FEDERAL AVIATION AGENCY

Washington, D.C.

Civil Aeronautics Manual 40

Scheduled Interstate Air Carrier Certification and Operation Rules

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Supplement No. 9 CAM 40 dated September 15, 1959 **June 1, 1963**

SUBJECT: Revisions to CAM 40.

This supplement is issued to incorporate into CAM 40 Civil Air Regulations Amendments 40-38 and 40-39, Amendments Nos. 1 and 2 to Special Civil Air Regulation No. SR-422B, Amendment No. 1 to Special Civil Air Regulation No. SR-425C, and Special Civil Air Regulations Nos. SR-446B and SR-455, and to delete Special Civil Air Regulation No. SR-423 which terminated December 20, 1962.

Amendment 40-38 concerns airborne distance measuring equipment, low frequency radio range, and automatic direction finding equipment requirements. It was issued January 11, 1963, to become effective July 1, 1963.

Amendment 40-39 concerns minimum standards for approval of airplane simulators. It was issued April 4, 1963, to become effective June 10, 1963.

Amendment No. 1 to SR-422B concerns three-engine airplanes. It was issued December 10, 1962, and became effective January 15, 1963. Amendment No. 2 to SR-422B concerns turboprop conversions of transport category airplanes. It was issued and became effective December 20, 1962.

Amendment No. 1 to SR-425C deleted the June 30, 1963, termination contained in the regulation. It was issued May 10, 1963, and became effective May 17, 1963.

Special regulation SR-446B concerns the use of portable frequency modulation (FM) type radio receivers on aircraft during flight. It was issued April 4, 1963, and became effective May 25, 1963, and supersedes Special Civil Air Regulation No. SR-446A.

Special regulation SR-455 concerns the use of air carrier inspector's credentials and admission to the pilot's compartment. It was issued November 21, 1962, and became effective on November 28, 1962.

New or revised material is enclosed in black brackets on the pages submitted with this supplement, except Special Civil Air Regulations SR-446B and SR-455, Appendix C, and the pages in the addendum containing the preambles of amendments.

Remove the following pages:	*Insert the following new pages:*
V through X	V through X
55 and 56	55 and 56
61 and 62	61 and 62
65 and 66	65 and 66
163 through 174	163 through 174-1
179 through 186	179 through 186
190-3	190-3
207 and 208	207 and 208
—	213 through 219
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G. S. MOORE, *Director,*
Flight Standards Service.

Attachments.

Special Airworthiness Requirements

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of ice on the portions of the wings which are critical from the standpoint of ice accumulation. When illuminating means are used, such means shall be of a type which will not cause glare or reflection which would handicap crew members in the performance of their normal functions.

40.208 *Flight recorders.*

(a) An approved flight recorder which records at least time, altitude, airspeed, vertical acceleration, and heading shall be installed in accordance with the following requirements:

(1) On all airplanes of more than 12,500 pounds maximum certificated takeoff weight which are certificated for operations above 25,000 feet altitude; and

(2) On and after November 1, 1960, on all turbine-powered airplanes of more than 12,500 pounds maximum certificated takeoff weight; *Provided,* That, the Director, Bureau of Flight Standards, or his authorized representative, may extend the November 1, 1960, compliance date for any air carrier who, prior to September 1, 1960, submits to the Federal Aviation Agency, in writing, a request for approval for such an extension, together with substantiating data, which shows to the satisfaction of the Director, or his authorized representative:

(i) That the air carrier will be unable to comply with the November 1, 1960, date due to flight recorder procurement or installation problems, and;

(ii) The action the air carrier has undertaken to insure that a progressive installation of the required flight recorder equipment will be completed at the earliest practicable date following November 1, 1960. In no event will the November 1, 1960, compliance date be extended beyond May 1, 1961.

(b) When a flight recorder is installed it shall be operated continuously from the instant the airplane commences the takeoff roll until it has completed the landing roll at an airport.

(c) Recorded information shall be retained by the air carrier for a period of at least 60 days. For a particular flight or series of flights, the information shall be retained for a longer period if requested by an authorized representative of the Administrator or the Civil Aeronautics Board.

(Amendment 40–27, published in 25 F.R. 6826, July 19, 1960, effective Aug. 18, 1960.)

Radio Equipment

40.230 *Radio equipment.* Each airplane used in scheduled air transportation shall be equipped with radio equipment specified for the type of operation in which it is engaged. Where two independent radio systems are required by sections 40.231 and 40.232, each system shall have an independent antenna installation: *Provided,* That where rigidly supported nonwire antennas or other antenna installations of equivalent reliability are used, only one such antenna need be provided.

40.230–1 *Independent radio systems (FAA interpretations which apply to sec. 40.230).* Radio systems are independent where each such system is separate and complete, and the function of any part or the whole of one system is not dependent on the continued functioning of any component of the other, and in event of failure in one system, the other system is capable of continued independent operation.

(Published in 18 F.R. 8612, December 22, 1953, effective January 1, 1954.)

40.231 *Radio equipment for operations under VFR over routes navigated by pilotage.*

(a) For operations 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 following functions:

(1) Communicate with at least one appropriate ground station (as specified in sec. 40.34) from any point on the route and 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 navigational 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 section 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 over routes on which navigation is based on low frequency radio range or automatic direction finding, only one low frequency radio range received or ADF receiver need be installed: *Provided,* That the airplane is equipped with two VOR receivers, and VOR navigational aids are so located and the airplane is so fueled that, in the case of failure of the low frequency radio range receiver or ADF receiver, the flight may proceed safely to a suitable airport by means of VOR aids and complete an instrument letdown by use of the remaining airplane radio system.

[(c) Whenever VOR navigational receivers are required by paragraphs (a) or (b) of this section, at least one approved distance measuring equipment unit (DME), capable of receiving and indicating distance information from VORTAC facilities, shall be installed on each airplane when operated within the 48 contiguous states and the District of Columbia at and above 24,000 feet MSL after June 30, 1963, and on each of the following airplanes, irrespective of the altitude flown, when operating within the 48 contiguous states and the District of Columbia after the following dates:

[(1) Turbojet airplanes—June 30, 1963;

[(2) Turboprop airplanes—December 31, 1963;

[(3) Pressurized reciprocating engine airplanes—June 30, 1964; and

[(4) Other airplanes having a maximum certificated takeoff weight of more than 12,500 pounds—June 30, 1965.

[(d) In the event that the distance measuring equipment (DME) becomes inoperative en route, the pilot shall notify Air Traffic Control of such failure as soon as it occurs.

[(Amendment 40-38, published in 28 F.R. 479, Jan. 18, 1963, effective July 1, 1963.)]

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.

ficiency check. The proficiency check may be given at any time during the month preceding or following the month in which it becomes due. The effective date of the check, if given within the preceding or following month, shall be the same as if given within the month in which it became due. Where such pilots serve in more than one airplane type, at least every other successive proficiency check shall be given in flight in the larger airplane type.

(Amendment 40–19, published in 24 F.R. 7865, Sept. 30, 1959, effective Oct. 29, 1959.)

(2) The pilot proficiency check shall include at least the following:

(i) The flight maneuvers specified in section 40.282(b)(1), except that the simulated engine failure during take-off need not be accomplished at speed V_1, nor at actual or simulated maximum authorized weight,

(ii) Flight maneuvers approved by the Administrator accomplished under simulated instrument conditions utilizing the navigational facilities and letdown procedures normally used by the pilot; ***Provided,*** That maneuvers other than those associated with approach procedures for which the lowest minimums are approved may be given in a synthetic trainer which contains the radio equipment and instruments necessary to simulate other navigational and letdown procedures approved for use by the air carrier.

[(3) Subsequent to the initial pilot proficiency check, an approved course of training conducted in an approved airplane simulator, if satisfactorily completed, may be substituted at alternate 6-month intervals for the proficiency checks required by subparagraph (1) of this paragraph if the simulator meets the minimum standards set forth in Appendix C and:

[(i) The simulator is maintained at the same level as required for *initial* approval;

[(ii) A functional preflight check of the simulator is performed each day prior to commencing simulator flight training or proficiency checks;

[(iii) A daily discrepancy log is maintained and an entry of each discrepancy is made by the simulator instructor or check airman before termination of each training or check flight; and

[(iv) If a modification is made to the airplane, a corresponding modification is made to the simulator if necessary for flight crew training or proficiency checks.

[The simulator may be used with inoperative instruments or equipment, if they are not applicable to the particular phase of training being given.

[(Amendment 40–39, published in 28 F.R. 3474, April 10, 1963, effective June 10, 1963.)]

40.302–1 *Pilot check—proficiency requirements (FAA rules which apply to sec. 40.302(b)).* The following items are required by the Administrator to determine the proficiency of the pilot in command:

(a) *Equipment examination (oral or written).*

(1) The equipment examination shall be pertinent to the type of aircraft to be flown by the pilot-in-command and may be given (i) in the air carrier's ground school, (ii) during a routine line check under the supervision of an authorized company check pilot, or (iii) during the proficiency check.

(2) The examination shall at least contain questions relative to engine power settings, airplane placard speeds, critical engine failure

speeds, control systems, fuel and lubrication systems, propeller and supercharger operations, hydraulic systems, electric systems, anti-icing, heating and ventilating, and pressurization system (if pressurized). A record should be maintained in the pilot's file which will indicate the date, condition under which equipment examination was given, and grade received.

(b) *Taxiing, sailing, or docking.* Attention shall be directed to the manner in which the pilot-in-command conducts taxiing, sailing, or docking with reference to the taxi instruction as issued by airport traffic control or other traffic control agency, and taxi instruction which may be published in the air carrier's operations manual, and general regard for the safety of the air carrier's and other equipment which may be affected by taxiing, sailing, or docking operation.

(c) *Runup.* Attention to detail in the use of cockpit checklist and cockpit procedure shall be observed on all proficiency flights.

(d) *Takeoff.* For those air carriers authorized takeoff minimums of less than 300–1, the pilot being examined shall whenever practicable execute a takeoff solely by reference to instruments, or at the option of the check pilot, a contact takeoff may be made following which instrument conditions shall be simulated at or before reaching 100 feet with the subsequent climb conducted solely by reference to instruments. The check pilot shall observe the pilot's ability to maintain a constant heading during the takeoff run, his proficiency in handling power, flap and gear operation during the critical period between takeoff (off ground) and reaching 500 feet. Should it become necessary for the check pilot to give assistance after becoming airborne, the maneuver shall be considered as unsatisfactory.

(e) *Climbs and climbing turns.* Climbs and climbing turns shall be performed in accordance with the airspeeds and power settings as prescribed by the air carrier or those set forth in the Airplane Flight Manual. The use of proper climb speeds and designated rates of climb shall be considered in determining the satisfactory performance of this phase of the proficiency flight.

(f) *Steep turns.* Except as provided hereinafter, steep turns shall consist of at least 45 degrees of bank. The turns shall be at least 180° of duration (but need not be more than 360°). Smooth control application, and ability to maneuver aircraft within prescribed limits, shall be the primary basis for judging performance. When information is available on the relation of increase of stall speeds vs. increase in angle of bank, such information shall be reviewed and discussed. As a guide, the tolerance of 100 feet plus or minus a given altitude shall be considered as acceptable deviation in the performance of steep turns. Consideration may be given to factors other than pilot proficiency which might make compliance with the above tolerances impractical. For example, where the range of vision from the safety observer's position is obstructed in certain types of aircraft while in a steep left turn, the degree of left bank in such instances may be reduced to not less than 30 degrees.

(g) *Maneuvers (minimum speeds).* Maneuvers at minimum speeds shall be accomplished while using the prescribed flap settings as set forth in the Airplane Flight Manual. In addition, attention shall be directed to airplane performance as related to use of flaps vs. clean configuration while operating at minimum speeds. Attention shall be directed towards the pilot's ability to recognize and hold minimum controllable airspeeds to maintain alti-

(c) certain critical maneuvers which demonstrate the instrument proficiency of a pilot are executed in an aircraft of the type flown by the pilot in air carrier service. The proficiency flight in the aircraft should include at least maneuvers (minimum speed), approach procedures, handling under circling approach conditions, and takeoff and landings, with engine failures as outlined in section 40.302–1, paragraphs (g), (q), (u), and (v), respectively.

(Published in 18 F.R. 6619, October 17, 1953, effective January 1, 1954.)

40.302–4 *Requirements for approved training course—aircraft simulator (FAA rules which apply to sec. 40.302(b)(3)).*

(a) *Application for approval.* An applicant desiring approval of an aircraft simulator training course shall submit his application in triplicate to the local Air Carrier Safety Inspector. The application shall contain a training course, including a description of the equipment, facilities, and material to be used, together with a letter to the Administrator of the Federal Aviation Agency requesting approval [7a] of the course. The application shall be prepared in looseleaf form, shall include a table of contents, time required for each phase of the course; and procedures for administering the following training course:

(1) *Training course.* Flight equipment used shall be identical to that used in actual flight operations and the course [7b] shall incorporate at least the following subjects:

(i) All of the required maneuvers in section 40.282(b)(1) and section 40.302–1 except the visual flight maneuvers performed around the airport.

(ii) A detailed description of the procedures to be employed in performing each of the required maneuvers applicable to the type aircraft being simulated.

(iii) Emergency procedures concerned with aircraft performance and also all emergency procedures outlined in the approved flight manual.

(b) *Revision of training course.* Requests for revisions of the approved training course, facilities, equipment, and material shall be accomplished in the manner established for securing approval of the original training course. Three copies of the revision shall be submitted in such form that entire pages of the approved course can be removed and replaced by the revision.

(c) *Satisfactory completion of course.* Determination of satisfactory completion of the approved aircraft simulator training course shall be made by an authorized representative of the Administrator or a check airman.

(d) *Cancellation of approval.* Failure to meet or maintain any of the standards established for the approval of a training course shall be considered sufficient reason for cancellation of approval.

(Published in 22 F.R. 8997, November 9, 1957, effective November 25, 1957.)

40.303 *Pilot route and airport qualification requirements.*

(a) An air carrier shall not utilize a pilot in command until he has been qualified for the route on which he is to serve in accordance with the provisions of this section and the appropriate instructor or check pilot has so certified.

(b) Each such pilot shall demonstrate adequate knowledge concerning the subjects listed below with respect to each route to be flown. Those portions of the demonstration pertaining to holding procedures and instrument approach procedures may be accomplished in a synthetic trainer which contains the radio equipment and instruments necessary to simulate the navigational and let-

[7a] The Administrator will review the training course, and if it is found adequate, will return an approved copy of the application to the applicant.

[7b] Any logical arrangement of the training course material will be acceptable, if all the required maneuvers are included, with appropriate description of techniques and procedures.

down procedures approved for use by the air carrier:

(1) Weather characteristics,

(2) Navigational facilities,

(3) Communication procedures,

(4) Type of en route terrain and obstruction hazards,

(5) Minimum safe flight levels,

(6) Position reporting points,

(7) Holding procedures,

(8) Pertinent traffic control procedures, and

(9) Congested areas, obstructions, physical layout, and all instrument approach procedures for each regular, provisional, and refueling airport approved for the route.

(c) Each such pilot shall make an entry as a member of the flight crew at each regular, provisional, and refueling airport into which he is scheduled to fly. Such entry shall include a landing and take-off. The qualifying pilot shall occupy a seat in the pilot compartment and he shall be accompanied by a pilot who is qualified at the airport.

(d) such pilot shall not be required to meet the entry requirements of paragraph (c) of this section when:

(1) The initial entry is made under VFR weather conditions at the particular airport involved; or

(2) The air carrier shows that the pilot airport qualifications can be accomplished by an approved pictorial means; or

(3) The air carrier notifies the Administrator that it intends to conduct operations at an airport in close proximity to an airport into which the pilot involved is presently qualified by entry, and the Administrator finds that such pilot is adequately qualified at the new airport. The Administrator, in making such finding, shall take into consideration at least the familiarity of the pilot with the layout, surrounding terrain, location of obstacles, and instrument approach and traffic control procedures at the new airport.

(e) On routes or route segments on which navigation must be accomplished by pilotage and on which flight is to be conducted at or below the level of the adjacent terrain which is within a horizontal distance of 25 miles on either side of the center line of the route to be flown, the pilot shall be familiarized with such route or route segments by not less than two one-way trips on the flight deck over the route or route segments under VFR weather conditions to permit the qualifying pilot to observe terrain along the route.

40.303–1 *Pilot route and airport qualification requirements (FAA interpretations which apply to sec. 40.303).* In order to meet the knowledge requirements of section 40.303(b), the pilot-in-command must demonstrate adequate knowledge of the subjects listed in section 40.303(b) for a route on which he is to serve between the regular, refueling, or provisional airports listed in the air carrier's operations specifications and any major differences which may exist between that route and any other route over which he may serve between such airports. In such case, the pilot is considered qualified over any off-airway route listed in the Form 514A or a Federal airway, control area extension, or control zone between such airports if he has also met the provisions of sections 40.303 (c) and (d) where applicable.

(Published in 18 F.R. 6619, October 17, 1953, effective January 1, 1954.)

40.304 ***Maintenance and reestablishment of pilot route and airport qualifications for particular trips.***

(a) To maintain pilot route and airport qualifications, each pilot being utilized as

SPECIAL CIVIL AIR REGULATION NO. SR–422B

(As amended by Amendment No. 1, issued Dec. 10, 1962, effective Jan. 15, 1963, published in 27 F.R. 12399, Dec. 14, 1962, and Amendment No. 2, issued Dec. 20, 1962, effective Dec. 20, 1962, published in 27 F.R. 12926, Dec. 29, 1962.)

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(24 F.R. 5629)
Corrected: July 15, 1959
(24 F.R. 5688)

Turbine-Powered Transport Category Airplane of Current Design

Special Civil Air Regulation No. SR–422, effective August 27, 1957, prescribes requirements applicable to the type certification and operation of turbine-powered transport category airplanes for which a type certificate is issued after August 27, 1957. Special Civil Air Regulation No. SR–422A, effective July 2, 1958, included substantive changes to SR–422 and was made applicable to all turbine-powered transport category airplanes for which a type certificate is issued after September 30, 1958.

This Special Civil Air Regulation makes further changes to the airworthiness rules for turbine-powered transport category airplanes to be applicable to all such airplanes for which a type certificate is issued after August 29, 1959. These changes were proposed in Draft Release No. 58–1C (24 F.R. 128) by the Civil Aeronautics Board in connection with the 1958 Annual Airworthiness Review. The amendments herein have been adopted after careful consideration of all the discussion and comment received thereon.

Substantive and minor changes have been made to the provisions of SR–422A. For ease in identification they are listed as follows:

(a) *Substantive changes: introductory paragraphs;* 4T.114 (b), (c), (d), (e), and (f); 4T.115(d); 4T.117a(b); 4T.120 (a)(3), (b), and (d); 40T.81(c); 43T.11(c); and item 5 (a) and (b).

(b) *Minor changes; item 2;* 4T.112 (title), (b)(1), (c), (d), and (e); 4T.113(b); 4T.116(i)(4); 4T.117(b) (1) and (2); 4T.120(a); 4T.121; 4T.122(d); 4T.123(a); 40T.82; and 40T.83.

Pertinent background information to this regulation is contained in the preambles to SR–422 and SR–422A. Following is a discussion of important issues relevant to the changed provisions contained herein.

One of the most important changes being introduced concerns the rotation speed V_R of the airplane during takeoff (4T.114). Experience gained in the certification of airplanes under the provisions of SR–422 and SR–422A indicates that relating V_R to the stall speed is not essential and might unduly penalize airplanes with superior flying qualities. It has been found that the primary limitations on V_R should be in terms of a margin between the actual lift-off speeds V_{LOF} and the minimum unstick speed V_{MU} at which the airplane can proceed safely with the takeoff. The provisions contained herein require that V_R speeds be established to be

applicable to takeoffs with one engine inoperative as well as with all engines operating. The V_{MC} speeds can be established from free air data provided that the data are verified by ground takeoff tests. Certain safeguards are included in conjunction with the establishment of V_R speeds to ensure that takeoffs in service can be made with consistent safety.

A change is being introduced to the provision in 4T.117a(b) concerning the manner in which the net takeoff flight path is obtained. In accordance with this provision as contained in SR–422A, the net takeoff flight path would have a negative slope throughout the acceleration segment. Since this segment usually represents level flight easily controlled by reference to the normal flight instruments, a significant reduction in the flight path's gradient would not be expected. For these reasons, the provision is being changed to permit an equivalent reduction in acceleration in lieu of a reduction in gradient.

Section 4T.117a(b) is being amended additionally by changing the value of gradient margin in the net flight path for two-engine airplanes from 1.0 percent to 0.8 percent. The value for four-engine airplanes remains 1.0 percent. Differentiation in gradient values in the net flight path between two and four-engine airplanes is consistent with the differentiation in the climb gradients for the takeoff, enroute, and approach stages of flight. Statistical analysis substantiates the specific reduction of the net flight path gradient to a value of 0.8 percent. Correlatively, a reevaluation of the climb gradients for twin-engine airplanes in the second segment takeoff and in the approach climb indicates that the respective values should be 2.4 percent and 2.1 percent and these changes are being made in 4T.120 (b) and (d).

A change is introduced in the conditions prescribed for meeting the climb gradient in the first segment takeoff climb (4T.120(a)), by changing the speed V_2 to the speed V_{LOF}. The intent of this requirement is to use the speed at which the airplane lifts off the ground. In SR–422 this speed was considered to be V_2; however, in SR–422A and in this regulation the speed V_2 is a higher speed which is reached at the end of the takeoff distance and no longer reflects the conditions pertinent to the first segment climb. In making this change consistent with relevant changes in SR–422A and in this regulation, no consideration has been given to the appropriateness of the minimum climb gradient values prescribed for the first segment climb. These are subject to alteration if results of further studies so indicate.

There is being introduced in this regulation the concept of "stopways," the definition of which is contained in item 5(b). Stopways have been used outside the United States in meeting the accelerate-stop distances in case of aborted takeoffs. They are considered to result in more practical operations. In order to ensure that they can be used without detrimental effects on safety, a provision is being included in 4T.115(d) requiring taking into account the surface characteristics of the stopways to be used in scheduling the accelerate-stop distances in the Airplane Flight Manual.

In conjunction with the introduction of stopways, there are changes being made in the definition of a "clearway" (item 5(a)). One of the changes is to specify that a clearway begins at the end of the runway whether or not a stopway is being used. Of the other changes, the most

significant one expresses the clearway in terms of a clearway plane and permits this plane to have an upward slope of 1.25 percent. In effect, this change will allow, in some cases, use of clearways which would not be allowed under the definition in SR–422A because of relatively small obstacles or slightly sloping terrain. (See also 40T.81(c) and 43T.11(c).)

There are also included in this regulation a number of minor, editorial, or clarifying changes.

Draft Release No. 58–1C included a proposal for expanding lateral obstacle clearances in the takeoff flight path. Studies indicate that some expanding lateral clearances are necessary for safety in operations with all turbine-powered airplanes. It appears, therefore, that an appropriate rule should be made applicable not only to airplanes certificated in accordance with this regulation, but also to those certificated in accordance with SR–422 and SR–422A. Accordingly, no change is being made in this regulation to the lateral obstacle clearance provisions, instead, a Notice of Proposed Rule Making is now being prepared to amend SR–422, SR–422A, and this regulation, to require expanding lateral obstacle clearances for all airplanes certificated thereunder.

This Special Civil Air Regulation is not intended to compromise the authority of the Administrator under section 4b.10 to impose such special conditions as are found necessary in any particular case to avoid unsafe design features and otherwise to ensure equivalent safety.

Interested persons have been afforded an opportunity to participate in the making of this regulation (24 F.R. 128), and due consideration has been given to all relevant matter presented.

This regulation does not require compliance until after August 29, 1959; however, since applicants for a type certificate for turbine-powered transport category airplanes may elect to show compliance with this regulation before that date, it is being made effective immediately.

In consideration of the foregoing, the following Special Civil Air Regulation is hereby promulgated to become effective immediately:

[Contrary provisions of the Civil Air Regulations notwithstanding, all turbine-powered transport category airplanes for which a type certificate is issued after August 29, 1959, shall comply with all of the following requirements, except that, turbopropeller-powered airplanes previously type certificated with the same number of reciprocating engines need only comply with the performance requirements of paragraph 2.] Applicants for a type certificate for a turbine-powered transport category airplane may elect and are authorized to meet the requirements of this Special Civil Air Regulation prior to August 29, 1959, in which case however, all of the following provisions must be complied with.

1. The provisions of Part 4b of the Civil Air Regulations, effective on the date of application for type certificate; and such of the provisions of all subsequent amendments to Part 4b, in effect prior to August 27, 1957, as the Administator finds necessary to ensure that the level of safety of turbine-powered airplanes is equivalent to that generally intended by Part 4b.

2. In lieu of sections 4b.110 through 4b.125, 4b.183, and 4b.743 of Part 4b of the Civil Air Regulations, the following shall be applicable:

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PERFORMANCE

4T.110 *General.*

(a) The performance of the airplane shall be determined and scheduled in accordance with, and shall meet the minima prescribed by, the provision of sections 4T.110 through 4T.123. The performance limitations, information, and other data shall be given in accordance with section 4T.743.

(b) Unless otherwise specifically prescribed, the performance shall correspond with ambient atmospheric conditions and still air. Humidity shall be accounted for as specified in paragraph (c) of this section.

(c) The performance as affected by engine power and/or thrust shall be based on a relative humidity of 80 percent at and below standard temperatures and on 34 percent at and above standard temperatures plus 50° F. Between these two temperatures the relative humidity shall vary linearly.

(d) The performance shall correspond with the propulsive thrust available under the particular ambient atmospheric conditions, the particular flight condition, and the relative humidity specified in paragraph (c) of this section. The available propulsive thrust shall correspond with engine power and/or thrust not exceeding the approved power and/or thrust less the installational losses and less the power and/or equivalent thrust absorbed by the accessories and services appropriate to the particular ambient atmospheric conditions and the particular flight condition.

4T.111 *Airplane configuration, speed, power, and/or thrust; general.*

(a) The airplane configuration (setting of wing and cowl flaps, air brakes, landing gear, propeller, etc.), denoted respectively as the takeoff, en route, approach, and landing configurations, shall be selected by the applicant except as otherwise prescribed.

(b) It shall be acceptable to make the airplane configurations variable with weight, altitude, and temperature, to an extent found by the Administrator to be compatible with operating procedures required in accordance with paragraph (c) of this section.

(c) In determining the accelerate-stop distances, takeoff flight paths, takeoff distances, and landing distances, changes in the airplane's configuration and speed, and in the power and thrust shall be in accordance with procedures established by the applicant for the operation of the airplane in service, except as otherwise prescribed. In addition, procedures shall be established for the execution of balked landings and missed approaches associated with the conditions prescribed in sections 4T.119 and 4T.120(d), respectively. All procedures shall comply with the provisions of subparagraphs (1) through (3) of this paragraph.

(1) The Administrator shall find that the procedures can be consistently executed in service by crews of average skill.

(2) The procedures shall not involve methods or the use of devices which have not been proven to be safe and reliable.

(3) Allowance shall be made for such time delays in the execution of the procedures as may be reasonably expected to occur during service.

4T.112 *Stalling and minimum control speeds.*

(a) The speed V_s shall denote the calibrated stilling speed, or the minimum steady flight speed at which the airplane is controllable, in knots, with:

(1) Zero thrust at the stalling speed, or engines idling and throttles closed if it is shown that the resultant thrust has no appreciable effect on the stalling speed;

(2) If applicable, propeller pitch controls in the position necessary for compliance with subparagraph (1) of this paragraph; the airplane in all other respects (flaps, landing gear, etc.) in the particular configuration corresponding with that in connection with which V_s is being used;

(3) The weight of the airplane equal to the weight in connection with which V_s is being used to determine compliance with a particular requirement;

(4) The center of gravity in the most unfavorable position within the the allowable range.

(b) The stall speed defined in this section shall be the minimum speed obtained in flight tests conducted in accordance with the procedure of subparagraphs (1) and (2) of this paragraph.

(1) With the airplane trimmed for straight flight at a speed chosen by the applicant, but not less than 1.2 V_s nor greater than 1.4 V_s, and from a speed sufficiently above the stalling speed to ensure steady conditions, the elevator control shall be applied at a rate such that the airplane speed reduction does not exceed 1 knot per second.

(2) During the test prescribed in subparagraph (1) of this paragraph, the flight characteristics provisions of section 4b.160 of Part 4b of the Civil Air Regulations shall be complied with.

(c) The minimum control speed V_{MC}, in terms of calibrated air speeed, shall be determined under the conditions specified in this paragraph so that, when the critical engine is suddenly made inoperative at that speed, it is possible to recover control of the airplane with the engine still inoperative and to maintain it in straight flight at that speed, either with zero yaw or, at the option of the applicant, with an angle of bank not in excess of 5 degrees. V_{MC} shall not exceed 1.2 V_s with:

(1) Engines operating at the maximum available takeoff thrust and/or power;

(2) Maximum sea level takeoff weight or such lesser weight as might be necessary to demonstrate V_{MC}.

(3) The airplane in the most critical takeoff configuration existing along the flight path after the airplane becomes airborne, except that the landing gear is retracted;

(4) The airplane trimmed for takeoff;

(5) The airplane airborne and the ground effect negligible;

(6) The center of gravity in the most unfavorable position;

(d) In demonstrating the minimum speed specified in paragraph (c) of this section, the rudder force required to maintain control shall not exceed 180 pounds and it shall not be necessary to reduce the power and/or thrust of the operative engine(s).

(e) During recovery from the maneuver specified in paragraph (c) of this section, the airplane shall not assume any dangerous attitude, nor shall it require exceptional skill, strength, or alertness on the part of the pilot to prevent a change of heading in excess of 20 degrees before recovery is complete.

4T.113 *Takeoff; general.*

(a) The takeoff data in sections 4T.114 through 4T.117 shall be determined under the conditions of subparagraphs (1) and (2) of this paragraph.

(1) At all weights, altitudes, and ambient temperatures, within the operational limits established by the applicant for the airplane.

(2) In the configuration for takeoff (see sec. 4T.111).

(b) Takeoff data shall be based on a smooth, dry, hard-surfaced runway and shall be determined in such a manner that reproduction of the performance does not require exceptional skill or alertness on the part of the pilot. In the case of seaplanes or float planes, the takeoff surface shall be smooth water, while for skiplane it shall be smooth, dry snow. In addition, the takeoff data shall include operational correction factors in accordance with subparagraphs (1) and (2) of this paragraph for wind and for runway gradients, within the operational limits established by the applicant for the airplane.

(1) Not more than 50 percent of nominal wind components along the takeoff path opposite to the direction of takeoff, and not less than 150 percent of nominal wind components along the takeoff path in the direction of takeoff.

(2) Effective runway gradients.

4T.114 *Takeoff speeds.*

(a) The critical-engine-failure speed V_1 in terms of calibrated air speed, shall be selected by the applicant, but shall not be less than the minimum speed at which controllability by primary aerodynamic controls alone is demonstrated during the takeoff run to be adequate to permit proceeding safely with the takeoff using average piloting skill, when the critical engine is suddenly made inoperative.

(b) The minimum takeoff safety speed $V_{2\,min}$, in terms of calibrated air speed, shall not be less than:

(1) 1.2 V_s for two-engine [and three-engine] propeller-driven airplanes and for airplanes without propellers which have no provisions for obtaining a significant reduction in the one-engine-inoperative power-on stalling speed;

(2) 1.15 V_s for propeller-driven airplanes having more than [three] engines and for airplanes without propellers which have provisions for obtaining a significant reduction in the one-engine-inoperative power-on stalling speed;

(3) 1.10 times the minimum control speed V_{MC}.

(c) The takeoff safety speed V_2, in terms of calibrated air speed, shall be selected by the applicant so as to permit the gradient of climb required in section 4T.120(b), but it shall not be less than:

(1) The speed $V_{2\,min}$,

(2) The rotation speed V_R (see paragraph (e) of this section) plus the increment in speed attained prior to reaching a height of 35 feet above the takeoff surface in compliance with section 4T.116(e).

(d) The minimum unstick speed V_{MU}, in terms of calibrated air speed, shall be the speed at and above which the airplane can be made to lift off the ground and to continue the takeoff without displaying any hazardous characteristics. V_{MU} speeds shall be selected by the applicant for the all-engines-operating and the one-engine-inoperative conditions. It shall be acceptable to establish the V_{MU} speeds from free air data: *Provided,* That these data are verified by ground takeoff tests.

NOTE: In certain cases, ground takeoff tests might involve some takeoffs at the V_{MU} speeds.

(e) The rotation speed V_R, in terms of calibrated air speed, shall be selected by the applicant in compliance with the conditions of subparagraphs (1) through (4) of this paragraph.

(1) The V_R speed shall not be less than:

(i) The speed V_1;

(ii) A speed equal to 105 percent of V_{MC};

(iii) A speed which permits the attainment of the speed V_2 prior to reaching a height of 35 feet above the takeoff surface as determined in accordance with section 4T.116(e);

(iv) A speed which, if the airplane is rotated at its maximum practicable rate, will result in a lift-off speed V_{LOF} (see paragraph (f) of this section) not less than 110 percent of V_{MU} in the all-engines-operating condition nor less than 105 percent of V_{MU} in the one-engine-inoperative condition.

(2) For any given set of conditions (weight, configuration, temperature, etc.), a single value of V_R speed obtained in accordance with this paragraph shall be used in showing compliance with both the one-engine-inoperative and the all-engines-operating takeoff provisions.

(3) It shall be shown that the one-engine-inoperative takeoff distance determined with a rotation speed 5 knots less than the V_R speed established in accordance with subparagraphs (1) and (2) of this paragraph does not exceed the corresponding one-engine-inoperative takeoff distance determined with the established V_R speed. The determination of the takeoff distances shall be in accordance with section 4T.117(a)(1).

(4) It shall be demonstrated that reasonably expected variations in service from the takeoff procedures established by the applicant for the operation of the airplane (see sec. 4T.111(c)) (e.g., over-rotation of the airplane, out of trim conditions) will not result in unsafe flight characteristics nor in marked increases in the scheduled takeoff distances established in accordance with section 4T.117(a).

(f) The lift-off speed V_{LOF}, in terms of calibrated air speed, shall be the speed at which the airplane first becomes airborne.

4T.115 *Accelerate-stop distance.*

(a) The accelerate-stop distance shall be the sum of the following:

(1) The distance required to accelerate the airplane from a standing start to the speed V_1;

(2) Assuming the critical engine to fail at the speed V_1, the distance required to bring the airplane to a full stop from the point corresponding with the speed V_1.

(b) In addition to, or in lieu of, wheel brakes, the use of other braking means shall be acceptable in determining the accelerate-stop distance, provided that such braking means shall have been proven to be safe and reliable, that the manner of their employment is such that consistent results can be expected in service and that exceptional skill is not required to control the airplane.

(c) The landing gear shall remain extended throughout the accelerate-stop distance.

(d) If the accelerate-stop distance is intended to include a stopway with surface characteristics substantially different from those of a smooth hard-surfaced runway, the takeoff data shall include operational correction factors for the accelerate-stop distance to account for the particular surface characteristics of the stopway and the variations in such characteristics with seasonal weather conditions (i.e., temperature, rain, snow, ice, etc.), within the operational limits established by the applicant.

4T.116 *Takeoff path.* The takeoff path shall be considered to extend from the standing start to a point in the takeoff where a height of 1,500 feet above the takeoff surface is reached or to a point in the takeoff where the transition from the takeoff to the en route configuration is completed and a speed is reached at which compliance with section 4T.120(c) is shown, whichever point is at a higher altitude. The conditions of paragraphs (a) through (i) of this section shall apply in determining the takeoff path.

(a) The takeoff path shall be based upon procedures prescribed in accordance with section 4T.111(c).

(b) The airplane shall be accelerated on the ground to the speed V_1 at which point the critical engine shall be made inoperative and shall remain inoperative during the remainder of the takeoff. Subsequent to attaining speed V_1, the airplane shall be accelerated to speed V_2 during which time it shall be permissible to initiate raising the nose gear off the ground at a speed not less than the rotating speed V_R.

(c) Landing gear retraction shall not be initiated until the airplane becomes airborne.

(d) The slope of the airborne portion of the takeoff path shall be positive at all points.

(e) The airplane shall attain the speed V_2 prior to reaching a height of 35 feet above the takeoff surface and shall continue at a speed as close as practical to, but not less than, V_2 until a height of 400 feet above the takeoff surface is reached.

(f) Except for gear retraction and propeller feathering, the airplane configuration shall not be changed before reaching a height of 400 feet above the takeoff surface.

(g) At all points along the takeoff path starting at the point where the airplane first reaches a height of 400 feet above the takeoff surface, the available gradient of climb shall not be less than 1.2 percent

for two-engine airplanes, [1.5 percent for three-engine airplanes,] and 1.7 percent for four-engine airplanes.

(h) The takeoff path shall be determined either by a continuous demonstrated takeoff, or alternatively, by synthesizing from segments the complete takeoff path.

(i) If the takeoff path is determined by the segmental method, the provisions of subparagraphs (1) through (4) of this paragraph shall be specifically applicable.

(1) The segments of a segmental takeoff path shall be clearly defined and shall be related to the distinct changes in the configuration of the airplane, in power and/or thrust, and in speed.

(2) The weight of the airplane, the configuration, and the power and/or thrust shall be constant throughout each segment and shall correspond with the most critical condition prevailing in the particular segment.

(3) The segmental flight path shall be based on the airplane's performance without ground effect.

(4) Segmental takeoff path data shall be checked by continuous demonstrated takeoffs up to the point where the airplane's performance is out of ground effect and the airplane's speed is stabilized, to ensure that the segmental path is conservative relative to the continuous path.

NOTE: The airplane usually is considered out of ground effect when it reaches a height above the ground equal to the airplane's wing span.

4T.117 *Takeoff distance and takeoff run.*

(a) *Takeoff distance.* The takeoff distance shall be the greater of the distances established in accordance with subparagraphs (1) and (2) of this paragraph.

(1) The horizontal distance along the takeoff path from the start of the takeoff to the point where the airplane attains a height of 35 feet above the takeoff surface, as determined in accordance with section 4T.116.

(2) A distance equal to 115 percent of the horizontal distance along the takeoff path, with all engines operating, from the start of the takeoff to the point where the airplane attains a height of 35 feet above the takeoff surface, as determined by a procedure consistent with that established in accordance with section 4T.116.

(b) *Takeoff run.* If the takeoff distance is intended to include a clearway (see item 5 of this regulation), the takeoff run shall be determined and shall be the greater of the distances established in accordance with subparagraphs (1) and (2) of this paragraph.

(1) The horizontal distance along the takeoff path from the start of the takeoff to a point equidistant between the point where the speed V_{LOF} is reached and the point where the airplane attains a height of 35 feet above the takeoff surface, as determined in accordance with section 4T.116.

(2) A distance equal to 115 percent of the horizontal distance along the takeoff path, with all engines operating, from the start of the takeoff to a point equidistant between the point where the speed V_{LOF} is reached and the point where the airplane attains a height of 35 feet above

the takeoff surface, as determined by a procedure consistent with that established in accordance with section 4T.116.

4T.117a *Takeoff flight path.*

(a) The takeoff flight path shall be considered to begin at a height of 35 feet above the takeoff surface at the end of the takeoff distance as determined in accordance with section 4T.117(a).

(b) The net takeoff flight path data shall be determined in such a manner that they represent the airplane's actual takeoff flight paths, determined in accordance with section 4T.116 and with paragraph (a) of this section, reduced at each point by a gradient of climb equal to 0.8 percent for two-engine airplanes, [equal to 0.9 percent for three-engine airplanes,] and equal to 1.0 percent for four-engine airplanes. It shall be acceptable to apply the prescribed reduction in climb gradient as an equivalent reduction in the airplane's acceleration along that portion of the actual takeoff flight path where the airplane is accelerated in level flight.

4T.118 *Climb; general.* Compliance shall be shown with the climb requirements of sections 4T.119 and 4T.120 at all weights, altitudes, and ambient temperatures, within the operational limits established by the applicant for the airplane. The airplane's center of gravity shall be in the most unfavorable position corresponding with the applicable configuration.

4T.119 *All-engine-operating landing climb.* In the landing configuration the steady gradient of climb shall not be less than 3.2 percent, with:

(a) All engines operating at the power and/or thrust which are available 8 seconds after initiation of movement of the power and/or thrust controls from the minimum flight idle to the takeoff position;

(b) A climb speed not in excess of 1.3 V_s.

4T.120 *One-engine-inoperative climb.*

(a) *Takeoff; landing gear extended.* In the critical takeoff configuration existing along the flight path between the points where the airplane reaches the speed V_{LOF} and where the landing gear is fully retracted, in accordance with section 4T.116 but without ground effect, the steady gradient of climb shall be positive for two-engine airplanes and shall not be less than [0.3 percent for three-engine airplanes, and not less than] 0.5 percent for four-engine airplanes, with:

(1) The critical engine inoperative, the remaining engine(s) operating at the available takeoff power and/or thrust existing in accordance with section 4T.116 at the time retraction of the airplane's landing gear is initiated, unless subsequently a more critical power operating condition exists along the flight path prior to the point where the landing gear is fully retracted;

(2) The weight equal to the airplane's weight existing in accordance with section 4T.116 at the time retraction of the airplane's landing gear is initiated;

(3) The speed equal to the speed V_{LOF}.

(b) *Takeoff; landing gear retracted.* In the takeoff configuration existing at the point of the flight path where the airplane's landing gear is fully retracted, in accordance with section 4T.116 but without ground effect, the steady gradient of climb shall not be less than 2.4 per-

cent for two-engine airplanes, [not less than 2.7 percent for three-engine airplanes,] and not less than 3.0 percent for four-engine airplanes, with:

(1) The critical engine inoperative, the remaining engine(s) operating at the available takeoff power and/or thrust existing in accordance with section 4T.116 at the time the landing gear is fully retracted, unless subsequently a more critical power operating condition exists along the flight path prior to the point where a height of 400 feet above the takeoff surface is reached;

(2) The weight equal to the airplane's weight existing in accordance with section 4T.116 at the time the airplane's landing gear is fully retracted;

(3) The speed equal to the speed V_2.

(c) *Final takeoff.* In the en route configuration, the steady gradient of climb shall not be less than 1.2 percent for two-engine airplanes, [not less than 1.5 percent for three-engine airplanes,] and not less than 1.7 percent for four-engine airplanes, at the end of the takeoff path as determined by section 4T.116, with:

(1) The critical engine inoperative, the remaining engine(s) operating at the available maximum continuous power and/or thrust;

(2) The weight equal to the airplane's weight existing in accordance with section 4T.116 at the end of the takeoff path.

(3) The speed equal to not less than 1.25 V_s.

(d) *Approach.* In the approach configuration corresponding with the normal all-engines-operating procedure such that V_s related to this configuration does not exceed 110 percent of the V_s corresponding with the related landing configuration, the steady gradient of climb shall not be less than 2.1 percent for two-engine airplanes, [not less than 2.4 percent for three-engine airplanes,] and not less than 2.7 percent for four-engine airplanes with:

(1) The critical engine inoperative, the remaining engine(s) operating at the available takeoff power and/or thrust;

(2) The weight equal to the maximum landing weight;

(3) A climb speed established by the applicant in connection with normal landing procedures, except that it shall not exceed 1.5 V_s (see sec. 4T.111(c)).

4T.121 *En route flight paths.* With the airplane in the en route configuration, the flight paths prescribed in paragraphs (a) and (b) of this section shall be determined at all weights, altitudes, and ambient temperatures, within the operational limits established by the applicant for the airplane.

(a) *One engine inoperative.* The one-engine-inoperative net flight path data shall be determined in such a manner that they represent the airplane's actual climb performance diminished by a gradient of climb equal to 1.1 percent for two-engine airplanes, [1.4 percent for three-engine airplanes,] and 1.6 percent for four-engine airplanes. It shall be acceptable to include in these data the variation of the airplane's weight along the flight path to take into account the progressive consumption of fuel and oil by the operating engine(s).

(b) *Two engines inoperative.* [For airplanes with three or four engines, the two-engine-inoperative net flight path data shall be determined in such a manner that they represent the airplane's actual climb performance diminished by a gradient of climb equal to 0.3 percent for three-engine airplanes and equal to 0.5 percent for four-engine airplanes.] It shall be acceptable to include in these data the variation of the airplane's weight along the flight path to take into account the progressive consumption of fuel and oil by the operating engines.

(c) *Conditions.* In determining the flight paths prescribed in paragraphs (a) and (b) of this section, the conditions of subparagraphs (1) through (4) of this paragraph shall apply.

(1) The airplane's center of gravity shall be in the most unfavorable position.

(2) The critical engine(s) shall be inoperative, the remaining engine(s) operating at the available maximum continuous power and/or thrust.

(3) Means for controlling the engine cooling air supply shall be in the position which provides adequate cooling in the hot-day condition.

(4) The speed shall be selected by the applicant.

4T.122 *Landing distance.* The landing distance shall be the horizontal distance required to land and to come to a complete stop (to a speed of approximately 3 knots in the case of seaplanes or float planes) from a point at a height of 50 feet above the landing surface. Landing distances shall be determined for standard temperatures at all weights, altitudes, and winds, within the operational limits established by the applicant for the airplane. The conditions of paragraphs (a) through (g) of this section shall apply.

(a) The airplane shall be in the landing configuration. During the landing, changes in the airplane's configuration, in power and/or thrust, and in speed shall be in accordance with procedures established by the applicant for the operation of the airplane in service. The procedures shall comply with the provisions of section 4T.111(c).

(b) The landing shall be preceded by a steady gliding approach down to the 50-foot height with a calibrated air speed of not less than 1.3 V_s.

(c) The landing distance shall be based on a smooth, dry, hard-surfaced runway, and shall be determined in such a manner that reproduction does not require exceptional skill or alertness on the part of the pilot. In the case of seaplanes or float planes, the landing surface shall be smooth water, while for skiplanes it shall be smooth, dry snow. During landing, the airplane shall not exhibit excessive vertical acceleration, a tendency to bounce, nose over, ground loop, porpoise, or water loop.

(d) The landing distance data shall include operational correction factors for not more than 50 percent of nominal wind components along the landing path opposite to the direction of landing and not less than 150 percent of nominal wind components along the landing path in the direction of landing.

(e) During landing, the operating pressures on the wheel braking system shall not be in excess of those approved by the manufacturer

of the brakes, and the wheel brakes shall not be used in such a manner as to produce excessive wear of brakes and tires.

(f) In addition to, or in lieu, of, wheel brakes, the use of other braking means shall be acceptable in determining the landing distance, provided such braking means shall have been proven to be safe and reliable, that the manner of their employment is such that consistent results can be expected in service, and that exceptional skill is not required to control the airplane.

(g) If the characteristics of a device (e.g., the propellers) dependent upon the operation of any of the engines noticeably increase the landing distance when the landing is made with the engine inoperative, the landing distance shall be determined with the critical engine inoperative unless the Administrator finds that the use of compensating means will result in a landing distance not greater than that attained with all engines operating.

4T.123 *Limitations and information.*

(a) *Limitations.* The performance limitations on the operation of the airplane shall be established in accordance with subparagraph (1) through (4) of this paragraph. (See also sec. 4T.743.)

(1) *Takeoff weights.* The maximum takeoff weights shall be established at which compliance is shown with the generally applicable provisions of this regulation and with the takeoff climb provisions pre-

obstruction clearance plane and the runway. The weight of the airplane shall be assumed to be reduced by the weight of the fuel and oil expected to be consumed in flight to the airport of intended destination. Compliance shall be shown with the conditions of subparagraphs (1) and (2) of this paragraph. (See secs. 4T.123(b) and 4T.743(b).)

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

(2) It shall be assumed that the airplane is landed on the most suitable runway considering the probable wind velocity and direction and taking due account of the ground handling characteristics of the airplane and of other conditions (i.e., landing aids, terrain, etc.). If full compliance with the provisions of this subparagraph is not shown, the airplane may be taken off if an alternate airport is designated which permits compliance with paragraph (b) of this section.

(b) *Alternate airport.* 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 provisions of paragraph (a) of this section, provided that the airplane can be brought to rest within 70 percent of the effective length of the runway.

4. In lieu of section 43.11 of Part 43 of the Civil Air Regulations the following shall be applicable.

43T.11 *Transport category airplane weight limitations.* The performance data in the Airplane Flight Manual shall be applied in determining compliance with the following provisions:

(a) No airplane shall be taken off at a weight which exceeds the takeoff weight specified in the Airplane Flight Manual for the elevation of the airport and for the ambient temperature existing at the time of the takeoff. (See secs. 4T.123(a)(1) and 4T.743(a).)

(b) No airplane shall be taken off at a weight such that, allowing for normal consumption of fuel and oil in flight to the airport of destination and to the alternate airports, the weight on arrival will exceed the landing weight specified in the Airplane Flight Manual for the elevation of each of the airports involved and for the ambient temperatures anticipated at the time of landing. (See secs. 4T.123(a)(2) and 4T.743(a).)

(c) No airplane shall be taken off at a weight which exceeds the weight at which, in accordance with the minimum distances for takeoff scheduled in the Airplane Flight Manual, compliance with subparagraphs (1) through (3) of this paragraph is shown. These distances shall correspond with the elevation of the airport, the runway to be used, the effective runway gradient, and the ambient temperature and wind component existing at the time of takeoff. (See secs. 4T.123(a)(3) and 4T.734(a).)

(1) The accelerate-stop distance shall not be greater than the length of the runway plus the length of the stopway if present.

(2) The takeoff distance shall not be greater than the length of the runway plus the length of the clearway if present, except that the length of the clearway shall not be greater than one-half of the length of the runway.

(3) The takeoff run shall not be greater than the length of the runway.

(d) No airplane shall be operated outside the operational limits specified in the Airplane Flight Manual. (See secs. 4T.123(a)(4) and 4T.743(a).)

5. The following definitions shall apply:

(a) *Clearway.* A clearway is an area beyond the runway, not less than 500 feet wide, centrally located about the extended center line of the runway, and under the control of the airport authorities. The clearway is expressed in terms of a clearway plane, extending from the end of the runway with an upward slope not exceeding 1.25 percent, above which no object nor any portion of the terrain protrudes, except that threshold lights may protrude above the plane if their height above the end of the runway is not greater than 26 inches and if they are located to each side of the runway.

NOTE: For the purpose of establishing takeoff distances and takeoff runs, in accordance with section 4T.117 of this regulation, the clearway plane is considered to be the takeoff surface.

(b) *Stopway.* A stopway is an area beyond the runway, not less in width than the width of the runway, centrally located about the extended center line of the runway, and designated by the airport authorities for use in decelerating the airplane during an aborted takeoff: To be considered as such, a stopway must be capable of supporting the airplane during an aborted takeoff without inducing structural damage to the airplane. (See also sec. 4T.115(d) of this regulation.)

(Pages 181 through 183 deleted by Supplement No. 9 dated June 1, 1963. Page 185 follows.)

SPECIAL CIVIL AIR REGULATION NO. SR-425C

(As amended by Amendment No. 1, issued May 10, 1963, published in 28 F.R. 4945, May 17, 1963.)

Effective: June 6, 1961
Adopted: May 31, 1961
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(26 F.R. 4990)

Provisional Certification and Operation of Aircraft

Special Civil Air Regulation No. SR-425A was adopted on July 22, 1958, to provide for provisional certification of turbine-powered transport category airplanes in order to permit certain air carriers and manufacturers to conduct crew training, service testing, and simulated air carrier operations prior to introduction of the airplanes into commercial service. The objective of this regulation was to provide a means whereby the air carriers and manufacturers could obtain as much experience as possible with turbine-powered airplanes which, although safe for flight, had not been approved for the issuance of a type certificate.

Special Civil Air Regulation No. SR-425B, which superseded SR-425A, was adopted on April 7, 1960, to extend the application of the regulation to: (1) piston-engine transport category aircraft, including rotorcraft; and (2) personal and executive type aircraft, including rotorcraft, irrespective of powerplant type. In addition, this regulation permitted operations such as sales demonstrations and market surveys with aircraft having a provisional type and airworthiness certificate.

To accomplish this, SR-425B provided for, among other things, the issuance of two classes of provisional type and airworthiness certificates. Class I provisional and airworthiness certificates could be issued for all types of aircraft for operation by the aircraft manufacturer. Class II provisional type and airworthiness certificates could be issued only for transport category aircraft, but these aircraft could be operated by either the aircraft manufacturer or a certificated air carrier. In general, the requirements for the issuance of Class I provisional certificates were less stringent, and the operating limitations less confining, than those for the issuance of Class II provisional certificates.

Under the provisions of SR-425B, however, eligibility to apply for Class I provisional certificates was limited to aircraft manufacturers. A recommendation that this eligibility be extended to include engine manufacturers had been evaluated by the Agency prior to the adoption of SR-425B, but rule making action on such extension was deferred until additional experience with provisional certification could be acquired.

Experience accumulated since the adoption of SR-425B has indicated that it would be practicable for engine manufacturers, who have altered a type certificated aircraft by installing type certificated engines of their own manufacture in place of the original engines, to show compliance with the currently effective requirements for issuance of Class I provisional type and provisional airworthiness certificates; and that compliance with these requirements will insure safe operation of provisionally certificated aircraft by such engine manufacturers. Further, the Agency

believes that operations conducted by engine manufacturers under the terms of Class I provisional certificates, for the purpose of sales demonstrations, market surveys, and other similar activities related to the sale of their engines, would contribute to the promotion and development of civil aeronautics in the United States.

SR-425B is therefore being superseded by SR-425C to permit certain engine manufacturers to apply for Class I provisional type and provisional airworthiness certificates if they have applied for the issuance of a supplemental type certificate.

Since this is a superseding regulation which relieves restrictions and imposes no additional burden on any person, notice and public procedures hereon are unnecessary, and this regulation may be made effective on less than 30 days' notice.

In consideration of the foregoing, the following Special Civil Air Regulation is adopted to become effective June 6, 1961:

GENERAL

1. *Applicability.* Contrary provisions of the Civil Air Regulations notwithstanding, provisional type and airworthiness certificates, amendments to provisional type certificates, and provisional amendments to type certificates, will be issued as prescribed in this regulation to a manufacturer or an air carrier. As used in this regulation, a manufacturer shall mean only a manufacturer who is a citizen of the United States; and the term air carrier shall not include an air taxi operator.

2. *Eligibility.*

(a) A manufacturer of aircraft manufactured by him within the United States may apply for Class I or Class II provisional type and provisional airworthiness certificates, for amendments to provisional type certificates held by him, and for provisional amendments to type certificates held by him.

(b) An air carrier holding an air carrier operating certificate authorizing him to conduct operations under Parts 40, 41, 42, or 46 of the Civil Air Regulations may apply for Class II provisional airworthiness certificates for transport category aircraft which meet the conditions of either subparagraphs (1) or (2) of this paragraph.

(1) The aircraft has a currently valid Class II provisional type certificate or an amendment thereto;

(2) The aircraft has a currently valid provisional amendment to a type certificate which was preceded by a corresponding Class II provisional type certificate.

(c) An engine manufacturer who has altered a type certificated aircraft by installing different type certificated engines, manufactured by him within the United States, in place of the original engines, may apply for Class I provisional type and provisional airworthiness certificates for such aircraft, and for amendments to Class I provisional type certificates held by him, if the basic aircraft, before alteration, was type certificated in the normal, utility, acrobatic, or transport category.

3. *Application.*

(a) *General.* Applications for provisional type and airworthiness certificates, for amendments to provisional type certificates, and for

representative of the Administrator determines that a change in design, construction, or operation is necessary to insure safe operation, until such change is made and approved by the authorized representative of the Administrator. Section 1.24 of Part 1 of the Civil Air Regulations shall be applicable to operations under this section.

(i) Only those persons who have a bona fide interest in the operations permitted under this section or who are specifically authorized by both the manufacturer and the authorized representative of the Administrator may be carried in provisionally certificated aircraft: *Provided,* That they have been advised by the operator of the provisional certification status of the aircraft.

(j) The authorized representative of the Administrator may prescribe such additional limitations or procedures as he finds necessary. This shall include limitations on the number of persons who may be carried aboard the aircraft.

14. *Additional limitations to operations by air carriers.* In addition to the limitations in section 13 of this regulation, operations by air carriers shall be subject to the provisions of paragraphs (a) through (d) of this section.

(a) In addition to crewmembers, the aircraft may carry only those persons who are listed in section 40.356(c) of Part 40 of the Civil Air Regulations or who are specifically authorized by both the air carrier and the authorized representative of the Administrator.

(b) The air carrier shall maintain current records for each flight crewmember. These records shall include such information as is necessary to show that each flight crewmember is properly trained and qualified to perform his assigned duties.

(c) The appropriate instructor, supervisor, or check airman shall certify to the proficiency of each flight crew member and such certification shall become a part of the flight crewmember's record.

(d) A log of all flights conducted under this regulation, and accurate and complete records of inspections made and maintenance accomplished, shall be kept by the air carrier and made available to the manufacturer and to an authorized representative of the Administrator.

15. *Other operations.* The Director, Bureau of Flight Standards, may credit toward the aircraft proving test requirements of the applicable air carrier regulations such operations conducted pursuant to this special regulation as he finds have met the applicable aircraft proving test requirements: *Provided,* That he also finds that there is no significant difference between the provisionally certificated aircraft and the aircraft for which application is made for operation pursuant to an air carrier operating certificate.

CERTIFICATES ISSUED UNDER SR–425A AND SR–425B

16. *Duration.* Currently valid provisional type and airworthiness certificates issued in accordance with Special Civil Air Regulations Nos. SR–425A and SR–425B shall remain in effect for the durations and under the conditions prescribed in those regulations.

This special regulation supersedes Special Civil Air Regulation No. SR–425B. [Termination date of June 30, 1963, deleted.]

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SPECIAL CIVIL AIR REGULATION No. SR-446B

Effective: May 25, 1963
Adopted: April 4, 1963
Published: April 13, 1963
(28 F.R. 3648)

Use of Portable Frequency Modulation (FM) Type Radio Receivers on Aircraft During Flight

The purpose of this special regulation is to continue in effect the provisions of currently effective Special Civil Air Regulation No. SR-446A (27 F.R. 4906). SR-446A prohibits the operation of portable frequency modulation (FM) radio receivers during flight on all civil aircraft of the United States operated by an air carrier or a commercial operator. It also prohibits the operation of portable FM radio receivers on all other VOR-equipped civil aircraft of the United States while such VOR equipment is being used for navigational purposes.

In 1961, during tests conducted by the Federal Aviation Agency, it was found that radio receivers having local oscillators operating within or near the VHF omnirange (VOR) frequency band (108 to 118 Mcs.) cause interference which adversely affects the operation of an aircraft's VOR navigational system. Various types of portable radio receivers (i.e., radio receivers capable of being carried aboard an aircraft by a passenger) were used in these tests and it was determined that the portable frequency modulation (FM) radio receiver was the only type receiver commonly usd by the general public that would create this unwanted interference. Although the tests conducted by the Agency were not completed, the initial finding that FM radio receivers operated aboard an aircraft would cause unwanted interference warranted immediate regulatory action to prevent these radios from endangering safety in air commerce. Accordingly, SR-446 (26 F.R. 4011) was issued May 4, 1961; however, to simplify revision of the rule if additional interference problems were found by the tests, it was issued as a temporary rule effective until May 24, 1962. Since the final evaluation of these tests by all interested parties would not have been completed by the time SR-446 was to expire, the provisions of that rule were continued in effect for an additional year until May 24, 1963, by the issuance of SR-446A on May 22, 1962.

The evaluation of the tests conducted by the Agency have now been completed and the evaluations have not revealed any additional interference problems other than that caused by FM radio receivers. Accordingly, since the interference problem which prompted the issuance of SR-446A still exists and since it is necessary in order to provide adequately for safety in air commerce to continue the provisions of that regulation in effect, I find it is in the public interest to make the provisions of that rule permanent.

In the preamble to SR-446A it was indicated that when the evaluation of the tests were completed, the provisions of SR-446A would be incorpo-

rated into the applicable operating parts, i.e., Parts 40, 41, 42, 43, 45, and 46. These parts are presently being recodified and as recodified, will contain the provisions of related Special Civil Air Regulations such as SR–446A. Until their recodification, the provisions contained in SR–446A will be continued in effect in the form of a Special Civil Air Regulation.

Since this regulation continues in effect a Special Civil Air Regulation which expires on May 24, 1963, and a lapse in the effectiveness of the regulation would endanger safety in air commerce, I find that notice and public procedure hereon would be contrary to the public interest.

In consideration of the foregoing, Special Civil Air Regulation No. SR–446A is superseded by the following Special Civil Air Regulation which is hereby adopted to become effective on May 25, 1963.

No person shall operate, nor shall any operator or pilot in command of an aircraft permit the operation of, a portable frequency modulation (FM) radio receiver on the following civil aircraft of the United States while such aircraft are engaged in flight in air commerce:

(a) Aircraft operated by an air carrier or commercial operator; and

(b) Any other aircraft equipped with VHF omnirange (VOR) navigational equipment while such VOR equipment is being used for navigational purposes.

This special regulation supersedes Special Civil Air Regulation No. SR–446A.

This Special Civil Air Regulation is issued under the authority of sections 313(a) and 601 of the Federal Aviation Act of 1958 (49 U.S.C. 1354 and 1421).

SPECIAL CIVIL AIR REGULATION No. SR–455

Effective: November 28, 1962
Adopted: November 21, 1962
Published: November 28, 1962
(27 F.R. 11691)
Correction: December 12, 1962
(27 F.R. 12258)

Air Carrier Inspector's Credential; Admission to Pilot's Compartment

The purpose of this Special Regulation is to authorize Federal Aviation Agency inspectors, upon presentation of the Credential Form FAA–110A, to have access to the pilot's compartment of an aircraft for the purpose of conducting his assigned duties during an en route or other inspection.

Under the present provisions of the regulations governing the operation of air carriers and commercial operators, inspectors of the Federal Aviation Agency are authorized to enter and have a seat available for their use in the pilot's compartment of an aircraft while conducting an en route inspection of the air carrier or commercial operator involved.

Inspectors who are authorized by the Administator to conduct such inspections are furnished a credential Form FAA–110A, entitled "Air Carrier Inspector's Credential". This form contains a picture and description of the inspector to whom it is issued and certifies that he is assigned to the duty of inspecting during flight air carrier aircraft, engines, propellers, appliances, route facilities, operational procedures or airman competency. It also contains an authorization for the inspector to enter and have access to the pilot's compartment in the performance of his duties. This authorization is, of course, necessary to conduct the required government inspections specified in sections 40.22, 41.5, 42.8, and 46.22 of the Civil Air Regulations (14 CFR Parts 40, 41, 42, and 46).

For many years the Form FAA–110A, or a similar credential has been used by inspectors of the FAA and its predecessor agencies as the official identification of those inspectors authorized to have access to the pilot's compartment in the performance of their duties. Until recently, there were no incidents in which the authority of these inspectors was questioned by the air carriers or the crewmembers. With the introduction into service of new type turbojet airplanes the Agency adopted Special Civil Air Regulation SR–440 (25 F.R. 5146) to make it clear that these inspectors must be given full and uninterrupted access to the aircraft, including a seat on the flight deck, as determined by the Administrator, for the proper performance and discharge of their en route inspection duties.

The Agency now finds that incidents have occurred in which the flight crewmembers have questioned the validity of the Form FAA–110A, or have refused to recognize such credential as authority to enter the pilot's

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compartment, and thereby obstructed or impeded the official duties of the inspector presenting the credential. To avoid any further repetition of such incidents it is necessary to adopt an additional rule which authorizes an inspector, upon presentation of the Credential Form FAA–110A, to have access to the pilot's compartment of an aircraft for the purpose of conducting his assigned duties during an en route or other inspection.

Notwithstanding the adoption of this rule each inspector of the Agency will continue, whenever possible, to give prior notification of the inspection in accordance with the procedures established by the air carrier concerned. However, there will be instances in which this notification is not practicable or feasible such as in the case of an emergency or special inspection, or an inspection originating at an intermediate stop. Therefore, in order to avoid any misunderstanding in this regard, it is to be noted that the lack of a prior noitfication by an inspector conducting an en route inspection does not affect his authority under this rule. In addition, it is to be noted that the inspector's authority under this rule is not affected in those cases in which the air carrier has failed to provide the necessary instructions or procedures by which an inspector may be given access to the pilot's compartment with or without a prior company clearance.

This rule, as in the case of that contained in SR–440, is declaratory of a long standing practice of the Agency. It imposes no additional burden on any person and compliance with the notice, procedures and effective date provisions may impede the due and timely execution of the functions of the FAA.

In consideration of the foregoing, this Special Civil Air Regulation is adopted with an immediate effective date to make it clear to all concerned that:

(1) The Form FAA–110A, "Air Carrier Inspector's Credential" certifies that the inspector named and described thereon is authorized to conduct en route or other inspections on aircraft of an air carrier or commercial operator, and

(2) Upon presentation of this credential to the pilot in command of an aircraft he will be admitted and given access to the pilot's compartment of the aircraft for the performance of his duties.

The following Special Civil Air Regulation is hereby adopted to become effective November 28, 1962:

Whenever an inspector of the Federal Aviation Agency shall, in the performance of his duties of conducting an inspection, present his credential Form FAA–110A, "Air Carrier Inspector's Credential",[1] to the pilot in command of an aircraft operated by an air carrier or commercial operator, he shall be given free and uninterrupted access to the pilot's compartment of such aircraft.

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[1] This credential contains a picture and description of the inspector to whom it is assigned and certifies that he is assigned to the duty of inspecting during flight. It also contains an authorization for the inspector to have access to the pilot's compartment in the performance of such duty.

Appendix C

Minimum Standards for the Approval of Airplane Simulators

1. *Application for approval.* An application for approval of an airplane simulator is submitted, in triplicate, to the authorized representative of the Administrator. The application must include the following:

(a) Information sufficient to show that the simulator adequately simulates the type of airplane with respect to the items and systems listed in section 3 of this appendix.

(b) Comparative data sheets showing that the performance and flight characteristics of the airplane simulator have been flight checked and found to be within the limits prescribed for the items listed in section 4 of this appendix. The airplane data used for comparison purposes must be applicable to the currently certificated airplanes. Such data may be obtained:

(1) From the approved Airplane Flight Manual, Type Inspection Reports, or other flight test data provided by the airplane manufacturer. Other sources of airplane data may be used if approved by the authorized representative of the Administrator. Such data must be submitted so as to allow sufficient time for investigation of their adequacy.

(2) By flight tests conducted in the air carrier's own airplane. If this procedure is used, performance and flight characteristics data for the center of gravity limits and weights used during training will be satisfactory. Before starting these flights, an outline of the tests to be conducted in the airplane must be prepared and coordinated by the air carrier with the authorized representative of the Administrator. This outline must contain procedures to be followed and data to be obtained during each phase of the flight testing program. The authorized representative of the Administrator may observe and participate in the flight test program to the extent he considers necessary and appropriate. Any data so obtained will be acceptable for use by other air carriers using the same type of airplane if appropriate arrangements are made with the air carrier originating the data.

2. *General requirements.*

(a) The effect of changes on the basic forces and moments must be introduced for all combinations of drag and thrust normally encountered in flight. The effect of changes in airplane attitude, power, drag, altitude, temperature, gross weight, center of gravity location, and configuration must be included.

(b) In response to control movement by a flight crew member, all instrument indications involved in the simulation of the applicable airplane must be entirely automatic in character unless otherwise specified.

(c) The rate of change of simulator instrument readings and of control forces must, unless specific tolerances are otherwise specified in

this appendix, reasonably correspond to the rate of change which would occur on the applicable airplane under actual flight conditions, for any given change in the applied load on the controls, in the applied power or in aircraft configuration.

(d) Control forces and degree of actuating control travel must, unless specific tolerances are otherwise specified in this appendix, reasonably correspond to that which would occur in the airplane under actual flight conditions.

(e) Through the medium of instrument indication, it must be possible to use the simulator for the training and checking of a pilot in the operational use of controls and instruments on the applicable airplane model during the simulated execution of ground operation, takeoff, landing, normal flight, unusual attitudes, navigation problems, and instrument approach procedures. In addition, the simulator must be designed so that malfunction of aircraft engines, propellers, and primary systems may be presented and corrective action taken by the crew to cope with such emergencies.

(f) Suitable course and altitude recorders must be provided.

(g) Communication and navigation aids of the applicable airplane must be simulated for on-the-ground and in-flight operations.

3. *Minimum standards for simulation of airplane systems.* The simulator shall simulate at least the following items and systems which are appropriate to the airplane being simulated:

(a) All normal cockpit noise related to engine or aerodynamic noise (adjustable volume is permissible);

(b) All flight controls;

(c) Gust locks;

(d) Trim tabs;

(e) Landing gear operation;

(f) Wheel brakes;

(g) Steering mechanisms used on the ground;

(h) Wing flaps and spoilers;

(i) Powerplant operations;

(j) Propeller controls and circuity;

(k) Antidetonation injection systems;

(l) Fuel and oil systems;

(m) Cockpit—the simulator shall represent a full scale mockup, including normal flight crew stations and accommodations for the instructor or check airman, and shall be representative of a typical fleet airplane;

(n) Circuit breaker stations manageable by the flight crew in the flight compartment (those not related to essential flight equipment or systems need not be operative);

(o) Hydraulic systems;

(p) Fire detection and extinguishing systems;

(q) Pneumatic systems (including emergency airbrakes);

(r) Electrical systems;

(s) Interior cockpit lights;

(t) Exterior light controls;

(u) Pressurization and air-conditioning systems (instrument indication and warning signals);

(v) Deicing and anti-icing systems;

(w) Supplemental breathing systems (the systems may be charged with or vented to air).

4. *Minimum standards of tolerance for performance and flight characteristics.* The simulator shall simulate the performance and flight characteristics of the particular type of airplane being simulated within the tolerance limits specified in paragraphs (a) and (b) of this section. If alternate tolerance limits are given, whichever is the greater shall apply.

(a) *Performance characteristics.* (Airplane weight and center of gravity optional.)

(1) Propeller feathering time, ± 3 seconds.

(2) Landing gear operating time, ± 3 seconds.

(3) Wing flap operating time, ± 3 seconds.

(4) Takeoff acceleration time, ± 10 percent.

(5) Calibration of gyrocompass and turn-and-bank indicator in standard rate turns and 30-degree banked turns, through a range of 180 degrees. Average rate of turn shall be within ± 10 percent.

(6) Minimum control speed (in flight), ± 5 knots.

(7) Stall speeds and stall warning speeds (wings level), as follows:

(i) Stall warning speed (initial buffet) in the takeoff, approach, and landing configuration, ± 3 knots.

(ii) Stall speeds in the takeoff, approach, and landing configuration, ± 5 knots.

(iii) The difference between stall warning (initial buffet) and stall speed shall be within ± 5 knots of that for the appropriate airplane, but in no case should the stall occur before the stall warning.

(8) Engine power (thrust) calibration at takeoff and maximum continuous ratings over an altitude range, as follows:

(i) Reciprocating engines: MP, for a given BMEP and RPM, ± 1 inch.

(ii) Turbine engines: N_1 and N_2, for a given EPR, ± 2 percent.

(iii) Critical altitude, piston engine simulators only, ± 800 feet or ± 10 percent.

(9) Speed versus power in level flight at cruise altitude, ± 5 knots, or 3 percent, or .03 Mach.

(10) Rates of climb versus altitude in the following configurations (propeller airplane simulators, ± 50 feet or 10 percent; jet airplane simulators, ± 100 feet or 10 percent):

(i) Takeoff gear down (one engine inoperative),

(ii) Takeoff gear up (one engine inoperative),

(iii) Final takeoff (one engine inoperative),

(iv) All engines en route,

(v) One-engine-inoperative en route climb,

(vi) Two-engine-inoperative en route climb (for airplanes with four or more engines),

(vii) Approach (one engine inoperative), and

(viii) Landing.

NOTE: At least two airplane weights must be included in at least one configuration, and at least two outside air temperatures must be included in at least one other configuration.

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(11) Rates of climb versus airspeed for one takeoff, and one en route configuration (propeller airplane simulators ± 50 feet or ± 10 percent; jet airplane simulators ± 100 feet or ± 10 percent).

(12) In determining compliance with subparagraphs (9), (10), and (11) of this paragraph, MP/BMEP/RPM relationships shall conform to airplane data within the tolerance specified in subparagraph (8)(i), and EPR/Compressor RPM relationships shall conform to airplane data within the tolerance specified in subparagraph (8)(ii) of this paragraph.

(b) *Flight characteristics.* (Airplane weight and center of gravity optional.)

(1) Static longitudinal control stability: In the landing, approach, cruise (high and low altitude), and climb configurations, return to trim, when the simulator speed is caused to depart 15 percent from trim speed, shall be within ± 5 knots of approved airplane data. The slope of the stick force curve shall be positive. One of these configurations shall cover a center of gravity range.

(2) Control forces: Simulator control forces in the following areas shall be within ± 8 pounds or ± 25 percent of the forces encountered in the airplane as indicated by the required data; except that, in regard to rudder forces, the tolerance shall be ± 10 pounds or ± 20 percent:

(i) Longitudinal control forces during flap retraction (power off and power on), flap extension, power or thrust application, go-around following a balked landing.

(ii) Minimum control speed (in flight), rudder and aileron forces.

(iii) Stick force per "g."

(3) The roll rate of the simulator shall be within ± 2 seconds or ± 25 percent, whichever is greater, of that of the airplane.

NOTE: If data for items in subparagraphs (2)(ii), (2)(iii) and (3) of this paragraph are not contained in the Type Inspection Report, the authorized representative of the Administrator may adjudge the adequacy of simulation.

(4) In the following areas, specified tolerance limitations are not set forth in these standards. In these areas of flight characteristics, when appropriate to the type of airplane being simulated, the adequacy of simulation shall be subject to the approval of the authorized representative of the Administrator:

(i) Compressibility trim change.

(ii) Approaches to stall in the takeoff, approach, and landing configuration (wings level), from initial buffet to stall; except that at least one approach to a stall must be done in a 20-degree bank turn.

(iii) Buffet at high Mach numbers up to design Mach limits.

(iv) Dutch roll.

(v) Emergency descents.

5. *Minimum standards of tolerance for simulator navigational accuracy.* At any altitude, on any heading, and at any airspeed, the navigational accuracy of the simulator must be as follows:

(a) The distance traveled with zero wind in a particular time interval must be equivalent to ± 5 percent of the horizontal component of the true airspeed multiplied by the time interval.

(b) The track of the simulator with no wind must agree with the true heading of the simulator within ± 3 degrees which shall include allowances for instrument error. (This shall apply when the simulator is turning as well as flying a straight course.)

(c) During simulated ILS approaches with zero wind, the descent path of the simulator, as indicated by airspeed, altitude, and rate of descent, must agree with the descent path as indicated by the flight instrument indicating glide path deviation, within ± 20 feet from 0 to 200 feet, ± 10 percent of the height above the runway, from 200 to 1,000 feet, and ± 100 feet from 1,000 to 5,000 feet above the airport elevation.

the month before or following the month in which they are due. Such flexibility will simplify recordkeeping and administration of the crewmember and dispatcher competence check requirements of section 40.289(b) in the same way that the pilot line and proficiency check requirements have been simplified.

The FAA has considered the foregoing recommendations and believes that the requirements with respect to the frequency of crewmember and dispatcher competence checks should be amended to provide the flexibility recommended.

Civil Air Regulations Draft Release No. 61-7, dated April 14, 1961, subject "Qualification and Training Requirements for Pilots Other Than Pilots in Command," proposed, among other matters, to amend Parts 40, 41, and 42 to permit the competence checks of crewmembers and dispatchers to be given at any time during the month preceding or following the month in which they become due.

No adverse comments were received with respect to this particular portion of Draft Release 61-7. *Accordingly, since it will permit more efficient administration of air carrier* training programs and will not adversely affect safety of the carriers' operations, it is being adopted at this time separately from the other proposals which were included in the draft release. The phrase "not to exceed 12 months" contained in the present regulations and in Draft Release 61-7 has been changed to "each 12 months" to make the wording consistent with that of revised Part 41 (27 F.R. 1977), which was circulated as Draft Release 60-19 (26 F.R. 12299) prior to its adoption. The remaining proposals and the comments received thereon are being evaluated by the Agency in conjunction with comments received in response to Draft Release 61-17, "Use of Aircraft Simulators for Pilot Training and Proficiency Checks," and Draft Release 62-9, "Approval of Air Carrier Training Programs."

Interested persons have been afforded an opportunity to participate in the making of this regulation (26 F.R. 3438), and due consideration has been given to all relevant matter presented. Since this regulatory action imposes no additional burden on any person, it may be made effective on less than 30 days' notice.

Amendment revised paragraph (b) of section 40.289.

Amendment 40-38

Airborne Distance Measuring Equipment, Low Frequency Radio Range, and Automatic Direction Finding Equipment Requirements	Adopted: Jan. 11, 1963 Effective: July 1, 1963 Published: Jan. 28, 1963 (28 F.R. 479)

This amendment provides that after June 30, 1963, an airplane which is required by the Civil Air Regulations to be equipped with VOR navigational equipment, and operates at and above 24,000 feet MSL in the 48 contiguous states and the District of Columbia must also be equipped with an approved distance measuring equipment unit, capable of receiving and indicating distance information from VORTAC facilities. When sufficient VORTAC facilities become available for use in Alaska and Hawaii, DME will also be required in these areas. In addition, the amendment requires that approved distance measuring equipment be installed on the following air carrier airplanes which are required to be equipped with VOR receivers and operate in the 48 contiguous states and the District of Columbia, regardless of the altitude at which they operate after the following dates:

1. Turbojet airplanes—June 30, 1963;
2. Turboprop airplanes—December 31, 1963;
3. Pressurized reciprocating engine airplanes—June 30, 1964; and
4. Other airplanes having a maximum certificated takeoff weight of more than 12,500 pounds—June 30, 1965.

This amendment also authorizes the operation of an air carrier airplane over low frequency routes with only one low frequency radio range receiver or automatic direction finding receiver under certain conditions. In addition, it deletes the authority presently contained in section 40.232(c) which permits operation with only one VOR receiver installed when navigation is predicated on the use of VOR ground aids.

The Federal Aviation Agency published as a notice of proposed rule making (26 F.R. 4455) and circulated as Civil Air Regulations Draft Release No. 61-11, dated May 24, 1961, a proposal to amend Parts 40, 41, 42, and 43 of the Civil Air Regulations to require the installation of distance measuring equipment (DME) in certain United States civil airplanes in accordance with a specific schedule.

Distance measuring equipment is that portion of the Rho Theta System of Short-range Navigation, the standard internationally adopted short-range system of navigation, which indicates to a pilot the distance his aircraft is from the ground station transmitter. To achieve the maximum safety and efficiency of operation possible from the use of the Rho Theta System of Short-range Navigation, or VORTAC System as commonly known, distance information is equally as important as bearing or azimuth information. The distance information obtained from distance measuring equipment assists a pilot in staying within the limits of the airspace assigned him by his air traffic control clearance. It is invaluable information particularly with respect to jet aircraft approaching terminal areas at high speeds. It reduces the margin of error in estimating position and the proper time to begin a deceleration. Distance information also facilitates the accurate navigation of aircraft in the avoidance of severe weather turbulence, in holding, and in rerouting by air traffic control.

In 1957, the President's Air Coordinating Committee, with representation from all segments of the aviation industry, concluded that traffic volume, complexity of operations, safety requirements, efficient use of airspace, and the expeditious movement of air traffic dictate that maximum use of both the azimuth and distance measuring capabilities of VORTAC be required by at least 1965 in the navigation of aircraft subject to positive separation and in the performance of air traffic control service for such aircraft. The committee recommended that by that time all aircraft to be operated under Instrument Flight Rules and those to be operated under Visual Flight Rules in such a manner that they will be subject to positive separation be required to have both distance measuring and azimuth capability. In accord with this recommendation, Draft Release No. 61-11 was published.

Subsequent to the publication of Draft Release 61-11, the report of the Task Force on Air Traffic Control, known as Project Beacon, set forth a long-range plan to insure the efficient and safe control of the nation's air traffic. This report, around which the nation's air navigation system is being built, firmly reiterated the need for DME in order to attain the degree of accuracy in navigation necessary for the safe control of air traffic.

In this connection the Agency conducted a public symposium in Washington, D.C., in February 1962, to discuss airborne equipment requirements associated with implementation of Project Beacon. The Agency emphasized that the Rho Theta system of air navigation, toward which the Federal government and the aviation industry had so long striven, required that VOR and DME be used in conjunction with each other. It was pointed out that the system had originally been adopted and developed with the concurrence of industry users and at considerable public expense. It was also stated that maximum safe utilization of the system is dependent on airborne navigation equipment being compatible with the ground environment, and that consideration must be given to the environment in which the airplane operates in determining the need for all navigational equipment, including DME.

All civil airplanes operating in the 48 contiguous states and the District of Columbia at altitudes of 24,000 feet and above are operating within the continental control area airspace. Additionally, they are in an environment of very high-speed air traffic which necessitates continuous position fixing capabilities and very accurate airborne navigational information. Therefore, in keeping with the concept that equipment requirements should be determined by the operational environment, it has been determined that distance measuring equipment should be required on all civil airplanes operating in the 48 contiguous states and the District of Columbia at altitudes of 24,000 feet and above after June 30, 1963, if VOR navigational equipment is required.

All DME ground installations serving the high-altitude route structure are scheduled to be completed by January 1, 1964. However, it is anticipated that virtually complete DME coverage for this route structure will be available by June 30, 1963. Other DME ground installations are proceeding rapidly and DME coverage in both the lower route structures and in terminal areas will be extensive by 1964–1965. These facts together with the availability of airborne DME meeting appropriate standards have been considered in the preparation of this amendment and in that pertaining to general aviation.

Public safety requires that all air carrier operations be conducted with the highest level of safety and with the best and most accurate navigational information available. In view thereof, and in consideration of the fact that large air carrier airplanes generally operate at higher speeds, in the higher density terminal areas, and in that airspace in which facilities and procedures for the use of DME are receiving priority, large air carrier airplanes operating in the 48 contiguous states and the District of Columbia, irrespective of operating altitudes, should be required to have DME installed in accordance with a prescribed schedule. In establishing this schedule, the Agency has taken into consideration the installation schedule of DME ground facilities and the types of airplanes which operate in the various airspace environments served by these facilities. Accordingly, whenever VOR navigational equipment is required, all airplanes operated by air carriers, and commercial operators conducting operations pursuant to Part 40, will be required to have DME installed as follows:

1. On July 1, 1963, all turbojet airplanes;
2. On January 1, 1964, all turboprop airplanes;
3. On July 1, 1964, all pressurized reciprocating engine airplanes; and
4. On July 1, 1965, all other airplanes having a maximum certificated takeoff weight of more than 12,500 pounds.

While this amendment requires DME only for operations in the 48 contiguous states and the District of Columbia, it will be extended to include operations in Alaska and Hawaii at such time as sufficient VORTAC facilities are installed in those areas.

A basic concept with respect to the safety standards applicable to air carriers is that their airplanes must be equipped with dual radio navigational and communications equipment in order to provide a high level of safety in the event of equipment failure. This concept will continue to be reflected in the regulations until such time as the reliability of the equipment indicates that a failure is most improbable. However, with respect to airborne DME, the Agency believes that the immediate demands on the available supply of this equipment will be such that the public interest would be better served if dual distance measuring equipment is not required at this time. This will assure the availability of airborne DME for installation at the time specified in the amendment and may permit such installation in advance of the times specified.

In addition to Draft Release No. 61–11 which pertained to DME requirements, the Agency, on October 6, 1961, issued a notice of proposed rule making (26 F.R. 9430) and circulated for comment Civil Air Regulations Draft Release No. 61–22. This draft release proposed to amend Part 40 of the Civil Air Regulations by amending section 40.232(b) and by deleting section 40.232(c) and the related section 40.232–1. Amendments to the rules pertaining to operations conducted pursuant to Parts 41 and 42 to effect the same regulatory changes were also proposed.

As explained in the draft release, the provisions which permitted air carriers, in certain instances, to equip their airplanes with only one VOR and one LF/MF receiver during the period of transition from an LF/MF airways system to a VOR airways system are no longer appropriate in view of the present coverage and the extensive use of VOR aids, and the rapidly diminishing number of LF/MF routes. It was, therefore, proposed to require all air carrier airplanes, which are to be operated IFR utilizing VOR aids, to be equipped with two VOR receivers. It was also considered feasible, and so proposed, to amend the regulations to permit an airplane equipped with two VOR receivers to operate on the few remaining low frequency route segments equipped with only one LF/MF receiver, provided the airplane is so fueled and VOR aids are so located that the airplane could, in the event of a failure of the LF/MF receiver, proceed safely to an airport by means of VOR aids and complete an instrument letdown by use of the remaining airplane radio system.

All comments received in response to this draft release have been given full consideration. In the judgment of the Agency, deletion of the provision contained in section 40.232(c), which permitted airplanes to be equipped with only one VOR and one LF/MF navigation receiver for IFR operations within the United States during the transition period, is considered necessary in view of the existing air carrier safety requirement for dual equipment, and appropriate in view of the fact that the period of transition from LF/MF to VOR ground aids in the United States is essentially completed. It is also considered appropriate and not detrimental to the safety of operations to permit air carrier airplanes equipped with two VOR receivers and one LF/MF receiver, to operate over the few remaining LF/MF route segments until such time as these route segments

are completely replaced by VOR airways, if an adequate alternate VOR routing is available by which the airplane could safely proceed, if necessary, due to the failure of the LF/MF receiver, and the airplane carries sufficient fuel in the event such routing becomes necessary. In order to provide sufficient leadtime for equipping airplanes which have only one VOR receiver installed with a second such receiver, this amendment is being made effective July 1, 1963.

The format of this amendment will be subject to such change as may be necessary for its recodification under the Agency's Recordification Program, announced in Draft Release No. 61-25 (26 F.R. 10698).

Interested persons have been afforded an opportunity to participate in the making of this regulation (26 F.R. 4455 and 9430), and due consideration has been given to all relevant matter presented.

Amendment revised paragraphs (b) and (c) of, and added a new paragraph (d) to, section 40.232; and deleted section 40.232-1.

Amendment 40-39

Minimum Standards for Approval of Airplane Simulators	Adopted: April 4, 1963 Effective: June 10, 1963 Published: April 10, 1963 (28 F.R. 3474)

This amendment to Part 40 sets forth the standards which must be met for approval of airplane simulators to be used in training programs which are substituted alternately for pilot proficiency checks.

The Federal Aviation Agency published as a notice of proposed rule making (26 F.R. 8461) and circulated as Civil Air Regulations Draft Release No. 61-17 on August 31, 1961, a proposal to amend Parts 40, 41, and 42 of the Civil Air Regulations to prescribe standards for the approval of aircraft simulators, for training courses in aircraft simulators, and for the use of synthetic trainers for proficiency flight check maneuvers.

In addition to the proposals contained in Draft Release 61-17, the Agency published on March 10, 1962, a separate notice of proposed rule making (27 F.R. 2319), circulated as Civil Air Regulations Draft Release No. 62-9, which concerns the proposed overall training standards to be used in approving an air carrier's training program. Therefore, all comments received in response to Draft Release 61-17 which concern training programs and standards will be considered in conjunction with the comments received on Draft Release 62-9. All other comments received which concern the minimum standards for the approval of airplane simulators have been considered in connection with this amendment.

Some of the comments received in response to Draft Release 61-17 indicated a basic assumption with respect to simulators which is not essentially correct. It was contended that simulator requirements should not be specified except in those areas directly related to maneuvers which the pilot is required to perform, in an airplane, during the course of a proficiency flight check. This reasoning assumes that the simulator is only used as a substitute for an airplane in the conduct of proficiency flight checks. When the regulations were amended to allow substitution of an airplane simulator training course for each alternative proficiency flight check in an airplane, the added contribution to safety which is derived from the full simulator training courses was considered as a justification for the amendment. Accordingly, if the simulator is to be used it should perform to the degree required to accomplish such a training course. Thus, the standards and tolerances contained in this amendment as Appendix C to Part 40 are those which must be met prior to approval of an airplane simulator for use in a simulator training course which is to be used as a substitute for alternative pilot proficiency flight checks as provided by sections 40.302(b)(3) and 40.305(b). To make this clear, the term "airplane simulator which meets the standards set forth in Appendix C" has been substituted in section 40.302(b)(3) of this amendment for the words "aircraft simulator," and the requirements in present section 40.302(b)(3) for approval of an airplane simulator have been incorporated in the Appendix.

In consideration of the many comments received in response to Draft Release 61-17, the standards contained in Appendix C for approval of the simulator differ somewhat from those proposed in the draft release. For example, the phraseology "* * * minimum and maximum limits of the systems * * * as shown in the approved Airplane Flight Manual and/or the maintenance section of the air carrier's manual" contained in section 1(a) of the proposal is being deleted for clarity. Industry objection to this terminology was based on the misunderstanding that it was applicable to flight characteristics, when in fact it applies only to airplane systems. To clarify this requirement this section has been changed by specifying the items of the systems which the simulator is required to simulate for approval.

The proposed section 1(c)(1) has been renumbered as section 1(b)(1) and revised to permit any adequate airplane data obtained from sources other than the approved Airplane Flight Manual, Type Inspection Report, or other flight test data provided by the airplane manufacturers, to be used for comparison purposes. As a determination by the Agency of the adequacy of such data cannot always be made immediately, this amendment requires the submission of these data by the carrier sufficiently in advance of the date set for the simulator evaluation to permit the Agency to investigate their adequacy.

Section 1(b)(2) provides for the acquisition of airplane data by flight tests conducted in the air carrier's airplane. This section clearly indicates that the procedures and methods to be followed in obtaining data must be coordinated with the FAA representative participating in the flight test program conducted to obtain these data. As such coordination, when accomplished, would require the concurrence of the participating FAA representative with the flight test methods and procedures to be utilized to obtain the data, the proposed reference to Part 4b of the Civil Air Regulations with respect to such flight tests is unnecessary and is deleted in this amendment. This section has also been changed to expressly provide that an Agency representative may permit the carrier to conduct such portions of the flight test program as he deems appropriate without participation by the representative.

The air carriers objected to the proposed requirements for airplane simulator maintenance. These objections indicated a need for rephrasing the requirements as proposed, without substantive change, to reflect more clearly the intent of the requirements. As a result, they have been rewritten and placed in section 40.302(b)(3). As rewritten, the requirements provide:

(1) That the air carrier is responsible for maintaining the simulator to the same standards as required for initial approval;

(2) That simulator flight training and/or proficiency flight check activities must not be started with a "cold" simulator; however, in order not to hinder the carrier's flexibility in scheduling the use of a simulator, the functional preflight check of the simulator is required to be conducted only once each day that the simulator is to be used for training or the conduct of proficiency flight checks, and at any convenient time prior to commencing daily simulator operations;

(3) That a daily discrepancy log must be maintained;

(4) That the simulator be modified, if appropriate, when a modification is made to the airplane; and

(5) That procedures for the continued use of the simulator with certain inoperative instruments or equipment may be established.

The Air Transport Association objected to proposed paragraph (x) of section 3 on the ground that it would "give blanket authority to the FAA to require additional systems" not specifically required by regulations. As it is intended that all standards for the approval of airplane simulators will be promulgated with opportunity for the industry to participate in the rule making, paragraph (x) has been deleted.

In order to indicate more specifically the tolerances applicable in each area of performance, the format of section 4(a) has also been revised.

With respect to rate-of-climb tolerances, Appendix C, while specifying a tolerance of ±50 feet per minute or 10 percent for propeller airplane simulators, allows ±100 feet per minute or 10 percent for jet airplane simulators in view of the much higher rates of climb encountered in the operation of jet airplanes.

A new item, section 4(a)(6), "Minimum control speed," has been inserted. As pointed out by industry comment, no airspeed tolerances had been proposed for V_{MC}.

Considerable objection was raised by the air carriers to the proposed requirement pertaining to stall speeds. As a result of consideration of comments received, these

standards provide more flexibility with respect to the range between initial buffet and stall, and give recognition to the relatively greater importance of accurate simulation of stall warning (initial buffet). These standards also clarify the stall requirements by specifically listing the applicable configurations in which stall and stall warning speeds must be checked.

With respect to the standards applicable to simulator flight characteristics, as proposed in section 4(b), several changes have been made as a result of industry comment. These do not constitute substantive changes in the intent of the proposed standards but do more clearly state the applicable requirements. These changes are as follows:

(1) In lieu of the proposed reference to force reversal, these standards require that, with respect to static longitudinal stability, the slope of the stick force curve of the simulator shall be positive.

(2) The standards have been rewritten to preclude any interpretation which would permit an individual inspector to prescribe specific standards other than those contained in Appendix C. As the prescription of specific limitations in certain areas is not feasible, the FAA personnel who evaluate an airplane simulator will adjudge the adequacy of simulation in these areas.

(3) The requirement contained in the proposed section 4(b)(1) that the simulator return to trim speed within ±5 knots was unintentional. Comment received called attention to the fact that the airplane, during certification, is required to return to within 10 percent of trim speed. The standards contained in Appendix C require that the simulator return to trim within ±5 knots of the speed at which the airplane returned during certification tests.

(4) The proposed sections 4(b)(3) and 4(b)(4) are being deleted as redundant in view of the fact that it is intended only to measure these forces in determining adequate simulation of minimum control speed as required in the proposed section 4(b)(5).

(5) Appendix C permits the authorized representative of the Administrator, in the event data pertaining to stick force versus "g", rudder and aileron forces at V_{MC}, or roll rates are not available in the Type Inspection Report, to use judgment in determining the adequacy of simulation in these areas.

(6) The proposed section 4(b)(11) has been deleted as the standards contained herein are complete. Should additional standards be considered necessary in the future, they will be included in Appendix C only after due notice of proposed rule making and a thorough consideration of industry views thereon.

The air carriers objected to the requirements proposed in section 5 regarding the standards of tolerance for simulator navigational recorders on the basis that the recorder should be treated as nonrequired auxiliary equipment. There is merit to their contention that a check pilot can judge a pilot's performance without reference to the recorder. However, in order for a simulator to fulfill completely its training objectives, it must, in addition to being able to simulate indications of position with respect to radio navigational facilities, provide a record of the track and altitude flown. In order to do so realistically, its track, distance traveled, and, in the case of an ILS approach, it descent path in stall air, must correspond with heading, true airspeed, and, during ILS approaches, glide path, altitude, airspeed, and rate-of-descent indications. In addition, the path of flight must be recorded in such a manner as to be available to the trainee and to the instructor or check pilot for evaluation after completion of a flight. As the recorder unit, of which the recorder indicators are in integral part, is essential to the navigational ability of most simulators presently in general use, the proposal specified simulator navigational accuracy in terms of recorder accuracy. In order to indicate more clearly the intent of these standards with respect to simulator navigational ability, they have been rewritten to specify tolerances pertaining to the navigational accuracy of the simulator. With respect to the tolerances themselves, the tolerances for an ILS glide path have been liberalized in accordance with comment received.

Finally, section 6 of the proposal has been rewritten, in accordance with industry suggestions, to indicate more clearly that, while failure to maintain a simulator to prescribed standards and tolerances shall be cause for cancelling approval for its use in accordance with the provisions of section 40.302(b)(3) and section 40.305(b), training may be continued with certain instruments or equipment inoperative. Further, this provision has been placed in section 40.302(b)(3) instead of in the Appendix.

Interested persons have been afforded an opportunity to participate in the making of this regulation (26 F.R. 8461), and due consideration has been given to all relevant matter presented.

Amendment revised section 40.302(b)(3), deleted section 40.302–5, and added Appendix C.

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