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CIVIL AERONAUTICS MANUAL 41

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. 1 — November 15, 1954

SUBJECT: Revisions to Civil Aeronautics Manual 41 dated April 1954.

This supplement is issued to provide subscribers of CAM 41 with recent CAR amendments and new or revised CAM material with respect to the form of application, amendment, and contents of Operations Specifications, Aircraft Maintenance and Aircraft Weight and Balance Control similar to that issued under Part 40.

Remove and destroy the following pages:	Insert in lieu thereof the following pages (Rev. 11/54):
iii through vi	iii through vi
11 and 12	11 through 12–4
21 through 28	21 through 28–5
47 and 48	47 through 48

Ink revisions: The following ink revisions should be made to CAM 41:

Page 6 and 7, section 41.1–2 (b)—the words "and deletion or addition of aircraft" should be deleted.

Page 15, section 41.23–1 (a) and (b)—footnote 3 should be renumbered 5.

Page 33, section 41.53–6 (e) through (p)—footnote 6 should be renumbered 9.

NOTE: New or revised material is indicated by brackets [ ].

Attachments

Introductory Note

Civil Aeronautics Manual 41 contains in a consolidated form (1) the certification and operation rules for scheduled air carrier operations outside the continental limits of the United States adopted by the Civil Aeronautics Board and (2) the rules, policies, and interpretations issued by the Administrator in application to the various sections of the regulations.

CAA *rules* are supplementary regulations issued pursuant to authority expressly conferred on the Administrator in the Civil Air Regulations. Such rules are mandatory and must be complied with.

CAA *policies* provide detailed technical information on recommended methods of complying with the Civil Air Regulations. Such policies are for the guidance of the public and are not mandatory in nature.

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.

The manual is arranged to show the number of each section of the regulations followed by the title of the particular section in italic letters. Any rules, policies, or interpretations follow the pertinent section of the regulations and are identified by consecutive dash numbers appended to the regulation section number with the title in bold type letters.

This manual includes and supersedes supplements number 1 through number 15 issued on or prior to October 28, 1952. Moreover, the contents of this manual supersede any contradictory material found in any Aviation Safety Release or like publication outstanding on the issuance date of this manual.

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case of an ILS procedure, in the approach area between the outer marker and the end of the runway, or in the case of a GCA procedure, in the approach area within a distance of 5 miles, outward from the end of the runway:

(*1*) Extend a line horizontally outward from the top of each obstruction and parallel with the runway center line to a point of intersection with the established slope line, and from that point extend a line vertically to a point of intersection with the glide path. The point of intersection at the highest level of the glide path as established by the foregoing formula will determine the minimum ceiling that may be considered.

(*2*) Where minimum obstruction clearances cannot be met in the transitional and horizontal surfaces immediately adjacent to the approach area and when deemed necessary, consideration will be given to an adjustment in the ceiling minimums commensurate with the degree of interference presented by the particular obstruction or obstructions.

(*3*) When application of the formula set forth in the preceding subparagraphs to an obstruction projecting above the established slope surface indicates a ceiling of less than 300 feet, the ceiling will not be reduced below 300 feet until it has been determined by flight checks that the lower ceiling may be authorized.

(4) *Lowest landing minimums utilizing back course of the ILS.* Straight-in approach minimums of 300–1 or 400–¾ may be approved on the back course of the ILS provided (i) the criteria outlined in section 609.10 of chapter II (i. e., Regulations of the Administrator) of this title is complied with, (ii) the approach is monitored by surveillance radar, (iii) high-intensity runway lights or approach lights are in operation on the runway to which the approach is being conducted, (iv) the obstruction clearance criteria is complied with as outlined in section 609.10, and (v) the establishment of such a procedure will not adversely affect traffic at the airport concerned.

(5) *PPI approach.* Minimums for a PPI approach will be established in the same manner as outlined in subparagraphs (1) (i) and (ii) of this paragraph for a regular or circling approach.

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(6) *Airports not served by a radio navigational or let-down facility.*

(i) *Takeoff minimums.* Takeoff minimums for both 2- and 4-engine aircraft may be approved as low as 300–1 if, after a consideration of all obstructions in the immediate vicinity of the end of the runway used, and of the facilities and procedures used to avoid all obstacles in the takeoff area, it is determined that a safe climb to the minimum enroute altitude can be made.

(ii) *Landing minimums.* Landing minimums as low as 1,000–1 may be approved for airports located outside of control zones; and as low as 1,000–3 for airports located in control zones if, after consideration of the terrain in the vicinity of the airport and the traffic density in that area, the Administrator deems that operations at these minimums assure an adequate level of safety.

(7) *Application of obstruction clearance criteria in determining landing ceiling minimums.* Unless safety requires otherwise, landing ceiling minimums for approaches using a radio range or comparable facility will be shown on the operations specifications—airport 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 subparagraph (1) (i). If, on the other hand, such obstruction were 250 feet high, minimums of 600 feet will normally apply. In cases where the ILS obstruction clearance criteria cannot be met, the ceiling arrived at by application of the formula contained in subparagraph (3) (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.

[41.1–5 *Form of application for issuance of initial or revised Operations Specifications, Aircraft Maintenance (CAA rules which apply to sec. 41.1).* Applications by the air carrier for new or amended Operations Specifications, Aircraft Maintenance, shall be made on Operations Specifications Form ACA–1014 or equivalent.

[Those pages of the Operations Specifications, Aircraft Maintenance, which contain the list of aircraft components, inspections, checks

and overhauls, and time limitations therefor, shall be prepared by the air carrier on a Form ACA–1014 or equivalent. Such pages shall be prepared to permit insertion in a suitable loose-leaf binder. Each page shall be consecutively numbered and identified as an Operations Specifications, Aircraft Maintenance.

[The air carrier shall list the aircraft components and the overhauls, inspections, checks, and time limitations therefor either on separate pages in the Operations Specifications, Aircraft Maintenance, or together on the same pages. If listed separately, the overhauls, inspections, and checks shall be appropriately and thoroughly identified, by number and/or nomenclature, to include any applicable abbreviations. The list of individual aircraft components shall show proper reference to the overhauls, inspections or checks by means of the applicable number, nomenclature or abbreviation thereof. When so listed, it shall mean that such components are overhauled, inspected or checked at the times identified in the Operations Specifications.

[Four copies of the application [3] and attachments shall be submitted to the assigned agents, the first copy of the application bearing the signature of a duly authorized representative of the air carrier. Approval or disapproval shall be indicated on the first and second copies of the application and attachments which will be returned to the air carrier. The air carrier shall, in turn, indicate receipt in the space provided on the second copy and return it to the assigned agent.

[41.1–6 *Form of application for issuance of initial or revised Operations Specifications, Aircraft Weight and Balance Control (CAA rules which apply to sec. 41.1).* Applications by the air carrier for new or amended Operations Specifications, Aircraft Weight and Balance Control,[4] shall be made on Operations Specifications Form ACA–1014 or equivalent.

[Four copies of the application shall be submitted, the first copy of the application bearing the signature of a duly authorized representative of the air carrier. Approval or disapproval of the carrier's application shall be indicated on the first and second copies of the application which will be returned to the air carrier. The air carrier shall, in turn, indicate receipt in space provided on the second copy and return it to the assigned agent.

[41.1–7 *Policies, procedures, and limitations governing issuance and amendment of Operations Specifications, Aircraft Maintenance (CAA policies which apply to Sec. 41.1).*

[(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 neces-

[3] Application for initial time limitations applicable to new aircraft, engines, propellers or appliances, not previously used in air carrier service may require Washington concurrence prior to final issuance by the CAA regional office and therefore, should be submitted as soon as possible, but not later than 15 days prior to the date that the aircraft or component is to be placed into service.]

[4] The Operations Specifications, Aircraft Weight and Balance Control, may combine weight control procedures common to more than one aircraft or they may separate weight and balance procedures specifically adapted to a particular aircraft type and model.]

sarily 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 1000 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 1000-hour or higher overhaul period. However, the Operations Specifications will require that the basic 1000-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) *Powerplants 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 1000-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 component 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 of known or evident trends toward malfunctioning. When electrical/electronic appliances are overhauled on an on-condition basis, special consideration will be given to the continued airworthiness of mechanical components of such equipment.

[(4) *Emergency equipment.* The inspection periods for first aid kits, flotation equipment, and other emergency equipment will assure the continued serviceability and immediate readiness of such equipment for its intended emergency purposes. Major inspection periods will be established for the purpose of determining that all components of the emergency equipment are complete and airworthy and may be expected to remain in this condition until the next major inspection or actual use under emergency conditions. Routine inspection periods will be established to assure that such equipment (or any component thereof) is installed or stored properly, has not been tampered with, damaged, or had articles removed since the last inspection. All inspection periods will be adjusted in accordance with service experience and pertinent operating conditions.

[41.1-8 *Content of Operations Specifications, Aircraft Maintenance (CAA policies which apply to sec. 41.1).* The Administrator will issue Operations Specifications, Aircraft Maintenance, which have the following minimum contents:

[(a) The Operations Specifications, Aircraft Maintenance, will contain a listing of the components of airframes, engines, propellers, and appliances, and the time limitations for checks, inspections and overhauls applicable to each listed component. The list of components will be complete and inclusive except that subcomponents which are subject to check, inspection, and overhaul at the same time limitations as the components to which they are related may be omitted from the listing (e. g., that form commonly called the "short form"). When this is done, the Operations Specifications will bear a statement to the effect that

parts and subcomponents not listed will be checked, inspected, and overhauled at the same time limitations specified for the component or assembly to which such components are related.

[When coded identifications or titles, such as "operation #1, #2, #3, etc." or "line check, intermediate check, base inspection, etc.," are used in connection with specified time limitations in the Operations Specifications, a brief description of such terms will be included which identifies the operation concerned.

[(b) If the carrier proposes Operations Specifications, Aircraft Maintenance, which would permit for all or any part of an aircraft a block overhaul system, a sampling inspection and overhaul system, or any other maintenance system which either (1) does not prescribe a fixed period for overhaul, inspection, or check of each component of an aircraft, or (2) includes alternative standards and procedures under which the air carrier may be given authority to establish and adjust such time limitations, the air carrier will fully define and describe the manner in which such a special maintenance program will be performed.

[(c) Operations Specifications identified as Operations Specifications, Aircraft Maintenance—General, will contain conditions uniformly applicable to all Operations Specifications, Aircraft Maintenance.

[41.1–9 *Content of Operations Specifications, Aircraft Weight and Balance Control (CAA policies which apply to sec. 41.1).* The Operations Specifications, Aircraft Weight and Balance Control, as submitted by an air carrier, will contain an accurate description of the procedures used to maintain control of weight and balance of all aircraft operated under the terms of the operating certificates which will insure that the aircraft, under all operating conditions, is loaded within the gross weight and center of gravity limitations. This description should include procedures used for determining weight of passengers, weight of baggage, periodic aircraft weighing, type of loading devices, and identification of aircraft concerned.]

"41.2 *Compliance.* All operations shall be conducted in accordance with the specifications of the air carrier operating certificate and the rules contained in this part.

"41.3 *Duration.* An air carrier operating certificate will continue in effect until canceled, suspended, or revoked, after which it shall be surrendered to any officer or employee of the Administrator upon request.

"41.4 *Display.* The air carrier operating certificate shall be available at the appropriate operations office for inspection by any authorized representative of the Administrator or Board.

"41.5 *Inspection.* An authorized representative of the Administrator shall be permitted at any time and place to make inspections or examinations to determine the operator's compliance with the appropriate requirements of the regulations in this subchapter (i. e., the Civil Air Regulations) and the Civil Aeronautics Act of 1938, as amended."

Passenger Operation Rules

Route Requirements

"41.10 *Airport spacing.* In the case of operations employing aircraft having 2 engines, airports adequate for the aircraft used shall be located so that the aircraft, when flying along the route, will at no time be at a greater distance therefrom than 45 minutes flying at normal cruising speed, except where the Administrator finds that because of the character of the terrain, the type of operation, and the performance of aircraft used adequate safety will be provided with airports spaced at greater distances.

"41.11 *Communications facilities.* A two-way ground-to-aircraft radio communications system shall be available at such points as are necessary to insure adequate communication between plane and ground over the entire route.

"41.12 *Weather reporting services.* Weather reporting services shall be available at such points along the route as are necessary to insure sufficient weather reports prepared from observations made and released by a source acceptable to the Administrator.

"41.13 *Navigational facilities.*

"(a) *Short distance operation.* Except in the case of a day contact operation where

the characteristics of the terrain are such that navigation can be accomplished by reference to landmarks, each route shall be equipped with radio navigational facilities so located as to permit navigation by such facilities over the entire route. For instrument operation a facility shall be so located with respect to each scheduled stop and required alternate airport as to provide adequate means for making an instrument approach. In day instrument operation such a facility is not required at an alternate used only when the weather conditions are as good as or better than: broken clouds, ceiling 1,000 feet, visibility 2 miles, with conditions stable or improving.

"(b) *Long distance operation.* Each route shall be equipped with radio navigational facilities so located as to permit the obtaining of reliable radio bearings when within 200 miles of any regular or approved alternate airport and a facility shall be so located with respect to each such airport as to provide adequate means for making an instrument approach: *Provided,* That the Administrator, at particular airports, may approve facilities which provide less coverage than that required in this section if he finds that adequate safety is provided."

41.13–1 *Day over-the-top short distance operation (CAA policies which apply to sec. 41.13 (a)).*

(a) *General.* The following policies will be applied by the Civil Aeronautics Administration in authorizing day over-the-top short distance operations by scheduled United States flag air carriers in certain localities outside the continental limits of the United States where the characteristics of the terrain are such that navigation during such operations can be accomplished by reference to landmarks.

(b) *Areas of application.* In certain localities beyond the continental limits of the United States, en route operations are restricted to day flight, providing 3-mile visibility or better exists, because of the characteristics of the terrain, the operating limits of the aircraft being used, or the en route navigational facilities. On some of the routes so restricted, the terminals and/or intermediate stops are equipped with adequate instrument approach facilities, and instrument

additional hand fire extinguishers as the Administrator finds necessary for compliance with section 41.20 (f) (2).

"(f) One landing gear position indicator or equivalent facility, if equipment includes a retractable landing gear,

"(g) One or more storage batteries or other source of electrical supply sufficient to operate all radio and electrical equipment necessary for the flight,

"(h) (1) Two of the following three units of radio equipment:

"(i) One transmitter for two-way communication,

"(ii) One receiver for two-way communication,

"(iii) One receiver capable of receiving navigational signals.

"(2) In addition to the instruments named in subparagraph (1) of this paragraph, one of the radio navigational systems required by section 41.21 (b), if navigational facilities on the route are required by section 41.13,

"(i) All radio equipment required by these regulations (night and instrument operation),

"(j) *Forward position and tail lights,* 2 landing lights, 1 set of instrument lights, and 2 landing flares each rated for at least 3-minute duration (night operation),

"(k) Fuel quantity indicators indicating the amount of fuel in each tank to be used for the remainder of the flight or, in the case of aircraft having a third flight crew member assigned as a member of the operating crew, an alternate means approved by the Administrator for determining the amount of fuel in each tank, [(night and instrument operation),]

"(l) An electrically heated pitot tube serving each pilot's air-speed indicator (night and instrument operation),

"(m) One gyro rate-of-turn indicator combined with a bank indicator, one artificial horizon indicator, and one gyro direction indicator (night and instrument operation),

"(n) One outside air temperature gauge with indicating dial in the pilot compartment and one carburetor air temperature indicator or equivalent approved device (night and instrument operation),

"(o) If vacuum system is used, one vacuum gauge with warning indicator on the instrument panel installed in lines leading to the rate-of-turn and artificial horizon indicators and the gyro direction indicator (night and instrument operation),

"(p) One clock with sweep second hand (night and instrument operation),

"(q) Three spare fuses of each capacity, or 25 percent of the number of each capacity, whichever is the greater.

[*"(r) After May 31, 1956, an approved anti-collision light for aircraft having a maximum certificated weight of more than 12,500 pounds; except that in the event of failure of such light, the aircraft may continue flight to the next stop where repairs or replacements can be made. (Night.)*

[*"(s) 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 responsible to the propeller blade angle."*]

Limitations

"41.26 *Aircraft certification limitations.*

"(a) Aircraft certificated as a basic type after June 30, 1942, shall be certificated in accordance with part 4b of this subchapter (i. e. the Civil Air Regulations), or the transport category requirements of part 4a of this subchapter (i. e. the Civil Air Regulations), and shall meet the requirements of section 41.27 over each route to be flown.

"(b) Aircraft certificated as a basic type prior to June 30, 1942, shall either:

"(1) Retain their present airworthiness certification status and meet the requirements of 41.36 except that until July 1, 1954, these aircraft may be operated in accordance with such operating limitations as the Administrator finds will provide a safe relation

between the performance of the aircraft and the dimensions of airports and terrain; or

"(2) Qualify by showing compliance with either the performance requirements contained in section 4a.737–T through 4a.750–T, or the requirements contained in Part 4b of this subchapter (i. e. the Civil Air Regulations), and when so qualified shall meet the requirements of section 41.27 over each route to be flown: *Provided,* That should any type be so qualified all aircraft of any one operator of the same or related types shall be similarly qualified and operated.

"41.27 *Operating limitations upon airplanes certificated under transport category requirements.* When operating any airplane certificated in accordance with the provisions of Part 4b of this subchapter (i. e. the Civil Air Regulations), or of sections 4a.737–T through 4a.750–T of this subchapter (i. e. the Civil Air Regulations), the provisions of sections 41.28–41.35 shall apply unless deviations therefrom are specifically authorized by the Administrator when he finds that, due to a peculiarity of a specific case, such application is unnecessary for safety.

"In determining compliance with these provisions the data obtained in testing the airplane for type certification may be applied, by interpolation or by computation of the effects of changes in specific variables, to conditions differing from those for which specific tests were made, where such interpolations or computations will give results substantially equalling in accuracy the results of a direct test.

"41.28 *General limitations.*

"(a) Airplanes shall be operated only from airports at altitudes within the altitude range for which maximum takeoff weights have been determined and set forth in the airplane operating manual and shall be dispatched only to airports of intended destination, or to airports specified as alternates, which are at altitudes within the range for which maximum landing weights have been determined and set forth in the airplane operating manual.

"(b) The weight of an airplane at takeoff shall not exceed the certificated maximum takeoff weight for the altitude of the airport from which the takeoff is made.

"(c) The weight at takeoff shall be such that, allowing for the consumption of the amount of fuel and oil which would normally be consumed in flight to the intended destination, the weight on arrival at the destination will not exceed the certificated maximum landing weight for the altitude of the airport of intended destination.

"(d) No airplane shall be taken off at a weight which exceeds the allowable weight for the runway being used as determined in accordance with the takeoff runway limitations of the transport category operating rules, after taking into account the temperature operating correction factors required by sections 4a.749a–T or 4b.117 of this subchapter (i. e. the Civil Air Regulations), and set forth in the Airplane Flight Manual for the airplane.

"41.29 *Takeoff limitations to provide for engine failure.* Takeoff shall be made only from such airports, in such directions, and under such weight limitations that the following conditions are fulfilled as shown by the performance data determined under section 4a.747–T or section 4b.91 of this subchapter (i. e. the Civil Air Regulations) and set forth in the airplane operating manual:

"(a) From any point on the takeoff up to the time of attaining the critical-engine-failure speed set forth in the airplane operating manual it shall be possible to bring the airplane to a safe stop within the landing area, as shown by the accelerate-and-stop distance data.

"(b) If the critical engine should fail at any instant after the airplane attains the critical-engine-failure speed, it shall be possible to proceed with the takeoff and attain a height of 50 feet, as indicated by the takeoff path data, before passing over the end of the takeoff area. Thereafter it must be possible to clear all obstacles either by at least 50 feet vertically, as shown by the takeoff path data, or by at least 200 feet horizontally within the airport boundaries and 300 feet horizontally after passing beyond such boundaries.

"In determining the allowable deviation of

the flight path in order to avoid obstacles, it is assumed that the airplane is not banked before reaching a height of 50 feet, as shown by the takeoff path data, and that the maximum bank thereafter does not exceed 15°.

"(c) In applying the requirements of paragraphs (a) and (b) of this section, corrections shall be made for any gradient of the takeoff surface. To allow for wind effect, takeoff data based on still air may be corrected by not more than 50 percent of the reported wind component along the takeoff path if opposite to the direction of takeoff, and shall be corrected by not less than 150 percent of the reported wind component if in the direction of takeoff.

"NOTE: All references in this section to sections of Part 4b of this subchapter (i. e. the Civil Air Regulations) are those sections in effect on October 1, 1949.

"41.30 *En route limitations.*

"(a) *All airplanes; all engines operating.* Airplanes shall be dispatched only at such takeoff weights that, in proceeding along the intended track with the weight of the airplane progressively reduced by the anticipated consumption of fuel and oil, the rate of climb with all engines operating (as set forth in the airplane operating manual), shall be, in feet per minute, 6 V_{s_0} at an altitude at least 1,000 feet above the elevation of the highest ground or obstruction within 10 miles of either side of the intended track; except that this requirement need not apply to airplanes certificated under the performance requirements of the regulations issued prior to November 9, 1945 (Part 4a of this subchapter (i. e. the Civil Air Regulations)).

"(b) *All airplanes; one engine inoperative.* Airplanes shall be dispatched only at such takeoff weights that, in proceeding along the intended track with the weight of the airplane progressively reduced by the anticipated consumption of fuel and oil, the rate of climb with 1 engine inoperative (as set forth in the Airplane Flight Manual) shall be, in feet per minute

$$\left(0.06-\frac{0.08}{N}\right)V_{s_0}^2,$$

where N is the number of engines installed and V_{s_0} is expressed in miles per hour, at an altitude at least 1,000 feet above the elevation of the highest ground or obstruction within 10 miles of either side of the intended track; except that for airplanes certificated under the performance requirements of Part 4a of this subchapter (i. e. the Civil Air Regulations) the above rate-of-climb value shall be 0.22 $V_{s_0}^2$ irrespective of the number of engines installed.

"(c) *Airplanes with four or more engines; two engines inoperative.* The provisions of this paragraph 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 subparagraph (1) or subparagraph (2) of this paragraph.

"(1) 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 41.34, assuming all engines to be operating at cruising power.

"(2) 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 $V_{s_0}^2$ ($V_{s_0}^2$ 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:

"(i) 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.

"(ii) 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.

"(iii) 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 41.34 and to arrive there at an altitude of at least 1,000 feet directly over the landing area.

"(d) *Special air navigation facilities.* Where special air navigation facilities provide for reliable and accurate identification of high ground or obstruction extending for less than 20 miles along the track, the lateral distance of 10 miles specified in section 41.30 (a), (b), (c) may be reduced to 5 miles.

"41.33 *Landing distance limitations.*

"(a) An airplane shall be dispatched only under such conditions that it would be possible, as shown by the still-air landing data obtained in section 4b.122 of this subchapter (i. e. the Civil Air Regulations), or section 4a.750–T of this subchapter (i. e. the Civil Air Regulations) and set forth in the airplane operating manual, at a weight corresponding to the maximum weight expected to exist at the time of arrival at the airport of intended destination, and under standard air conditions for the altitude of such airport, to bring the airplane to rest from a point 50 feet directly above the intersection of the obstruction clearance line (as defined in section 41.35) and the landing surface, within a total distance not in excess of 60 percent of the effective length of the landing area (as defined in section 41.35) most suitable for landing in still air.

"(b) For every probable condition of wind velocity and direction and the corresponding landing direction at the airport of intended destination required either by the ground handling characteristics of the airplane type involved or by other conditions (e. g., landing aids, terrain, etc.) the ratio of landing distance to effective length of landing area shall not be greater than that as specified in paragraph (a) of this section, after allowing for the effect on 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 requirement of paragraph (a) of this section can be met, but the requirement of paragraph (b) of this section cannot be fully met, at an airport of intended destination, a flight to such airport may be dispatched if at least one approved alternate airport is designated in the flight plan at which the requirements of paragraphs (a) and (b) of this section, as modified by section 41.34, are met.

"41.34 *Landing distance at alternate fields.* The conditions of section 41.35 will apply with respect to alternate airports specified in the flight plan, except that in the case of alternate airports the landing distance as defined in that section shall not exceed 70 percent of the effective length of the landing area.

"41.35 *Definition of effective length of landing area.* The effective length of the landing area is the distance from the point where the obstruction clearance line, as defined below, intersects the landing surface to the far end of the landing area.

"The obstruction clearance line is a line drawn tangent to or clearing all obstructions showing in a profile of the approach area as defined below. The obstruction clearance line is further limited by having a slope to the horizontal of 1:20 as it approaches the landing area.

"The approach area, as used in this section, shall be an area symmetrical about a centerline coinciding with and prolonging the centerline of the runway, except that where there is a multiplicity of parallel runways or

a large area continuously available for landing, the centerline of the approach area shall coincide with the most probable landing path for instrument approaches. The approach area shall be considered as extending longitudinally from the landing area out to the most remote obstacle touched by the obstruction clearance line, assuming the centerline of the approach area in plan view to be straight for at least 1,500 feet from the intersection of the obstruction clearance line with the landing surface and thereafter continuing in a path consistent with the instrument approach procedures for the runway in question, or, where such procedures are not specified, consistent with turns of at least 4,000 feet in radius; and as extending laterally to a distance of 200 feet on either side of its centerline at the point of intersection of the obstruction clearance line with the landing surface, with this distance increasing uniformly to 500 feet on either side of the centerline of the area at a longitudinal distance of 1,500 feet from the intersection of the obstruction clearance line with the landing surface, and maintaining a distance of 500 feet from the centerline thereafter.

"41.36 *Nontransport category airplane operating limitations.* In operating any nontransport category airplane in passenger service on or after July 1, 1954, the provisions of sections 41.36a through 41.36d 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 sections 41.36a through 41.36d 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 41.36a through 41.36d.

"41.36a *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 one-half percent. The average runway gradient is the difference between the 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.

"41.36b *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,

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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.

"41.36c *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.

"41.36d *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 41.36c: *Provided,* That the airplane can be brought to rest within 70 percent of the effective length of the runway."

Maintenance

"41.38 *Maintenance organization.* The air carrier is responsible for the continuous airworthiness of all aircraft, engines, propellers, and appliances. Unless maintenance is performed by another agency under a contract approved by the Administrator, it is responsible for maintaining adequate maintenance facilities, the adequacy and competence of maintenance personnel, and for the preparation of such maintenance reports as are required by the Administrator.

"41.39 *Alterations and repairs.* Aircraft, engines, propellers, and appliances must be altered or repaired only in conformity with the procedures and, insofar as they apply, the methods provided for in Part 18 of this subchapter (i. e., the Civil Air Regulations). Reports of such alterations or repairs must be submitted promptly to the Administrator.

"41.40 *Inspection.* The air carrier shall maintain an inspection organization which is responsible for determining that all maintenance conforms to at least the minimum standards prescribed by the Administrator as to workmanship, methods employed, and materials used. Each inspector must hold a valid mechanic certificate and rating for the type of inspection involved.

"41.41 *Maintenance manual.* The air carrier shall prepare and maintain a manual for the use and guidance of maintenance personnel which contains full information per-

taining to the repair and service of flight equipment and clearly outlines the responsibilities of maintenance personnel. It must be in a form approved by the Administrator and copies furnished to all persons designated by the Administrator or Board. All copies in the hands of designated company personnel must be kept up to date.

"(a) *Changes.* The extension of any overhaul, check, or inspection period must have the written approval of the Administrator. Other changes in the maintenance manual may be made without the prior approval of the Administrator, if such changes are not inconsistent with any Federal regulation, the air carrier operating certificate, or safe maintenance practice."

[41.41–1 *Contents of manual—methods and procedures for maintaining weight and balance control (CAA policies which apply to sec. 41.41).*

[(a) *General.* The air carrier may utilize any loading schedule, procedure, or means by which the air carrier can show that the aircraft is properly loaded and will not exceed authorized weight and balance limitations during operation.

[By whatever method used, the air carrier should account for all probable loading conditions which may be experienced in service and show that the loading schedule will provide satisfactory loading. Loading schedules may be applied to individual aircraft or to a complete fleet. Unless otherwise authorized, a copy of pertinent loading data should be carried in each aircraft. When an air carrier operates several types or models of aircraft, the loading schedule, which may be index type, tabular type or a mechanical computer, will be identified with the type or model of aircraft for which it is designed.

[(b) *Loading provisions.* All seats, compartments, and other loading stations will be properly marked, and the identification used will correspond with the instructions established for computing the weight and balance of the aircraft. When the loading schedule provides blocking off of seats or compartments in order to remain within the center of gravity limits, effective means will be provided to assure that such seats or compartments are not occupied during operations specified. Cargo compartments will be placarded showing the maximum weight of each compartment, and such placards will be readily legible to the loading personnel. Instructions will be prepared for crew members, cargo handlers, and other personnel concerned, giving complete information necessary regarding distribution of passengers, cargo, fuel, and other items. Information relative to maximum capacities and other pertinent limitations affecting the weight or balance of the aircraft will be included in these instructions. When it is possible by adverse distribution of passengers to exceed the approved C. G. limits of the aircraft, special instructions will be issued to the appropriate crew members so that the load distribution can be maintained within the approved limitations.

[(c) *Terms, descriptions, and general standards.* For the purpose of weight and balance control, the following terms, descriptions, and general standards will apply. Deviations from these standards by the individual operator due to the nature of his operation will be acceptable.

[(1) *Empty weight.* The empty weight of an aircraft is considered to be the maximum gross weight less the following:

[(i) All fuel and oil, excepting system fuel and oil.[6]

[(ii) Drainable anti-detonant injector and de-icing fluids.

[(iii) Crew and baggage.

[(iv) Passengers and cargo (revenue and non-revenue).

[(v) Removable passenger service equipment, food, magazines, etc., including drainable washing and drinking water.

[(vi) Emergency equipment (overwater, tropical, frigid).

[(vii) Other equipment, variable for flights.

[(viii) Flight spares (spark plugs, wheel, cylinder, etc.).

[(2) *Operating weight.* The basic operating weight established by the air carrier for a particular model aircraft will include the following standard items of the operator in addi-

[6 System fuel and oil is that amount required to fill both systems and the tanks, where applicable, up to the tank outlets to the engines. When oil is used for propeller feathering, such oil is included as system oil.]

tion to the empty weight of the aircraft unless otherwise specified:

(i) Normal oil quantity.

(ii) Anti-detonant injector and deicing (winter) fluids.

(iii) Crew and baggage.

(iv) Passenger service equipment, including washing and drinking water, magazines, etc.

(v) Emergency equipment, if required for all flights.

(vi) All other items of equipment considered standard by the air carrier concerned.

(3) *Aircraft, zero fuel weight.* The zero fuel weight of an aircraft is the maximum weight authorized for such aircraft without fuel. The weight of fuel carried in the fuselage, or equivalent locations, will be deducted from such maximum. When zero fuel weight limitations or equivalent restrictions are specified, proper provision for loading will be made by the operator so that such structural limitations are not exceeded.

(d) *Aircraft weights.* Aircraft weight and balance control will contain provisions for determining aircraft weights in accordance with the following procedures:

(1) *Individual aircraft weights and changes.* The loading schedule may utilize the individual weight of the aircraft in computing pertinent gross weight and balance. The individual weight and balance of each aircraft will be re-established at the specified reweighing periods. It also will be re-established whenever the accumulated changes to the operating weight exceeds plus or minus one-half of one percent of the maximum landing weight or the cumulative change in c. g. position exceeds one-half of one percent of the MAC.

(2) *Fleet weights, establishment and changes.* For a fleet or group of aircraft, of the same model and configuration, an average operating fleet weight may be utilized if the operating weights and CG positions are within the limits established herein. The fleet weight will be calculated on the following basis:

(i) An operator's empty fleet weight will be determined by weighing aircraft according to the following table: For fleet of 1 to 3, weigh all aircraft; For fleet of 4 to 9, weigh 3 aircraft plus at least 50% of the number over 3; For fleet of over 9, weigh 6 aircraft plus at least 10% of the number over 9.

(ii) In choosing the aircraft to be weighed, the aircraft in the fleet having the highest time since last weighing should be selected. When the average empty weight and c. g. position has been determined for aircraft weighed and the basic operating fleet weight (winter and summer, if applicable) established, necessary data should be computed for aircraft not weighed but which are considered eligible under such fleet weight. If the basic operating weight of any aircraft weighed or the calculated basic operating weight of any of the remaining aircraft in the fleet varies by an amount more than plus or minus one-half of one percent of the maximum landing weight from the established basic operating fleet weight or the c. g. position varies more than plus or minus one-half of one percent of the MAC from the fleet weight c. g., that airplane will be omitted from that group and operated on its actual or calculated operating weight and c. g. position. If it falls within the limits of another fleet or group, it may then become part of that operating fleet weight. In cases where the aircraft is within the operating fleet weight tolerance but the c. g. position varies in excess of the tolerance allowed, the aircraft may still be utilized under the applicable operating fleet weight but with an individual c. g. position.

(iii) Re-establishment of the operator's empty fleet weight or the operating fleet weight and corresponding c. g. positions may be accomplished between weighing periods by calculation based on the current empty weight of the aircraft previously weighed for fleet weight purposes. Weighing for re-establishment of all fleet weights will be conducted on a two-year basis unless shorter periods are desired by the air carrier.

(3) *Establishing initial weight before use in air carrier service.* Prior to being used in air carrier service, each aircraft will be weighed and the empty weight and center of gravity location established. New production transport category aircraft delivered to air carriers normally are weighed at the factory and are eligible for air carrier operations without reweighing if the weight and balance records have been adjusted for alterations or modifica-

tions to the aircraft. Aircraft transferred from one air carrier to another need not be weighed prior to utilization by the latter unless more than twenty-four calendar months have elapsed since last weighing.

[(4) *Periodic weighing—aircraft using individual weights.* Aircraft operated under a loading schedule utilizing individual aircraft weights in computing the gross weight will be weighed at intervals of twenty-four calendar months. An air carrier may, however, apply for extension of this weighing period for a particular model aircraft, when pertinent records and actual routine weighing during the preceding twenty-four months of air carrier operation show that weight and balance records maintained are sufficiently accurate to indicate aircraft weights within the established limitations. Such application should be limited to increases in increments of twelve months and will be substantiated in each instance with at least two aircraft weighings. Increases may not be granted which exceed a time which is equivalent to the aircraft overhaul period.

[(5) *Periodic weighing, aircraft using "fleet weights."* Aircraft operating under fleet weights should be weighed in accordance with procedures outlined for the establishment of fleet weights. Since each fleet weight will be re-established every two years and a specified number of aircraft weighed at such periods, no additional weighing is considered necessary. A rotation program should, however, be incorporated so all aircraft in the fleet will be reweighed periodically.

[(6) *Weighing procedure.* Normal precautions, consistent with good practices in the weighing procedure, such as checking for completeness of the aircraft and equipment, determining that fluids are properly accounted for, and that weighing is accomplished in an enclosed building preventing the effect of the wind, will prevail. Any acceptable scales may be used for weighings provided they are properly calibrated, zeroed and used in accordance with the manufacturer's instructions. Each scale should have been calibrated, either by the manufacturer or by a civil Department of Weights and Measures, within one year prior to weighing any aircraft for this purpose unless the air carrier can show evidence which warrants a longer period between calibrations.

[(e) *Passenger weights.* The air carrier may elect to use either the actual passenger weight or the average passenger weight to compute passenger loads over any route, except in those cases where nonstandard weight passenger groups are carried. Both methods may be used interchangeably provided only one method is used for any flight from originating to terminating point of the particular trip or flight involved, except as indicated in subparagraph (3). Provisions will be incorporated in the load manifest to clearly indicate to personnel concerned whether actual or average passenger weights are to be used in computing the passenger load.

[(1) *Actual passenger weight.* Actual passenger weight may be determined by scale weighing of each passenger prior to boarding the aircraft, and such weight is to include minor articles carried on board by the passenger. If such articles are not weighed, the estimated weight is to be accounted for. The actual passenger weight may also be determined by asking each passenger his weight and adding thereto a pre-determined constant to provide for hand-carried articles and also to cover possible seasonal effect upon passenger weight due to variance in clothing weight. The constant may be approved for an air carrier on the basis of a detailed study conducted by the operator over the particular routes involved and during the extreme seasons when applicable.

[(2) *Average passenger weight.* An average weight of 160 pounds (summer) may be used for each adult passenger during the calendar period of May 1 through October 31.

[An average weight of 165 pounds (winter) may be used for each adult passenger during the calendar period through April 30.

[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 meth-

od 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 c. g. 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 c. g. 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 c. g. position due to landing gear retraction will be investigated and results accounted for.

[(3) *Fuel.* The effect on the c. g. 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 run-up.* 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 run-up 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.]

"41.42 *Training program.* The air carrier must provide for the proper and periodic instruction of all maintenance personnel, particularly in connection with the introduction into service of new or unfamiliar equipment.

"41.43 *Records.* Current records shall be kept of the total time in service, the time

since last overhaul, and the time since last inspection on all aircraft components, engines, propellers, and, where practicable, on instruments, equipment, and accessories, except that in the case of a propeller for which there is no previous operating history, the Administrator may authorize the use of a new record if the hub is rebuilt and is fitted with blades which are free from defects and within the manufacturer's production tolerances. Such rebuilding of the propeller shall be accomplished by the manufacturer or by a certificated repair station having the proper rating. The new record shall be signed by the manufacturer or by the repair agency, giving the date the propeller hub or blade was rebuilt and such other information as the Administrator may require.

"41.44 *Cockpit checklist.*

"(a) The air carrier shall provide for each type aircraft a cockpit checklist, approved by the Administrator, adapted to each operation in which the aircraft is to be utilized. An approved checklist shall be installed in a readily accessible location in the cockpit of each aircraft and shall be appropriately used by the flight crew for each flight.

"(b) The cockpit checklist shall include procedures prior to starting engines, prior to takeoff, prior to landing, and for powerplant emergencies."

41.44–1 *Air carrier cockpit checklist (CAA policies which apply to sec. 41.44).*

(a) *General.* The policies set forth in this section are issued pursuant to section 41.44 (a) so as to provide a guide in the approval of an air carrier cockpit checklist by the Administrator and to assist an air carrier in providing a cockpit checklist which will meet with such approval and will comply with the provisions of section 41.44 (b).

The checklist which follows has been prepared in general terms and is considered a normal checklist for compliance with section 41.44 except that those items not applicable to a particular aircraft may be deleted and the order of arrangement for the individual items may be changed at the discretion of the air carrier. The checklist provided by an air carrier should include all applicable items but should not necessarily be limited thereto.

PRIOR TO STARTING ENGINE

Fuel system:
- Quantity—checked.
- Proper tank selection—checked.
- Mixtures—as required.
- Fuel booster pumps—as required.
- Cross feeds—as required.

Hydraulic system:[7]
- Brakes—set.

Electrical system:
- Battery switch—proper position.

PRIOR TO TAKEOFF

Weight and balance:
- Pilot is aware of weights and takeoff limitations.

Fuel system:[7]
- Quantity—rechecked.
- Proper tank selection—rechecked.
- Mixtures—takeoff position.
- Fuel booster pumps—as required.
- Cross feeds—as required.

Hydraulic system:[7]
- Hydraulic pressures and quantity—checked.
- Brakes—checked.
- Hydraulic selector valves—checked.

Anti-icing and de-icing equipment.[7] Checked and set.

Electrical system:
- Battery switch—proper position.
- Invertors—as required.
- Ignition—checked.
- Generators—checked.
- Radio—checked.

Power plants and propellers:[7]
- Propellers—checked and set in takeoff position.
- All engines—checked for proper functioning and required power.
- Super chargers—checked and set in proper takeoff position.

Heaters. Checked and set.

[7] Items thus marked will be doublechecked such as by challenge and response, or positively checked such as by a mechanical method.

Instruments—Engine:
Oil—quantity, temperature and pressure—normal for takeoff.
Fuel pressure—normal for takeoff.
Carburetor—temperature—normal for takeoff.
Cylinder head—temperature—checked.
Instruments—flight:
Static and vacuum selectors—checked.
Directional gyro—set.
Altimeter—set.
Horizon—uncaged.
Turn and bank—checked.
Clock—set.
Pressurization.[7] Checked.
Flaps:[7]
Wing flaps—takeoff position.
Cowl flaps—takeoff position.
Controls:[7]
Auto pilot—off.
Trim tabs—set for takeoff.
Gust locks—off.
Free and tested for through full limit of travel.

PRIOR TO LANDING

Fuel system:[8]
Proper tank selection—checked.
Mixtures—landing position.
Fuel booster pumps—as required.
Cross feeds—as required.
Weight and balance:
Maximum landing gross weight—checked.
Hydraulic system:[8]
Hydraulic pressure—checked.
Brakes—checked and off.
Hydraulic selector valves—checked.
Anti-icing and de-icing equipment[8]—checked.
Power plants and propellers:
Propellers—as required.
Super chargers—as required.
Manual reverse pitch actuator or indicator[8]—checked.
Heaters[8]—checked.
Instruments:
Static and vacuum selectors—checked.
Altimeter—set.
Directional gyro—set.
Pressurization[8]—checked.
Controls:
Auto pilot—off.
Trim tabs—as desired.
Landing gear:[7]
Down and locked—checked.
Flaps:[8]
Wing flaps—as desired.
Cowl flaps—as desired.

POWERPLANT EMERGENCIES

Fuel system:
Mixtures—idle cutoff on dead engine—required position on all others.
Fuel selector valve—dead engine—off.
Fuel booster pumps—dead engine—off.
Cross feeds—as required.
Throttle—dead engine—closed.
Hydraulic system:
Hydraulic selector valve—set on proper engine.
Hydraulic pressures—checked.
Brakes—checked.
Ignition—off—dead engine.
Generators—off—dead engine.
Power plants and propellers:
Propellers—Low r. p. m. and feathered on dead engine—set as required on all live engines.
Engines—All live engines set for proper functioning and required power.
Superchargers—checked and set in proper position.
Heaters. Checked and set in safe operation position.
Instruments:
Engine—oil temperature and pressure checked.
Engine—fuel supply and pressure checked.
Carburetor—temperature checked.
Cylinder head—temperature checked.
Flight instruments. Checked and reset if necessary.
Pressurization. Checked.

[7] Items thus marked will be doublechecked such as by challenge and response, or positively checked such as by a mechanical method.

[8] Items thus marked should be doublechecked as prescribed in footnote 7; except that when the aircraft requires a flight crew of only two pilots, one pilot should call out the item to be checked, either pilot should perform the operation, and the pilot not performing the operation should make a momentary visual check after the operation is completed.

[“41.45 *Air-speed indicators, limitations, and related information.*

[(a) Air-speed limitations and related information contained in the Airplane Flight Manual and pertinent placards shall be expressed in the same units as used on the air-speed indicator.

[(b) When more than one air-speed indicator is required, all such indicators shall be calibrated to read in the same units.

[(c) When an air-speed indicator is calibrated in statute miles per hour, a readily usable means shall be provided for the flight crew to convert statute miles per hour to knots.

[(d) On and after April 1, 1956, all air-speed indicators shall be calibrated in knots, and all air-speed limitations and related information contained in the Airplane Flight Manual and pertinent placards shall be expressed in knots.”]

Airman Rules

Pilot

“41.48 *Certificate.*

“(a) Any pilot serving as pilot in command shall hold a valid airline transport pilot certificate and a rating for the aircraft in which he is to serve.

“(b) Any pilot serving as second in command in an aircraft requiring two pilots shall hold at least a commercial pilot certificate and instrument rating and must have demonstrated to an air carrier inspector of the Administrator, or to an authorized check pilot of the air carrier, his ability to take off and land aircraft in which he is to serve.

“(c) Any pilot serving as second in command in an aircraft requiring three or more pilots shall meet the requirements of paragraph (a) of this section: *Provided,* That until June 1, 1946, any pilot may serve as

office and submitted, with recommendations regarding approval, to appropriate supervisory personnel of the Civil Aeronautics Administration.

"41.129 *Aircraft proving tests.*

"(a) A new type of air carrier aircraft shall have at least 100 hours of proving tests under the supervision of an authorized representative of the Administrator before authority for carrying passengers is issued. At least 50 hours of such tests shall be flown over authorized routes and shall include at least 10 hours of night operation.

["(b) In a case of major changes on aircraft previously proved, or the use of the same aircraft on a substantially different operation, 50 hours of tests similar to those outlined in the preceding paragraph shall be required, 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.]

"(c) During the tests specified in paragraphs (a) and (b) of this section no person shall be carried other than those essential to the tests. Mail, express, and cargo may be carried at the discretion of the Administrator."

41.129–1 *Aircraft proving tests (CAA rules which apply to sec. 41.129).*

(a) *Purpose.* The purpose of aircraft proving tests is to determine the air carrier's ability to conduct the proposed operation in compliance with applicable provisions of the regulations in this subchapter (i. e. the Civil Air Regulations) and in accordance with the minimum safety requirements of the Civil Aeronautics Administration.

(b) *Application.* At least 30 days prior to the scheduling of aircraft proving tests, officials of the air carrier shall submit to the Civil Aeronautics Administration office handling its operations specifications, a written request for the assignment of Civil Aeronautics Administration personnel to observe the tests. The request must be accompanied by an original application and copies of pertinent proposed amendments to the operations specifications, and must include sufficient data pertaining to the aircraft to satisfy the Administrator that the air carrier is prepared for the aircraft proving tests. This will allow sufficient time for making any necessary additions or corrections, thus preventing delays or misunderstandings.

(c) *Conduct.* After the air carrier has made all the necessary preparations to conduct the aircraft proving tests, duly designated representatives of the Civil Aeronautics Administration will be assigned to observe them. Such portions of the aircraft proving tests as may be conducted under conditions of scheduled operation, shall be undertaken exactly as the operator intends to operate in scheduled air transportation when carrying passengers, property, or mail, or any combination thereof. Air carrier personnel assigned to conduct the aircraft proving tests shall be regular crew members who, it is anticipated, will be assigned to the aircraft.

(d) *Conclusion.* On completion of the aircraft proving tests, a reasonable period of time will be required in order that the information gained during the tests can be compiled by the field office and submitted, with recommendations regarding approval, to appropriate supervisory personnel of the Civil Aeronautics Administration.

"41.130 *Reports.* Each air carrier shall furnish the Administrator the following reports:

"(a) A monthly operations report shall be submitted on and in accordance with the form supplied or approved by the Administrator for the purpose not later than the 20th day of the next succeeding month.

"(b) A mechanical interruption report shall be submitted on the form supplied for the purpose not later than 10 days after the return of the aircraft to its operating base. Any partial or complete instrument or equipment mechanical failure which occurs during flight shall be reported. The records of such mechanical failure must be made available to any authorized representative of the Administrator or Board on request."

41.130–1 *Mechanical hazard and difficulty reports (CAA rules which apply to sec. 41.130).*

(a) *Daily mechanical reports.* Whenever a failure, malfunctioning, or other defect is de-

tected in flight or on the ground in an aircraft or aircraft component which may reasonably be expected by the air carrier to cause a serious hazard in the operation of any aircraft, notice thereof shall be transmitted through the air carrier's principal maintenance base to the aviation safety agent or adviser, maintenance, assigned to the air carrier.

NOTE: Failures, malfunctionings, or other defects required to be reported under this part comprise generally the following basic items:

Fire hazards.

Structural hazards.

Serious system or component malfunctioning or failure.

Unsafe procedures or conditions, and

Defects in design or quality of parts and materials found installed on aircraft or intended for such installation.

Such daily reports shall be required only where mechanical hazards have been detected; shall cover the 24-hour period from midnight to midnight of each day; and shall be transmitted to the assigned aviation safety agent or adviser, maintenance, before noon of the following working day, except that reports for Fridays, Saturdays, and Sundays may be submitted not later than noon of the following Mondays.

Such reports may be transmitted in a manner and on a form convenient to the air carrier's system of communications and procedures.

(1) *Guide for preparation of daily reports.* Whenever practicable, the following guide for each aircraft category should be used by the air carrier in the preparation of the daily reports:

(i) Category, "N" identification of aircraft, airline and trip number.

(ii) Emergency procedure effected (unscheduled landing, dumped fuel, etc.).

(iii) Nature of condition (fire, structural failure, etc.).

(iv) Identification of part and system involved.

(v) Apparent cause of trouble (wear, cracks, design, personnel error, etc.).

(vi) Disposition (repaired, replaced, aircraft grounded, etc.).

(vii) Brief narrative summary to supply any other pertinent data required for more complete identification, determination of seriousness, etc.

The daily reports should not be withheld pending presentation of all specific details pertaining to such items of information. As soon as the additional information is obtained it may be submitted as a supplement to the report.

(b) *Monthly report of mechanical difficulties.*

(1) *General.* The following procedures are to be utilized in compliance with the requirement of a monthly report of chronic mechanical difficulties.

(2) *Scope of report.* The monthly report of chronic mechanical difficulties will be compiled by the Civil Aeronautics Administration from information furnished daily by the scheduled air carriers to the assigned aviation safety agents or advisers. This report will include all aircraft occurrences due to known or suspected malfunctions or mechanical difficulties which result in an interruption to a scheduled flight or a change of aircraft. The information required for the report shall be furnished to the CAA in the form of a daily summary of such occurrences. Any mechanical malfunction or suspected malfunction occurring in flight or on the ground during scheduled operation which results in a change in the aircraft schedule, regardless of cause, shall be included in the summary. The daily summary of mechanical delays, which is prepared for internal use by the air carriers, will in almost all cases, contain the information necessary for this requirement. Submission of copies of this report will be satisfactory, provided it contains sufficient information as outlined below. In some cases it may be necessary to make slight modifications or add further information if this report is to be used. The daily submission of information for compilation of the monthly chronic report does not affect, in any way, the reporting of items covered under the Daily Mechanical Report.

The summary shall also include the number of engines removed prematurely because of mechanical trouble, listed by make and model, and the number of propeller featherings for any reason indicating the flight attitude at the time of feathering, such as takeoff, climb, cruise, etc. A statement of cause is not required with the numerical report of engine removals and propeller featherings.