28	102	31 28	27	101	31 55	26	100	32 21	26	99	32 47	25	98	33 12	25	97	33 37	24	96	34 01	24	95	34 25	23	94	34 48	22	93	35 10	22	91	35 32	21	90	303
58	28 42	29	105	29 11	28	104	29 39	28	103	30 07	27	102	30 34	27	101	31 01	26	100	31 27	26	99	31 53	25	98	32 18	25	97	32 43	24	95	33 07	24	94	33 31	23	93	33 54	22	92	34 16	22	91	34 38	21	90	302
59	27 50	28	104	28 18	28	103	28 46	28	102	29 14	27	101	29 41	26	100	30 07	26	99	30 33	26	98	30 59	25	97	31 24	25	96	31 49	24	95	32 13	23	94	32 36	23	93	32 59	23	92	33 22	21	91	33 43	21	89	301
60	26 57	+28	104	27 25	+28	[illegible]	27 53	+27	102	28 20	+27	101	28 47	+27	100	29 14	+26	99	29 40	+25	98	30 05	+25	97	30 30	+25	96	30 55	+24	95	31 19	+23	93	31 42	+23	92	32 05	+22	91	32 27	+22	90	32 49	+21	89	300
61	26 04	28	103	26 32	28	102	27 00	27	101	27 27	27	100	27 54	26	99	28 20	26	98	28 46	25	97	29 11	25	96	29 36	24	95	30 00	24	94	30 24	24	93	30 48	23	92	31 11	22	91	31 33	22	90	31 55	21	89	299
62	25 11	28	103	25 39	27	102	26 06	27	101	26 33	27	100	27 00	26	99	27 26	26	98	27 52	25	97	28 17	25	96	28 42	24	95	29 06	24	94	29 30	23	93	29 53	23	91	30 16	22	90	30 38	22	89	31 00	21	88	298
63	24 18	27	102	24 45	28	101	25 13	27	100	25 40	26	99	26 06	26	98	26 32	26	97	26 58	25	96	27 23	25	95	27 48	24	94	28 12	24	93	28 36	23	92	28 59	23	91	29 22	22	90	29 44	22	89	30 06	21	88	297
64	23 25	27	102	23 52	27	101	24 19	27	100	24 46	26	99	25 12	26	98	25 38	26	97	26 04	25	96	26 29	24	95	26 53	25	94	27 18	23	93	27 41	24	92	28 05	22	91	28 27	23	90	28 50	22	89	29 12	21	87	296
65	22 31	+28	101	22 59	+27	100	23 26	+26	99	23 52	+26	98	24 18	+26	97	24 44	+25	96	25 09	+25	95	25 34	+25	94	25 59	+24	93	26 23	+24	92	26 47	+23	91	27 10	+23	90	27 33	+22	89	27 55	+22	88	28 17	+22	87	295
66	21 38	27	101	22 05	27	100	22 32	26	99	22 58	26	98	23 24	26	97	23 50	25	96	24 15	25	95	24 40	25	94	25 05	24	93	25 29	24	92	25 53	23	91	26 16	23	90	26 39	22	89	27 01	22	88	27 23	21	87	294
67	20 44	27	100	21 11	27	99	21 38	26	98	22 04	26	97	22 30	26	96	22 56	25	95	23 21	25	94	23 46	24	93	24 10	25	92	24 35	23	91	24 58	23	90	25 21	23	89	25 44	23	88	26 07	22	87	26 29	21	86	293
68	19 51	27	100	20 18	26	99	20 44	26	98	21 10	26	97	21 36	26	96	22 02	25	95	22 27	25	94	22 52	24	93	23 16	24	92	23 40	24	91	24 04	23	90	24 27	23	89	24 50	22	88	25 12	22	87	25 34	22	86	292
69	18 57	27	99	19 24	26	98	19 50	26	97	20 16	26	96	20 42	25	95	21 07	26	94	21 33	24	93	21 57	25	93	22 22	24	92	22 46	23	91	23 09	24	90	23 33	23	89	23 56	22	88	24 18	22	87	24 40	22	85	291
	0°			1°			2°			3°			4°			5°			6°			7°			8°			9°			10°			11°			12°			13°			14°			

S. Lat. {LHA greater than 180°.......Zn=180−Z; LHA less than 180°.......Zn=180+Z}

DECLINATION (0°-14°) SAME NAME AS LATITUDE

FIGURE 145.—Declination (0° - 14°) LAT 25°.

N. Lat. {LHA greater than 180°....Zn=Z; LHA less than 180°....Zn=360−Z}

DECLINATION (0°-14°) SAME NAME AS LATITUDE

LHA	0° Hc	d	Z	1° Hc	d	Z	2° Hc	d	Z	3° Hc	d	Z	4° Hc	d	Z	5° Hc	d	Z	6° Hc	d	Z	7° Hc	d	Z	8° Hc	d	Z	9° Hc	d	Z	10° Hc	d	Z	11° Hc	d	Z	12° Hc	d	Z	13° Hc	d	Z	14° Hc	d	Z	LHA
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	
70	18 04	+26	99	18 30	+26	98	18 56	+26	97	19 22	+26	96	19 48	+25	95	20 13	+25	94	20 38	+25	93	21 03	+24	92	21 27	+24	91	21 51	+24	90	22 15	+23	89	22 38	+23	88	23 01	+23	87	23 24	+22	86	23 46	+22	85	290
71	17 10	26	98	17 36	26	97	18 02	26	96	18 28	26	95	18 54	25	95	19 19	25	94	19 44	25	93	20 09	24	92	20 33	24	91	20 57	24	90	21 21	23	89	21 44	23	88	22 07	23	87	22 30	22	86	22 52	22	85	289
72	16 16	26	98	16 42	26	97	17 08	26	96	17 34	25	95	17 59	26	94	18 25	25	93	18 50	24	92	19 14	25	91	19 39	24	90	20 03	23	89	20 26	24	88	20 50	23	87	21 13	22	86	21 35	23	85	21 58	22	84	288
73	15 22	26	97	15 48	26	96	16 14	26	96	16 40	25	95	17 05	25	94	17 30	25	93	17 55	25	92	18 20	24	91	18 44	24	90	19 08	24	89	19 32	23	88	19 55	23	87	20 18	23	86	20 41	23	85	21 04	22	84	287
74	14 28	26	97	14 54	26	96	15 20	26	95	15 46	25	94	16 11	25	93	16 36	25	92	17 01	25	91	17 26	24	90	17 50	24	89	18 14	24	88	18 38	23	87	19 01	23	86	19 24	23	36	19 47	23	85	20 10	22	84	286
75	13 34	+26	97	14 00	+26	96	14 26	+25	95	14 51	+26	94	15 17	+25	93	15 42	+25	92	16 07	+24	91	16 31	+24	90	16 55	+25	89	17 20	+23	88	17 43	+24	87	18 07	+23	86	18 30	+23	85	18 53	+23	84	19 16	+22	83	285
76	12 40	26	96	13 06	26	95	13 32	25	94	13 57	25	93	14 22	25	92	14 47	25	91	15 12	25	90	15 37	24	90	16 01	24	89	16 25	24	88	16 49	24	87	17 13	23	86	17 36	23	85	17 59	23	84	18 22	22	83	284
77	11 46	26	96	12 12	25	95	12 37	26	94	13 03	25	93	13 28	25	92	13 53	25	91	14 18	24	90	14 42	25	89	15 07	24	88	15 31	24	87	15 55	23	86	16 18	24	85	16 42	23	84	17 05	23	83	17 28	22	82	283
78	10 52	25	95	11 17	26	94	11 43	25	93	12 08	26	92	12 34	25	91	12 59	24	91	13 23	25	90	13 48	24	89	14 12	25	88	14 37	24	87	15 01	23	86	15 24	24	85	15 48	23	84	16 11	23	83	16 34	23	82	282
79	09 58	25	95	10 23	26	94	10 49	25	93	11 14	25	92	11 39	25	91	12 04	25	90	12 29	25	89	12 54	24	88	13 18	24	87	13 42	24	86	14 06	24	85	14 30	24	84	14 54	23	84	15 17	23	83	15 40	23	82	281
80	09 03	+26	94	09 29	+25	93	09 54	+26	92	10 20	+25	92	10 45	+25	91	11 10	+25	90	11 35	+24	89	11 59	+25	88	12 24	+24	87	12 48	+24	86	13 12	+24	85	13 36	+24	84	14 00	+23	83	14 23	+23	82	14 46	+23	81	280
81	08 09	26	94	08 35	25	93	09 00	25	92	09 25	26	91	09 51	24	90	10 15	25	89	10 40	25	88	11 05	25	87	11 30	24	87	11 54	24	86	12 18	24	85	12 42	24	84	13 06	23	83	13 29	24	82	13 53	23	81	279
82	07 15	25	93	07 40	26	93	08 06	25	92	08 31	25	91	08 56	25	90	09 21	25	89	09 46	25	88	10 11	24	87	10 35	25	86	11 00	24	85	11 24	24	84	11 48	24	83	12 12	23	82	12 35	24	81	12 59	23	80	278
83	06 21	25	93	06 46	25	92	07 11	26	91	07 37	25	90	08 02	25	89	08 27	25	88	08 52	24	88	09 16	25	87	09 41	24	86	10 05	25	85	10 30	24	84	10 54	24	83	11 18	24	82	11 42	23	81	12 05	24	80	277
84	05 26	26	93	05 52	25	92	06 17	25	91	06 42	25	90	07 07	25	89	07 32	25	88	07 57	25	87	08 22	25	86	08 47	24	85	09 11	25	84	09 36	24	83	10 00	24	82	10 24	24	82	10 48	24	81	11 12	23	80	276
85	04 32	+25	92	04 57	+26	91	05 23	+25	90	05 48	+25	89	06 13	+25	89	06 38	+25	88	07 03	+25	87	07 28	+25	86	07 53	+24	85	08 17	+25	84	08 42	+24	83	09 06	+24	82	09 30	+24	81	09 54	+24	80	10 18	+24	79	275
86	03 37	26	92	04 03	25	91	04 28	25	90	04 53	26	89	05 19	25	88	05 44	25	87	06 09	25	86	06 34	25	85	06 59	24	84	07 23	25	84	07 48	24	83	08 12	25	82	08 37	24	81	09 01	24	80	09 25	24	79	274
87	02 43	25	91	03 08	26	90	03 34	25	89	03 59	25	89	04 24	25	88	04 49	26	87	05 15	25	86	05 40	24	85	06 04	25	84	06 29	25	83	06 54	25	82	07 19	24	81	07 43	24	80	08 07	25	79	08 32	24	79	273
88	01 49	25	91	02 14	25	90	02 39	26	89	03 05	25	88	03 30	25	87	03 55	25	86	04 20	25	85	04 45	25	84	05 10	25	84	05 35	25	83	06 00	25	82	06 25	24	81	06 49	25	80	07 14	24	79	07 38	25	78	272
89	00 54	26	90	01 20	25	90	01 45	25	89	02 10	26	88	02 36	25	87	03 01	25	86	03 26	25	85	03 51	25	84	04 16	25	83	04 41	25	82	05 06	25	81	05 31	25	80	05 56	25	80	06 21	24	79	06 45	25	78	271
90	00 00	+25	90	00 25	+26	89	00 51	+25	88	01 16	+25	87	01 41	+26	86	02 07	+25	85	02 32	+25	85	02 57	+25	84	03 22	+25	83	03 47	+26	82	04 13	+25	81	04 38	+25	80	05 03	+24	79	05 27	+25	78	05 52	+25	77	270
91	−0 54	25	90	−0 29	25	89	−0 04	26	88	00 22	25	87	00 47	25	86	01 12	26	85	01 38	25	84	02 03	25	83	02 28	26	82	02 54	25	81	03 19	25	81	03 44	25	80	04 09	25	79	04 34	25	78	04 59	25	77	269
92	−1 49	26	89	−1 23	25	88	−0 58	25	87	−0 33	26	86	−0 07	25	86	00 18	26	85	00 44	25	84	01 09	26	83	01 35	25	82	02 00	25	81	02 25	26	80	02 51	25	79	03 16	25	78	03 41	25	77	04 06	25	76	268
93	−2 43	25	89	−2 18	26	88	−1 52	25	87	−1 27	26	86	−1 01	25	85	−0 36	26	84	−0 10	25	83	00 15	26	82	00 41	25	81	01 06	26	81	01 32	25	80	01 57	26	79	02 23	25	78	02 48	25	77	03 13	26	76	267
94	−3 37	25	88	−3 12	25	87	−2 47	26	86	−2 21	26	86	−1 55	25	85	−1 30	26	84	−1 04	25	83	−0 39	26	82	−0 13	26	81	00 13	25	80	00 38	26	79	01 04	25	78	01 29	26	77	01 55	26	77	02 21	25	76	266
95	−4 32	+26	88	−4 06	+25	87	−3 41	+26	86	−3 15	+25	85	−2 50	+26	84	−2 24	+26	83	−1 58	+26	82	−1 32	+25	82	−1 07	+26	81	−0 41	+26	80	−0 15	+26	79	00 11	+25	78	00 36	+26	77	01 02	+26	76	01 28	+26	75	265
96	−5 26	25	87	−5 01	26	87	−4 35	26	86	−4 09	25	85	−3 44	26	84	−3 18	26	83	−2 52	26	82	−2 26	26	81	−2 00	26	80	−1 34	26	79	−1 08	26	78	−0 42	26	78	−0 16	25	77	00 09	26	76	00 35	26	75	264
97	−6 21	26	87	−5 55	26	86	−5 29	25	85	−5 04	26	84	−4 38	26	83	−4 12	26	82	−3 46	26	82	−3 20	26	81	−2 54	26	80	−2 28	26	79	−2 02	27	78	−1 35	26	77	−1 09	26	76	−0 43	26	75	−0 17	26	74	263
98							−6 23	25	85	−5 58	26	84	−5 32	26	83	−5 06	26	82	−4 40	26	81	−4 14	27	80	−3 47	26	79	−3 21	26	78	−2 55	27	78	−2 28	26	77	−2 02	26	76	−1 36	27	75	−1 09	26	74	262
99													−6 26	26	82	−6 00	27	82	−5 33	26	81	−5 07	26	80	−4 41	27	79	−4 14	26	78	−3 48	27	77	−3 21	26	76	−2 55	27	75	−2 28	27	74	−2 01	26	74	261
100																			−6 27	+26	80	−6 01	+27	79	−5 34	+26	78	−5 08	+27	78	−4 41	+27	77	−4 14	+27	76	−3 47	+26	75	−3 21	+27	74	−2 54	+27	73	260
101																									−6 27	26	78	−6 01	27	77	−5 34	27	76	−5 07	27	75	−4 40	27	74	−4 13	27	74	−3 46	28	73	259
102																															−6 27	28	76	−5 59	27	75	−5 32	27	74	−5 05	28	73	−4 37	27	72	258
103																																					−6 24	27	73	−5 57	28	73	−5 29	28	72	257
104																																											−6 21	28	71	256

DECLINATION (0°-14°) CONTRARY NAME TO LATITUDE

LHA	0° Hc	d	Z	1° Hc	d	Z	2° Hc	d	Z	3° Hc	d	Z	4° Hc	d	Z	5° Hc	d	Z	6° Hc	d	Z	7° Hc	d	Z	8° Hc	d	Z	9° Hc	d	Z	10° Hc	d	Z	11° Hc	d	Z	12° Hc	d	Z	13° Hc	d	Z	14° Hc	d	Z	LHA
97	−6 21	25	87	−6 46	25	88																																								263
96	−5 26	26	87	−5 52	25	88	−6 17	25	89	−6 42	25	91																																		264
95	−4 32	−25	88	−4 57	−26	89	−5 23	−25	90	−5 48	−25	91	−6 13	−25	91	−6 38	−25	92																												265
94	−3 37	26	88	−4 03	25	89	−4 28	25	90	−4 53	26	91	−5 19	25	92	−5 44	25	93	−6 09	25	94	−6 34	25	95																						266
93	−2 43	25	89	−3 08	26	90	−3 34	25	91	−3 59	25	91	−4 24	25	92	−4 49	26	93	−5 15	25	94	−5 40	24	95	−6 04	25	96	−6 29	25	97																267
92	−1 49	25	89	−2 14	25	90	−2 39	26	90	−3 05	25	92	−3 30	25	93	−3 55	25	93	−4 20	25	95	−4 45	25	96	−5 10	25	96	−5 35	25	97	−6 00	25	98	−6 25	24	99										268
91	−0 54	26	90	−1 20	25	90	−1 45	25	91	−2 10	26	92	−2 36	25	93	−3 01	25	94	−3 26	25	95	−3 51	25	95	−4 16	25	97	−4 41	25	98	−5 06	25	99	−5 31	25	100	−5 56	25	100	−6 21	24	101	−6 45	25	102	269
90	00 00	−25	90	−0 25	−26	91	−0 51	−25	92	−1 16	−25	93	−1 41	−26	94	−2 07	−25	95	−2 32	−25	95	−2 57	−25	96	−3 22	−25	97	−3 47	−26	98	−4 13	−25	99	−4 38	−25	100	−5 03	−24	101	−5 27	−25	102	−5 52	−25	103	270
89	00 54	25	90	00 29	25	91	00 04	26	92	−0 22	25	93	−0 47	25	94	−1 12	26	95	−1 38	25	96	−2 03	25	97	−2 28	26	98	−2 54	25	99	−3 19	25	99	−3 44	25	100	−4 09	25	101	−4 34	25	102	−4 59	25	103	271
88	01 49	26	91	01 23	25	92	00 58	25	93	00 33	26	94	00 07	25	94	−0 18	26	95	−0 44	25	96	−1 09	26	97	−1 35	25	98	−2 00	25	99	−2 25	26	100	−2 51	25	101	−3 16	25	102	−3 41	25	103	−4 06	25	104	272
87	02 43	25	91	02 18	26	92	01 52	25	92	01 27	26	94	01 01	25	95	00 36	26	96	00 10	25	97	−0 15	26	98	−0 41	25	99	−1 06	26	99	−1 32	25	100	−1 57	26	101	−2 23	25	102	−2 48	25	103	−3 13	26	104	273
86	03 37	25	92	03 12	25	93	02 47	26	94	02 21	26	94	01 55	25	95	01 30	26	96	01 04	25	97	00 39	26	98	00 13	26	99	−0 13	25	100	−0 38	26	101	−1 04	25	102	−1 29	26	103	−1 55	26	103	−2 21	25	104	274
85	04 32	−26	92	04 06	−25	93	03 41	−26	94	03 15	−25	95	02 50	−26	96	02 24	−26	97	01 58	−26	98	01 32	−25	98	01 07	−26	99	00 41	−26	100	00 15	−26	101	−0 11	−25	102	−0 36	−26	103	−1 02	−26	104	−1 28	−26	105	275
84	05 26	25	93	05 01	26	94	04 35	26	94	04 09	25	95	03 44	26	96	03 18	26	97	02 52	26	98	02 26	26	99	02 00	26	100	01 34	26	101	01 08	26	102	00 42	26	102	00 16	25	103	−0 09	26	104	−0 35	26	105	276
83	06 21	26	93	05 55	26	94	05 29	25	95	05 04	26	96	04 38	26	97	04 12	26	98	03 46	26	98	03 20	26	99	02 54	26	100	02 28	26	101	02 02	27	102	01 35	26	103	01 09	26	104	00 43	26	105	00 17	26	106	277
82	07 15	26	93	06 49	26	94	06 23	25	95	05 58	26	96	05 32	26	97	05 06	26	98	04 40	26	99	04 14	27	100	03 47	26	101	03 21	26	102	02 55	27	102	02 28	26	103	02 02	26	104	01 36	27	105	01 09	26	106	278
81	08 09	26	94	07 43	25	95	07 18	26	96	06 52	26	97	06 26	26	98	06 00	27	99	05 33	26	99	05 07	26	100	04 41	27	101	04 14	26	102	03 48	27	103	03 21	26	104	02 55	27	105	02 28	27	106	02 01	26	106	279
80	09 03	−25	94	08 38	−26	95	08 12	−26	96	07 46	−26	97	07 20	−27	98	06 53	−26	99	06 27	−26	100	06 01	−27	101	05 34	−26	102	05 08	−27	102	04 41	−27	103	04 14	−27	104	03 47	−26	105	03 21	−27	106	02 54	−27	107	280
79	09 58	26	95	09 32	26	96	09 06	26	97	08 40	27	97	08 13	26	98	07 47	26	99	07 21	27	100	06 54	27	101	06 27	26	102	06 01	27	103	05 34	27	104	05 07	27	105	04 40	27	106	04 13	27	106	03 46	28	107	281
78	10 52	26	95	10 26	26	96	10 00	26	96	09 34	27	97	09 07	26	98	08 41	27	99	08 14	27	100	07 47	26	101	07 21	27	102	06 54	27	103	06 27	28	104	05 59	27	105	05 32	27	106	05 05	28	107	04 37	27	108	282
77	11 46	26	96	11 20	26	96	10 54	27	97	10 27	26	98	10 01	27	99	09 34	26	100	09 08	27	101	08 41	27	102	08 14	28	103	07 46	27	104	07 19	27	105	06 52	28	106	06 24	27	107	05 57	28	107	05 29	28	108	283
76	12 40	26	96	12 14	26	97	11 48	27	98	11 21	26	99	10 55	27	100	10 28	27	101	10 01	27	102	09 34	27	102	09 07	28	103	08 39	27	104	08 12	28	105	07 44	28	106	07 16	27	107	06 49	28	108	06 21	28	109	284
75	13 34	−26	97	13 08	−27	97	12 41	−26	98	12 15	−27	99	11 48	−27	100	11 21	−27	101	10 54	−27	102	10 27	−28	103	09 59	−27	104	09 32	−28	105	09 04	−28	106	08 36	−28	107	08 08	−28	107	07 40	−28	108	07 12	−28	109	285
74	14 28	26	97	14 02	27	98	13 35	26	99	13 09	27	100	12 42	27	101	12 15	28	102	11 47	27	102	11 20	28	103	10 52	28	104	10 24	28	105	09 56	28	106	09 28	28	107	09 00	28	108	08 32	29	109	08 03	28	110	286
73	15 22	26	97	14 56	27	98	14 29	27	99	14 02	27	100	13 35	27	101	13 08	28	102	12 40	27	103	12 13	28	104	11 45	28	105	11 17	28	106	10 49	29	107	10 20	28	107	09 52	29	108	09 23	28	109	08 55	29	110	287
72	16 16	27	98	15 49	26	99	15 23	27	100	14 56	28	101	14 28	27	101	14 01	28	102	13 33	28	103	13 05	28	104	12 37	28	105	12 09	28	106	11 41	29	107	11 12	29	108	10 43	28	109	10 15	29	110	09 46	29	111	288
71	17 10	27	98	16 43	27	99	16 16	27	100	15 49	27	101	15 22	28	102	14 54	28	103	14 26	28	104	13 58	28	105	13 30	29	106	13 01	28	107	12 33	29	108	12 04	29	108	11 35	29	109	11 06	30	110	10 36	29	111	289
70	18 04	−27	99	17 37	−27	100	17 10	−28	101	16 42	−27	102	16 15	−28	103	15 47	−28	103	15 19	−28	104	14 51	−29	105	14 22	−29	106	13 53	−28	107	13 25	−30	108	12 55	−29	109	12 26	−29	110	11 57	−30	111	11 27	−30	112	290

S. Lat. {LHA greater than 180°....Zn=180−Z; LHA less than 180°....Zn=180+Z}

LAT 25°

LAT 25°

FIGURE 146.—Declination (0° - 14°) LAT 25°.

DECLINATION (0°-14°) SAME NAME AS LATITUDE

LAT 27°

DECLINATION (0°-14°) SAME NAME AS LATITUDE

LAT 27°

FIGURE 147.—Declination (0° – 14°) LAT 27°.

N. Lat. {LHA greater than 180°.... Zn=Z
LHA less than 180°....... Zn=360−Z}

DECLINATION (15°-29°) SAME NAME AS LATITUDE

LHA	15° Hc	d	Z	16° Hc	d	Z	17° Hc	d	Z	18° Hc	d	Z	19° Hc	d	Z	20° Hc	d	Z	21° Hc	d	Z	22° Hc	d	Z
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°
0	78 00	+60	180	79 00	+60	180	80 00	+60	180	81 00	+60	180	82 00	+60	180	83 00	+60	180	84 00	+60	180	85 00	+60	180
1	77 58	60	175	78 58	59	175	79 57	60	175	80 57	60	174	81 57	59	173	82 56	60	172	83 56	59	171	84 55	59	170
2	77 51	60	171	78 51	59	170	79 50	59	169	80 49	59	168	81 48	58	167	82 46	58	165	83 44	57	163	84 41	56	160
3	77 41	58	166	78 39	58	165	79 37	58	164	80 35	57	162	81 32	57	160	82 29	55	158	83 24	54	155	84 18	52	151
4	77 26	57	162	78 23	57	161	79 20	56	159	80 16	56	157	81 12	54	155	82 06	53	152	82 59	50	148	83 49	47	143
5	77 08	+56	158	78 04	+55	156	78 59	+54	154	79 53	+53	152	80 46	+52	149	81 38	+50	146	82 28	+47	142	83 15	+42	137
6	76 46	54	154	77 40	54	152	78 34	52	150	79 26	51	147	80 17	49	144	81 06	47	141	81 53	43	136	82 36	39	131
7	76 21	53	150	77 14	51	148	78 05	50	146	78 55	49	143	79 44	46	140	80 30	44	136	81 14	40	132	81 54	36	127
8	75 53	51	147	76 44	50	144	77 34	48	142	78 22	46	139	79 08	44	136	79 52	41	132	80 33	37	128	81 10	33	123
9	75 22	49	143	76 11	48	141	76 59	46	138	77 45	45	135	78 30	41	132	79 11	39	128	79 50	35	124	80 25	30	120
10	74 49	+47	140	75 36	+47	138	76 23	+44	135	77 07	+42	132	77 49	+39	129	78 28	+37	125	79 05	+32	121	79 37	+29	117
11	74 14	46	137	75 00	44	135	75 44	42	132	76 26	40	129	77 06	38	126	77 44	34	123	78 18	31	119	78 49	27	114
12	73 36	45	135	74 21	43	132	75 04	40	130	75 44	39	127	76 23	35	123	76 58	33	120	77 31	29	116	78 00	25	112
13	72 58	42	132	73 40	42	130	74 22	39	127	75 01	36	124	75 37	34	121	76 11	31	118	76 42	28	114	77 10	24	110
14	72 17	42	130	72 59	39	127	73 38	38	125	74 16	35	122	74 51	33	119	75 24	29	116	75 53	27	112	76 20	22	108
15	71 35	+41	128	72 16	+38	125	72 54	+36	123	73 30	+34	120	74 04	+31	117	74 35	+28	114	75 03	+26	110	75 29	+21	107
16	70 53	38	126	71 31	37	123	72 08	35	121	72 43	33	118	73 16	30	115	73 46	27	112	74 13	24	109	74 37	21	106
17	70 09	37	124	70 46	36	121	71 22	34	119	71 56	31	116	72 27	29	114	72 56	26	111	73 22	24	108	73 46	20	104
18	69 24	36	122	70 00	35	120	70 35	32	117	71 07	31	115	71 38	28	112	72 06	25	109	72 31	23	106	72 54	19	103
19	68 38	35	120	69 13	34	118	69 47	32	116	70 19	29	113	70 48	27	111	71 15	25	108	71 40	21	105	72 01	20	102
20	67 51	+35	119	68 26	+33	117	68 59	+30	114	69 29	+29	112	69 58	+26	109	70 24	+24	107	70 48	+21	104	71 09	+19	101
21	67 04	34	117	67 38	32	115	68 10	29	113	68 39	28	111	69 07	26	108	69 33	23	106	69 56	21	103	70 17	18	100
22	66 16	33	116	66 49	31	114	67 20	29	112	67 49	27	109	68 16	25	107	68 41	23	105	69 04	20	102	69 24	18	99
23	65 28	32	115	66 00	30	113	66 30	28	110	66 58	27	108	67 25	24	106	67 49	22	104	68 11	20	101	68 31	17	98
24	64 39	31	113	65 10	30	111	65 40	28	109	66 08	25	107	66 33	24	105	66 57	22	103	67 19	19	100	67 38	17	98
25	63 50	+30	112	64 20	+29	110	64 49	+27	108	65 16	+25	106	65 41	+24	104	66 05	+21	102	66 26	+19	99	66 45	+17	97
26	63 00	30	111	63 30	28	109	63 58	27	107	64 25	24	105	64 49	23	103	65 12	21	101	65 33	19	99	65 52	17	96
27	62 10	29	110	62 39	28	108	63 07	26	106	63 33	24	104	63 57	23	102	64 20	20	100	64 40	19	98	64 59	16	96
28	61 20	29	109	61 49	27	107	62 16	25	105	62 41	24	103	63 05	22	101	63 27	20	99	63 47	19	97	64 06	16	95
29	60 29	28	108	60 57	27	106	61 24	25	104	61 49	23	103	62 12	22	101	62 34	20	99	62 54	18	97	63 12	16	94
30	59 38	+28	107	60 06	+26	105	60 32	+25	104	60 57	+23	102	61 20	+21	100	61 41	+20	98	62 01	+18	96	62 19	+16	94
31	58 47	27	106	59 14	26	105	59 40	24	103	60 04	23	101	60 27	21	99	60 48	20	97	61 08	18	95	61 26	16	93
32	57 56	26	105	58 22	26	104	58 48	24	102	59 12	22	100	59 34	21	98	59 55	20	97	60 15	17	95	60 32	16	93
33	57 04	26	105	57 30	25	103	57 55	24	101	58 19	22	100	58 41	21	98	59 02	19	96	59 21	18	94	59 39	16	92
34	56 12	26	104	56 38	25	102	57 03	23	101	57 26	22	99	57 48	21	97	58 09	19	95	58 28	17	94	58 45	16	92
35	55 20	+26	103	55 46	+24	102	56 10	+23	100	56 33	+22	98	56 55	+21	97	57 16	+19	95	57 35	+17	93	57 52	+16	91
36	54 28	25	102	54 53	25	101	55 18	23	99	55 41	21	98	56 02	20	96	56 22	19	94	56 41	17	93	56 58	16	91
37	53 36	25	102	54 01	24	100	54 25	22	99	54 47	22	97	55 09	20	95	55 29	19	94	55 48	17	92	56 05	16	90
38	52 43	25	101	53 08	24	99	53 32	22	98	53 54	22	96	54 16	20	95	54 36	18	93	54 54	18	92	55 12	15	90
39	51 51	24	100	52 15	24	99	52 39	22	97	53 01	21	96	53 22	20	94	53 42	19	93	54 01	17	91	54 18	16	89
40	50 58	+25	100	51 23	+23	98	51 46	+22	97	52 08	+21	95	52 29	+20	94	52 49	+18	92	53 07	+18	91	53 25	+16	89
41	50 05	25	99	50 30	23	98	50 53	22	96	51 15	21	95	51 36	19	93	51 55	19	92	52 14	17	90	52 31	16	89
42	49 13	24	98	49 37	23	97	50 00	21	96	50 21	21	94	50 42	20	93	51 02	18	91	51 20	18	90	51 38	16	88
43	48 20	23	98	48 43	23	96	49 06	22	95	49 28	21	94	49 49	19	92	50 08	19	91	50 27	17	89	50 44	16	88
44	47 27	23	97	47 50	23	96	48 13	22	95	48 35	20	93	48 55	20	92	49 15	19	90	49 34	17	89	49 51	16	87
45	46 34	+23	97	46 57	+23	95	47 20	+21	94	47 41	+21	93	48 02	+20	91	48 22	+18	90	48 40	+18	88	48 58	+16	87
46	45 40	24	96	46 04	22	95	46 26	22	93	46 48	21	92	47 09	19	91	47 28	19	89	47 47	17	88	48 04	17	87
47	44 47	24	96	45 11	22	94	45 33	21	93	45 54	21	92	46 15	20	90	46 35	18	89	46 53	18	88	47 11	16	86
48	43 54	23	95	44 17	23	94	44 40	21	92	45 01	21	91	45 22	19	90	45 41	19	88	46 00	17	87	46 17	17	86
49	43 01	23	95	43 24	22	93	43 46	22	92	44 08	20	91	44 28	20	89	44 48	18	88	45 06	18	87	45 24	17	85
50	42 07	+23	94	42 30	+23	93	42 53	+21	92	43 14	+21	90	43 35	+19	89	43 54	+19	88	44 13	+18	86	44 31	+17	85
51	41 14	23	94	41 37	22	92	41 59	22	91	42 21	20	90	42 41	20	88	43 01	19	87	43 20	18	86	43 38	17	85
52	40 21	23	93	40 44	22	92	41 06	21	91	41 27	21	89	41 48	20	88	42 08	18	87	42 26	18	86	42 44	18	84
53	39 27	23	93	39 50	22	91	40 12	22	90	40 34	20	89	40 54	20	88	41 14	19	86	41 33	18	85	41 51	18	84
54	38 34	23	92	38 57	22	91	39 19	21	90	39 40	21	88	40 01	20	87	40 21	19	86	40 40	18	85	40 58	18	83
55	37 40	+23	92	38 03	+22	90	38 25	+22	89	38 47	+21	88	39 08	+20	87	39 28	+19	86	39 47	+18	84	40 05	+18	83
56	36 47	23	91	37 10	22	90	37 32	21	89	37 53	21	88	38 14	20	86	38 34	20	85	38 54	18	84	39 12	18	83
57	35 53	23	91	36 16	23	89	36 39	21	88	37 00	21	87	37 21	20	86	37 41	19	85	38 00	19	84	38 19	18	82
58	35 00	23	90	35 23	22	89	35 45	22	88	36 07	21	87	36 28	20	86	36 48	19	84	37 07	19	83	37 26	18	82
59	34 07	22	90	34 29	23	89	34 52	21	87	35 13	21	86	35 34	21	85	35 55	19	84	36 14	19	83	36 33	18	82
60	33 13	+23	89	33 36	+22	88	33 58	+22	87	34 20	+21	86	34 41	+20	85	35 01	+20	84	35 21	+19	82	35 40	+19	81
61	32 20	23	89	32 43	22	88	33 05	22	87	33 27	21	86	33 48	20	84	34 08	20	83	34 28	19	82	34 47	19	81
62	31 26	23	88	31 49	23	87	32 12	21	86	32 33	22	85	32 55	20	84	33 15	20	83	33 35	20	82	33 55	19	81
63	30 33	23	88	30 56	22	87	31 18	22	86	31 40	21	85	32 01	21	84	32 22	20	82	32 42	20	81	33 02	19	80
64	29 39	23	88	30 02	23	86	30 25	22	85	30 47	21	84	31 08	21	83	31 29	21	82	31 50	19	81	32 09	20	80
65	28 46	+23	87	29 09	+23	86	29 32	+22	85	29 54	+21	84	30 15	+21	83	30 36	+21	82	30 57	+20	81	31 17	+19	80
66	27 53	23	87	28 16	22	86	28 38	23	85	29 01	21	84	29 22	21	82	29 43	21	81	30 04	20	80	30 24	20	79
67	26 59	23	86	27 22	23	85	27 45	23	84	28 08	21	83	28 29	22	82	28 51	20	81	29 11	21	80	29 32	20	79
68	26 06	23	86	26 29	23	85	26 52	22	84	27 14	22	83	27 36	22	82	27 58	21	81	28 19	20	80	28 39	20	78
69	25 13	23	85	25 36	23	84	25 59	23	83	26 22	22	82	26 44	21	81	27 05	21	80	27 26	21	79	27 47	20	78

LHA	23° Hc	d	Z	24° Hc	d	Z	25° Hc	d	Z	26° Hc	d	Z	27° Hc	d	Z	28° Hc	d	Z	29° Hc	d	Z	LHA
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	
0	86 00	+60	180	87 00	+60	180	88 00	+60	180	89 00	+60	180	90 00	−60	..	89 00	−60	0	88 00	−60	0	360
1	85 54	58	167	86 52	56	163	87 48	52	156	88 40	27	138	89 07	27	90	88 40	51	41	87 49	57	24	359
2	85 37	53	155	86 30	49	149	87 19	38	138	87 57	16	119	88 13	15	90	87 58	38	60	87 20	49	41	358
3	85 10	48	145	85 58	41	137	86 39	29	126	87 08	12	110	87 20	11	89	87 09	28	69	86 41	41	52	357
4	84 36	42	137	85 18	35	129	85 53	24	118	86 17	9	105	86 26	7	89	86 19	22	73	85 57	34	60	356
5	83 57	+38	130	84 35	+30	123	85 05	+20	113	85 25	+8	102	85 33	−6	89	85 27	−18	76	85 09	−28	65	355
6	83 15	34	125	83 49	26	118	84 15	17	109	84 32	7	99	84 39	4	89	84 35	15	78	84 20	24	68	354
7	82 30	31	121	83 01	23	114	83 24	15	106	83 39	7	98	83 46	3	88	83 43	13	79	83 30	20	70	353
8	81 43	28	117	82 11	21	111	82 32	14	104	82 46	6	96	82 52	2	88	82 50	10	80	82 40	18	72	352
9	80 55	26	114	81 21	19	108	81 40	13	102	81 53	6	95	81 59	2	88	81 57	8	81	81 49	16	74	351
10	80 06	+24	112	80 30	+18	106	80 48	+12	100	81 00	+6	94	81 06	−1	88	81 05	−8	81	80 57	−14	75	350
11	79 16	22	110	79 38	17	104	79 55	12	99	80 07	5	93	80 12	0	88	80 12	7	82	80 05	12	76	349
12	78 25	21	108	78 46	16	103	79 02	11	98	79 13	6	93	79 19	0	87	79 19	6	82	79 13	10	77	348
13	77 34	20	106	77 54	15	102	78 09	11	97	78 20	5	92	78 25	+1	87	78 26	5	82	78 21	9	77	347
14	76 42	19	104	77 01	15	100	77 16	10	96	77 26	6	91	77 32	1	87	77 33	4	82	77 29	8	78	346
15	75 50	+19	103	76 09	+14	99	76 23	+10	95	76 33	+6	91	76 39	+1	87	76 40	−3	82	76 37	−7	78	345
16	74 58	18	102	75 16	14	98	75 30	9	94	75 39	6	90	75 45	2	86	75 47	2	82	75 45	7	78	344
17	74 06	17	101	74 23	13	97	74 36	10	94	74 46	6	90	74 52	2	86	74 54	2	82	74 52	5	79	343
18	73 13	17	100	73 30	13	97	73 43	9	93	73 52	7	90	73 59	2	86	74 01	1	82	74 00	5	79	342
19	72 21	16	99	72 37	12	96	72 49	10	92	72 59	6	89	73 05	3	86	73 08	−1	82	73 07	4	79	341
20	71 28	+15	98	71 43	+13	95	71 56	+10	92	72 06	+6	89	72 12	+3	85	72 15	0	82	72 15	−5	79	340
21	70 35	15	97	70 50	13	94	71 03	9	91	71 12	7	88	71 19	3	85	71 22	+1	82	71 23	3	79	339
22	69 42	15	97	69 57	12	94	70 09	10	91	70 19	6	88	70 25	4	85	70 29	1	82	70 30	2	79	338
23	68 48	15	96	69 03	13	93	69 16	9	90	69 25	7	88	69 32	4	85	69 36	2	82	69 38	2	79	337
24	67 55	15	95	68 10	12	93	68 22	10	90	68 32	7	87	68 39	4	85	68 43	2	82	68 45	1	79	336
25	67 02	+15	95	67 17	+12	92	67 29	+9	90	67 38	+8	87	67 46	+4	84	67 50	+3	82	67 53	−1	79	335
26	66 09	14	94	66 23	12	92	66 35	10	89	66 45	8	87	66 53	5	84	66 58	2	82	67 00	0	79	334
27	65 15	15	93	65 30	12	91	65 42	10	89	65 52	7	86	65 59	6	84	66 05	3	81	66 08	0	79	333
28	64 22	14	93	64 36	12	91	64 48	10	88	64 58	8	86	65 06	6	84	65 12	3	81	65 15	+1	79	332
29	63 28	15	92	63 43	12	90	63 55	10	88	64 05	8	86	64 13	6	83	64 19	4	81	64 23	1	79	331
30	62 35	+14	92	62 49	+13	90	63 02	+10	87	63 12	+8	85	63 20	+6	83	63 26	+4	81	63 30	+2	79	330
31	61 42	14	91	61 56	12	89	62 08	11	87	62 19	8	85	62 27	7	83	62 34	4	81	62 38	3	79	329
32	60 48	14	91	61 02	13	89	61 15	10	87	61 25	9	85	61 34	7	83	61 41	5	81	61 46	5	78	328
33	59 55	14	90	60 09	12	88	60 21	11	86	60 32	9	84	60 41	7	82	60 48	5	80	60 53	4	78	327
34	59 01	14	90	59 15	13	88	59 28	11	86	59 39	9	84	59 48	7	82	59 55	6	80	60 01	4	78	326
35	58 08	+14	89	58 22	+13	88	58 35	+11	86	58 46	+9	84	58 55	+8	82	59 03	+6	80	59 09	+4	78	325
36	57 14	15	89	57 29	12	87	57 41	12	85	57 53	9	84	58 02	8	82	58 10	6	80	58 16	5	78	324
37	56 21	14	89	56 35	13	87	56 48	12	85	57 00	9	83	57 09	9	81	57 18	6	80	57 24	5	78	323
38	55 27	15	88	55 42	13	86	55 55	11	85	56 06	10	83	56 16	9	81	56 25	7	79	56 32	5	78	322
39	54 34	15	88	54 49	13	86	55 02	11	84	55 13	11	83	55 24	8	81	55 32	4	79	55 40	6	77	321
40	53 41	+14	87	53 55	+14	86	54 09	+11	84	54 20	+11	82	54 31	+9	81	54 40	+8	79	54 48	+6	77	320
41	52 47	15	87	53 02	13	85	53 15	12	84	53 27	11	82	53 38	10	80	53 48	7	79	53 55	7	77	319
42	51 54	15	87	52 09	13	85	52 22	13	83	52 35	11	82	52 46	9	80	52 55	8	79	53 03	7	77	318
43	51 00	15	86	51 15	14	85	51 29	13	83	51 42	11	81	51 53	10	80	52 03	8	78	52 11	8	77	317
44	50 07	15	86	50 22	14	84	50 36	13	83	50 49	11	81	51 00	10	80	51 10	9	78	51 19	8	77	316
45	49 14	+15	85	49 29	+14	84	49 43	+13	82	49 56	+12	81	50 08	+10	79	50 18	+9	78	50 27	+8	76	315
46	48 21	15	85	48 36	14	84	48 50	13	82	49 03	12	81	49 15	11	79	49 26	10	78	49 36	4	76	314
47	47 27	16	85	47 43	14	83	47 57	14	82	48 11	12	80	48 23	11	79	48 34	10	77	48 44	8	76	313
48	46 34	16	84	46 50	14	83	47 04	14	82	47 18	12	80	47 30	12	79	47 42	10	77	47 52	9	76	312
49	45 41	16	84	45 57	14	83	46 11	14	81	46 25	13	80	46 38	12	78	46 50	10	77	47 00	10	75	311
50	44 48	+16	84	45 04	+15	82	45 19	+14	81	45 33	+13	79	45 46	+11	78	45 57	+11	77	46 08	+10	75	310
51	43 55	16	83	44 11	15	82	44 26	14	81	44 40	13	79	44 53	13	78	45 06	11	76	45 17	10	75	309
52	43 02	16	83	43 18	15	82	43 33	15	80	43 48	13	79	44 01	13	78	44 14	11	76	44 25	11	75	308
53	42 09	16	83	42 25	16	81	42 41	14	80	42 55	14	79	43 09	13	77	43 22	12	76	43 34	10	75	307
54	41 16	16	82	41 32	16	81	41 48	15	80	42 03	14	78	42 17	13	77	42 30	12	76	42 42	11	74	306
55	40 23	+16	82	40 39	+16	81	40 55	+16	79	41 11	+14	78	41 25	+13	77	41 38	+13	75	41 51	+11	74	305
56	39 30	17	82	39 47	16	80	40 03	15	79	40 18	15	78	40 33	13	76	40 46	13	75	40 59	12	74	304
57	38 37	17	81	38 54	16	80	39 10	16	79	39 26	15	77	39 41	14	76	39 55	13	75	40 08	12	74	303
58	37 44	18	81	38 02	16	80	38 18	16	78	38 34	15	77	38 49	14	76	39 03	14	75	39 17	12	73	302
59	36 51	18	80	37 09	17	79	37 26	16	78	37 42	15	77	37 57	15	76	38 12	13	74	38 25	13	73	301
60	35 59	+17	80	36 16	+17	79	36 33	+17	78	36 50	+15	77	37 05	+15	75	37 20	+14	74	37 34	+14	73	300
61	35 06	18	80	35 24	17	79	35 41	17	77	35 58	16	76	36 14	15	75	36 29	14	74	36 43	14	73	299
62	34 14	18	79	34 32	17	78	34 49	17	77	35 06	16	76	35 22	16	75	35 38	14	74	35 52	14	72	298
63	33 21	18	79	33 39	18	78	33 57	17	77	34 14	17	76	34 31	15	75	34 46	15	73	35 01	15	72	297
64	32 29	18	79	32 47	18	78	33 05	17	77	33 22	17	75	33 39	16	74	33 55	16	73	34 11	14	72	296
65	31 36	+19	78	31 55	+18	77	32 13	+18	76	32 31	+17	75	32 48	+16	74	33 04	+16	73	33 20	+15	72	295
66	30 44	19	78	31 03	18	77	31 21	18	76	31 39	17	75	31 56	17	74	32 13	16	72	32 29	16	71	294
67	29 52	19	78	30 11	18	77	30 29	19	76	30 48	17	74	31 05	17	73	31 22	16	72	31 38	16	71	293
68	28 59	20	77	29 19	19	76	29 38	18	75	29 56	18	74	30 14	17	73	30 31	17	72	30 48	16	71	292
69	28 07	20	77	28 27	19	76	28 46	19	75	29 05	18	74	29 23	18	73	29 41	17	72	29 58	16	71	291

S. Lat. {LHA greater than 180° Zn=180−Z
LHA less than 180° Zn=180+Z}

DECLINATION (15°-29°) SAME NAME AS LATITUDE

LAT 27°

FIGURE 148.—Declination (15° - 29°) LAT 27°.

N. Lat. {LHA greater than 180° ... Zn=Z; LHA less than 180° ... Zn=360−Z}

DECLINATION (0°-14°) SAME NAME AS LATITUDE

LHA	0° Hc	d	Z	1° Hc	d	Z	2° Hc	d	Z	3° Hc	d	Z	4° Hc	d	Z	5° Hc	d	Z	6° Hc	d	Z	7° Hc	d	Z	LHA
	° '	'	°	° '	'	°	° '	'	°	° '	'	°	° '	'	°	° '	'	°	° '	'	°	° '	'	°	
70	17 03	+30	101	17 35	+30	100	18 07	+30	99	18 39	+31	98	19 10	+31	97	19 41	+31	96	20 12	+31	95	20 43	+30	94	290
71	16 12	30	100	16 44	30	99	17 16	30	98	17 48	31	97	18 19	31	97	18 50	31	96	19 21	31	95	19 52	30	94	289
72	15 22	30	100	15 54	30	99	16 25	30	98	16 57	31	97	17 28	31	96	17 59	31	95	18 30	30	94	19 00	31	93	288
73	14 31	30	99	15 03	31	98	15 34	30	97	16 06	31	96	16 37	31	95	17 08	31	95	17 39	30	94	18 09	30	93	287
74	13 40	30	98	14 12	31	98	14 43	30	97	15 15	31	96	15 46	31	95	16 17	30	94	16 47	31	93	17 18	30	92	286
75	12 49	+32	98	13 21	+31	97	13 52	+31	96	14 23	+31	95	14 54	+31	94	15 25	+31	94	15 56	+30	93	16 26	+30	92	285
76	11 58	30	97	12 30	31	96	13 01	31	96	13 32	31	95	14 03	31	94	14 34	30	93	15 04	31	92	15 35	30	91	284
77	11 07	32	97	11 39	31	96	12 10	31	95	12 41	31	94	13 12	31	93	13 43	30	92	14 13	30	92	14 43	31	91	283
78	10 16	31	96	10 47	30	95	11 19	31	95	11 50	30	94	12 20	31	93	12 51	31	92	13 22	30	91	13 52	30	90	282
79	09 25	31	96	09 56	31	95	10 27	31	94	10 58	31	93	11 29	31	92	12 00	30	91	12 30	31	91	13 01	30	90	281
80	08 34	+31	95	09 05	+31	94	09 36	+31	94	10 07	+31	93	10 38	+30	92	11 08	+31	91	11 39	+30	90	12 09	+30	89	280
81	07 42	30	95	08 14	31	94	08 45	30	93	09 15	31	92	09 46	31	91	10 17	30	90	10 47	31	89	11 18	30	89	279
82	06 51	31	94	07 22	31	93	07 53	31	92	08 24	31	92	08 55	30	91	09 25	31	90	09 56	30	89	10 26	31	88	278
83	06 00	31	94	06 31	31	93	07 02	31	92	07 33	30	91	08 03	31	90	08 34	31	89	09 05	30	88	09 35	30	88	277
84	05 08	31	93	05 39	31	92	06 10	31	91	06 41	31	91	07 12	31	90	07 43	30	89	08 13	31	88	08 44	30	87	276
85	04 17	+31	93	04 48	+31	92	05 19	+31	91	05 50	+30	90	06 21	+30	89	06 51	+31	88	07 22	+30	87	07 52	+31	87	275
86	03 26	31	92	03 57	30	91	04 27	31	90	04 58	31	89	05 29	31	89	06 00	30	88	06 30	31	87	07 01	30	86	274
87	02 34	30	92	03 05	31	91	03 36	31	90	04 07	30	89	04 38	30	88	05 08	31	87	05 39	31	86	06 10	30	86	273
88	01 43	31	91	02 14	31	90	02 45	30	89	03 15	31	88	03 46	31	88	04 17	31	87	04 48	30	86	05 18	31	85	272
89	00 51	30	91	01 22	31	90	01 53	30	89	02 24	31	88	02 55	31	87	03 26	30	86	03 56	31	85	04 27	31	85	271
90	00 00	+31	90	00 31	+31	89	01 02	+31	88	01 33	+31	87	02 04	+30	87	02 34	+31	86	03 05	+31	85	03 36	+31	84	270
91	-0 51	30	89	-0 21	31	89	00 10	31	88	00 41	31	87	01 12	31	86	01 43	31	85	02 14	31	84	02 45	31	83	269
92	-1 43	31	89	-1 12	31	88	-0 41	31	87	-0 18	31	86	00 21	31	86	00 52	31	85	01 23	31	84	01 54	31	83	268
93	-2 34	31	88	-2 03	31	88	-1 32	31	87	-1 01	31	86	-0 30	31	85	00 01	31	84	00 32	31	83	01 03	31	82	267
94	-3 26	30	88	-2 55	31	87	-2 28	31	86	-1 53	31	85	-1 22	30	85	-0 50	31	84	-0 19	31	83	00 12	31	82	266
95	-4 17	+31	87	-3 46	+31	87	-3 15	+31	86	-2 44	+31	85	-2 13	+31	84	-1 42	+32	83	-1 10	+31	82	0 39	+31	81	265
96	-5 08	31	87	-4 37	31	86	-4 06	31	85	-3 35	31	84	-3 04	31	83	-2 33	32	83	-2 01	31	82	1 30	31	81	264
97	-6 00	31	86	-5 29	32	86	-4 57	31	85	-4 26	31	84	-3 55	31	83	-3 24	32	82	-2 52	31	81	2 21	32	80	263
98				-6 20	31	85	-5 49	32	84	-5 17	31	83	-4 46	32	82	-4 14	31	82	-3 43	32	81	-3 11	31	80	262
99							-6 40	32	84	-6 08	31	83	-5 37	32	82	-5 05	31	81	-4 34	32	80	-4 02	32	79	261
100													-6 28	+32	8[illegible]	-5 56	+32	81	-5 24	+32	80	4 52	+31	79	260
101																			-6 15	32	79	5 43	32	78	259
102																						-6 33	32	78	258

LHA	8° Hc	d	Z	9° Hc	d	Z	10° Hc	d	Z	11° Hc	d	Z	12° Hc	d	Z	13° Hc	d	Z	14° Hc	d	Z	LHA
	° '	'	°	° '	'	°	° '	'	°	° '	'	°	° '	'	°	° '	'	°	° '	'	°	
70	21 13	+30	93	21 43	+30	93	22 13	+30	92	22 43	+29	91	23 12	+29	90	23 40	+29	89	24 09	+28	88	290
71	20 22	30	93	20 52	30	92	21 22	29	91	21 51	29	90	22 20	29	89	22 49	28	88	23 17	29	87	289
72	19 31	30	92	20 01	29	91	20 30	30	91	21 00	29	90	21 29	29	89	21 58	28	88	22 26	28	87	288
73	18 39	30	92	19 09	30	91	19 39	29	90	20 08	29	89	20 37	29	88	21 06	28	87	21 35	28	86	287
74	17 48	30	91	18 18	29	90	18 47	30	90	19 17	29	89	19 46	29	88	20 15	28	87	20 43	29	86	286
75	16 56	+30	91	17 26	+30	90	17 56	+29	89	18 25	+30	88	18 55	+29	87	19 24	+28	86	19 52	+28	85	285
76	16 05	30	90	16 35	30	89	17 05	29	88	17 34	29	88	18 03	29	87	18 32	29	86	19 01	28	85	284
77	15 14	30	90	15 44	29	89	16 13	30	88	16 43	29	87	17 12	29	86	17 41	29	85	18 10	28	84	283
78	14 22	30	89	14 52	30	88	15 22	29	87	15 51	30	87	16 21	29	86	16 50	29	85	17 19	28	84	282
79	13 31	30	89	14 01	29	88	14 30	30	87	15 00	29	86	15 29	30	85	15 59	28	84	16 27	29	83	281
80	12 39	+30	88	13 09	+30	87	13 39		86	14 09	+29	86	14 38	+29	85	15 07	+29	84	15 36	+29	83	280
81	11 48	30	88	12 18	30	87	12 48	30	86	13 18	29	85	13 47	29	84	14 16	29	83	14 45	29	82	279
82	10 57	30	87	11 27	30	86	11 57	29	85	12 26	30	85	12 56	29	84	13 25	29	83	13 54	29	82	278
83	10 05	30	87	10 35	30	86	11 05	30	85	11 35	30	84	12 05	29	83	12 34	30	82	13 04	29	81	277
84	09 14	30	86	09 44	30	85	10 14	30	84	10 44	30	84	11 14	29	83	11 43	30	82	12 13	29	81	276
85	08 23	+30	86	08 53	+30	85	09 23	+30	84	09 53	+30	83	10 23	+29	82	10 52	+30	81	11 22	+29	80	275
86	07 31	31	85	08 02	30	84	08 32	30	83	09 02	30	83	09 32	30	82	10 02	29	81	10 31	30	80	274
87	06 40	30	85	07 10	31	84	07 41	30	83	08 11	30	82	08 41	30	81	09 11	30	80	09 41	29	79	273
88	05 49	30	84	06 19	31	83	06 50	30	82	07 20	30	82	07 50	30	81	08 20	30	80	08 50	30	79	272
89	04 58	30	84	05 28	31	83	05 59	30	82	06 29	31	81	07 00	30	80	07 30	30	79	08 00	30	78	271
90	04 07	+30	83	04 37	+31	82	05 08	+30	81	05 38	+31	81	06 09	+30	80	06 39	+31	79	07 10	+30	78	270
91	03 16	30	83	03 46	31	82	04 17	31	81	04 48	30	80	05 18	31	79	05 49	30	78	06 19	31	77	269
92	02 25	30	82	02 55	31	81	03 26	31	80	03 57	31	80	04 28	30	79	04 58	31	78	05 29	31	77	268
93	01 34	31	82	02 05	31	81	02 36	31	80	03 07	30	79	03 37	31	78	04 08	31	77	04 39	31	76	267
94	00 43	31	81	01 14	31	80	01 45	31	79	02 16	31	79	02 47	31	78	03 18	31	77	03 49	31	76	266
95	-0 08	+31	81	00 23	+32	80	00 55	+31	79	01 26	+31	78	01 57	+31	77	02 28	+31	76	02 59	+31	75	265
96	0 59	32	80	0 27	31	79	00 04	31	78	00 35	32	78	01 07	31	77	01 38	32	76	02 10	31	75	264
97	1 49	31	80	1 18	32	[illegible]	[illegible]16	31	78	0 15	32	77	00 17	31	76	00 48	32	75	01 20	31	74	263
98	-2 40	32	79	2 08	32	78	-1 36	31	77	-1 05	32	76	0 33	32	76	-0 01	31	75	00 30	32	74	262
99	3 30	32	79	-2 58	31	78	-2 27	32	77	-1 55	32	76	-1 23	32	75	-0 51	32	74	-0 19	32	73	261
100	-4 21	+32	78	-3 49	+32	77	-3 17	+32	76	-2 45	+33	75	-2 12	+32	75	-1 40	+32	74	-1 08	+32	73	260
101	-5 11	32	77	-4 39	31	77	-4 06	32	76	-3 34	32	75	-3 02	32	74	2 30	33	73	-1 57	32	72	259
102	6 01	32	77	-5 29	31	76	-4 56	32	75	-4 24	33	74	[illegible]51	32	74	-3 19	33	73	-2 46	32	72	258
103				-6 19	31	76	-5 46	31	75	-5 13	32	74	4 41	33	73	4 08	33	72	-3 35	33	71	257
104							-6 36	31	74	-6 03	33	73	-5 30	33	72	-4 57	33	72	-4 24	33	71	256
105													-6 19	+34	72	-5 45	+33	71	-5 12	+33	70	255
106																-6 34	34	70	-6 00	33	70	254

LHA	0° Hc	d	Z	1° Hc	d	Z	2° Hc	d	Z	3° Hc	d	Z	4° Hc	d	Z	5° Hc	d	Z	6° Hc	d	Z	7° Hc	d	Z	LHA
97	-6 00	31	86	-6 31	31	87																			263
96	-5 08	30	87	-5 39	31	88	-6 10	31	89	-6 41	31	90													264
95	-4 17	-31	87	-4 48	-31	88	-5 19	-31	89	-5 50	-31	90	-6 21	-30	91										265
94	-3 26	31	88	-3 5[illegible]	30	89	-4 27	32	90	-4 58	31	91	-5 29	31	91	-6 00	30	92	-6 30	31	93				266
93	-2 34	30	88	-3 05	31	89	-3 36	31	90	-4 07	31	91	-4 38	30	92	-5 08	31	93	-5 39	31	94	-6 10	30	94	267
92	-1 83	31	89	-2 18	33	90	-2 45	30	91	-3 15	31	92	-3 46	31	92	-4 17	31	93	-4 48	30	94	-5 18	31	95	268
91	-0 51	31	89	-1 22	31	90	-1 53	31	91	-2 24	31	92	-2 55	31	93	3 26	30	94	-3 56	31	95	-4 27	31	95	269
90	00 00	-31	90	-0 31	-31	91	-1 02	-31	92	-1 33	-31	93	-2 04	-30	93	-2 34	-31	94	-3 05	-31	95	-3 36	-31	96	270
89	00 51	30	91	00 21	31	91	-0 10	31	92	-0 41	31	93	-1 12	31	94	-1 43	31	95	-2 14	31	96	-2 45	31	97	271
88	01 43	31	91	01 12	31	92	00 41	31	93	00 10	31	94	-0 21	31	94	0 52	31	95	-1 23	31	96	-1 5[illegible]	31	97	272
87	02 34	30	92	02 03	31	92	01 32	31	93	01 01	31	94	00 30	31	95	[illegible]1	31	96	-0 32	31	97	-1 03	31	98	273
86	03 26	31	92	02 55	31	93	02 24	31	94	01 53	31	95	01 22	32	95	[illegible]0	31	96	00 19	31	97	-0 12	31	98	274
85	04 17	-31	93	03 46	-31	93	03 15	-31	94	02 44	-31	95	02 13	-31	96	01 42	-32	97	01 10	-31	98	00 39	-31	99	275
84	05 08	31	93	04 37	31	94	04 06	31	95	03 35	31	96	03 04	31	97	02 33	32	97	02 01	31	98	01 30	[illegible]	99	276
83	06 00	31	94	05 29	32	95	04 57	31	95	04 26	31	96	03 55	31	97	03 24	32	98	02 52	31	99	02 21	[illegible]	100	277
82	06 51	31	94	06 20	31	95	05 49	32	96	05 17	31	97	04 46	32	98	04 14	31	98	03 43	32	99	03 11	31	100	278
81	07 42	31	95	07 11	31	96	06 40	32	96	06 08	31	97	05 37	32	98	05 05	31	99	04 34	32	100	04 02	32	101	279
80	08 34	-32	95	08 02	-31	96	07 31	-32	97	06 59	-31	98	06 28	-32	99	05 56	-30	100	05 24	-32	100	04 52	-31	101	280
79	09 25	32	96	08 53	31	97	08 22	32	97	07 50	31	98	07 19	32	99	06 47	32	100	06 15	32	101	05 43	32	102	281
78	10 16	31	96	09 45	32	97	09 13	32	98	08 41	32	99	08 09	32	100	07 37	32	101	07 05	32	101	06 33	32	102	282
77	11 07	31	97	10 36	32	98	10 04	32	99	09 32	32	99	09 00	32	100	08 28	32	101	07 56	33	102	07 23	32	103	283
76	11 58	32	97	11 26	31	98	10 55	32	99	10 23	32	100	09 51	33	101	09 18	32	102	08 46	32	103	08 14	33	103	284
75	12 49	-32	98	12 17	-32	99	11 45	-32	100	11 13	-32	101	10 41	-32	101	10 09	-33	102	09 36	-32	103	09 04	-33	104	285
74	13 40	32	98	13 08	32	99	12 36	32	100	12 04	33	101	11 31	32	102	10 59	33	103	10 26	33	104	09 53	33	104	286
73	14 31	32	99	13 59	32	100	13 27	33	101	12 54	32	102	12 22	33	102	11 49	33	103	11 16	33	104	10 43	33	105	287
72	15 22	30	100	14 49	32	100	14 17	32	101	13 45	33	102	13 12	33	103	12 39	33	104	12 06	33	105	11 33	34	106	288
71	16 12	32	100	15 40	32	101	15 08	32	102	14 35	33	103	14 02	33	104	13 29	33	104	12 56	34	105	12 22	33	106	289
70	17 03	-30	101	16 30	-32	102	15 58	-31	102	15 25	-33	103	14 52	-33	104	14 19	-34	105	13 45	-33	106	13 12	-34	107	290
	0°			1°			2°			3°			4°			5°			6°			7°			

LHA	8° Hc	d	Z	9° Hc	d	Z	10° Hc	d	Z	11° Hc	d	Z	12° Hc	d	Z	13° Hc	d	Z	14° Hc	d	Z	LHA
93	-[illegible]40	30	95																			267
92	5 49	30	96	6 19	31	97																268
91	-4 56	30	96	-5 28	31	97	-5 59	30	98	-6 29	31	99										269
90	-4 07	-30	97	-4 37	-31	98	-5 08	-30	99	-5 38	-31	99	-6 09	-30	100	-6 39	-31	101				270
89	3 16	30	97	-3 46	31	98	-4 17	31	99	-4 48	30	100	-5 18	31	101	-5 49	30	102	-6 19	31	103	271
88	-2 25	30	98	-2 55	31	99	-3 26	31	100	-3 57	31	100	-4 28	30	101	-4 58	31	102	-5 29	31	103	272
87	-1 34	31	98	-2 05	31	99	-2 36	31	100	-3 07	30	101	-3 37	31	102	-4 08	31	103	4 39	31	104	273
86	-0 43	31	99	-1 14	31	100	-1 45	31	101	-2 16	31	101	-2 47	31	102	-3 18	31	103	-3 49	31	104	274
85	00 08	-31	99	-0 03	-32	100	-0 55	-31	101	-1 26	-31	102	-1 57	-31	103	-2 28	-31	104	-2 59	-31	105	275
84	00 59	32	100	00 27	31	101	-0 04	31	102	-0 35	32	102	-1 07	31	103	-1 38	32	104	-2 10	31	105	276
83	01 49	31	100	01 18	32	101	00 46	31	102	00 15	32	103	-0 17	31	104	-0 48	32	105	-1 20	31	106	277
82	02 40	32	101	02 08	32	102	01 36	31	103	01 05	32	104	00 33	32	10[illegible]	00 01	31	105	-0 30	32	10[illegible]	278
81	03 30	32	101	02 58	31	102	02 27	32	103	01 55	32	104	01 23	32	105	00 51	32	106	00 19	32	107	279
80	04 21	-32	102	03 49	-32	103	03 17	-32	104	02 45	-33	105	02 12	-32	105	01 40	-32	1[illegible]	01 08	-32	107	280
79	05 11	32	103	04 39	33	103	04 06	32	104	03 34	30	105	03 02	32	106	02 30	33	107	01 57	32	108	281
78	06 01	32	103	05 29	33	104	04 56	32	10[illegible]	04 24	33	106	03 51	32	106	03 19	33	107	02 46	32	108	282
77	06 51	32	104	06 19	33	105	05 46	33	105	05 13	32	106	04 41	33	107	04 08	33	108	03 35	33	109	283
76	07 41	33	104	07 08	32	105	06 36	33	106	06 03	33	107	05 30	33	108	04 57	33	108	04 24	33	109	284
75	08 31	-33	105	07 58	-33	106	07 25	-33	106	06 52	-33	107	06 19	-34	108	05 45	-33	109	05 12	-33	110	285
74	09 20	33	105	08 47	33	106	08 14	33	107	07 41	33	108	07 08	34	109	06 34	34	110	06 00	33	110	286
73	10 10	33	106	09 37	34	107	09 0[illegible]	33	108	08 30	34	108	07 56	34	109	07 22	33	110	06 49	34	111	287
72	10 59	33	106	10 26	34	107	09 57	30	108	09 19	34	109	08 45	34	110	08 11	34	111	07 [illegible]7	35	111	288
71	11 49	34	107	11 15	34	108	10 41	34	109	10 07	34	110	09 33	34	110	08 59	35	111	03 24	34	112	289
70	12 38	-34	10[illegible]	12 04	-34	108	11 30	-35	109	10 55	-34	110	10 21	-34	111	09 47	-35	112	09 12	-35	11[illegible]	290
	8°			9°			10°			11°			12°			13°			14°			

S. Lat. {LHA greater than 180° ... Zn=180−Z; LHA less than 180° ... Zn=180+Z}

DECLINATION (0°-14°) CONTRARY NAME TO LATITUDE

LAT 31°

LAT 31°

FIGURE 149.—Declination (0° - 14°) LAT 31°.

DECLINATION (0°-14°) SAME NAME AS LATITUDE

N. Lat. {LHA greater than 180°.........Zn=Z / LHA less than 180°..........Zn=360−Z}

DECLINATION (0°-14°) CONTRARY NAME TO LATITUDE

S. Lat. {LHA greater than 180°.........Zn=180−Z / LHA less than 180°..........Zn=180+Z}

LAT 32°

FIGURE 150.—Declination (0° - 14°) LAT 32°.

N. Lat. {LHA greater than 180°..........Zn=Z; LHA less than 180°..........Zn=360−Z}

DECLINATION (15°-29°) CONTRARY NAME TO LATITUDE

LHA	15° Hc	d	Z	16° Hc	d	Z	17° Hc	d	Z	18° Hc	d	Z	19° Hc	d	Z	20° Hc	d	Z	21° Hc	d	Z	22° Hc	d	Z	23° Hc	d	Z	24° Hc	d	Z	25° Hc	d	Z	26° Hc	d	Z	27° Hc	d	Z	28° Hc	d	Z	29° Hc	d	Z	LHA
	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	° ′	′	°	
69	09 00	36	114	08 24	36	115	07 48	36	116	07 12	36	117	06 36	37	117	05 59	36	118	05 23	36	119	04 47	37	120	04 10	36	121	03 34	37	121	02 57	37	122	02 20	36	123	01 44	39	124	01 07	36	124	00 31	37	125	291
68	09 46	36	115	09 10	36	116	08 34	36	116	07 57	36	117	07 21	37	118	06 44	37	119	06 07	38	120	05 31	37	120	04 54	37	121	04 17	37	122	03 40	37	123	03 03	37	123	02 26	37	124	01 49	37	125	01 12	37	126	292
67	10 32	36	115	09 56	36	116	09 19	37	117	08 42	36	118	08 06	37	119	07 29	37	119	06 52	38	120	06 15	38	121	05 37	37	122	05 00	37	122	04 23	38	123	03 45	37	124	03 08	37	125	02 31	38	126	01 53	37	126	293
66	11 18	37	116	10 41	36	117	10 05	38	118	09 27	37	118	08 50	37	119	08 13	37	120	07 36	38	120	06 58	37	121	06 21	38	122	05 43	38	123	05 05	38	124	04 27	37	125	03 50	38	125	03 12	38	126	02 34	38	127	294
65	12 04	−37	117	11 27	−37	117	10 50	−38	118	10 12	−38	119	09 35	−38	120	08 57	−38	120	08 19	−38	121	07 41	−38	122	07 03	−38	123	06 25	−38	124	05 47	−38	124	05 09	−38	125	04 31	−38	126	03 53	−38	127	03 15	−39	127	295
64	12 49	37	117	12 12	38	118	11 34	38	119	10 57	38	120	10 19	38	120	09 41	38	121	09 03	39	122	08 24	38	123	07 46	38	123	07 08	39	124	06 29	38	125	05 51	39	126	05 12	39	127	04 33	38	127	03 55	39	128	296
63	13 35	38	118	12 57	38	119	12 19	38	119	11 41	38	120	11 03	39	121	10 24	38	122	09 46	39	122	09 07	39	123	08 28	38	124	07 50	39	125	07 11	39	126	06 32	39	126	05 53	39	127	05 14	39	128	04 35	40	129	297
62	14 20	38	118	13 41	38	119	13 03	38	120	12 25	39	121	11 46	39	122	11 07	39	122	10 28	39	123	09 50	40	124	09 10	39	125	08 31	39	125	07 52	39	126	07 13	40	127	06 33	39	128	05 54	40	128	05 14	40	129	298
61	15 04	38	119	14 26	39	120	13 47	39	121	13 08	39	121	12 29	39	122	11 50	39	123	11 11	39	124	10 32	40	124	09 52	39	125	09 13	40	126	08 33	40	127	07 53	39	128	07 14	40	128	06 34	40	129	05 54	40	130	299
60	15 49	−39	120	15 10	−39	120	14 31	−39	121	13 52	−40	122	13 12	−39	123	12 33	−40	124	11 53	−40	124	11 13	−39	125	10 34	−40	126	09 54	−40	127	09 14	−40	127	08 34	−41	128	07 53	−40	129	07 13	−40	130	06 33	−41	130	300
59	16 33	40	120	15 53	39	121	15 14	39	122	14 35	40	123	13 55	40	123	13 15	40	124	12 35	40	125	11 55	40	126	11 15	41	126	10 34	40	127	09 54	41	128	09 13	40	129	08 33	41	129	07 52	41	130	07 11	40	131	301
58	17 16	39	121	16 37	40	122	15 57	40	123	15 17	40	123	14 37	40	124	13 57	40	125	13 17	41	126	12 36	41	126	11 55	40	127	11 15	41	128	10 34	41	129	09 53	41	129	09 12	41	130	08 31	41	131	07 50	40	132	302
57	18 00	40	122	17 20	40	122	16 40	40	123	16 00	41	124	15 19	40	125	14 39	41	125	13 58	41	126	13 17	41	127	12 36	41	128	11 55	41	129	11 14	40	129	10 32	41	130	09 51	40	131	09 09	42	131	08 27	41	132	303
56	18 43	40	122	18 03	41	123	17 22	40	124	16 42	41	124	16 01	41	125	15 20	41	126	14 39	40	127	13 57	41	128	13 16	40	128	12 34	41	129	11 53	40	130	11 11	41	131	10 29	41	131	09 47	42	132	09 05	42	133	304
55	19 26	−41	123	18 45	−41	124	18 04	−41	[illegible]	17 23	−41	125	16 42	−41	126	16 01	−41	127	15 19	−41	128	14 38	−42	128	13 56	−42	129	13 14	−42	130	12 32	−41	131	11 49	−41	131	11 07	−42	132	10 25	−43	133	09 42	−42	133	305
54	20 09	41	124	19 27	41	124	18 46	41	125	18 05	41	126	17 23	42	127	16 41	42	128	15 59	42	128	15 17	42	129	14 35	42	130	13 53	43	130	13 10	42	131	12 28	43	132	11 45	43	133	11 02	43	133	10 19	43	134	306
53	20 51	41	124	20 09	41	125	19 28	42	126	18 46	42	127	18 04	42	127	17 22	43	128	16 39	42	129	15 57	43	130	15 14	43	130	14 31	43	131	13 48	43	132	13 05	43	133	12 22	43	133	11 39	44	134	10 55	43	135	307
52	21 33	41	125	20 51	41	126	20 09	43	127	19 26	42	127	18 44	43	128	18 01	42	129	17 19	43	130	16 36	43	130	15 53	44	131	15 09	43	132	14 26	43	133	13 43	44	133	12 59	44	134	12 15	44	135	11 31	44	135	308
51	22 14	41	126	21 32	42	127	20 49	42	127	20 07	43	128	19 24	43	129	1°41	43	130	17 58	44	130	17 14	43	131	16 31	44	132	15 47	44	133	15 03	44	133	14 19	44	134	13 35	44	135	12 51	44	135	12 07	44	136	309
50	22 55	−41	127	22 12	−42	127	21 30	−44	128	20 46	−43	129	20 03	−43	130	19 20	−44	130	18 36	−44	131	17 52	−43	132	17 09	−45	132	16 24	−44	133	15 40	−44	134	14 56	−45	135	14 11	−44	135	13 27	−45	136	12 42	−45	137	310
49	23 36	43	127	22 53	44	128	22 09	43	129	21 26	44	130	20 42	44	130	19 58	44	131	19 14	44	132	18 30	44	132	17 46	45	133	17 01	44	134	16 17	45	135	15 32	44	135	14 47	46	136	14 02	45	137	13 17	44	137	311
48	24 16	43	128	23 33	44	129	22 49	44	130	22 05	44	130	21 21	44	131	20 37	45	132	19 52	44	133	19 08	44	133	18 23	45	134	17 38	44	135	16 53	45	135	16 08	44	136	15 22	45	137	14 37	46	137	13 51	46	138	312
47	24 56	44	129	24 12	44	130	23 28	44	130	22 44	45	131	21 59	44	132	21 14	44	133	20 29	45	133	19 44	45	134	18 59	45	135	18 14	46	135	17 28	44	136	16 43	46	137	15 57	46	137	15 11	46	138	14 25	46	139	313
46	25 35	44	130	24 51	44	130	24 06	44	131	23 22	45	132	22 37	45	133	21 52	46	133	21 06	45	134	20 21	46	135	19 35	46	135	18 49	46	136	18 03	46	137	17 17	46	137	16 31	46	138	15 45	47	139	14 58	46	139	314
45	26 14	−44	130	25 29	−44	131	24 45	−46	132	23 59	−45	133	23 14	−46	133	22 28	−44	134	21 43	−46	135	20 57	−46	135	20 11	−47	136	19 24	−46	137	18 38	−46	137	17 52	−47	138	17 05	−47	139	16 18	−47	139	15 31	−47	140	315
44	26 53	44	131	26 08	46	132	25 22	45	133	74 37	46	133	23 51	46	134	23 05	46	135	22 19	47	136	21 32	46	136	20 46	47	137	19 59	47	138	19 12	47	138	18 25	47	139	17 38	47	140	16 51	47	140	16 04	48	141	316
43	27 31	46	132	26 45	46	133	25 59	46	134	25 13	46	134	24 27	46	135	23 41	47	136	22 54	47	136	22 07	47	137	21 20	47	138	20 33	47	138	19 46	47	139	18 59	48	140	18 11	48	140	17 23	47	141	16 36	48	142	317
42	28 08	46	133	27 22	46	134	26 36	46	134	25 50	47	135	25 03	47	136	24 16	47	136	23 29	47	137	22 42	48	138	21 54	47	138	21 07	48	139	20 19	48	140	19 31	48	140	18 43	48	141	17 55	48	142	17 07	48	142	318
41	28 45	46	134	27 59	47	134	27 12	47	135	26 25	47	136	25 38	47	137	24 51	48	137	24 03	47	138	23 16	48	139	22 28	48	139	21 40	48	140	20 52	49	141	20 03	48	141	19 15	48	142	18 27	49	142	17 38	49	143	319
40	29 22	−47	135	28 35	−47	135	27 48	−48	136	27 00	−47	137	26 13	−48	137	25 25	−48	138	24 37	−48	139	23 49	−48	139	23 01	−49	140	22 12	−48	141	21 24	−49	141	20 35	−49	142	19 46	−49	143	18 57	−49	143	18 08	−49	144	320
39	29 58	48	135	29 10	47	136	28 23	48	137	27 35	48	138	26 47	48	138	25 59	48	139	25 11	49	140	24 22	49	140	23 33	49	141	22 44	49	141	21 55	49	142	21 06	49	143	20 17	49	143	19 28	50	144	18 38	50	145	321
38	30 33	48	136	29 45	48	137	28 57	48	138	28 09	48	138	27 21	49	139	26 32	49	140	25 43	49	140	24 54	49	141	24 05	49	142	23 16	50	142	22 26	49	143	21 37	50	144	20 47	50	144	19 57	50	145	19 07	50	145	322
37	31 08	48	137	30 20	49	138	29 31	48	139	28 43	49	139	27 54	49	140	27 05	50	141	26 15	49	141	25 26	50	142	24 36	49	143	23 47	50	143	22 57	50	144	22 07	50	144	21 17	51	145	20 26	50	146	19 36	50	146	323
36	31 42	48	138	30 54	49	139	30 05	49	140	29 16	50	140	28 26	49	141	27 37	50	141	26 47	50	142	25 57	50	143	25 07	50	143	24 17	50	144	23 27	51	145	22 36	50	145	21 46	51	146	20 55	51	146	20 04	51	147	324
35	32 16	−49	139	31 27	−50	140	30 37	−49	140	29 48	−50	141	28 58	−50	142	28 08	−50	142	27 18	−50	143	26 28	−51	144	25 37	−50	144	24 47	−51	145	23 56	−51	145	23 05	−51	146	22 14	−51	147	21 23	−51	147	20 32	−52	148	325
34	32 49	50	140	31 59	49	141	31 10	50	141	30 20	51	142	29 29	50	143	28 39	51	143	27 48	50	144	26 58	51	144	26 07	51	145	25 16	51	146	24 25	52	146	23 33	51	147	22 42	52	147	21 50	52	148	20 59	52	148	326
33	33 21	50	141	32 31	50	142	31 41	50	142	30 51	51	143	30 00	51	144	29 09	51	144	28 18	51	145	27 27	51	145	26 36	52	146	25 44	51	147	24 53	52	147	24 01	52	148	23 09	52	148	22 17	52	149	21 25	52	149	327
32	33 53	50	142	33 03	51	143	32 12	51	143	31 21	51	144	30 30	51	144	29 39	52	145	28 47	51	146	27 56	52	146	27 04	52	147	26 12	52	147	25 20	52	148	24 28	52	148	23 36	53	149	22 43	52	150	21 51	53	150	328
31	34 24	51	143	33 33	51	144	32 42	51	144	31 51	52	145	30 59	52	145	30 07	52	146	29 15	52	147	28 23	52	147	27 31	52	148	26 39	52	148	25 47	53	149	24 54	53	149	24 01	52	150	23 09	53	150	22 16	52	151	329
30	34 54	−52	144	34 03	−52	145	33 11	−52	145	32 20	−52	146	31 20	−52	146	30 35	−52	147	29 43	−52	148	28 51	−52	148	[illegible]7 58	−52	149	27 05	−52	149	26 13	−52	150	25 28	−52	150	24 27	−53	151	23 34	−54	151	22 40	−53	152	330
29	35 24	52	145	34 32	52	146	33 48	52	146	32 48	53	147	31 55	52	147	31 03	53	148	30 10	53	148	29 17	53	149	[illegible]	53	150	27 31	53	150	26 38	53	151	25 45	54	151	24 51	53	152	23 58	54	152	23 04	54	153	331
28	35 53	52	146	35 01	53	147	34 00	53	147	33 15	52	148	32 23	53	148	31 30	54	149	30 36	53	149	29 43	53	150	[illegible]	54	150	27 56	53	151	27 03	54	152	26 09	54	152	25 15	54	153	24 21	54	153	23 27	54	153	332
27	36 21	53	147	35 28	53	148	34 35	53	148	33 42	53	149	32 49	53	149	31 56	54	150	31 02	54	150	30 08	53	151	[illegible]	54	151	28 21	54	152	27 27	54	152	26 33	55	153	25 38	54	153	24 44	54	154	23 50	55	154	333
26	36 48	53	148	35 55	53	149	35 02	54	149	34 08	53	150	33 15	54	150	32 21	54	151	31 27	54	151	30 33	54	152	29 39	55	152	28 44	54	153	27 50	55	153	26 55	54	154	26 01	55	154	25 06	55	[illegible]	24 11	54	155	334
25	37 15	−54	149	36 21	−54	150	35 27	−54	150	34 33	−54	151	33 39	−54	151	32 45	−54	152	31 51	−55	152	30 56	−54	153	30 02	−55	153	29 07	−55	154	28 12	−55	154	27 17	−54	155	26 23	−55	155	25 28	−55	15[illegible]	24 32	−55	156	335
24	37 41	54	150	36 46	54	151	35 52	54	151	34 58	55	152	34 03	54	152	33 09	54	153	32 14	55	153	31 19	55	154	30 24	55	154	29 29	55	155	28 34	54	155	27 39	55	156	26 44	56	156	25 48	55	157	24 53	56	157	336
23	38 05	54	151	37 11	55	152	36 16	55	152	35 21	54	153	34 27	55	153	33 32	56	154	32 36	55	154	31 41	55	155	30 46	55	155	29 51	56	156	28 55	56	156	27 59	55	157	27 04	56	157	26 08	56	157	25 12	56	158	337
22	38 29	55	153	37 34	55	153	36 39	55	154	35 44	56	154	34 49	56	154	33 54	56	155	32 58	56	155	32 03	56	156	31 07	56	156	30 11	56	157	29 15	56	157	28 19	56	158	27 23	56	158	26 27	55	158	25 31	56	159	338
21	38 52	55	154	37 57	55	154	37 02	56	155	36 06	56	155	35 10	55	156	34 15	56	156	33 19	56	156	32 23	56	157	31 27	56	157	30 31	56	158	29 35	55	158	28 38	56	159	27 42	56	159	26 46	57	159	25 49	56	160	339
20	39 15	−56	155	38 19	−56	155	37 23	−56	156	36 27	−56	156	35 31	−56	157	34 35	−56	157	33 39	−56	157	32 43	−57	158	31 46	−56	158	30 50	−57	159	29 53	−56	159	28 57	−57	159	28 00	−57	160	27 03	−56	160	26 07	−57	161	340
19	39 36	56	156	38 48	56	156	37 44	57	157	36 47	56	157	35 51	57	158	34 54	56	158	33 58	57	159	33 01	56	159	32 05	57	159	31 08	57	160	30 11	57	160	29 14	57	160	28 17	57	161	27 20	57	161	26 23	57	162	341
18	39 56	56	157	[illegible]	57	158	38 03	56	158	37 07	57	158	36 10	57	159	35 13	57	159	34 16	57	160	33 19	57	160	32 22	57	160	31 25	57	161	30 28	57	161	29 31	57	151	28 34	58	162	27 36	57	162	26 39	57	162	342
17	40 15	56	158	39 19	57	159	38 22	57	159	37 25	57	160	36 28	57	160	35 31	58	160	34 33	57	161	33 36	57	161	32 39	57	161	31 42	58	162	30 44	57	162	29 47	58	162	28 49	57	163	27 52	58	163	26 54	58	163	343
16	40 34	57	160	39 37	58	160	38 39	57	160	37 42	53	161	36 45	58	161	35 47	57	161	34 50	58	162	33 52	57	162	32 55	58	162	31 57	58	163	30 59	57	163	30 02	58	163	29 04	58	161	28 06	58	164	27 08	58	164	344
15	40 51	−57	161	39 54	−58	161	38 56	−58	161	37 58	−57	162	37 01	−58	162	36 03	−58	163	35 05	−57	163	34 08	−58	163	33 10	−58	164	32 12	−58	164	31 14	−58	164	30 16	−58	164	29 18	−58	165	28 20	−59	165	27 21	−58	165	345
14	41 07	57	162	40 18	58	162	39 12	58	163	38 14	58	163	37 16	58	163	36 18	58	164	35 20	58	164	34 22	58	164	33 24	59	165	32 25	58	165	31 27	58	165	30 29	58	165	29 31	59	166	28 32	58	166	27 34	58	166	346
13	41 23	58	163	40 25	59	164	39 26	58	164	38 28	58	164	37 30	58	164	36 32	58	165	35 34	59	165	34 35	58	165	33 37	59	166	32 38	58	166	31 40	59	166	30 41	58	166	29 43	59	167	28 44	58	167	27 46	59	167	347
12	41 37	58	164	40 39	59	165	39 40	58	165	38 42	59	165	37 43	58	166	36 45	59	166	35 46	58	166	34 48	59	166	33 49	59	167	32 50	58	167	31 52	59	167	30 53	59	167	29 54	59	168	28 55	58	168	27 57	59	168	348
11	41 50	59	166	40 51	58	166	39 53	59	166	38 54	59	167	37 55	58	167	36 57	59	167	35 58	59	167	34 59	59	168	34 00	59	16[illegible]	33 01	59	168	32 02	58	168	31 04	59	169	30 05	59	169	29 06	59	169	28 07	59	169	349
10	42 02	−58	167	41 03	−58	167	40 04	−59	168	39 05	−58	168	38 06	−58	168	37 08	−59	168	36 09	−58	168	35 10	−59	169	34 11	−60	169	33 11	−59	169	32 12	−59	169	31 13	−59	170	30 14	−59	170	29 15	−59	170	28 16	−59	170	350
9	42 13	59	168	41 14	59	169	40 15	59	169	39 16	59	169	38 17	60	169	37 17	59	169	36 18	59	170	35 19	59	170	34 20	59	170	33 21	60	170	32 21	59	170	31 22	59	171	30 23	59	171	29 24	60	171	28 24	59	171	351
8	42 23	59	170	41 24	60	170	40 24	59	170	39 25	59	170	38 26	60	170	37 26	59	171	36 27	59	171	35 28	60	171	34 28	59	171	33 29	60	171	32 29	59	171	31 30	59	172	30 31	58	172	29 31	59	172	28 32	60	172	352
7	42 31	59	171	41 32	59	171	40 33	60	171	39 33	59	171	38 34	60	172	37 34	59	172	36 35	60	172	35 35	59	172	34 36	60	172	33 36	59	172	32 37	60	173	31 37	59	173	30 38	60	173	29 38	60	173	28 38	59	173	353
6	42 39	60	172	41 39	59	172	40 40	60	172	39 40	59	173	38 41	60	173	37 41	60	173	36 41	59	173	35 42	60	173	34 42	60	173	33 42	59	173	32 43	60	174	31 43	60	174	30 43	59	174	29 44	60	174	28 44	60	174	354
5	42 45	−59	173	41 46	−60	174	40 46	−60	174	39 46	−59	174	38 47	−60	174	37 47	−60	174	36 47	−60	174	35 47	−59	174	34 48	−60	174	33 48	−60	175	32 48	−60	175	31 48	−59	175	30 49	−60	175	29 49	−60	175	28 49	−60	175	355
4	42 51	60	175	41 51	60	175	40 51	60	175	39 51	60	175	38 51	59	175	37 52	60	175	36 52	60	175	35 52	60	175	34 52	60	176	33 52	60	176	32 52	59	176	31 53	60	176	30 53	60	176	29 53	60	176	28 53	60	176	356
3	42 55	60	176	41 55	60	176	40 55	60	176	39 55	60	176	38 55	60	176	37 55	60	176	36 55	60	177	35 55	59	177	34 56	60	177	33 56	60	177	32 56	60	177	31 56	60	177	30 56	60	177	29 56	60	177	28 56	60	177	357
2	42 58	60	177	41 58	60	177	40 58	60	178	39 58	60	178	38 58	60	178	37 58	60	178	36 58	60	178	35 58	60	178	34 58	60	178	33 58	60	178	32 58	60	178	31 58	60	178	30 58	60	178	29 58	60	178	28 58	60	178	358
1	42 59	60	179	41 59	60	179	40 59	60	179	39 59	59	179	39 00	60	179	38 00	60	179	37 00	60	179	36 00	60	179	35 00	60	179	34 00	60	179	33 00	60	179	32 00	60	179	31 00	60	179	30 00	60	179	29 00	60	179	359
0	43 00	−60	180	42 00	−60	180	41 00	−60	180	40 00	−60	180	39 00	−60	180	38 00	−60	180	37 00	−60	180	36 00	−60	180	35 00	−60	180	34 00	−60	180	33 00	−60	180	32 00	−60	180	31 00	−60	180	30 00	−60	180	29 00	−60	180	360
	15°			16°			17°			18°			19°			20°			21°			22°			23°			24°			25°			26°			27°			28°			29°			

S. Lat. {LHA greater than 180°..........Zn=180−Z; LHA less than 180°..........Zn=180+Z}

DECLINATION (15°-29°) CONTRARY NAME TO LATITUDE

LAT 32°

FIGURE 151.—Declination (15° - 29°) LAT 32°.

TABLE 5.—Correction to Tabulated Altitude for Minutes of Declination

δ / ′	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	δ / ′
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3
4	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4
5	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5
6	0	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	6	6	6	6	6	6	6
7	0	0	0	0	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	6	6	6	6	6	6	6	6	7	7	7	7	7	7
8	0	0	0	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	6	6	6	6	6	6	6	7	7	7	7	7	7	7	7	8	8	8	8	8
9	0	0	0	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3	3	4	4	4	4	4	4	4	5	5	5	5	5	5	6	6	6	6	6	6	6	7	7	7	7	7	7	8	8	8	8	8	8	8	9	9	9	9	9
10	0	0	0	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10
11	0	0	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	10	11	11	11	11
12	0	0	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	7	8	8	8	8	8	9	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12
13	0	0	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	5	5	5	5	5	6	6	6	6	6	7	7	7	7	8	8	8	8	8	9	9	9	9	10	10	10	10	10	11	11	11	11	11	12	12	12	12	13	13	13	13
14	0	0	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7	7	8	8	8	8	9	9	9	9	10	10	10	10	10	11	11	11	11	12	12	12	12	13	13	13	13	14	14	14	14
15	0	0	1	1	1	2	2	2	2	2	3	3	3	4	4	4	4	4	5	5	5	6	6	6	6	6	7	7	7	8	8	8	8	8	9	9	9	10	10	10	10	10	11	11	11	12	12	12	12	12	13	13	13	14	14	14	14	14	15	15	15
16	0	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7	8	8	8	9	9	9	9	10	10	10	10	11	11	11	11	12	12	12	13	13	13	13	14	14	14	14	15	15	15	15	16	16	16
17	0	1	1	1	1	2	2	2	3	3	3	3	4	4	4	5	5	5	5	6	6	6	7	7	7	7	8	8	8	8	9	9	9	10	10	10	10	11	11	11	12	12	12	12	13	13	13	14	14	14	14	15	15	15	16	16	16	16	17	17	17
18	0	1	1	1	2	2	2	2	3	3	3	4	4	4	4	5	5	5	6	6	6	7	7	7	8	8	8	8	9	9	9	10	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	14	15	15	15	16	16	16	16	17	17	17	18	18	18
19	0	1	1	1	2	2	2	3	3	3	3	4	4	4	5	5	5	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	15	15	15	16	16	16	16	17	17	17	18	18	18	19	19	19
20	0	1	1	1	2	2	2	3	3	3	4	4	4	5	5	5	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	15	15	15	16	16	16	17	17	17	18	18	18	19	19	19	20	20	20
21	0	1	1	1	2	2	2	3	3	4	4	4	5	5	5	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	11	11	12	12	12	13	13	13	14	14	14	15	15	15	16	16	16	17	17	18	18	18	19	19	19	20	20	20	21	21	21
22	0	1	1	1	2	2	3	3	3	4	4	4	5	5	6	6	6	7	7	7	8	8	8	9	9	10	10	10	11	11	11	12	12	12	13	13	14	14	14	15	15	15	16	16	16	17	17	18	18	18	19	19	19	20	20	21	21	21	22	22	22
23	0	1	1	2	2	2	3	3	3	4	4	5	5	5	6	6	7	7	7	8	8	8	9	9	10	10	10	11	11	12	12	12	13	13	13	14	14	15	15	15	16	16	16	17	17	18	18	18	19	19	20	20	20	21	21	21	22	22	23	23	23
24	0	1	1	2	2	2	3	3	4	4	4	5	5	6	6	6	7	7	8	8	8	9	9	10	10	10	11	11	12	12	12	13	13	14	14	14	15	15	16	16	16	17	17	18	18	18	19	19	20	20	20	21	21	22	22	22	23	23	24	24	24
25	0	1	1	2	2	2	3	3	4	4	5	5	5	6	6	7	7	8	8	8	9	9	10	10	10	11	11	12	12	12	13	13	14	14	15	15	15	16	16	17	17	18	18	18	19	19	20	20	20	21	21	22	22	22	23	23	24	24	25	25	25
26	0	1	1	2	2	3	3	3	4	4	5	5	6	6	6	7	7	8	8	9	9	10	10	10	11	11	12	12	13	13	13	14	14	15	15	16	16	16	17	17	18	18	19	19	20	20	20	21	21	22	22	23	23	23	24	24	25	25	26	26	26
27	0	1	1	2	2	3	3	4	4	4	5	5	6	6	7	7	8	8	9	9	9	10	10	11	11	12	12	13	13	14	14	14	15	15	16	16	17	17	18	18	18	19	19	20	20	21	21	22	22	22	23	23	24	24	25	25	26	26	27	27	27
28	0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	21	21	22	22	23	23	24	24	25	25	26	26	27	27	28	28	28
29	0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24	24	25	25	26	26	27	27	28	28	29	29	29
30	0	1	2	2	2	3	4	4	4	5	6	6	6	7	8	8	8	9	10	10	10	11	12	12	12	13	14	14	14	15	16	16	16	17	18	18	18	19	20	20	20	21	22	22	22	23	24	24	24	25	26	26	26	27	28	28	28	29	30	30	30
31	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24	24	25	25	26	26	27	27	28	28	29	29	30	30	31	31
32	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24	25	25	26	26	27	27	28	28	29	29	30	30	31	31	32	32
33	1	1	2	2	3	3	4	4	5	6	6	7	7	8	8	9	9	10	10	11	12	12	13	13	14	14	15	15	16	16	17	18	18	19	19	20	20	21	21	22	23	23	24	24	25	25	26	26	27	28	28	29	29	30	30	31	31	32	32	33	33
34	1	1	2	2	3	3	4	5	5	6	6	7	7	8	8	9	10	10	11	11	12	12	13	14	14	15	15	16	16	17	18	18	19	19	20	20	21	22	22	23	23	24	24	25	26	26	27	27	28	28	29	29	30	31	31	32	32	33	33	34	34
35	1	1	2	2	3	4	4	5	5	6	6	7	8	8	9	9	10	10	11	12	12	13	13	14	15	15	16	16	17	18	18	19	19	20	20	21	22	22	23	23	24	24	25	26	26	27	27	28	29	29	30	30	31	32	32	33	33	34	34	35	35
36	1	1	2	2	3	4	4	5	5	6	7	7	8	8	9	10	10	11	11	12	13	13	14	14	15	16	16	17	17	18	19	19	20	20	21	22	22	23	23	24	25	25	26	26	27	28	28	29	29	30	31	31	32	32	33	34	34	35	35	36	36
37	1	1	2	2	3	4	4	5	6	6	7	7	8	9	9	10	10	11	12	12	13	14	14	15	15	16	17	17	18	18	19	20	20	21	22	22	23	23	24	25	25	26	27	27	28	28	29	30	30	31	31	32	33	33	34	35	35	36	36	37	37
38	1	1	2	3	3	4	4	5	6	6	7	8	8	9	10	10	11	11	12	13	13	14	15	15	16	16	17	18	18	19	20	20	21	22	22	23	23	24	25	25	26	27	27	28	28	29	30	30	31	32	32	33	34	34	35	35	36	37	37	38	38
39	1	1	2	3	3	4	5	5	6	6	7	8	8	9	10	10	11	12	12	13	14	14	15	16	16	17	18	18	19	20	20	21	21	22	23	23	24	25	25	26	27	27	28	29	29	30	31	31	32	32	33	34	34	35	36	36	37	38	38	39	39
40	1	1	2	3	3	4	5	5	6	7	7	8	9	9	10	11	11	12	13	13	14	15	15	16	17	17	18	19	19	20	21	21	22	23	23	24	25	25	26	27	27	28	29	29	30	31	31	32	33	33	34	35	35	36	37	37	38	39	39	40	40
41	1	1	2	3	3	4	5	5	6	7	8	8	9	10	10	11	12	12	13	14	14	15	16	16	17	18	18	19	20	20	21	22	23	23	24	25	25	26	27	27	28	29	29	30	31	31	32	33	33	34	35	36	36	37	38	38	39	40	40	41	41
42	1	1	2	3	4	4	5	6	6	7	8	8	9	10	10	11	12	13	13	14	15	15	16	17	18	18	19	20	20	21	22	22	23	24	24	25	26	27	27	28	29	29	30	31	32	32	33	34	34	35	36	36	37	38	38	39	40	41	41	42	42
43	1	1	2	3	4	4	5	6	6	7	8	9	9	10	11	11	12	13	14	14	15	16	16	17	18	19	19	20	21	22	22	23	24	24	25	26	27	27	28	29	29	30	31	32	32	33	34	34	35	36	37	37	38	39	39	40	41	42	42	43	43
44	1	1	2	3	4	4	5	6	7	7	8	9	10	10	11	12	12	13	14	15	15	16	17	18	18	19	20	21	21	22	23	23	24	25	26	26	27	28	29	29	30	31	32	32	33	34	34	35	36	37	37	38	39	40	40	41	42	43	43	44	44
45	1	2	2	3	4	4	5	6	7	8	8	9	10	10	11	12	13	14	14	15	16	16	17	18	19	20	20	21	22	22	23	24	25	26	26	27	28	28	29	30	31	32	32	33	34	34	35	36	37	38	38	39	40	40	41	42	43	44	44	45	45
46	1	2	2	3	4	5	5	6	7	8	8	9	10	11	12	12	13	14	15	15	16	17	18	18	19	20	21	21	22	23	24	25	25	26	27	28	28	29	30	31	31	32	33	34	34	35	36	37	38	38	39	40	41	41	42	43	44	44	45	46	46
47	1	2	2	3	4	5	5	6	7	8	9	9	10	11	12	13	13	14	15	16	16	17	18	19	20	20	21	22	23	24	24	25	26	27	27	28	29	30	31	31	32	33	34	34	35	36	37	38	38	39	40	41	42	42	43	44	45	45	46	47	47
48	1	2	2	3	4	5	6	6	7	8	9	10	10	11	12	13	14	14	15	16	17	18	18	19	20	21	22	22	23	24	25	26	26	27	28	29	30	30	31	32	33	34	34	35	36	37	38	38	39	40	41	42	42	43	44	45	46	46	47	48	48
49	1	2	2	3	4	5	6	7	7	8	9	10	11	11	12	13	14	15	16	16	17	18	19	20	20	21	22	23	24	24	25	26	27	28	29	29	30	31	32	33	33	34	35	36	37	38	38	39	40	41	42	42	43	44	45	46	47	47	48	49	49
50	1	2	2	3	4	5	6	7	8	8	9	10	11	12	12	13	14	15	16	17	18	18	19	20	21	22	22	23	24	25	26	27	28	28	29	30	31	32	32	33	34	35	36	37	38	38	39	40	41	42	42	43	44	45	46	47	48	48	49	50	50
51	1	2	3	3	4	5	6	7	8	8	9	10	11	12	13	14	14	15	16	17	18	19	20	20	21	22	23	24	25	26	26	27	28	29	30	31	31	32	33	34	35	36	37	37	38	39	40	41	42	42	43	44	45	46	47	48	48	49	50	51	51
52	1	2	3	3	4	5	6	7	8	9	10	10	11	12	13	14	15	16	16	17	18	19	20	21	22	23	23	24	25	26	27	28	29	29	30	31	32	33	34	35	36	36	37	38	39	40	41	42	42	43	44	45	46	47	48	49	49	50	51	52	52
53	1	2	3	4	4	5	6	7	8	9	10	11	11	12	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	26	27	28	29	30	31	32	33	34	34	35	36	37	38	39	40	41	42	42	43	44	45	46	47	48	49	49	50	51	52	53	53
54	1	2	3	4	4	5	6	7	8	9	10	11	12	13	14	14	15	16	17	18	19	20	21	22	22	23	24	25	26	27	28	29	30	31	32	32	33	34	35	36	37	38	39	40	40	41	42	43	44	45	46	47	48	49	50	50	51	52	53	54	54
55	1	2	3	4	5	6	6	7	8	9	10	11	12	13	14	15	16	16	17	18	19	20	21	22	23	24	25	26	27	28	28	29	30	31	32	33	34	35	36	37	38	38	39	40	41	42	43	44	45	46	47	48	49	50	50	51	52	53	54	55	55
56	1	2	3	4	5	6	7	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	49	50	51	52	53	54	55	56	56
57	1	2	3	4	5	6	7	8	9	10	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	48	49	50	51	52	53	54	55	56	57	57
58	1	2	3	4	5	6	7	8	9	10	11	12	13	14	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	58
59	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	59

FIGURE 152.—Tabulated Altitude Correction Table.

TABLE 1.—Altitude Correction for Change in Position of Observer

Correction for 4 Minutes of Time

Rel. Zn	Ground Speed in Knots																		Rel. Zn
	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	
°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	°
000	+3	+7	+10	+13	+17	+20	+23	+27	+30	+33	+37	+40	+43	+47	+50	+53	+57	+60	000
005	3	7	10	13	17	20	23	27	30	33	37	40	43	46	50	53	56	60	355
010	3	7	10	13	16	20	23	26	30	33	36	39	43	46	49	53	56	59	350
015	3	6	10	13	16	19	23	26	29	32	35	39	42	45	48	52	55	58	345
020	3	6	9	13	16	19	22	25	28	31	34	38	41	44	47	50	53	56	340
025	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	335
030	+3	+6	+9	+12	+14	+17	+20	+23	+26	+29	+32	+35	+38	+40	+43	+46	+49	+52	330
035	3	5	8	11	14	16	19	22	25	27	30	33	35	38	41	44	46	49	325
040	3	5	8	10	13	15	18	20	23	26	28	31	33	36	38	41	43	46	320
045	2	5	7	9	12	14	16	19	21	24	26	28	31	33	35	38	40	42	315
050	2	4	6	9	11	13	15	17	19	21	24	26	28	30	32	34	36	39	310
055	2	4	6	8	10	11	13	15	17	19	21	23	25	27	29	31	33	34	305
060	+2	+3	+5	+7	+8	+10	+12	+13	+15	+17	+18	+20	+22	+23	+25	+27	+28	+30	300
065	1	3	4	6	7	8	10	11	13	14	15	17	18	20	21	23	24	25	295
070	1	2	3	5	6	7	8	9	10	11	13	14	15	16	17	18	19	21	290
075	1	2	3	3	4	5	6	7	8	9	9	10	11	12	13	14	15	16	285
080	1	1	2	2	3	3	4	5	5	6	6	7	8	8	9	9	10	10	280
085	+0	+1	+1	+1	+1	+2	+2	+2	+3	+3	+3	+3	+4	+4	+4	+5	+5	+5	275
090	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	270
095	−0	−1	−1	−1	−1	−2	−2	−2	−3	−3	−3	−3	−4	−4	−4	−5	−5	−5	265
100	1	1	2	2	3	3	4	5	5	6	6	7	8	8	9	9	10	10	260
105	1	2	3	3	4	5	6	7	8	9	9	10	11	12	13	14	15	16	255
110	1	2	3	5	6	7	8	9	10	11	13	14	15	16	17	18	19	21	250
115	1	3	4	6	7	8	10	11	13	14	15	17	18	20	21	23	24	25	245
120	2	3	5	7	8	10	12	13	15	17	18	20	22	23	25	27	28	30	240
125	−2	−4	−6	−8	−10	−11	−13	−15	−17	−19	−21	−23	−25	−27	−29	−31	−33	−34	235
130	2	4	6	9	11	13	15	1.	19	21	24	26	28	30	32	34	36	39	230
135	2	5	7	9	12	14	16	19	21	24	26	28	31	33	35	38	40	42	225
140	3	5	8	10	13	15	18	20	23	26	28	31	33	36	38	41	43	46	220
145	3	5	8	11	14	16	19	22	25	27	30	33	35	38	41	44	46	49	215
150	3	6	9	12	14	17	20	23	26	29	32	35	38	40	43	46	49	52	210
155	−3	−6	−9	−12	−15	−18	−21	−24	−27	−30	−33	−36	−39	−42	−45	−48	−51	−54	205
160	3	6	9	13	16	19	22	25	28	31	34	38	41	44	47	50	53	56	200
165	3	6	10	13	16	19	23	26	29	32	35	39	42	45	48	52	55	58	195
170	3	7	10	13	16	20	23	26	30	33	36	39	43	46	49	53	56	59	190
175	3	7	10	13	17	20	23	27	30	33	37	40	43	46	50	53	56	60	185
180	−3	−7	−10	−13	−17	−20	−23	−27	−30	−33	−37	−40	−43	−47	−50	−53	−57	−60	180

Time of fix (tab 1) or computation (tab 2)	Sign from 4.min. Table	To observed altitude	To tabulated altitude	To intercept
Later than observation	+	Add	Subtract	Toward
	−	Subtract	Add	Away
Earlier than observation	+	Subtract	Add	Away
	−	Add	Subtract	Toward

FIGURE 153.—Altitude Correction for Position Table.

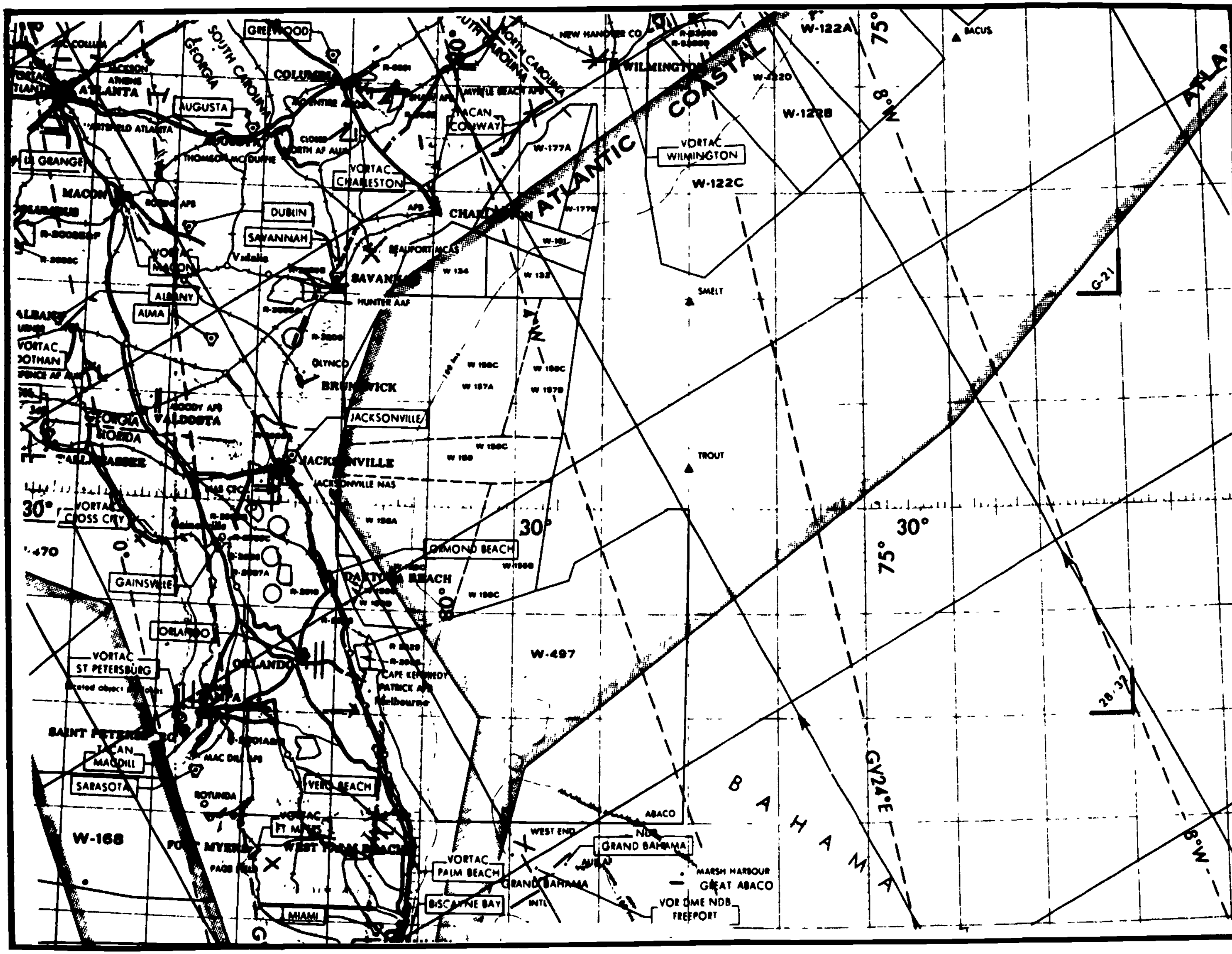

FIGURE 154.—Navigation Chart.

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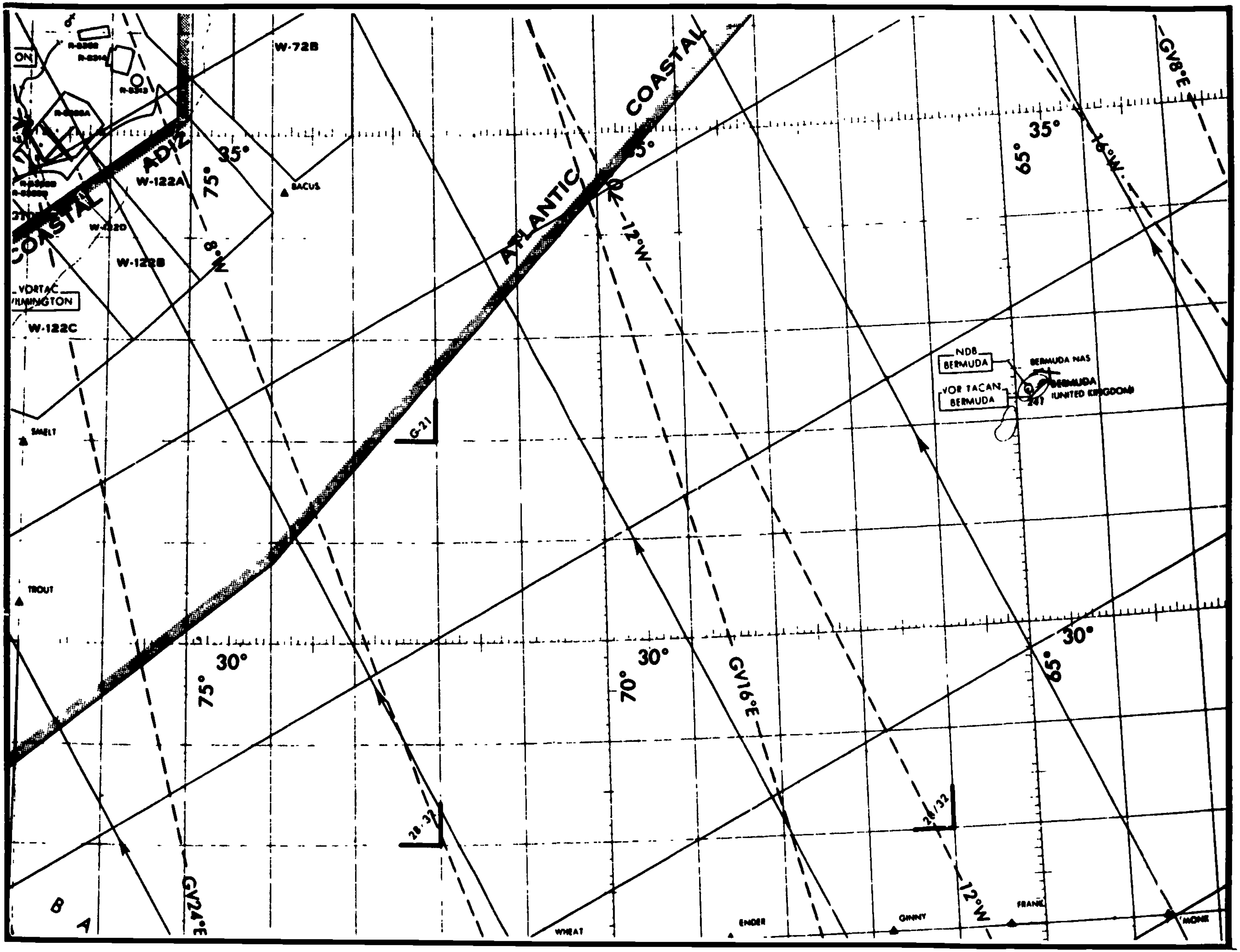

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FIGURE 155.—Navigation Chart.

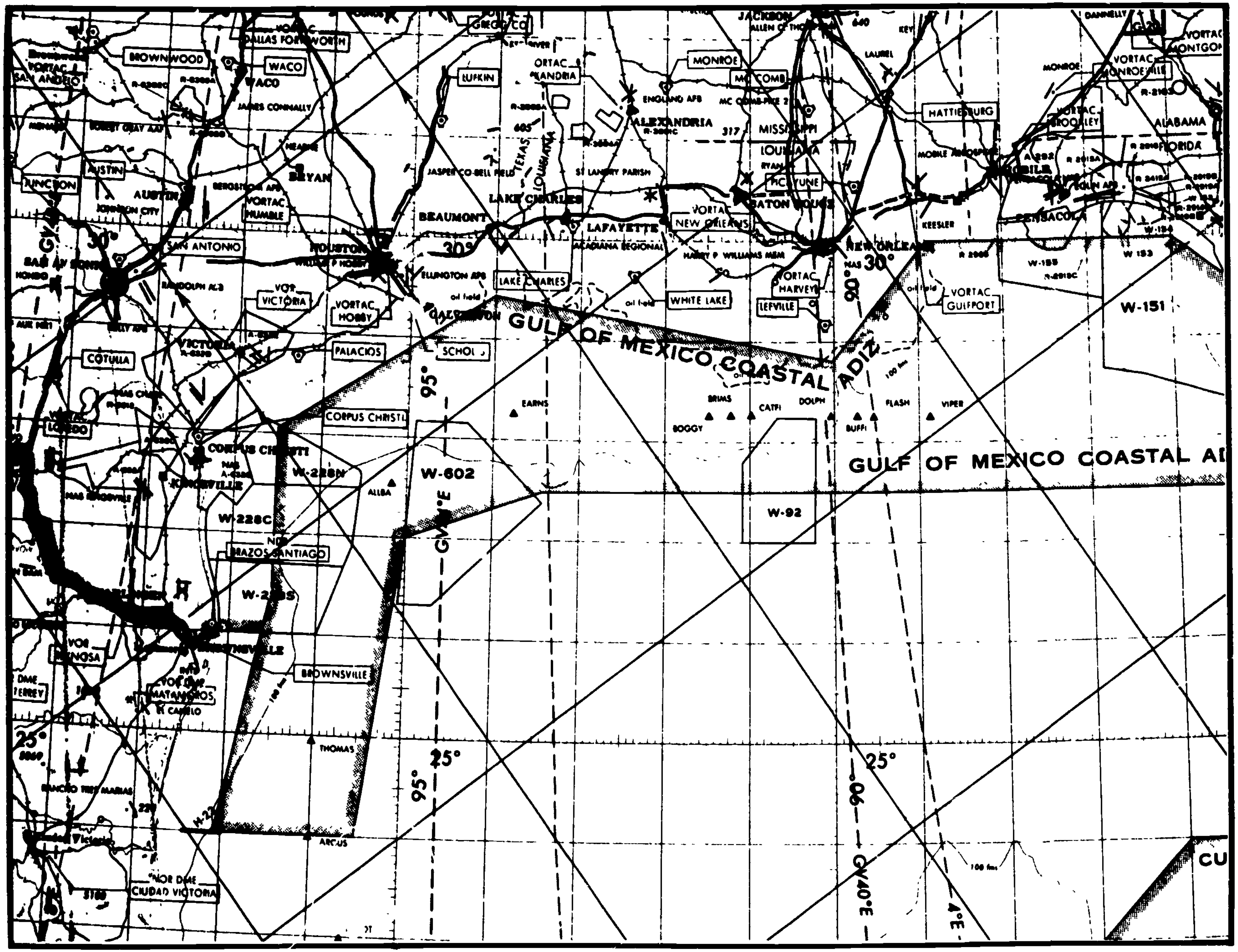

FIGURE 156.—Navigation Chart.

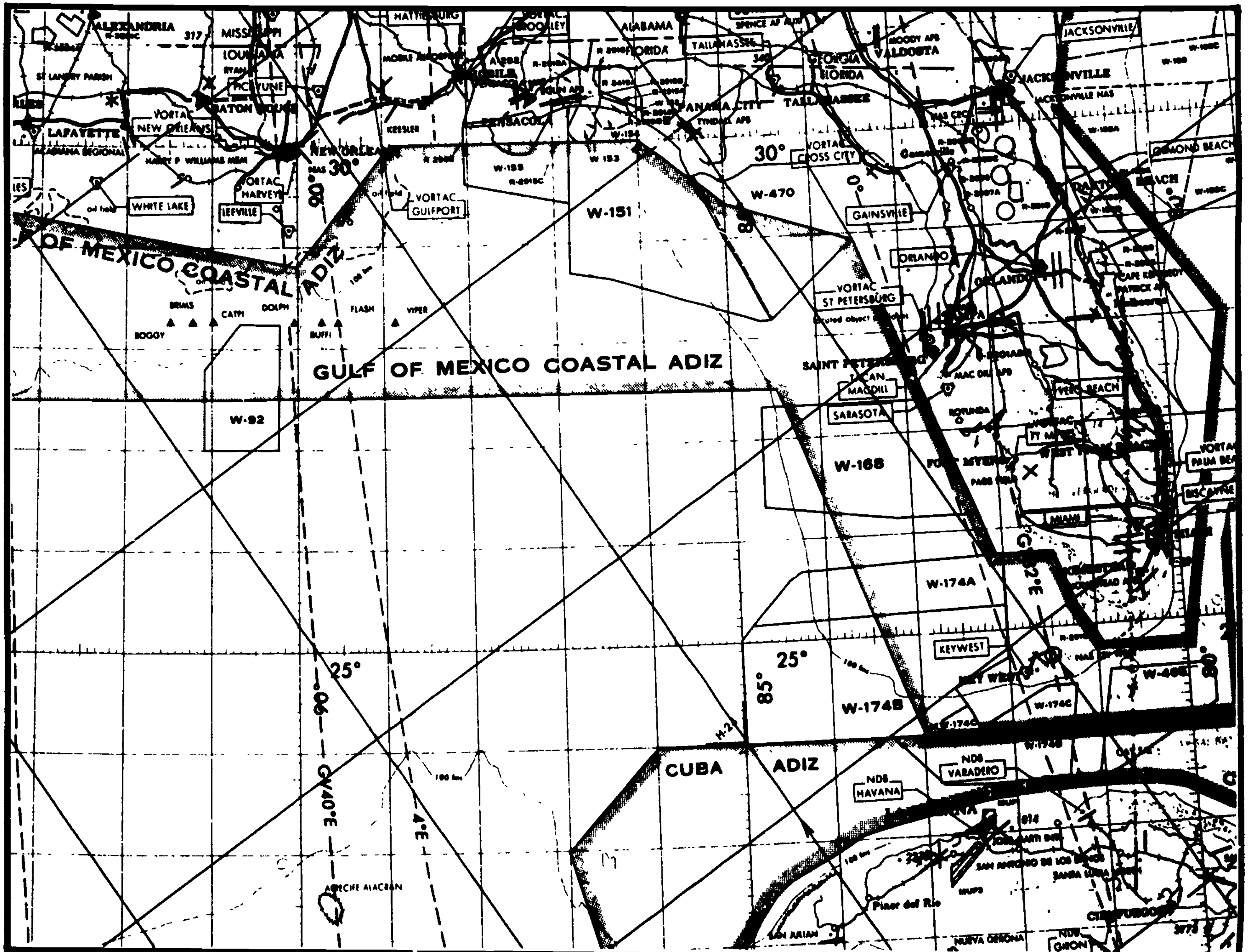

FIGURE 157.—Navigation Chart.

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