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CIVIL AERONAUTICS MANUAL 40

U. S. Department of Commerce — Civil Aeronautics Administration

Civil Aeronautics Manuals and supplements thereto are issued by the Office of Aviation Safety, Civil Aeronautics Administration, for the guidance of the public and are published in the Federal Register and Code of Federal Regulations.

Supplement No. 2 — November 15, 1954

SUBJECT: Revisions to Civil Aeronautics Manual 40 dated April 1954.

This supplement is issued to provide subscribers of CAM 40 with recent CAR amendments and the following new or revised CAM material:

(1) A change in policy with respect to the requirements that air carriers submit supplemental amendments when making application for extension of currently approved time limitations on powerplants and related components. The policy requires that an air carrier merely furnish a letter to the assigned CAA agent outlining the desired time limitations and designate three to five sample engines for disassembly inspection.

(2) A correction in the procedures used in computing the effects of runway gradient for transport category airplanes.

(3) Revised performance data for takeoff limitations to correct the procedure used in computing the effects of runway gradient; and an increase in the tailwind component for nontransport airplanes.

(4) Landing distance limitations for nontransport category airplanes which are the same as those for transport category airplanes; landing distance performance data at alternate airports, and landing minimums at alternate airports.

(5) The use of a trip or code number in the dispatch release from the clearance of a particular trip instead of specifying each terminal and intermediate airport.

(6) Revised examples in Appendix A to correspond to the revised CAM material relative to runway gradient accountability.

Remove and destroy the following pages:

	Insert in lieu thereof the following pages:
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V–VI	V–VI
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23–24	23–24
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NOTE: New material is indicated by brackets [ ].

Attachments.

Introductory Note

Civil Aeronautics manuals are publications issued by the Civil Aeronautics Administration to implement and explain the Civil Air Regulations. They include the Civil Air Regulations and are a convenient medium through which the public is apprised of CAA rules, interpretations, and policies.

CAA rules are issued pursuant to authority conferred upon the Administrator in the Civil Air Regulations. Such rules are mandatory and must be complied with.

CAA interpretations define or explain words and phrases of the Civil Air Regulations. Such interpretations are for the guidance of the public and will be followed by the administration in determining compliance with the regulations.

CAA policies provide recommended methods of complying with the Civil Air Regulations and are issued for the guidance of the public.

For convenience the Civil Air Regulations are quoted in bold face type ahead of the manual material. Both the regulation and the manual material are numbered in accordance with Federal Register regulations to facilitate the publication of the contents of the manual in the Code of Federal Regulations as required by the Administrative Procedure Act. For example, the CAR section identified as 40.18 is followed by related CAM sections designated as 40.18–1 and 40.18–2. The numbering system is applied to paragraphs and subdivision of paragraphs as follows:

40.18–1
(a), (b), (c), etc.
(1), (2), (3), etc.
(i), (ii), (iii), (iv), etc.
(*a*), (*b*), (*c*), etc.
(*1*), (*2*), (*3*), etc.
(*i*), (*ii*), (*iii*), (*iv*), etc.

This particular manual contains material interpreting and explaining the certification and operation rules for domestic scheduled interstate air carriers specified in Civil Air Regulations, Part 40, adopted by the Civil Aeronautics Board on April 13, 1953, and made effective April 1954. It supersedes all CAM supplements to Part 40 issued prior to April 1954, all CAM supplements to Part 61, and Aviation Releases 209, 250, 270, 278 and 320, as well as any contradictory material which may be found in any other Aviation Safety Release or like publication outstanding on the issuance date of this manual.

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governing issuance and amendment of Operations Specifications, Aircraft Maintenance (CAA policies which apply to sec. 40.18 (a)).

(a) *General.* The Administrator will issue and amend Operations Specifications, Aircraft Maintenance, in accordance with the following policies, procedures, and limitations. The criteria hereinafter set forth will be followed by the Administrator in fixing time limitations for the performance of overhaul, inspections, and checks, or in permitting or requiring revisions thereto. The basic principle followed by the Administrator will be that the inspections, checks, maintenance, or overhaul be performed at times well within the expected or proven service life of each component of the aircraft. In determining what the expected or proven service life of an aircraft or any of its components might be, the Administrator will consider the following factors: (1) geographical area or areas of operation; (2) engine operating powers, procedures, etc.; (3) number of landings, long haul versus short haul, etc.; (4) maintenance organization and inspection procedures; (5) other operators' service experience records; (6) manufacturers' recommendations; (7) service history, particularly of known or evident trends toward malfunctioning. Special reliance will be placed on service experience, including the information obtained from such tests, inspections, or measurements as have been performed in accumulating such service experience.

(b) *Procedure for establishing new or revised time limitations.* Time limitations may be established in terms of hours of operation, multiples of engine overhaul periods, or multiples of inspection periods. Time limitations for components on which deterioration is not necessarily a function of operating hours, such as electronic units, pitot tubes, and emergency flotation equipment, may be established in terms of calendar months. Certain items may be maintained on an on-condition overhaul basis.

On-condition overhaul is applicable to components on which a determination of airworthiness may be made by visual inspection, measurements, tests, or other means without a teardown inspection or overhaul.

(c) *Airframe—Initial time limitations.* The initial time limitations for overhauls, inspections, or checks of airframes may be established on a recurrent fixed time basis or by adoption of a structural inspection specification covering procedures such as pattern inspections, block overhauls, or progressive inspections. Regardless of the basis upon which the time limitations are established, the same basic standards will be applicable. The maintenance program must specify checks, inspections, and overhauls to be performed and times at which they will be performed.

(d) *Appliances—Initial time limitations.* Initial time limitations for inspections, bench checks, major inspections, or overhaul, as applicable, to the appliance involved, should not be greater than those limitations applicable to the same or similar appliances used in existing aircraft operated by the air carrier. When the usage or installation of such appliances differs to a substantial extent from the previous usage or installation, the time limitations shall be adjusted to reflect the extent of such difference. When new usage or installation is involved, conservative time limitations should be established until service experience shows that more liberal time limits can be used. In those cases where an appliance has a subcomponent which is subject to wear with time in service, the air carrier will establish maintenance procedures for periodic inspection of such subcomponent to insure its continued airworthiness.

(e) *Powerplants—Initial time limitations.* The initial overhaul time limitations for any engine which has never been used in air carrier service will tentatively be established at 1000 hours. However, the Operations Specifications will require sample overhaul of a representative number of engines, but not less than three, to be accomplished at each increment of 100 hours, beginning at 800 hours, unless such new model engine incorporates certain unconventional features not previously employed in air carrier operations, in which case, the initial overhaul period will be established by the Administrator. Satisfactory teardown inspection will be necessary before increasing the fleet overhaul period to the next higher increment. This sample overhaul procedure and evaluation of service experience will provide the operator with necessary information to substantiate the basic 1000 hour overhaul.

The initial time limitations for overhaul of

an engine model which has received substantial air carrier service experience, but not by the applicant, will tentatively be established at 1,000 hours. An engine model will not be considered as having substantial air carrier service experience unless it has been satisfactorily operated by another carrier on an approved 1,000 hour or higher overhaul period. However, the Operations Specifications will require that the basic 1,000 hour overhaul period be substantiated on the same basis as outlined for a new engine except that sample overhauls of a representative number of engines will be accomplished in increments of 100 hour periods beginning at 900 hours. The initial time limitations for overhaul of accessories which are a part of the power package, including propellers, will be established at the overhaul period fixed for the engine itself, unless service experience permits or requires higher or lower overhaul periods.

(f) *Revision of time limitations—General.* The inspection and overhaul time limitations applicable to airframes, powerplants, propellers, and appliances will be revised on the basis of service experience. Increases in such time limitations may be made when the record of service experience for the previous 90 days indicates that such increase will not adversely affect the continuous condition of airworthiness. When the service records indicate that any component or subcomponent consistently requires repair, adjustment, or other maintenance because of damage, wear, or deterioration, within the current time limitations, the air carrier will be responsible for initiating corrective action.

(1) *Airframe—Revision of time limitations.* The increases of time limitations for overhaul (or major inspection in case of pattern system, etc.) of airframes will be based on evaluation of all pertinent service records and examination of at least one aircraft, of the model involved, that has been overhauled at the currently approved time limitations. When a pattern or block overhaul type of maintenance system is used, it will be permissible to reschedule individual items in another block or pattern, if performance and condition of the specific item warrants such an increase.

[(2) *Powerplant and associated mechanical appliances—revision of time limitations.* Increases in engine overhaul periods will not be approved in increments greater than 100 hours. Increases in time limitations above the 1,000-hour basic engine overhaul period will be considered on the basis of satisfactory service experience at the currently approved time limitations. The operator may request amendment to the currently approved time limitations by submitting a letter to the assigned CAA agent indicating the desired time limitations on the particular engines involved, and designating three to five engines for disassembly inspection by the CAA agent. The engines chosen for exhibit must have operated in a satisfactory manner for the maximum time permissible under currently approved time limitations. If, after disassembly and inspection of the exhibit engines and related components, it is found that the new time limitations are justified, the air carrier may then submit a formal application for an amendment in the routine manner requesting the extension of the overhaul period on the entire fleet of engines and related components of the same type and model. Engine accessories may be operated to double or triple the approved engine overhaul time limitations if it is found that previous satisfactory service and overhaul experience, including the service to be performed at each engine change period, would justify the increase as not adversely affecting the continuous condition of airworthiness of the component involved. The procedure for requesting and granting increases in overhaul time limitations for such components will be the same as used for the basic engine.]

(3) *Appliances, general—Revision of time limitations.* Increases in established times for inspections, bench tests, or overhaul periods will be based on consideration of the following factors: (i) geographical area or areas of operation; (ii) number of landings, long haul versus short haul, (iii) maintenance organization and inspection procedures; (iv) manufacturers' recommendations; (v) service history, particularly

An average weight of 80 pounds may be used for children between the ages of 3 and 12. Children above 12 years of age are classified as adults for the purpose of weight and balance computations. Children less than 3 years old are considered "babes in arms."

The average passenger weight includes minor items normally carried by a passenger.

(3) *Non-standard weight groups of passengers.* The average passenger weight method will not be used in the case of flights carrying large groups of passengers whose average weight obviously does not conform with the normal standard weight. Actual weights will be used when a passenger load consists to a large extent of athletic squads or other special group which is smaller or larger than the U. S. average. Where such a group forms only a part of the total passenger load, the actual weights may be used for such group and average weights used for the balance of the passenger load. In such instances, a notation will be made on the load manifest, indicating number of persons in the special group and identifying the group (i. e. football squad, Blank Nationals, etc.).

(f) *Crew weight.* The actual weight of crew members may be used or the following approved average weights may be utilized:

(1) Male cabin attendants 150 pounds; female cabin attendants 130 pounds.

(2) All other crew members 170 pounds.

(g) *Passenger and crew baggage.* Procedures should be provided so that all baggage, including that carried on board by the passengers, is properly accounted for. If desired by the air carrier, a standard crew baggage weight may be used.

(h) *Center of gravity travel during flight.* The air carrier will show that the procedures fully account for the extreme variations in center of gravity travel during flight caused by all or any combination of the following variables:

(1) The movement of a number of passengers and cabin attendants equal to the placarded capacity of the lounges or lavatories from their normal position in the aircraft cabin to such lounge or lavatory. If the capacity of such compartment is one, the movement of either one passenger or one cabin attendant, whichever most adversely affects the CG condition will be considered. When the capacity of the lavatory or lounge is two or more, the movement of that number of passengers or cabin attendants from positions evenly distributed throughout the aircraft may be used. Where seats are blocked off, the movement of passengers and/or cabin attendants evenly distributed throughout only the actual loaded section of the aircraft will be used. The extreme movements of the cabin attendants carrying out their assigned duties within the cabin will be considered. The various conditions will be combined in such a manner that the most adverse effect on the CG will be obtained and so accounted for in the development of the loading schedule to assure the aircraft being loaded within the approved limits at all times during flight.

(2) *Landing gear retraction.* Possible change in CG position due to landing gear retraction will be investigated and results accounted for.

(3) *Fuel.* The effect on the CG travel of the aircraft during flight due to fuel used down to the required reserve fuel or to an acceptable minimum reserve fuel established by the air carrier will be accounted for.

(i) *Fuel allowance for taxiing and runup.* The weight and balance system may provide for a weight allowance of 3 pounds of fuel for each 100 horsepower (maximum continuous) available to the aircraft from all of its engines to be added to the maximum gross weight of the aircraft to compensate for fuel used during runup and taxiing.

(j) *Records.* The weight and balance system will include methods by which the air carrier will maintain a complete, current, and continuous record of the weight and center of gravity of each aircraft. Such records should reflect all alterations and changes affecting either the weight or balance of the aircraft, and will include a complete and current equipment list. When fleet weights are used, pertinent computations should also be available in individual aircraft files.

(k) *Weight of fluids.* The weight of all fluids used in aircraft may be established on the basis of actual weight, a standard volume conversion, or a volume conversion utilizing appropriate temperature correction factors to accurately determine the weight by computation of the quantity of fluid on board.

"40.52 *Distribution of manual.*

"(a) Copies of the entire manual, or appropriate portions thereof, together with revisions thereto shall be furnished to the following:

"(1) Appropriate ground operations and maintenance personnel of the air carrier,

"(2) Flight crew members,

"(3) Authorized representatives of the Administrator assigned to the air carrier to act as aviation safety agents.

"(b) All copies of the manual shall be kept up to date."

Airplane Requirements

"40.60 *General.* Airplanes shall be identified, certificated, and equipped in accordance with the applicable airworthiness requirements of the regulations in this subchapter. No air carrier shall operate any airplane in scheduled operation unless such airplane meets the requirements of this part and is in an airworthy condition."

"40.61 *Airplanes certification requirements.*

"(a) *Airplane certificated on or before June 30, 1942.* Airplanes certificated as a basic type on or before June 30, 1942, shall either:

"(1) Retain their present airworthiness certification status and meet the requirements of section 40.90, or

"(2) Comply with either the performance requirements of sections 4a.737–T through 4a.750–T of this subchapter or the performance requirements of sections 4b.110 through 4b.125 of this subchapter and in addition shall meet the requirements of sections 40.70 through 40.78: *Provided,* That should any type be so qualified, all airplanes of any one operator of the same or related types shall be similarly qualified and operated.

"(b) *Airplanes certificated after June 30, 1942.* Airplanes certificated as a basic type after June 30, 1942, and used in passenger operation shall be certificated as transport category airplanes and shall meet the requirements of section 40.70."

"40.62 *Airplane limitation for type of route.* All airplanes used in passenger air transportation shall be multi-engine airplanes and shall comply with the following requirements:

"(a) *Two- or three-engine airplanes.* Two- or three-engine airplanes shall not be used in passenger-carrying operations unless adequate airports are so located along the route that the airplanes will at no time be at a greater distance therefrom than one hour of flying time in still air at normal cruising speed with one engine inoperative: *Provided,* That the Administrator may specify distances greater or less than those set forth herein when he determines that the character of the terrain, the type of operation, or the performance of the airplanes to be used so permit or require.

"(b) *Land airplanes on extended overwater routes.* Land airplanes operated on flights involving extended overwater operations shall be certificated as adequate for ditching in accordance with the ditching provisions of Part 4b of this subchapter."

"40.63 *Proving tests.*

"(a) A type of airplane not previously approved for use in scheduled operation shall have at least 100 hours of proving tests, in addition to the airplane certification tests, accomplished under the supervision of an authorized representative of the Administrator. As part of the 100-hour total at least 50 hours shall be flown over authorized routes and at least 10 hours shall be flown at night.

"(b) A type of airplane which has been previously proved shall be tested for at least 50 hours of which at least 25 hours shall be flown over authorized routes, unless deviations are specifically authorized by the Administrator on the ground that the special circumstances of a particular case make a

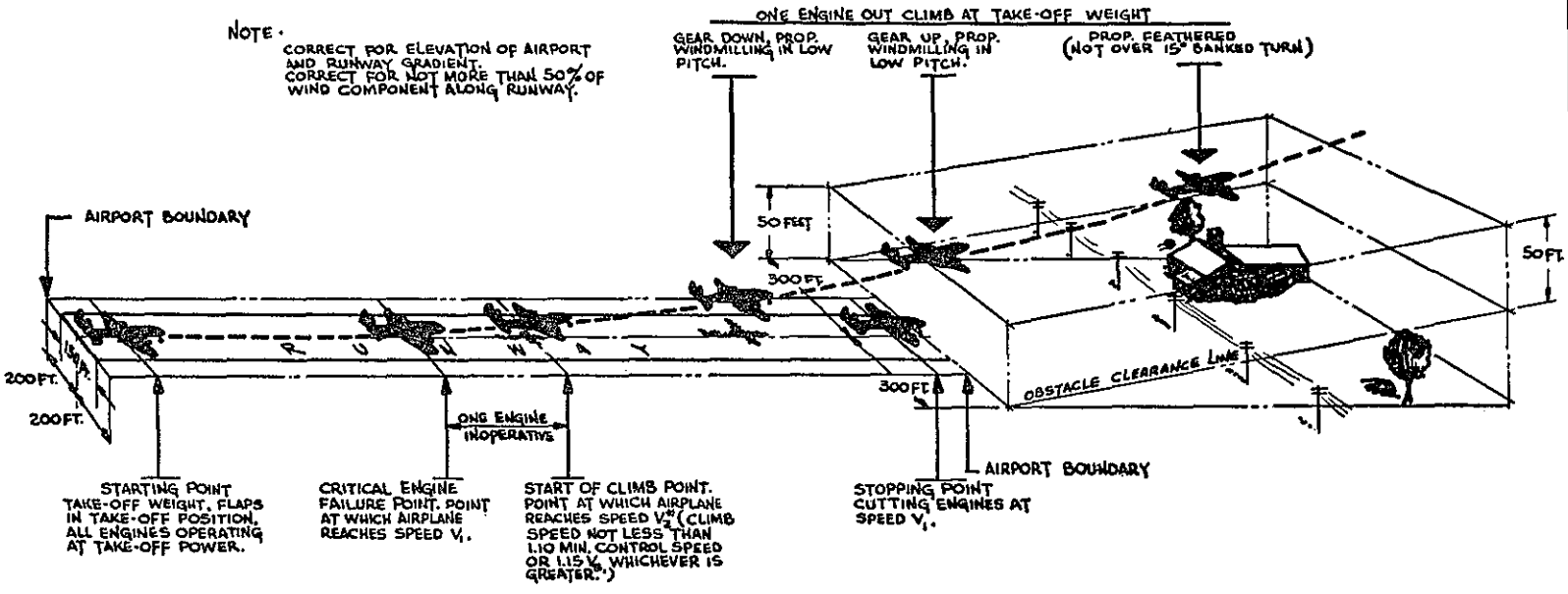
literal observance of the requirements of this paragraph unnecessary for safety, when the airplane:]

"(1) Is materially altered in design, or

"(2) Is to be used by an air carrier who has not previously proved such a type.

"(c) During proving tests only those persons required to make the tests and those designated by the Board or the Administrator shall be carried. Mail, express, and other cargo may be carried when approved by the Administrator."

TAKE-OFF · AIRPORT LIMITATIONS



THE AIRPLANE SHALL RUN UP TO A SPECIFIED SPEED AND FROM THERE BE ABLE TO:

1. STOP WITHIN THE AIRPORT BOUNDARIES.
2. CONTINUE WITH ONE ENGINE INOPERATIVE AND CLEAR OBSTACLES AS SHOWN.

* $1.2V_S$ FOR AIRPLANES WITH TWO ENGINES; $1.15V_S$ FOR AIRPLANES WITH MORE THAN TWO ENGINES. } V_S = STALL SPEED WITH TAKE-OFF CONFIGURATION.

Diagram I

surfaces or other airport areas suitable for use in takeoff and landing. Furthermore, the Obstruction Plans necessarily contain data which may be several months old and which may not completely conform to the existing obstructions. Therefore, it may be necessary, for the air carrier operator, to supplement its data with information obtained from other sources. However, gross weight data calculated on the basis of such data should be rechecked or recalculated as soon as appropriate data from the Coast and Geodetic Survey becomes available.

(c) *Runways.*

(1) Normally, only paved runways will be approved for use in takeoff. However, in some cases there may be a defined rectangular area hereinafter designated as a stopway at the end of a runway in the direction of takeoff, selected and approved as a suitable area, in which the aircraft can be stopped after an interrupted takeoff. The stopway should have the same width as the runway it augments. The stopway should be so prepared or constructed as to enable the aircraft to come to a stop on it without hazard at the operating speeds that might be expected in this area after an interrupted takeoff. If it is desired to use a stopway to meet the "climb to a 50-foot height" requirement, the stopway should be suitable for the aircraft to traverse it at takeoff speeds without hazard.

(2) In all cases the takeoff should be assumed to begin on the paved runway and not on an unpaved area. No allowance need be made for the length of the airplane in determining what should be considered to be the proper point for beginning the takeoff. Limitations established by the airport operator may make it necessary to stipulate that the beginning of the takeoff area be at some point down the runway from the actual end of the paving.

(d) *Turns to avoid obstructions.*

(1) Section 40.72 provides that after reaching a height of 50 feet, the aircraft may be turned with a bank not exceeding 15° to comply with the obstruction clearance criteria. Only one turn to a definite heading should be considered in detailing the takeoff path.

(2) The radius of turn resulting from a banked turn of 15° may be determined from the following formula:

Radius of turn $= V^2 \times 0.25$ feet.

where V = climb speed in mph, TAS

For example: at a climb speed of 120 mph, the radius of turn for a 15° banked turn would be,

$$120 \times 120 \times 0.25 = 3600 \text{ feet.}$$

The effects of wind in altering a flight path need not be considered unless they are large (¼ climb speed) and the angle of turn is more than 45° from the runway heading.

[(e) *Effect of runway gradient.*

[(1) The effect of runway gradient on the accelerate distance, decelerate (stopping) distance, and ground run portion of the takeoff path may be calculated from the following equation or by other means by which the effects of gradient may be accurately or conservatively computed.

$$S_G = \left[\frac{S}{1 \pm \left(\frac{2 S g \sin \alpha}{V^2}\right)}\right]$$

where S_G = acceleration or deceleration distance with gradient.

S = acceleration or deceleration distance without gradient.

g = acceleration of gravity = 32.2 (ft/sec²).

V = appropriate speed, feet per second, True Air Speed (For accelerate and decelerate distances, use V_1; for the takeoff path, use V_2).

α = angle of grade with horizontal.

The following sign conventions (±) must be used in the above equation:

Uphill gradient	*Downhill gradient*
accelerate (−)	accelerate (+)
decelerate (+)	decelerate (−)]

(2) The above formula is based on certain simplifying assumptions, i. e., that a uniform grade exists and that the airplane is accelerated uniformly throughout the ground run. Neither of these assumptions may be exactly correct, but the errors introduced by making such assumptions are small provided the airplane acceleration and the actual point-to-point grade do not depart from the average values of those quantities by any great amount.

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(3) The effect of gradient during the climb-out should be determined by comparing the airplane rate of climb with the change in runway elevation, to determine first the weight or wind condition at which the airplane clears the end of the runway and all obstacles by an actual 50 feet and second, that the airplane clears all points on the runway after takeoff.

(4) For purposes of simplification in calculating the effect of runway gradient on the take-off flight path, an average gradient consisting of the difference in elevation of the two ends of the runway divided by the runway length may be used, provided that no intervening point on the runway lies more than 5 feet above or below a straight line joining the two ends of the runway. In this case, the gradient effects on the acceleration portion of the take-off flight path and for the accelerate-stop portion may be presented together in simple chart form without introducing excessive errors. However, the actual gradient should be used for the climb-out segments of the flight path and in no case should the gradient be greater than the first segment climb.

(5) In those cases in which intermediate points on the runway depart more than five feet from the mean line, the gradient effects on the acceleration portions, the deceleration portion, and the climb portion of the flight path should be computed separately. An average gradient may be assumed for the ground run portion of the problem because the error resulting therefrom is so small that a more rigorous treatment is not justified, provided a truly representative gradient is chosen. Where there are no reversals or significant changes in the runway slope during the ground run, the average may be taken to be the difference in elevation between the starting point and the point of attaining take-off climb speed, V_2, divided by the distance between the two points. However, if the gradient is not essentially constant, an average gradient should be assumed that more nearly parallels the high-speed portion of the acceleration run, since the gradient has a greater effect on the distance traversed at high speed. The average gradient selected in this way will usually serve for determining gradient effects on the acceleration distance in either the take-off flight path or the accelerate-stop distance. An average gradient should be determined in the same way in determining the gradient effects on the stopping distance, while the actual gradient should be determined in checking the climb segment to the 50-foot point.

(6) The operator may take advantage of the favorable effect of a downhill gradient on the takeoff flight path, if he wishes, but the unfavorable effect of such a gradient on the stopping distance should be accounted for in all cases.

(f) *Effects of wind.*

(1) Section 40.72 permits the use of 50% of the headwind component and requires consideration of 150% of any tailwind component.

The effect of wind on runway requirements can be determined by use of the following equation:

(i) For all headwind components, and tailwind components of 10 mph or less.

$$S_w = S\left(\frac{V_2 - V_w}{V_2}\right)^{1.85}$$

where S_w = runway required with wind
S = runway required, zero wind
V_2 = take-off safety speed (mph)
V_w = −(1.5 x tailwind component) + (.5 x headwind component) or,

(ii) If tailwind components in excess of 10 mph are approved, the equation will be:

$$S_w = S\left(\frac{V_2 - V_w}{V_2}\right)^2$$

Alternately, the exponent can be that which is determined to be appropriate to the separation of deceleration characteristics of the airplane type, as applicable.

(2) For steady wind conditions, the wind velocity and direction will be used in computing the effective headwind and tailwind components, and the maximum gust velocity and most unfavorable direction will be used in computing the crosswind component.

"40.73 *En route limitations; all engines operating.* No airplane shall be taken off at a weight in excess of that which would permit a rate of climb (expressed in feet per minute), with all engines operating, of at least 6 V_{s_0} (when V_{s_0} is expressed in miles per hour) at an altitude of at least 1,000 feet above the elevation of the highest ground

or obstruction within 10 miles on either side of the intended track. Transport category airplanes certificated under Part 4a of this subchapter are not required to comply with this section. For the purpose of this section it shall be assumed that the weight of the airplane as it proceeds along its intended track is progressively reduced by normal consumption of fuel and oil."

"40.74 *En route limitations; one engine inoperative.* No airplane shall be taken off at a weight in excess of that which would permit a rate of climb (expressed in feet per minute), with one engine inoperative, of at least $\left(0.06-\frac{0.08}{N}\right)V_{s_0}^2$ (when N is the number of engines installed and V_{s_0} is expressed in miles per hour) at an altitude of at least 1,000 feet above the elevation of the highest ground or obstruction within 10 miles of either side of the intended track: *Provided,* That for transport category airplanes certificated under Part 4a of this subchapter, the rate of climb shall be 0.02 $V_{s_0}^2$. For the purpose of this section it shall be assumed that the weight of the airplane as it proceeds along its intended track is progressively reduced by normal consumption of fuel and oil."

["40.75 *En route limitations; two engines inoperative.* The provisions of this section shall apply only to airplanes certificated in accordance with the performance requirements of Part 4b of this subchapter. No airplane having four or more engines shall be flown along an intended track except under the conditions of either paragraph (a) or paragraph (b) of this section.

["(a) No place along the intended track shall be more than 90 minutes away from an available landing area at which a landing can be made in accordance with the requirements of section 40.78, assuming all engines to be operating at cruising power.

["(b) The takeoff weight shall not be greater than that which would permit the airplane, with the two critical engines inoperative, to have a rate of climb in feet per minute equal to 0.01 $V_{s_0}^2$ (V_{s_0} being expressed in miles per hour) along all points of the route, from the point where the two engines are assumed to fail simultaneously to the landing area, either at an altitude of 1,000 feet above the elevation of the highest ground or obstruction within 10 miles on either side of the intended track or at an altitude of 5,000 feet, whichever is higher. The point where the two engines are assumed to fail shall be that point along the route which is most critical with respect to the takeoff weight. In showing compliance with this prescribed rate of climb, the following shall apply;

["(1) It shall be permissible to consider that the weight of the airplane as it proceeds along its intended track is progressively reduced by normal consumption of fuel and oil with all engines operating up to the point where the two engines are assumed to fail and with two engines operating beyond that point.

["(2) Where the engines are assumed to fail at an altitude above the prescribed minimum altitude, compliance with the prescribed rate of climb at the prescribed minimum altitude need not be shown during the descent from the cruising altitude to an altitude at which the rate of descent becomes zero, if the latter is sufficiently above the prescribed minimum altitude to assure compliance with the prescribed rate of climb at the prescribed minimum altitudes during the subsequent portion of the flight.

["(3) If fuel jettisoning is provided, the airplane's weight at the point where the two engines are assumed to fail shall be considered to be not less than that which would include sufficient fuel to proceed to an available landing area at which a landing can be made in accordance with the requirements of section 40.78 and to arrive there at an altitude of at least 1,000 feet directly over the landing area."]

"40.76 *Special en route limitations.* The 10-mile lateral distance specified in sections 40.73 through 40.75 may, for a distance of no more than 20 miles, be reduced to 5 miles, if operating VFR, or if air navigational facilities are so located as to provide a reliable and accurate identification of any high

ground or obstruction located outside of such 5-mile lateral distance but within the 10-mile distance."

40.76–1 *Special en route limitations (CAA policies which apply to sec. 40.76).* No attempt is made to classify specific types of navigational facilities as acceptable or unacceptable for the purposes of section 40.76, but each case will be examined on its own merits. In general, however, the facility should be of a type that gives the pilot a continuous fix of his position with an error of not more than two miles, or a continuous on-course indication with an error of not more than two miles, or a continuous indication of the bearing and distance of the obstacle from the airplane, with an accuracy adequate to allow the pilot to turn away from the obstacle with ample clearance. Any mechanical or electrical facilities that are to be acceptable should be thoroughly reliable regardless of weather or other operating conditions. Such considerations only apply for IFR operations.

"40.77 *Landing distance limitations; airport of destination.* No airplane shall be taken off at a weight in excess of that which, under the conditions stated in this part would permit the airplane to be brought to rest at the field of intended destination within 60 percent of the effective length of the runway from a point 50 feet directly above the intersection of the obstruction clearance plane and the runway. For the purpose of this section it shall be assumed that the takeoff weight of the airplane is reduced by the weight of the fuel and oil expected to be consumed in flight to the field of intended destination.

"(a) It shall be assumed that the airplane is landed on the most favorable runway and direction in still air.

"(b) It shall be assumed, considering the probable wind velocity and direction, that the airplane is landed on the most suitable runway, taking due account of the ground handling characteristics of the airplane type involved and other conditions (e. g., landing aids, terrain, etc.) and allowing for the effect on the landing path and roll of not more than 50 percent of the wind component along the landing path if opposite to the direction of landing, or not less than 150 percent of the wind component if in the direction of landing.

"(c) If the airport of intended destination will not permit full compliance with paragraph (b) of this section, the airplane may be taken off if an alternate airport is designated which permits compliance with section 40.78."

40.77–1 *Landing distance limitations; airport of destination (CAA policies which apply to sec. 40.77).*

(a) Section 40.77 establishes two major considerations in determining the permissible landing weight at the airport of destination. The first is that the aircraft weight will be such on arrival that it can be landed within 60 percent of the effective landing length of the most favorable (normally the longest) runway in still air. This maximum weight for an airport/aircraft configuration, once established, remains constant and cannot be exceeded, regardless of wind conditions.

(b) The second is that consideration be given to the maximum weight that will be permitted due to the necessity of using another runway because of the probable wind condition, ground handling characteristics of the aircraft, landing aids, etc. This consideration may result in a lower gross weight than permitted in paragraph (a) of this section, in which case, dispatch must be based on this lesser weight.

(c) The probable wind referred to in (b) of this section, is the wind forecasted to exist at the time of arrival.

(d) If the forecast conditions are such that consideration of the requirements in section 40.77 (b) would preclude a landing at the intended destination, the aircraft may be dispatched if an alternate airport is designated which permits compliance with section 40.78.

(e) (1) If a flight has been properly dispatched, but arrives at the destination with a weight higher than anticipated due to unexpected wind conditions or fuel consumption, section 40.77 (b) should not be construed as prohibiting a landing at the overweight condition, provided the crosswind and/or tailwind operating limitations are not exceeded.

If conditions are such that the crosswind

and/or tailwind limitations will be exceeded, the flight must proceed to its alternate, if one has been named to meet the requirements of section 40.77 (b). However, if an alternate was not provided, and upon arrival the wind conditions were such that the crosswind and/or tailwind limitations would be exceeded, the pilot should exercise the authority granted him in section 40.360 (a).

(f) For application of the wind components as allowed in section 40.77 (b), refer to section 40.72–1 (f).

"40.78 *Landing distance limitations; alternate airports.* No airport shall be designated as an alternate airport in a dispatch release unless the airplane at the weight anticipated at the time of arrival at such airport can comply with the requirements of section 40.77: *Provided,* That the airplane can be brought to rest within 70 percent of the effective length of the runway."

Airplane Performance Operating Limitations; Nontransport Category

"40.90 *Nontransport category airplane operating limitations.* In operating any large, nontransport category airplane in passenger service after December 31, 1953, the provisions of sections 40.91 through [40.94] shall be complied with, unless deviations therefrom are specifically authorized by the Administrator on the ground that the special circumstances of a particular case make a literal observance of the requirements unnecessary for safety. Prior to that date such airplanes shall be operated either in accordance with section 40.91 through [40.94] or in accordance with such operating limitations as the Administrator determines will provide a safe relation between the performance of the airplanes and the airports to be used and the areas to be traversed. Performance data published or approved by the Administrator for each such nontransport category airplane shall be used in determining compliance with the provisions of sections 40.91 through [40.94]."

40.90–1 *Performance data (CAA rules which apply to sec. 40.90).* Performance data published by the Administrator to determine performance requirements in relation to the airports to be used and the areas to be traversed are set forth in figures 1 through 10[5] and section 40.91–1 (b). For the purpose of determining performance data, Figures 1, 3 and 6, "paved runway" shall mean paved with asphalt or concrete. Figures 2, 4 and 7 shall be used for all other runway surfaces, except in individual cases where the Administrator finds that a particular runway surface justifies the use of the paved runway data or a specific correction factor. Data based on flight tests conducted under the supervision of CAA Aircraft Engineering Division and approved by the Administrator may be used in lieu of the published data. An application for any deviation shall include all supporting data and shall be forwarded to the CAA Aviation Safety District Office charged with the over-all inspection of the air carriers' operations.

"40.91 *Takeoff limitations.* No takeoff shall be made at a weight in excess of that which will permit the airplane to be brought to a safe stop within the effective length of the runway from any point during the takeoff up to the time of attaining 105 percent of minimum control speed or 115 percent of the power-off stalling speed in the takeoff configuration, whichever is the greater. In applying the requirements of this section:

"(a) It may be assumed that takeoff power is used on all engines during the acceleration;

"(b) Account may be taken of not more than 50 percent of the reported wind component along the takeoff path if opposite to the direction of takeoff, and account shall be taken of not less than 150 percent of the reported wind component if in the direction of the takeoff;

"(c) Account shall be taken of the average runway gradient when the average gradient is greater than ½ percent. The average runway gradient is the difference between the

[5] The charts are presented in graph form for selected values. Other values may be determined by interpolation or extrapolation, provided the operating and structural limitations are not exceeded. Examples which explain the use of figures 1 to 10, inclusive, will be found in the Appendix on page 73.

elevations of the end points of the runway divided by the total length;

"(d) It shall be assumed that the airplane is operating in the standard atmosphere."

[40.91–1 *Takeoff limitations (CAA rules which apply to sec. 40.91).*

(a) Figures 1, 2, 3, 4, 8, 9, and 10 shall be used in determining takeoff limitations. The weight of de-icing equipment, when installed, must be included in the computations of allowable takeoff weights.

[(b) If the gradient of the runway exceeds ½ percent, the effect of the total average gradient shall be accounted for. The effect of gradient shall be calculated as shown in figure 11 or by any other method by which the effect of gradient may be accurately or conservatively computed.]

(c) The maximum allowable takeoff weight from sod runways shall be the lesser gross weight as determined by application of the effective length to the appropriate takeoff table (Figure 1 or 3) and by application of the actual runway length to the corresponding takeoff table (Figure 2 or 4). Figures 1 and 3 are used to determine the maximum allowable gross weight which will permit the aircraft to takeoff within the effective runway length, while Figures 2 and 4 are used to determine the maximum allowable gross weight which will permit the particular aircraft to be accelerated and brought to a full stop within the actual length of available runway.

40.91–2 *Takeoff limitations (CAA policies which apply to sec. 40.91).*

(a) The maximum tailwind component should be [10 m. p. h.] unless another value has been approved by the Administrator.

"40.92 *En route limitations; one engine inoperative.*

"(a) No takeoff shall be made at a weight in excess of that which will permit the airplane to climb at a rate of at least 50 feet per minute with the critical engine inoperative at an altitude of at least 1,000 feet above the elevation of the highest obstacle within 5 miles on either side of the intended track or at an altitude of 5,000 feet, whichever is the higher: *Provided,* That in the alternative an air carrier may utilize a procedure whereby the airplane is operated at an altitude such that, in event of an engine failure, the airplane can clear the obstacles within 5 miles on either side of the intended track by 1,000 feet, if the air carrier can demonstrate to the satisfaction of the Administrator that such a procedure can be used without impairing the safety of operation. If such a procedure is utilized, the rate of descent for the appropriate weight and altitude shall be assumed to be 50 feet per minute greater than indicated by the performance information published or approved by the Administrator. Before approving such a procedure, the Administrator shall take into account, for the particular route, route segment, or areas concerned, the reliability of wind and weather forecasting, the location and types of aids to navigation, the prevailing weather conditions, particularly the frequency and amount of turbulence normally encountered, terrain features, air traffic control problems, and all other operational factors which affect the safety of an operation utilizing such a procedure.

"(b) In applying the requirements of paragraph (a) of this section, it shall be assumed that:

"(1) The critical engine is inoperative;

"(2) The propeller of the inoperative engine is in the minimum drag position;

"(3) The wing flaps and landing gear are in the most favorable positions;

"(4) The operative engine or engines are operating at the maximum continuous power available;

"(5) The airplane is operating in the standard atmosphere;

"(6) The weight of the airplane is progressively reduced by the weight of the anticipated consumption of fuel and oil."

40.92–1 *En route limitations (CAA rules which apply to sec. 40.92).*

(a) Figure 5 shall be used in determining the en route limitations. An application for approval of "drift-down" procedures shall include all supporting data. The application will be forwarded to the CAA Aviation Safety District Office charged with the over-all inspection of the air carriers operations.

"40.93 *Landing distance limitations; airport of intended destination.* No takeoff shall be made at a weight in excess of that which, allowing for the anticipated weight reduction due to consumption of fuel and oil, will permit the airplane to be brought to a stop within 60 percent of the effective length of the most suitable runway at the airport of intended destination.

"(a) This weight shall in no instance be greater than that permissible if the landing were to be made:

"(1) On the runway with the greatest effective length in still air and;

"(2) On the runway required by the probable wind, taking into account not more than 50 percent of the probable headwind component and not less than 150 percent of the probable tailwind component.

"(b) In applying the requirements of this section it shall be assumed that:

"(1) The airplane passes directly over the intersection of the obstruction clearance plane and the runway at a height of 50 feet in a steady gliding approach at a true indicated air speed of at least 1.3 V_{s_0};

"(2) The landing is made in such a manner that it does not require any exceptional degree of skill on the part of the pilot.

"(3) The airplane is operating in the standard atmosphere.

40.93–1 *Landing distance limitations (CAA rules which apply to sec. 40.93).*

(a) Figures 6, 8, 9, and 10 shall be used in determining landing distance limitations on paved runways.

(b) Figures 7, 8, 9, and 10 shall be used in determining landing distance limitations on sod runways.

[40.93–2 *Landing distance limitations; airport of destination (CAA policies which apply to sec. 40.93).*

[(a) Section 40.93 establishes two major considerations in determining the permissible landing weight at the airport of destination. The first is that the aircraft weight will be such on arrival that it can be landed within 60 percent of the effective landing length of the most favorable (normally the longest) runway in still air. This maximum weight for an airport/aircraft configuration, once established, remains constant and cannot be exceeded, regardless of wind conditions.

[(b) The second is that consideration be given to the maximum weight that will be permitted due to the necessity of using another runway because of the probable wind condition, ground handling characteristics of the aircraft, landing aids, etc. This consideration may result in a lower gross weight than permitted in paragraph (a) of this section, in which case, dispatch must be based on this lesser weight.

[(c) The probable wind referred to in paragraph (b) of this section is the wind forecasted to exist at the time of arrival.

[(d) If the forecast conditions are such that consideration of the requirements in section 40.93 (a) (2) would preclude a landing at the intended destination, the aircraft may be dispatched if an alternate airport is designated which permits compliance with section 40.94.

[(e) If a flight has been properly dispatched, but arrives at the destination with a weight higher than anticipated due to unexpected wind conditions or fuel consumption, section 40.93 (a) (2) should not be construed as prohibiting a landing at the overweight condition, provided the crosswind and/or tailwind operating limitations are not exceeded.

[If conditions are such that the crosswind and/or tailwind limitations will be exceeded, the flight must proceed to its alternate, if one has been named to meet the requirements of section 40.93 (a) (2). However, if an alternate was not provided, and upon arrival the wind conditions were such that the crosswind and/or tailwind limitations would be exceeded, the pilot should exercise the authority granted him in section 40.360 (a).

[(f) For application of the wind components as allowed in section 40.93 (a) (2), refer to section 40.72–1 (f).

[(g) The maximum tailwind component should be 10 m.p.h., unless another value has been approved by the Administrator.]

"40.94 *Landing distance limitations; alternate airports.* No airport shall be designated as an alternate airport in a dispatch release unless the airplane at the weight

anticipated at the time of arrival at such airport can comply with the requirements of 40.93: *Provided,* That the airplane can be brought to rest within 70 percent of the effective length of the runway."

[40.94–1 *Landing distance limitations; alternate airports (CAA rules which apply to sec. 40.94).*

(a) Figures 6A, 8, 9, and 10 shall be used in determining landing distance limitations on paved runways.

[(b) Figures 7A, 8, 9, and 10 shall be used in determining landing distance limitations on sod runways.]

Special Airworthiness Requirements

"40.110 *Fire prevention.* All airplanes used in passenger service, powered by engines rated at more than 600 horsepower each for maximum continuous operation and which have not been certificated in accordance with the provisions of Part 4b of this subchapter in effect on or after November 1, 1946, shall comply with the requirements contained in sections 40.111 through 40.143: *Provided,* That if the Administrator finds that in particular models of existing airplanes literal compliance with specific items of these requirements might be extremely difficult of accomplishment and that such compliance would not contribute materially to the objective sought, he may accept such measures of compliance as he finds will effectively accomplish the basic objectives of these regulations." [3]

[3] "The requirements of sections 40.111 through 40.143 are taken directly from Part 04, as amended by Amendment 04–4, effective November 1, 1946, and are the requirements made applicable by the Board in Amendment 61–2, effective November 1, 1946, to all airplanes powered by engines of more than 600 horsepower each for maximum continuous operation when used in passenger service. As the requirements of Part 04 pertaining to liquid-cooling systems are not applicable, they have been omitted from this part."

"40.111 *Susceptibility of materials to fire.* The Administrator shall prescribe the heat conditions and testing procedures which any specific material or individual part must meet where necessary for the purpose of applying the following defined terms: fireproof, fire-resistant, flame-resistant, flash-resistant, and flammable."

"40.112 *Cabin interior.* All compartments occupied or used by the crew or passengers shall comply with the following provisions:

"(a) Materials in no case be less than flash-resistant,

"(b) The wall and ceiling linings, the covering of all upholstering, floors, and furnishings shall be flame-resistant,

"(c) Compartments where smoking is to be permitted shall be equipped with ash trays of the self-contained type which are completely removable. All other compartments shall be placarded against smoking.

"(d) All receptables for used towels, papers, and wastes shall be of fire-resistant material and shall incorporate covers or other provisions for containing possible fires started in the receptacles."

"40.113 *Internal doors.* Where internal doors are equipped with louvres or other ventilating means, provision convenient to the crew shall be made for closing the flow of air through the door when such action is found necessary."

"40.114 *Ventilation.* All passengers and crew compartments shall be suitably ventilated. Carbon monoxide concentration shall not exceed one part in 20,000 parts of air, and fuel fumes shall not be present. Where partitions between compartments are

tank when a transfer or separate oil reserve supply is used.

"(i) Oil-in temperature indicator for each engine.

"(j) Tachometer for each engine.

"(k) On and after January 1, 1955, an *independent fuel pressure warning device* for each engine or a master warning device for all engines with means for isolating the *individual warning circuits from the master* warning device.

[**"(1) Effective September 1, 1955, a means shall be provided for each reversible propeller on airplanes equipped with reversible propellers, which will indicate to the pilots when the propeller is in reverse pitch. Such means may be actuated at any point in the reversing cycle between the normal low pitch stop position and full reverse pitch. No indication shall be given at or above the normal low pitch stop position. The source of indication shall be actuated by the propeller blade angle or be directly responsive to the propeller blade angle."**]

"40.173 *Emergency equipment for all operations.*

"(a) The emergency equipment specified in paragraphs (b), (c), and (d) of this section is required for all operations. Such equipment shall be readily accessible to the crew, and the method of operation shall be plainly indicated. When such equipment is carried in compartments or containers, the compartments or containers shall be so marked as to be readily identifiable.

"(b) *Hand fire extinguishers for crew, passenger, and cargo compartments.* Hand fire extinguishers of an approved type shall be provided for use in crew, passenger, and cargo compartments in accordance with the following requirements:

"(1) The type and quantity of extinguishing agent shall be suitable for the type of fires likely to occur in the compartment where the extinguisher is intended to be used.

"(2) At least one hand fire extinguisher shall be provided and conveniently located on the flight deck for use by the flight crew.

"(3) On and after November 1, 1954, at least one hand fire extinguisher shall be conveniently located in the passenger compartment of airplanes accommodating more than six but less than 31 passengers. On airplanes accommodating more than 30 passengers, at least two fire extinguishers shall be provided. None need be provided in passenger compartments of airplanes accommodating six or less persons.

"(c) *First-aid equipment.* First-aid equipment suitable for treatment of injuries likely to occur in flight or in minor accidents shall be provided in a quantity appropriate to the number of passengers and crew accommodated in the airplane.

"(d) *Crash ax.* On and after January 1, 1955, all airplanes shall be equipped with at least one crash ax, and if accommodations are provided for more than 30 persons including the crew, airplanes shall be equipped with at least two crash axes. This equipment shall be stowed in readily accessible locations."

40.173–1 *Hand fire extinguishers for crew, passenger, and cargo compartments (CAA interpretations which apply to sec. 40.173 (b)).* Approved extinguishers are extinguishers which have been approved by the Administrator or by the Underwriters Laboratories (UL), the Factory Mutual Laboratories (FML), or any other agency which may be deemed qualified by the Administrator in accordance with section 4b.18.

"40.174 *Seats and safety belts for all occupants.* A seat and an individual safety belt are required for each passenger and crew member, excluding infants, who are in other than a recumbent position during take-off and landing. One safety belt only is required in a berth for one or two persons in a recumbent position during takeoff and landing. During flight between takeoff and landing, one safety belt is sufficient for two persons occupying a multiple lounge or divan seat."

"40.175 *Miscellaneous equipment for all operations.* All airplanes shall have installed the following equipment:

"(a) If protective fuses are used, spare fuses of a number approved for the particu-

lar airplane and appropriately described in the air carrier manual,

"(b) Windshield wiper or equivalent for each pilot,

"(c) A power supply and distribution system capable of producing and distributing the load for all required instruments and equipment using an external power supply in the event of failure of any one power source or component of the power distribution system: *Provided,* That the Administrator may authorize the use of common elements in the power distribution system when he finds that such elements are so designed as to be reasonably protected against malfunction. Engine-driven sources of energy, when used, shall be on separate engines: *And provided further,* That the provisions of this paragraph with respect to required instruments and equipment other than flight instruments shall not be mandatory prior to July 1, 1955.

"(d) On and after December 1, 1954, means for indicating the adequacy of the power being supplied to required flight instruments.

"(e) Two independent static pressure systems, so vented to the outside atmospheric pressure that they will be least affected by air flow variation, moisture, or other foreign matter, and so installed as to be airtight except for the vent. When a means is provided for transferring an instrument from its primary operating system to an alternate system, such means shall include a positive positioning control and shall be marked to indicate clearly which system is being used.

"(f) Means for locking all companionway doors which separate passenger compartments from flight crew compartments. Keys for all doors which separate passenger compartments from other compartments having emergency exit provisions shall be readily available to all crew members. Any door which is the means of access to a required passenger emergency exit shall be placarded to indicate that it must be open during takeoff and landing. All doors which lead to compartments normally accessible to passengers and which are capable of being locked by passengers shall be provided with means for unlocking by the crew in the event of any emergency.

"(g) For seaplanes only, an anchor light or lights, a warning bell for signaling when not under way during fog conditions, and an anchor adequate for the size of the seaplane."

40.175–1 *Power supply requirements for operation of instruments (CAA interpretations which apply to sec. 40.175 (c)).*

(a) Instruments and equipment using an external power source are interpreted to mean all instruments and equipment which derive their operative or motive power from an external source such as radios, air driven instruments, electric gyro instruments, etc., as contrasted with spring driven clocks or magnetic compasses which have a self-contained power source.

(b) The requirement that all airplanes have installed "a power supply and distribution system capable of producing and distributing the load for all required instruments and equipment using an external power source in the event of failure of any one power source or component of the power distribution system" is interpreted to mean that an alternate power source or sources and power distribution system or systems will be necessary to assure that all required instruments and equipment, using an external power source, receive their essential operative or motive power regardless of failure of any one power source or component of a power distribution system.

"40.176 ***Cockpit check procedure for all operations.*** **The air carrier shall provide for each type of airplane a cockpit check procedure. This procedure shall include all items necessary for flight crew members to check for safety prior to starting engines, prior to taking off, prior to landing, and in engine emergencies. It shall be so designed as to obviate the necessity for a flight crew member to rely upon his memory for items to be checked and shall be readily usable in the cockpit of each airplane."**

"40.177 ***Passenger information for all operations.*** **All airplanes shall be equipped with signs visible to passengers and cabin**

attendants to notify such persons when smoking is prohibited and when safety belts should be fastened. These signs shall be capable of on-off operation by the crew."

"40.178 *Exit and evacuation marking for all operations.* After December 31, 1953, all airplanes shall comply with the provisions of this section.

"(a) Emergency exits of airplanes carrying passengers shall be clearly marked as such in letters not less than three-fourths of an inch high with luminous paint, such markings to be located either on or immediately adjacent to the pertinent exit and readily visible to passengers. Location and method of operation of the handles shall be marked with luminous paint.

"(b) The exterior areas of the fuselage of an airplane shall be marked to indicate the location of mechanisms of access and those areas suitable for cutting to facilitate the escape and rescue of occupants in the event of an accident. *Provided,* That marking of areas suitable for cutting need not be applied prior to [April 1, 1955."]

Instruments and Equipment for Special Operations

"40.200 *Instruments and equipment for operations at night.* Each airplane operated at night shall be equipped with the following instruments and equipment in addition to those required by sections 40.171 through 40.178:

"(a) Flashing position lights,

["(b) After May 31, 1956, an anti-collision light for airplanes having a maximum certificated weight of more than 12,500 pounds,]

"(c) Two landing lights,

"(d) Two class 1 or class 1A landing flares,

"(e) Instrument lights providing sufficient illumination to make all instruments, switches, etc., easily readable, so installed that their direct rays are shielded from the flight crew members' eyes and that no objectionable reflections are visible to them. A means of controlling the intensity of illumination shall be provided unless it is shown that nondimming instrument lights are satisfactory.

"(f) An air-speed indicating system with heated pitot tube or equivalent means for preventing malfunctioning due to icing, and

"(g) A sensitive altimeter."

"40.201 *Instruments and equipment for operations under IFR or over-the-top.* Each airplane operated under IFR or over-the-top shall be equipped with the following instruments and equipment in addition to those required by sections 40.171 through 40.178:

"(a) An air-speed indicating system with heated pitot tube or equivalent means for preventing malfunctioning due to icing,

"(b) A sensitive altimeter, and

"(c) Instrument lights providing sufficient illumination to make all instruments, switches, etc., easily readable, so installed that their direct rays are shielded from the flight crew members' eyes and that no objectionable reflections are visible to them. A means of controlling the intensity of illumination shall be provided unless it is shown that nondimming instrument lights are satisfactory."

"40.202 *Supplemental oxygen.*

(a) *General.* Except where supplemental oxygen is provided in accordance with the requirements of section 40.203, supplemental oxygen shall be furnished and used as set forth in paragraphs (b) and (c) of this section. The amount of supplemental oxygen required for a particular operation to comply with the rules in this part shall be determined on the basis of flight altitudes and flight duration consistent with the operating procedures established for each such operation and route. As used in the oxygen requirements hereinafter set forth, 'altitude' shall mean the pressure altitude corresponding with the pressure in the cabin of the airplane, and 'flight altitude' shall mean the altitude above sea level at which the airplane is operated.

"(b) *Crew members.*

"(1) At altitudes above 10,000 feet to and including 12,000 feet oxygen shall be provided for, and used by, each member of the

flight crew on flight deck duty, and provided for all other crew members during the portion of the flight in excess of 30 minutes within this range of altitudes.

"(2) At altitudes above 12,000 feet oxygen shall be provided for, and used by, each member of the flight crew on flight deck duty, and provided for all other crew members during the entire flight time at such altitudes.

"(c) *Passengers.* Each air carrier shall provide a supply of oxygen for passenger safety as approved by the Administrator in accordance with the following standards:

"(1) For flights of over 30-minute duration at altitudes above 8,000 feet to and including 14,000 feet a supply of oxygen sufficient to furnish oxygen for 30 minutes to 10 percent of the number of passengers carried shall be required.

"(2) For flights at altitudes above 14,000 feet to and including 15,000 feet a supply of oxygen sufficient to provide oxygen for the duration of the flight at such altitudes for 30 percent of the number of passengers carried shall generally be considered adequate.

"(3) For flights at altitudes above 15,000 feet a supply of oxygen sufficient to provide oxygen for each passenger carried during the entire flight at such altitudes shall be required."

40.202–1 *Supplemental oxygen for crew members. (CAA interpretations which apply to sec. 40.202 (b) (1)).* The phrase, "during the portion of flight in excess of 30 minutes within this range of altitudes" applies to all crew members including the flight crew members on flight deck duty. Thus, oxygen is required to be provided for, and used by, each member of the flight crew on flight deck duty only during the portion of the flight in excess of 30 minutes within this range of altitudes.

40.202–2 *Oxygen requirements for standby crew members. (CAA interpretations which apply to sec. 40.202 (b)).* Standby crew members who are on call or are definitely going to have flight deck duty prior to the completion of a flight must be provided with the same amount of supplemental oxygen as that provided for crew members on duty other than on flight deck duty. However, if the standby crew members are not on call and will not be on flight deck duty during the remainder of the flight, they must be considered as passengers with regard to supplemental oxygen.

40.202–3 *Operating instructions (CAA policies which apply to sec. 40.202).* Operating instructions appropriate to the type of system and masks installed should be provided for the flight crew in the appropriate air carrier manual. These operating instructions should contain a graph or a table which will show the duration of the oxygen supply for the various bottle pressures and pressure altitudes.

40.202–4 *Oxygen requirements for jump seat occupant (CAA policies which apply to sec. 40.202).* When the jump seat is occupied by a check airman, a crew member, or a flight crew member, as defined by section 40.5, oxygen should be provided in accordance with the requirements of section 40.202. The provision of oxygen at the jump seat location may be accomplished either by a portable oxygen unit or an outlet in a fixed system.

40.202–5 *Oxygen requirements for infants-in-arms (CAA policies which apply to sec. 40.202 (c)).* Provisions should be made for administering oxygen to infants-in-arms and additional oxygen should be carried whenever an unusually large number of infants is carried. This additional oxygen is needed only when there is a passenger or infant for each seat position and the number of infants not provided for exceeds 50 percent of the seat positions. Acceptable methods of administering the oxygen to infants and now used by many operators are: (a) A disposable plastic mask which can be fitted to the face; (b) an infant size BLB oro-nasal mask, and (c) semirigid paper cups, specifically reserved for the purpose, which can be fitted over the infant's nose and mouth, with a hole punched through the bottom through which an oxygen tube or a Y-connector can be inserted. Any other acceptable method may also be used.

40.202–6 *Oxygen requirements for clinical purposes (CAA policies which apply to sec. 40.202 (c)).* The regulations do not require that oxygen be provided for clinical purposes; hence, if the air carrier believes that such oxy-

gen is to be desired, he should provide oxygen for this purpose. It is suggested that portable units of any size the air carrier desires be used for this purpose in order that the minimum supply required for supplementary breathing purposes will be preserved. If, however, the operator wishes to use a common source of supply for the oxygen required by the regulations and for clinical purposes, he may do so if he provides an amount of oxygen sufficiently greater than that required by the regulations. A quantity of 300 liters STPD would probably be considered as satisfying reasonable needs.

"40.203 *Supplemental oxygen requirements for pressurized cabin airplanes.* When operating pressurized cabin airplanes, the air carrier shall so equip such airplanes as to permit compliance with the following requirements in the event of cabin pressurization failure:

"(a) *For crew members.* When operating such airplanes at flight altitudes above 10,000 feet, the air carrier shall provide sufficient oxygen for all crew members for the duration of the flight at such altitudes:

40.34) from any point on the route and with other airplanes operated by the air carrier;

"(2) Communicate with airport traffic control towers from any point in the control zone within which flights are intended; and

"(3) Receive meteorological information from any point en route by either of two independent systems.

"(b) For all operations at night conducted under VFR over routes on which navigation can be accomplished by pilotage, each airplane shall be equipped with such radio equipment as is necessary under normal operating conditions to fulfill the functions specified in paragraph (a) of this section and to receive radio navigation signals applicable to the route flown except that no marker beacon receiver or ILS receiver need be provided."

"40.232 *Radio equipment for operations under VFR over routes not navigated by pilotage or for operations under IFR or over-the-top.*

"(a) For operations conducted under VFR over routes on which navigation cannot be accomplished by pilotage or for operations conducted under IFR or over-the-top, each airplane shall be equipped with such radio equipment as is necessary under normal operating conditions to fulfill the functions specified in 40.231 (a) and to receive satisfactorily, by either of two independent systems, radio navigational signals from all primary en route and approach navigational facilities intended to be used, except that only one marker beacon receiver which provides visual and aural signals and one ILS receiver need be provided. Equipment provided to receive signals en route may be used to receive signals on approach, if it is capable of receiving both signals.

"(b) In the case of operation on routes using procedures based on automatic direction finding, only one automatic direction finding system need be installed: *Provided,* That ground facilities are so located and the airplane is so fueled that, in case of failure of the automatic direction finding equipment, the flight may proceed safely to a suitable airport which has ground radio navigational facilities whose signals may be received by the use of the remaining airplane radio systems.

"(c) During the period of transition from low frequency to very high frequency radio navigational systems one means of satisfactorily receiving signals over each of these systems shall be considered as complying with the requirement that two independent systems be provided to receive en route or approach navigational facility signals: *Provided,* That ground facilities are so located and the airplane is so fueled that in case of failure of either system the flight may proceed safely to a suitable airport which has ground radio navigational facilities whose signals may be received by use of the remaining airplane radio system."

40.232–1 *Dispatch of aircraft equipped with one VHF and one low frequency radio receiver (CAA interpretations which apply to sec. 40.232 (c).* When an aircraft equipped with one VHF radio navigation receiver and one low frequency radio navigation receiver is dispatched under conditions requiring an alternate airport for departure or destination, such alternate airport must be:

(a) An alternate airport served by both low frequency and VOR (or VAR) radio navigation facilities each of which has an approved instrument approach procedure established for such airport, or

(b) An alternate airport served by a VOR (or VAR) radio navigation facility, provided another alternate airport is specified which is served by a low frequency radio navigation facility and an approved instrument approach procedure is established at each such airport, or

(c) An alternate airport for which the weather reports and forecasts, or a combination thereof, indicate that the weather conditions will remain at or above the weather minimums prescribed in section 40.390 (c) until such time as the flight would arrive at such alternate airport.

Maintenance and Inspection Requirements

"40.240 *Responsibility for maintenance.* Irrespective of whether the air carrier has made arrangements with any other person for the performance of maintenance and

inspection functions, each air carrier shall have the primary responsibility for the airworthiness of its airplanes and required equipment."

"40.241 *Maintenance and inspection requirements.*

"(a) The air carrier or the person with whom arrangements have been made for the performance of maintenance and inspection functions shall establish an adequate inspection organization responsible for determining that workmanship, methods employed, and material used are in conformity with the requirements of the Civil Air Regulations, with accepted standards and good practices, and that any airframe, engine, propeller, or appliance released for flight is airworthy.

"(b) Any individual who is directly in charge of inspection, maintenance, overhaul, or repair of any airframe, engine, propeller, or appliance shall hold an appropriate license or airman certificate."

40.241-1 *Persons directly in charge of inspection, maintenance, overhaul, or repair of airframes, engines, propellers, or appliances (CAA interpretations which apply to sec. 40.241 (b)).* The individual "directly in charge" is interpreted to mean each individual assigned by the carrier or other person performing maintenance, to a position in which he is responsible for the work of a shop or station which performs inspections, maintenance, repairs, alterations, or other functions affecting aircraft airworthiness. Such individuals need not necessarily physically observe and direct each worker constantly, but must be available for consultation and decision on matters requiring instruction or decision from higher authority than that of the individuals performing the work.

"40.242 *Maintenance and inspection training program.* The air carrier, or the person with whom arrangements have been made for the performance of maintenance and inspection functions, shall establish and maintain a training program to insure that all maintenance and inspection personnel charged with determining the adequacy of work performed are fully informed with respect to all procedures and techniques and with new equipment introduced into service, and are competent to perform their duties."

"40.243 *Maintenance and inspection personnel duty time limitations.* All maintenance and inspection personnel shall be relieved of all duty for a period of at least 24 consecutive hours during any 7 consecutive days or equivalent thereof within any one month."

Airman and Crew Member Requirements

"40.260 *Utilization of airman.* No air carrier shall utilize an individual as an airman unless he holds a valid appropriate airman certificate issued by the Administrator and is otherwise qualified for the particular operation in which he is to be utilized."

"40.261 *Composition of flight crew.*

"(a) No air carrier shall operate an airplane with less than the minimum flight crew specified in the airworthiness certificate for the type of airplane and required in this part for the type of operation.

"(b) Where the provisions of this part require the performance of two or more functions for which an airman certificate is necessary, such requirement shall not be satisfied by the performance of multiple functions at the same time by any airman.

"(c) Where the air carrier is authorized to operate under instrument conditions or operates airplanes of more than 12,500 pounds maximum certificated weight, the minimum pilot crew shall be 2 pilots.

"(d) On flights requiring a flight engineer, at least one other flight crew member shall be sufficiently qualified, so that in the event of illness or other incapacity, emergency coverage can be provided for that function for the safe completion of the flight. A pilot need not hold a flight engineer certificate to function in the capacity of a flight engineer [for emergency conditions only. A pilot need not hold a flight engineer certificate to function in the capacity of a flight engineer for such emergency coverage."]

"40.263 *Flight engineer.* An airman holding a valid flight engineer certificate shall be required on all airplanes certificated for more than 80,000 pounds maximum certificated take-off weight. Such airman shall also be required on all four-engine airplanes

minimums, and the regulations of this subchapter.

"(b) If an emergency situation arises during the course of a flight which requires immediate decision and action on the part of the aircraft dispatcher, and which is known to him, he shall advise the pilot in command of such situation. The aircraft dispatcher shall ascertain the decision of the pilot in command and shall cause the same to be made a matter of record. If unable to communicate with the pilot, the dispatcher shall declare an emergency and follow any course of action which he considers necessary under the circumstances.

"(c) When emergency authority is exercised by the pilot in command or by the dispatcher, the appropriate dispatch center shall be kept fully informed regarding the progress of the flight, and within 10 days after the completion of the particular flight a written report of any deviation shall be submitted by the individual declaring the emergency to the Administrator through the air carrier operations manager.

"(d) In cases where the pilot in command selects an airport other than the nearest suitable airport in point of time, he shall, upon completion of the trip, submit a written report, in duplicate, to his operations manager setting forth his reasons for determining that the selection of an airport other than the nearest was as safe a course of action as landing at the nearest suitable airport. The operations manager shall, within 7 days after completion of the trip, furnish a copy of this report with his own comments thereon to the Administrator."

"40.361 *Reporting potentially hazardous meteorological conditions and irregularities of ground and navigational facilities.* When any meteorological condition or irregularity of ground or navigational facilities is encountered in flight, the knowledge of which the pilot in command considers essential to the safety of other flights, he shall notify an appropriate ground radio station as soon as practicable. Such information shall thereupon be relayed by that station to the appropriate governmental agency."

"40.362 *Reporting mechanical irregularities.* The pilot in command shall enter or cause to be entered in the maintenance log of the airplane all mechanical irregularities encountered during flight. He shall, prior to each flight, inspect the log to ascertain the status of any irregularities entered in the log at the end of the last preceding flight."

"40.363 *Engine failure or precautionary stoppage.*

"(a) Except as provided in paragraph (b) of this section, when one engine of an airplane fails or where the rotation of an engine of an airplane is stopped in flight as a precautionary measure to prevent possible damage, a landing shall be made at the nearest suitable airport in point of time where a safe landing can be effected.

"(b) The pilot in command of an airplane having 4 or more engines may, if not more than 1 engine fails or the rotation thereof is stopped, proceed to an airport of his selection, if, upon consideration of the following factors, he determines such action to be as safe a course of action as landing at the nearest suitable airport:

"(1) The nature of the malfunctioning and the possible mechanical difficulties which may be encountered if flight is continued,

"(2) The availability of the [inoperative] engine for use,

"(3) The altitude, airplane weight, and usable fuel at the time of engine stoppage,

"(4) The weather conditions en route and at possible landing points,

"(5) The air traffic congestion,

"(6) The type of terrain, and

"(7) The familiarity of the pilot with the airport to be used.

"(c) When engine rotation is stopped in flight, the pilot in command shall immediately notify the proper ground station and shall keep such station fully informed regarding the progress of the flight.

"40.364 *Instrument approach procedures.* When an instrument approach is necessary, the instrument approach procedures and

weather minimums authorized in the operations specifications shall be adhered to."

"40.365 *Requirements for air carrier equipment interchange.*

"(a) Prior to conducting any operations pursuant to an interchange agreement authorized by the Civil Aeronautics Board, the air carrier shall show that:

"(1) The procedures proposed for the conduct of such operations by the carriers involved conform with the provisions of this subchapter and with safe operating practices;

"(2) All operations personnel involved are familiar with the airplanes and equipment of the air carrier with whom interchange is to be effected, and with the communications and dispatching procedures to be used;

"(3) All maintenance personnel involved are familiar with the airplanes and equipment, and the maintenance procedures of the air carrier with whom interchange is to be effected;

"(4) The flight crew and the dispatchers involved meet the appropriate route and airport qualifications; and

"(5) All airplanes operated are essentially similar to those airplanes of the carrier with whom interchange is to be effected with respect to flight instruments and their arrangement and with respect to the arrangement and motion of controls critical to safety, unless the Administrator determines that adequate training programs have been established to insure that any dissimilarities which might be a potential hazard will be safely overcome by flight crew familiarization.

"(b) The pertinent provisions and procedures affecting the carriers involved shall be included in their manuals.

Dispatching Rules

"40.381 *Necessity for dispatching authority.* No flight shall be started without specific authority from an aircraft dispatcher, except when an airplane has landed at an intermediate airport specified in the original dispatch release and has remained there for one hour or less."

"40.382 *Familiarity with weather conditions.* No aircraft dispatcher shall release a flight unless he is thoroughly familiar with existing and anticipated weather conditions along the route to be flown."

"40.383 *Facilities and services.* The dispatcher shall furnish to the pilot in command all available current reports or information pertaining to irregularities of navigational facilities and airport conditions which may affect the safety of the flight. He shall also furnish the pilot, while en route, any additional available information concerning meteorological conditions and irregularities of facilities and services which may affect the safety of the flight."

"40.384 *Airplane equipment required for dispatch.* All airplanes dispatched shall be airworthy and shall be equipped in accordance with the provisions of section 40.170."

"40.385 *Communications and navigational facilities required for dispatch.* No [airplane] shall be dispatched over any route or route segment unless the communications and navigational facilities required by sections 40.34 and 40.36 are in satisfactory operating condition."

"40.386 *Dispatching under VFR.* Airplanes shall be dispatched for operation under VFR only if the appropriate weather reports and forecasts, or a combination thereof, indicate that the ceilings and visibilities along the route to be flown are, and will remain, at or above the minimums required for flight under VFR until the flight arrives at the airport or airports of intended landing specified in the dispatch release."

"40.387 *Dispatching under IFR or over-the-top.* [Airplanes] shall be dispatched for operation under IFR or over-the-top only if the appropriate weather reports and forecasts, or a combination thereof, pertaining to the airport or airports to which dispatched indicate that the ceilings and visibilities will be at or above the minimums approved by the Administrator at the estimated time of arrival thereat."

"40.388 *Alternate airport for departure.*

"(a) If the weather conditions at the airport of take-off are below the approved landing minimums for that airport, no airplane shall be dispatched from that airport unless an alternate airport located with respect to the airport of takeoff as follows is specified in the dispatch release: *Provided,* That such alternate need not be selected if the ceiling and visibility respectively at the takeoff airport are at least 300 feet and 1 mile, 400 feet and three-quarters mile, or 500 feet and one-half mile.

"(1) *Airplanes having 2 or 3 engines.* Alternate airport located at a distance no greater than 1 hour of flying time in still air at normal cruising speed with 1 engine inoperative.

"(2) *Airplanes having 4 or more engines.* Alternate airport located at a distance no greater than 2 hours of flying time in still air at normal cruising speed with 1 engine inoperative.

"(b) The alternate airport weather requirements shall be those specified in section 40.390.

"(c) All required alternate airports shall be listed in the dispatch release."

"40.389 *Alternate airport for destination; IFR or over-the-top.*

"(a) For all IFR or over-the-top operations there shall be at least one alternate airport designated for each airport of destination and, when the weather conditions forecast for the destination and first alternate are marginal, at least one additional alternate airport: *Provided,* That no alternate need be designated when, for the period 2 hours before to 2 hours after the estimates time of arrival, the ceiling at the airport to which the flight is dispatched is forecast to be at least 1,000 feet above the minimum initial approach altitude applicable to such airport and the visibility at such airport is forecast to be at least 3 miles.

"(b) The alternate airport weather requirements shall be those specified in section 40.390.

"(c) All required alternate airports shall be listed in the dispatch release."

"40.390 *Alternate airport weather minimums.* An airport shall not be specified in the dispatch release as an alternate airport unless the weather conditions existing there at the time of dispatch are equal to or above the ceiling and visibility minimums approved for such airport when using it as an alternate, and the appropriate weather reports and forecasts, or a combination thereof, indicate that the weather conditions will be at or above such minimums until the flight shall arrive thereat. The weather minimums at such alternate airport shall not be less than one of the following and in no event less than the corresponding minimums specified for the airport when used as a regular airport: *Provided,* That the Administrator may approve higher or lower minimums at particular airports where the safe conduct of flight requires or permits, considering the character of the terrain being traversed, the meteorological service and navigational facilities available, and other conditions affecting flight.

"(a) An airport served by an approved radio navigational facility and either an instrument landing system or a ground control approach system which the carrier has been authorized to use: Ceiling 800 feet and visibility of 1 mile; or ceiling 700 feet and visibility of 1½ miles; or ceiling 600 feet and visibility of 2 miles;

"(b) An airport served by an approved radio-navigational facility: Ceiling 1,000 feet and visibility of 1 mile; or ceiling 900 feet and visibility of 1½ miles; or ceiling 800 feet and visibility of 2 miles;

"(c) An airport not served by an approved radio navigational facility: If overcast, ceiling 1,000 feet above the minimum en route instrument altitude applicable to the route to such alternate airport and visibility of 2 miles; if broken clouds, ceiling 1,000 feet above the elevation of the airport and visibility of 2 miles."

[40.390–1 *Alternate airport landing minimums for airports not served by a radio navigation facility (CAA policies which apply to sec. 40.390 (c)).* When there is no minimum en route instrument altitude associated with an

alternate airport, the approval of alternate airport landing minimums under overcast conditions will be contingent upon (a) the incorporation of appropriate minimum en route altitudes in the air carriers operations manual in order to provide a basis for establishing weather minimums in accordance with section 40.390 (c) and (b) the availability of radio navigation facilities of sufficient adequacy to permit safe navigation *over* such alternate airport. The latter may be accomplished by using any of the following or a combination thereof.

[(1) Radio bearings from the airport of intended destination,

[(2) Radio range course from the airport of intended destination,

[(3) Radio range course projected over the alternate airport on a line with the intended course to be flown,

[(4) Radio bearing from a radio facility located beyond the alternate airport on a line with the intended course to be flown, or

[(5) Radio bearing from a radio facility located along the intended course to be flown.]

"40.391 ***Continuance of flight; flight hazards.***

"(a) No airplane shall be continued in flight toward any airport to which it has been dispatched when, in the opinion of the pilot in command or the aircraft dispatcher, the flight cannot be completed with safety, unless in the opinion of the pilot in command there is no safer procedure. In the latter event, continuation shall constitute an emergency situation as set forth in section 40.360.

"(b) If any item of equipment required pursuant to the regulations of this subchapter for the particular operation being conducted becomes unserviceable en route, the pilot in command shall comply with the procedures specified in the manual for such occurrence: *Provided,* That the Administrator may authorize the incorporation in the air carrier manual of procedures for the continued operation of an airplane beyond a scheduled terminal where he finds that, in the particular circumstances of the case, literal compliance with this requirement is not necessary in the interest of safety."

"40.392 ***Operation in icing conditions.***

"(a) An airplane shall not be dispatched, en route operations continued, or landing made when, in the opinion of the pilot in command or aircraft dispatcher, icing conditions are expected or encountered which might adversely affect the safety of the flight.

"(b) No airplane shall take off when frost, snow, or ice is adhering to the wings, control surfaces, or propellers of the airplane."

"40.393 ***Redispatch and continuance of flight.***

"(a) Any regular, provisional, or refueling airport, the use of which is authorized for the type of airplane to be operated may be specified as a destination for the purpose of original dispatch.

"(b) An airport specified as a destination or alternate for the purpose of original dispatch may be changed en route to another airport which is authorized for the type of airplane to be operated, provided that the appropriate requirements of sections 40.381 through 40.409 and section 40.70 or section 40.90 are met at the time of redispatch.

"(c) No flight shall be continued to any airport to which it has been dispatched unless the weather conditions at an alternate airport specified in the dispatch release remain at or above the minimums specified for such airport when used as an alternate: *Provided,* That the dispatch release may be amended en route to include any approved alternate airport lying within the fuel range of the airplane as specified in sections 40.396 and 40.397.

"(d) When the dispatch release is amended while the airplane is en route, such amendments shall be made a matter of record."

"40.394 ***Dispatch to and from provisional airport.***

"(a) No aircraft dispatcher shall dispatch an airplane to a provisional airport unless such airport complies with all of the requirements of this part pertinent to regular airports.

"(b) Dispatch from a provisional airport shall be accomplished in accordance with the same regulations governing dispatch from a regular airport."

"40.395 *Takeoffs from alternate airports or from airports not listed in the operations specifications.* No airplane shall take off from an alternate airport or from an airport which is not listed in the air carrier operations specifications unless:

"(a) Such airport and related facilities are adequate for the operation of the airplane,

"(b) In taking off it is possible to comply with the applicable airplane operating limitations,

"(c) The weather conditions at that airport are equal to or better than those prescribed for such airport, and

"(d) The airplane is dispatched in accordance with all dispatching rules applicable to operation from an approved airport."

"40.396 *Fuel supply for all operations.* No airplane shall be dispatched unless it carries sufficient fuel:

"(a) To fly to the airport to which dispatched, and thereafter,

"(b) To fly to and land at the most distant alternate for the airport to which dispatched where such alternate is required and thereafter,

"(c) To fly for a period of at least 45 minutes at normal cruising consumption."

"40.397 *Factors involved in computing fuel required.* In computing the fuel required, consideration shall be given to the wind and other weather conditions forecast, traffic delays anticipated, and any other conditions which might delay the landing of the airplane. Required fuel shall be additional to unusable fuel."

"40.405 *Takeoff and landing weather minimum; VFR.* Irrespective of any clearance which may be obtained from air traffic control, no airplane shall take off or land under VFR when the reported ceiling or ground

must, of necessity, proceed outbound along the localizer course from the middle marker for the purpose of conducting a procedure turn. In such cases 300–¾ will be approved only when approaching aircraft can clear by 300 feet all obstructions from the approach end of the ILS runway to the point of glide slope interception within the approach area described in Regulations of the Administrator 609.10 (f) (1) (i) and (iii). The ceiling minimum may be approved to the nearest 100 feet as provided by subparagraph (11) of this paragraph, if a flight check has shown such ceiling minimum to be safe. The final approach altitude between the point the procedure turn is completed and the point of glide slope interception will be at least equal to the minimum altitude at glide slope interception inbound as specified in the applicable ILS instrument approach procedure. Straight-in landing minimums of 300–¾ may also be predicated on the glide slope obstruction clearance criteria outlined in Regulations of the Administrator 609.10 (f); *Provided*, That in addition to the middle marker or middle compass locator, a fix can be obtained along the ILS localizer course within 7 miles from the approach end of the ILS runway by means of (*1*) surveillance radar, (*2*) a fan marker which provides the same degree of accuracy as an ILS outer marker installation, (*3*) a reliable fix as described in subparagraph 9 (i), or (*4*) a radio facility which provides the same degree of accuracy as an ILS outer compass locator installation.

(*c*) *Use of ILS back course.* The foregoing may also be applied to the back course of an ILS which is normally provided with all components of a complete ILS.

(ii) *Straight-in approaches—more than one ILS component inoperative.* The air carrier operations specifications permit straight-in ILS approaches down to minimums of 300–1 when the localizer and either the outer marker or outer compass locator are the only components of the ILS in normal operation, or when these are the only components that can be received by the aircraft. Minimums of 300–1 may be approved under these conditions when approaching aircraft can clear by 300 feet all obstructions from the approach end of the ILS runway to the outer marker within the approach area described in Regulations of the Administrator 609.10 (f) (1) (i) and (iii). The ceiling minimum may be approved to the nearest 100 feet as provided by subparagraph 11 below, if a flight check has shown such ceiling minimum to be safe. The final approach altitude over the outer marker will provide at least 500 feet obstruction clearance for a distance of at least 10 miles outward from the outer marker within an area of 5 miles on each side of the center-line of the localizer course. The foregoing may also be applied to ILS back courses equipped with either an outer marker or outer compass locator.

(iii) *Circling ILS approaches when ILS components inoperative.* Circling ILS landing minimums will be established in accordance with subparagraph (1), except that 300 feet obstruction clearance may be provided from the approach end of the ILS runway to the outer marker within the approach area described in Regulations of the Administrator 609.10 (f) (1) (i) and (iii), in lieu of the 2-mile distance each side of the final approach course to the airport as specified in subparagraph (1). The air carrier operations specifications permit circling ILS approaches to be conducted down to such minimums when the localizer and either the outer marker or outer compass locator are the only components in normal operation, or when these are the only components that can be received by the aircraft. The final approach altitude over the outer marker will provide at least 500 feet obstruction clearance for a distance of at least 10 miles outward from the outer marker within an area of 5 miles on each side of the localizer course. The foregoing may also be applied to ILS back courses equipped with either an outer marker or outer compass locator.

(9) *Instrument approach procedures using ILS localizer.*

(i) *General.* Ceiling and visibility minimums for instrument approach procedures predicated on (*a*) the use of the localizer course of an ILS (either front or back course) and (*b*) a reliable fix located on the ILS localizer course, will normally be established in accordance with subparagraph (1) of this paragraph for circling approaches, and subparagraph (2) of this paragraph for straight-in approaches.

Such instrument approach procedures will normally not be established when the radio fix is located at a distance greater than seven miles from the airport. The obstruction clearance will be determined within the approach area described in Regulations of the Administrator 609.10 (f) (1) (i) and (iii). For the purpose of this subparagraph, a reliable fix is considered to be a fix formed by the intersection of the localizer course and a bearing from a radio facility located within twenty-five miles of the fix and such bearing intersects the localizer course at an angle of at least forty-five degrees.

(ii) *Lower minimums using additional or improved aids.* Straight-in approach minimums as low as 300–1 may be authorized on an ILS front course or back course when the fix located on the localizer course within seven miles of the ILS runway is (*a*) a fan marker which provides the same degree of accuracy as an ILS outer marker installation (*b*) a radio facility which provides the same degree of accuracy as an ILS outer compass locator installation, or (*c*) surveillance radar.

(10) *Effect of distance between radio facility and airport on landing minimums.*

(i) *Using a radio range (L/MF or VOR) or non-directional L/MF radio facility.*

(*a*) For both circling and straight-in instrument approach procedures, the following minimums may be established after consideration of the obstruction clearance requirements of Part 609 of the Regulations of the Administrator, when the radio facility is located at distances greater than seven miles from the airport:

(*1*) Over 7 to 10 miles—
Straight-in, 500–1 day, 500–2 night
*Circling, 500–1½ day, 500–2 night

(*2*) Over 10 to 12 miles—
Straight-in, 700–1 day, 700–2 night
*Circling, 700–1½ day, 700–2 night

(*3*) Over 12 miles—
Straight-in, 1000–1 day, 1000–2 night
*Circling, 1000–1½ day, 1000–2 night

When a radio facility is over 7 miles from an airport, straight-in landing ceiling minimums will not be lower than the circling landing ceiling minimums established at the particular airport.

(11) *Application of obstruction clearance criteria in determining landing ceiling minimums.* Unless safety requires otherwise, landing ceiling minimums for instrument approaches using a radio range or nondirectional L/MF facility will be shown on the applicable Form ACA–511 to the nearest 100 feet. For example; assuming that the controlling obstruction at an airport is 249 feet high, a ceiling minimum of 500 feet will normally be considered as meeting the obstruction clearance criteria outlined in paragraph (1) (i). If, on the other hand, such obstructions were 250 feet high, a ceiling minimum of 600 feet would normally apply. In cases where the ILS obstruction clearance criteria cannot be met, the ceiling arrived at by application of the formula contained in paragraph (6) (v) (*a*) will normally be shown to the nearest 100 feet; except that a flight check is required where application of the formula indicates a ceiling of less than 300 feet.

(d) *Airports not served by a radio navigational facility.* Takeoff and landing minimums at such airports will be approved in accordance with VFR.

[40.406–3 *Instrument approach procedures and IFR landing weather minimums at airports served by both ILS and GCA (CAA interpretations which apply to 40.406 (c)).* (a) The instrument approach must be conducted in accordance with the information provided the pilot from the primary aid. The landing minimums must be those prescribed in the operations specifications based on the operative components of the primary aid. The information provided the pilot from the secondary aid must be used for monitoring purposes. Either ILS or GCA (PAR) may be used as the primary approach aid. When GCA (PAR) is used as a secondary aid, specific authorization

*Visibility minimums for two-engine aircraft may be established in accordance with subparagraphs (1) (i) or (1) (ii) of this paragraph.

for use of such aid is not required, however, the procedures specified in the Radar Procedures for Air Traffic Control Towers for monitored approaches must apply.

[(b) Both the elevation and azimuth (or localizer and glide slope) elements of the secondary aid must be operating.

[(c) The ILS and PAR must be aligned with the same runway. Straight-in or circling approaches may be made provided that weather conditions equal to or higher than the prescribed minimums for the primary aid are found to exist by the pilot-in-command upon reaching the authorized minimum altitude associated with the type of approach (straight-in or circling) being conducted.

[(d) The use of operational military radar (other than training units) as a secondary aid is permissible without individual authorizations.

[(e) The phrase "ceiling or visibility" as used in section 40.406 (c) means that either or both elements of the weather report may be reported below minimums.]

"40.408 *Flight altitude rules.* **Except when necessary for take-off and landing, the flight altitude rules prescribed in paragraphs (a) and (b) of this section, in addition to the applicable provisions of section 60.17, shall govern air carrier operations: *Provided,* That other altitudes may be established by the Administrator for any route or portion thereof where he finds, after considering the character of the terrain being traversed, the quality and quantity of meteorological service, the navigational facilities available, and other flight conditions, that the safe conduct of flight permits or requires such other altitudes.**

"(a) *Day VFR passenger operations.* No airplane engaged in passenger operations shall be flown at an altitude less than 1,000 feet above the surface or less than 1,000 feet from any mountain, hill, or other obstruction to flight.

"(b) *Night VFR or IFR operations including over-the-top.* No airplane shall be flown at an altitude less than 1,000 feet above the highest obstacle located within a horizontal distance of 5 miles from the center of the course intended to be flown or, in mountainous terrain designated by the Administrator, 2,000 feet above the highest obstacle located within a horizontal distance of 5 miles from the center of the course intended to be flown: *Provided,* That in VFR operations at night in such mountainous areas airplanes may be flown over a lighted civil airway at a minimum altitude of 1,000 feet above such obstacle: *And provided further,* That in the case of high-altitude operations, the minimum altitude shall be not less than 2,000 feet above the elevation of the highest ground within 25 miles of the intended track: *And provided further,* That adherence to a minimum flight altitude will not be required during the time a flight is proceeding in accordance with paragraph (c) of this section.

"(c) *Daytime over-the-top operations below minimum en route altitudes.* Over-the-top operations may be conducted at flight altitudes lower than the minimum en route IFR altitudes by day only and in accordance with the following provisions:

"(1) Such operations shall be conducted at least 1,000 feet above the top of lower broken or overcast cloud cover;

"(2) The top of the lower cloud cover shall be generally uniform and level;

"(3) Flight visibility shall be at least 5 miles;

"(4) The base of any higher broken or overcast cloud cover shall be generally uniform and level and shall be at least 1,000 feet above the minimum en route IFR altitude for the route segment."

"40.409 *Altitude maintenance on initial approach.*

"(a) When making an initial approach to a radio navigational facility under IFR (excluding over-the-top conducted in accordance with the provisions of section 40.408 (c), an airplane shall not descend below the pertinent minimum altitude for initial approach specified by the Administrator for such facility until arrival over the radio facility has been definitely established;

"(b) When making an initial approach on a flight being conducted in accordance with the provisions of section 40.408 (c), a pilot

shall not commence an instrument approach until arrival over the radio facility has definitely been established. In executing an instrument approach procedure under such circumstances, the airplane shall not be flown at an altitude lower than 1,000 feet above the top of the lower cloud or the minimum altitude specified by the Administrator for that portion of the instrument approach procedure being flown, whichever is the lower."

40.411 *Preparation of dispatch release.* A dispatch release shall be prepared for each flight between specified points from information furnished by the authorized aircraft dispatcher. This release shall be signed by the pilot in command and by the authorized aircraft dispatcher only when both believe the flight can be made with safety. The aircraft dispatcher may delegate authority to sign such release for a particular flight, but he shall not delegate the authority to dispatch."

"40.412 *Preparation of load manifest.* The air carrier shall be responsible for the preparation and accuracy of a load manifest form prior to each take-off. This form shall be prepared by personnel of the air carrier charged with the duty of supervising the loading of airplanes and the preparation of load manifest forms or by other qualified persons authorized by the air carrier."

Required Records and Reports

"40.500 *Records.* Each scheduled air carrier shall maintain records and submit reports in accordance with the requirements of section 40.501 through 40.511. All records shall be retained for the period specified in Part 249 of Subchapter B of this chapter (Economic Regulations), unless otherwise specified in sections 40.501 through 40.511."

"40.501 *Crew member and dispatcher records.* Each air carrier shall maintain current records of every crew member and aircraft dispatcher. These records shall contain such information concerning the qualifications of each such crew member and dispatcher as is necessary to show compliance with the appropriate requirements of the regulations of this subchapter, e. g., proficiency and route checks, airplane qualifications, training, physical examinations, and flight time records. The disposition of any flight crew member or aircraft dispatcher released from the employ of the air carrier, or who becomes physically or professionally disqualified, shall be indicated in these records which shall be retained by the air carrier for at least three months."

40.501–1 *Crew member and dispatcher records (CAA policies which apply to sec. 40.501).*

(a) The following pertinent information is considered the minimum necessary in the airman records required by this section.

(1) Name (full);

(2) Current date of assignment (pilots, flight engineer, dispatchers, etc.);

(3) Airman certificates (type, number and ratings);

(4) Date, result and class of last physical examination;

(5) Date, place, aircraft type and number, duration, and result of last proficiency and/or line check for each pilot-in-command;

(6) Record of the flight time of each flight crew member including, where applicable, instrument flight time and the flight time in the make and model aircraft on which he is currently qualified;

(7) Routes over which and airports into which applicable flight crew members and dispatchers are currently qualified together with qualification records, grades and dates;

(8) Dates, results, and types of training given to all crew members, flight crew members, and dispatchers;

(9) Check pilot authorization where applicable;

"40.502 *List of airplanes.* Each air carrier shall maintain a current list of all airplanes being operated by it in scheduled air transportation: *Provided,* That airplanes of another air carrier being operated in accordance with an interchange agreement may be incorporated by reference."

"40.503 *Dispatch release form.*

"(a) The dispatch release may be in any form but shall contain at least the following information with respect to each flight:

"(1) Identification number of the airplane to be used, and the trip number,

"(2) Airport of departure, intermediate stops, destination, and alternates therefor,

"(3) Minimum fuel supply,

"(4) Type of operation, e. g., IFR, VFR.

"(b) The dispatch release shall contain, or have attached thereto, weather reports, available weather forecasts, or a combination thereof, for the destination, intermediate stops, and alternates specified therein which shall be the latest available at the time the dispatch release is signed by the pilot in command and dispatcher. It shall include such additional weather reports and forecasts, as available, considered necessary or desirable by the pilot in command and aircraft dispatcher."

[40.503–1 *Dispatch release form (CAA interpretations which apply to sec. 40.503 (a) (2)).* The dispatch release form may contain a trip or code number for the clearance of the particular trip instead of specifying each terminal and intermediate airport. This number used in the dispatch release must correspond with the number listed in the air carrier's published schedule or operations manual, which will list all the regular and intermediate stops of the particular trip for which clearance was given. In the event field condition, weather, etc., are such that routine operations are not to be conducted in accordance with the number for the particular trip, the dispatch release will specify the exceptions indicating the reason for the nonroutine operation.]

"40.504 *Load manifest.*

"(a) The load manifest shall contain at least the following information with respect to the loading of an airplane at the time of take-off:

"(1) The weight of:

"(i) Airplane,

"(ii) Fuel and oil,

'(iii) Cargo, including mail and baggage, and

"(iv) Passengers;

"(2) The maximum allowable weight applicable for the particular flight;

"(3) The total weight computed in accordance with approved procedures;

"(4) Evidence that the airplane is loaded in accordance with an approved schedule which insures that the center of gravity is within approved limits.

"(b) The load manifest shall be prepared and signed for each flight by qualified personnel of the air carrier charged with the duty of supervising the loading of the airplane and the preparation of load manifest forms, or by other qualified personnel authorized by the air carrier."

"40.505 *Disposition of load manifest, dispatch release form, and flight plans.* Copies of the completed load manifest, or informa-

Appendix

[Examples which explain use of figures 1 to 11 inclusive, on pages 75 to 82, inclusive]

[Example 1

[Figure 8 is used in the following manner:

[(a) Determine the wind velocity and wind angle relative to the runway. (In the example illustrated in figure 8, for Runway 27, and a wind for WNW at 25 mph, the relative wind angle is 22°.)

[(b) Enter the chart with the above information at point A.

[(c) Enter chart at point B using the existing effective runway length and project a line horizontally.

[(d) Project a vertical line from point A to intersect line from point B.

[(e) At point C, the intersection of these two lines, read the effective runway length available for zero wind. This figure, after *being corrected for runway gradient, is used* with the appropriate takeoff or landing chart to determine the maximum permissible gross weight. It should be noted that a reverse of this procedure will furnish information on the actual runway required if the zero wind runway required is known for a given gross weight.

[(f) By projecting a line horizontally from point A to point D, the crosswind component can be determined.

[Example 2

[Operating conditions for takeoff:

Aircraft=DC–3 SIC3G

Airport=Elevation=4,000 feet

Effective runway length=3,500 feet (paved)

Runway gradient=+1.5%

[The equivalent runway length due to gradient is obtained from figure 11 in the following manner:

[(a) Follow 35-foot line on runway length scale to +1.5% gradient, point A.

[(b) Proceed parallel to gradient guide lines to zero gradient, point B.

[(c) Proceed horizontally to runway length scale, point C, and read zero gradient runway length of 3,585 feet. (Note: The reasons for the equivalent runway length with an uphill gradient being longer than the effective runway length are:

[(1) Section 40.91 defines the *taffeoff* distance as the accelerate-stop distance, and;

[(2) The stopping distance from 1.05 V_{mc}, for a DC–3 is greater than the distance to accelerate to 1.05 V_{mc}, except at the higher altitudes.)

[It will be noted that a runway length of 3,585 feet at an elevation of 4,000 feet, is outside the guide lines plotted on figure 3. However, a value of approximately 21,000 lbs. is determined by extrapolation.

[In order to permit takeoff from the runway under consideration, at the maximum allowable weight of 25,346 lbs. (with de-icer equipment), it is noted that a zero gradient runway length of 3980 feet is required.

[To determine the headwind component which will produce this equivalent runway length, refer to figure 8. Enter the chart with 3,585 feet at the effective runway length scale. Proceed horizontally to the zero wind runway length required, 3,980 feet. Then proceed vertically and read a wind value of 10 mph. However, since figure 8 is based on TAS, it is necessary to correct the length of 3,980 feet by a correction factor obtained from figure 9. Enter figure 9 with 98 mph TAS (obtained from figure 10 for TIAS of 92 at 4,000 feet), and 10 mph headwind component. The correction factor is found to be 1.006. This results in a corrected length of 4,004 feet or 4 feet more. In this case, the correction appears negligible. By observation of figure 9, it will

be seen that corrections for airspeed above 92.4 TAS, with headwind components, may be disregarded since the results will be conservative, and for airspeed less than 92.4 TAS, tailwind components, will produce conservative results.

[Example 3

[Operations conditions for takeoff:
Aircraft=DC-3
Airport=Elevation=4,000 feet
Effective runway length=4,000 feet (paved)
Runway gradient=−1.0%

[Proceed as in Example 2 subparagraps (a), (b) and (c) to appropriate points in (d), (e), and (f), shown on figure 11, and note that zero gradient runway length is 3,925 feet.

[Figure 3 indicates this distance will permit takeoff at approximately 24,800 lbs.

[Figure 8 indicates that a one mph headwind component will produce the equivalent runway length of 3,980 feet necessary to permit takeoff at 25,346 lbs.

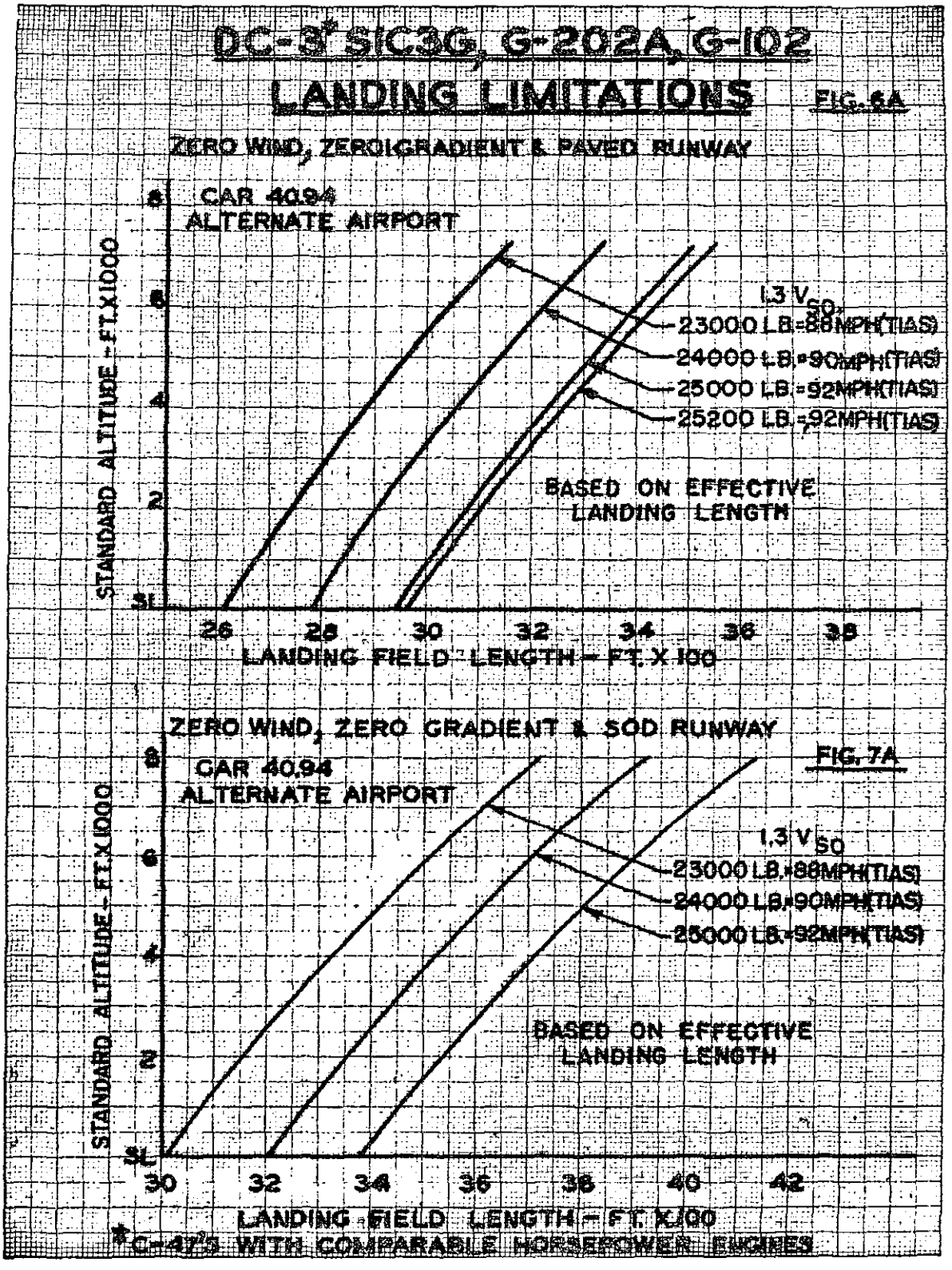
[The correction factor from figure 9, of 1.008 for a one m.p.h. headwind component and TAS of 98 m.p.h. results in a runway length correction of +3 feet. This can be disregarded since it is within the accuracy limits of the charts.

[Example 4

[Operating conditions for landing:
Aircraft=DC-3 S1C3G
Airport=Elevation=4,000 feet
Effective runway length=3,300 feet (paved)

[(Note: Section 40.93 does not require consideration of gradient in detailing the landing limitations.)

[Referring to figure 6, we find that a 3,300-foot paved runway at an elevation of 4,000 feet. permits a landing gross weight of 22,600 lbs, in a zero wind condition. If a 25 m. p. h. headwind component is forecast, we find by reference to figure 8 that the zero wind runway length becomes 4,300 feet. In this example, the distance of 4,300 feet is predicated on 1.3 V_{s_0}=92 m.p.h. Therefore, by reference, figure 10, 1.3 V_{s_0} is found to be 98 m.p.h. at 4,000 feet and by reference to figure 9, it is found that the correction factor is 1.018, resulting in a zero wind runway length of 4,300×1.018=4,377 feet. Figure 6 indicates that this zero wind runway length will permit landing at the maximum gross weight.]



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Figures 6A and 7A

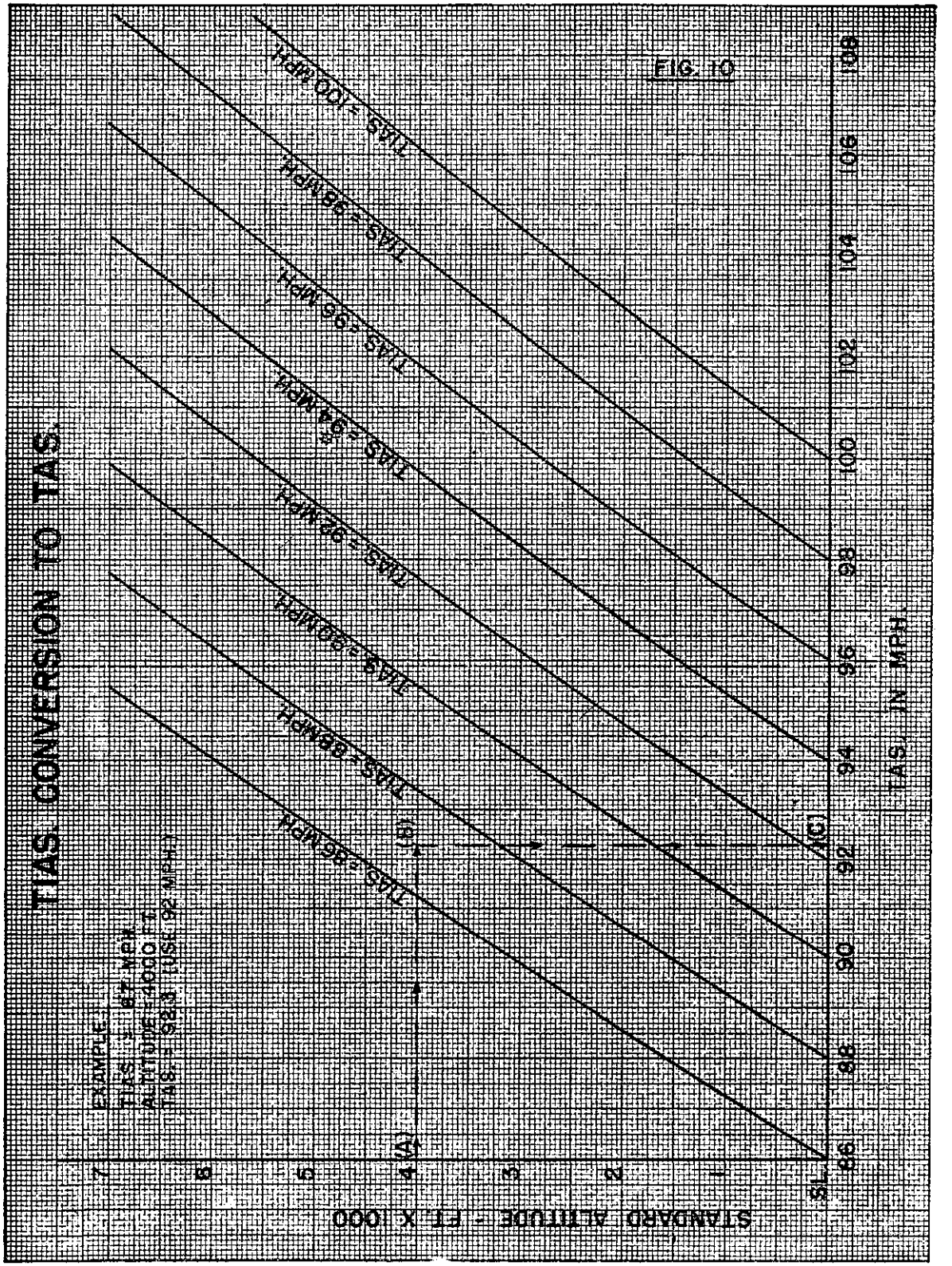
TIAS. CONVERSION TO TAS.
FIG. 10
TIAS = 100 MPH
TIAS = 98 MPH
TIAS = 96 MPH
TIAS = 94 MPH
TIAS = 92 MPH
TIAS = 90 MPH
TIAS = 88 MPH
TIAS = 86 MPH
EXAMPLE:
TIAS = 87 MPH
ALTITUDE = 4000 FT.
TAS = 92.3 (USE 92 MPH)
(A)
(B)
(C)
SL
1
2
3
4
5
6
7
86
88
90
92
94
96
98
100
102
104
106
108
TAS. IN MPH.
STANDARD ALTITUDE - FT. X 1000

Figure 10

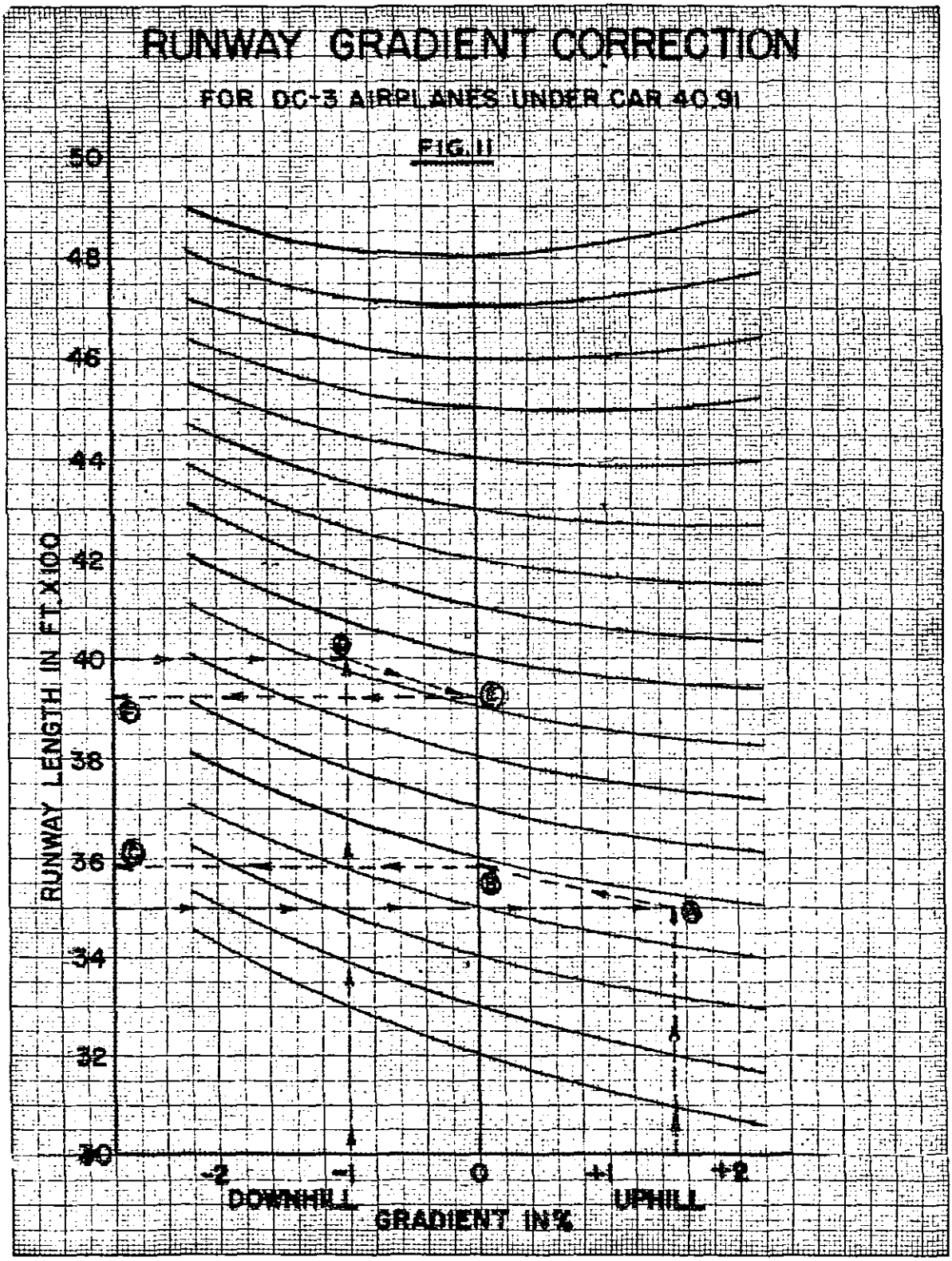

Figure 11 (Rev. 11/15/54)