U. S. DEPARTMENT OF COMMERCE

Sinclair Weeks, Secretary

CIVIL AERONAUTICS ADMINISTRATION

F. B. Lee, Administrator

Scheduled Interstate Air Carrier Certification and Operation Rules

April 1954

Civil Aeronautics Manual 40

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.
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Introductory Note

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

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

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

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

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

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Scheduled Interstate Air Carrier Certification and Operation Rules

Applicability and Definitions

"40.1 *Applicability of this part.* The provisions of this part are applicable to air carriers holding certificates of public convenience and necessity issued in accordance with Title IV of the Civil Aeronautics Act of 1938, as amended, when they engage in scheduled interstate air transportation within the continental limits of the United States: *Provided,* That the provisions of this part shall not apply to operations conducted pursuant to economic exemption authority issued by the Board for a period of 90 days or less: *And provided further,* That the Administrator may authorize any air carrier holding authority to engage in scheduled cargo operations pursuant to Title IV of the Civil Aeronautics Act of 1938, as amended, to conduct such operations in accordance with the air carrier certification and operations rules prescribed in Part 42 of this subchapter: *And provided further,* That in the case of segments of routes extending beyond the continental limits of the United States, the Administrator may authorize an air carrier to conduct operations over such route segments pursuant to provisions of this part."

"40.2 *Applicability of Parts 43 and 60 of this subchapter.* The provisions of Parts 43 and 60 of this subchapter shall be applicable to all air carrier operations conducted under the provisions of this part unless otherwise specified in this part."

"40.5 *Definitions.* As used in this part terms shall be defined as follows:

"*Accelerate-stop distance.* Accelerate-stop distance is the distance required to accelerate an airplane to a specified speed and, assuming failure of the critical engine at the instant that speed is attained, to bring the airplane to a stop. (See the pertinent airworthiness requirements for the manner in which such distance is determined.)

"*Administrator.* The Administrator is the Administrator of Civil Aeronautics.

"*Air carrier.* Air carrier means any citizen of the United States who directly, or by lease or by other arrangement, undertakes the carriage by airplane of persons or property as a common carrier for compensation or hire, or the carriage of mail by airplane.

"*Air traffic clearance.* An air traffic clearance is an authorization issued by air traffic control for an airplane to proceed under specified conditions.

"*Air traffic control.* Air traffic control is a service provided for the purpose of: (1) Preventing collisions between airplanes, and, on the airport ground maneuvering area, between airplanes and obstructions; and (2) expediting and maintaining an orderly flow of air traffic.

"*Aircraft dispatcher.* An aircraft dispatcher is an individual holding a valid aircraft dispatcher certificate issued by the Administrator who exercises responsibility with the pilot in command in the operational control of each flight.

"*Airframe.* Airframe shall mean any and all kinds of fuselages, booms, nacelles, cowlings, fairings, empennages, airfoil surfaces, and landing gear, and all parts, accessories, or controls, of whatever description, appertaining thereto, but not including engines and propellers.

"*Airplane.* A power-driven fixed-wing aircraft, heavier than air, which is supported by the dynamic reaction of the air against its wings.

"*Airport.* An airport is an area of land

or water which is used, or intended for use, for the landing and take-off of airplanes.

"Alternate airport. An alternate airport is an approved airport to which a flight may proceed if a landing at the airport to which the flight was dispatched becomes inadvisable.

"Appliances. Appliances shall mean instruments, equipment, apparatus, parts, appurtenance, or accessories of whatever description, which are used, or are capable of being or intended to be used, in the navigation, operation, or control of airplanes in flight (including communication equipment, electronic devices, and any other mechanism or mechanisms installed in or attached to airplanes during flight, but excluding parachutes), and which are not a part or parts of airframes, engines, or propellers.

"Approved. Approved, when used alone or as modifying terms such as means, method, action, equipment, etc., shall mean approved by the Administrator.

"Authorized representative of the Administrator. An authorized representative of the Administrator shall mean any employee of the Civil Aeronautics Administrator or any private person, authorized by the Administrator to perform particular duties of the Administrator under the provisions of this part.

"Ceiling. Ceiling is the height above the ground or water of the lowest layer of clouds or obscuring phenomena that is reported as "broken," "overcast," or "obscuration" and not classified as "thin" or "partial."

"Check airman. A check airman is an airman designated by the air carrier and approved by the Administrator to examine other airmen to determine their proficiency with respect to procedures and technique and their competence to perform their respective airman duties.

"Control area. Control area is airspace having defined dimensions, designated by the Administrator, which extends upward from an altitude of 700 feet above the surface, within which air traffic control is exercised. In the case of operations conducted in the airspace of a foreign country, control area shall mean the airspace designated by the appropriate authority of such country.

"Control zone. Control zone is airspace having defined dimensions, designated by the Administrator, which extends upward from the surface, which includes one or more airports, and within which rules additional to those governing control areas apply for the protection of air traffic. In the case of control zones located in foreign countries, the control zone shall be designated by the appropriate authority of such country.

"Crew member. A crew member is any individual assigned by an air carrier for the performance of duty on an airplane in flight.

"Critical engine. The critical engine is that engine the failure of which gives the most adverse effect on the airplane flight characteristics relative to the case under consideration.

"Critical-engine-failure speed. V_1 *(transport category airplanes).* The critical-engine-failure speed is the airplane speed used in the determination of the take-off distance required at which the critical engine is assumed to fail. (See the pertinent airworthiness requirements for the manner in which such speed is determined.)

"Dispatch release. A dispatch is an authorization issued by an air carrier specifying the conditions for the origination or continuance of a particular flight.

"Duty aloft. Duty aloft includes the entire period during which an individual is assigned as a member of an airplane crew during flight time.

"Effective length of runway.

"(1) Take-off. The effective length of runway for take-off as used in the take-off operating limitations for nontransport category airplanes is the distance from the end of the runway at which the take-off is started to the point at which the obstruction clearance plane associated with the other end of the runway intersects the center line of the runway.

"(2) Landing. The effective length of runway for landing as used in the landing operating limitations for both transport and nontransport category airplanes is the distance from the point at which the obstruc-

tion clearance plane associated with the approach end of the runway intersects the center line of the runway to the far end thereof.

"En route. En route shall mean the entire flight from the point of origination to the point of termination, including intermediate stops.

"Extended overwater operation. An extended overwater operation shall be considered an operation over water conducted at a distance in excess of 50 miles from the nearest shore line.

"Fireproof. Fireproof material means a material which will withstand heat equally well or better than steel in dimensions appropriate for the purpose for which it is to be used. When applied to material and parts used to confine fires in designated fire zones, fireproof means that the material or part will perform this function under the most severe conditions of fire and duration likely to occur in such zones.

"Fire-resistant. When applied to sheet or structural members, fire-resistant material means a material which will withstand heat equally well or better than aluminum alloy in dimensions appropriate for the purpose for which it is to be used. When applied to fluid-carrying lines, this term refers to a line and fitting assembly which will perform its intended protective functions under the heat and other conditions likely to occur at the particular location.

"Flame-resistant. Flame-resistant material means a material which will not support combustion to the point of propagating, beyond safe limits, a flame after the removal of the ignition source.

"Flammable. Flammable fluids or gases mean those which will ignite readily or explode.

"Flash-resistant. Flash-resistant material means material which will not burn violently when ignited.

"Flight crew member. A flight crew member is a crew member assigned to duty on an airplane as a pilot or flight engineer.

"Flight engineer. A flight engineer is an individual holding a valid flight engineer certificate issued by the Administrator and whose primary assigned duty during flight is to assist the pilots in the mechanical operation of an airplane.

"Flight time. Flight time is the time from the moment the airplane first moves under its own power for the purpose of flight until it comes to rest at the next point of landing (block-to-block time).

"High-altitude operation. High-altitude operation is flight conducted at or above 12,500 feet above sea level east of longitude 100° W. and at or above 14,500 feet above sea level west of longitude 100° W.

"IFR. IFR is the symbol used to designate instrument flight rules.

"Interstate air transportation. Interstate air transportation is the carriage by airplane of persons or property as a common carrier for compensation or hire or the carriage of mail by airplane, in commerce between a place in any State of the United States, or the District of Columbia, and a place in any other State of the United States, or the District of Columbia; or between places in the same State of the United States, or the District of Columbia; whether such commerce moves wholly by airplane or partly by airplane and partly by other forms of transportation.

"Maximum certificated take-off weight. Maximum certificated take-off weight is the maximum take-off weight authorized by the terms of the airplane airworthiness certificate.[1]

[1] The airplane airworthiness certificate incorporates as a part thereof the airplane operating record or that portion of an Airplane Flight Manual which contains the pertinent limitation."

"Minimum control speed. The minimum control speed is the minimum speed at which an airplane can be safely controlled in flight after an engine suddenly becomes inoperative. (See pertinent airworthiness requirements for the manner in which such speed is determined.)

"Month. Month shall mean that period of time extending from the first day of any month as delineated by the calendar through the last day thereof.

"Night. Night is the time between the ending of evening civil twilight and the beginning of morning civil twilight as published in the American Air Almanac con-

verted to local time for the locality concerned.[2]

"[2] The American Air Almanac containing the ending of evening twilight and the beginning of morning twilight tables may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Information is also available concerning such tables in the offices of the Civil Aeronautics Administration or the United States Weather Bureau."

"Obstruction clearance area:

(1) Take-off. A take-off obstruction clearance area as used in the take-off operating limitations for nontransport category airplanes is an area on the earth's surface defined as follows: The center line of the obstruction clearance area in plain view shall coincide with and prolong the center line of the runway, beginning at the point where the obstruction clearance plane intersects the center line of the runway and proceeding to a point not less than 1,500 feet from the beginning point. Thereafter the center line shall proceed in a path consistent with the take-off procedure for the runway or, where such a procedure has not been established, consistent with turns of at least 4,000-foot radius until a point is reached beyond which the obstruction clearance plane clears all obstructions. The obstruction clearance area shall extend laterally for a distance of 200 feet on each side of the center line at the point where the obstruction clearance plane intersects the runway and shall continue at this width until the end of the runway; thence it shall increase uniformly to 500 feet on each side of the center line at a point 1,500 feet from the intersection of the obstruction clearance plane with the runway; thereafter it shall extend laterally for a distance of 500 feet on each side of the center line.

"(2) Landing. A landing obstruction clearance area as used in the landing operating limitations for both transport and nontransport category airplanes is an area on the earth's surface defined as follows: The center line of the obstruction clearance area in plan view shall coincide with and prolong the center line of the runway, beginning at the point where the obstruction clearance plane intersects the center line of the runway and proceeding to a point not less than 1,500 feet from the beginning point. Thereafter the center line shall proceed in a path consistent with the instrument approach procedure for the runway or, where such a procedure has not been established, consistent with turns of at least 4,000-foot radius until a point is reached beyond which the obstruction clearance plane clears all obstructions. The obstruction clearance area shall extend laterally for a distance of 200 feet on each side of the center line at the point where the obstruction clearance plane intersects the runway and shall continue at this width until the end of the runway; thence it shall increase uniformly to 500 feet on each side of the center line at a point 1,500 feet from the intersection of the obstruction clearance plane with the runway; thereafter it shall extend laterally for a distance of 500 feet on each side of the center line.

"Obstruction clearance plane. An obstruction plane is a plane which is tangent to or clears all obstructions within the obstruction clearance area and which slopes upward from the runway at a slope of 1:20 to the horizontal as shown in a profile view of the obstruction clearance area.

"Operational control. Operational control is the exercise of authority over initiation, continuation, diversion, or termination of a flight.

"Over-the-top. Over-the-top shall mean the operation of an airplane above a layer of clouds or obscuring phenomena that is reported as 'broken,' 'overcast,' or 'obscuration' and not classified as 'thin' or 'partial.'

"Pilot in command. The pilot in command is the pilot designated by the air carrier as the pilot responsible for the operation and safety of the airplane during the time defined as flight time.

"Pilotage. Pilotage is navigation by means of visual reference to landmarks.

"Propeller. Propeller shall mean a device for propelling an airplane through the air, having blades mounted on a power-driven shaft, which when rotated produces by its action on the air a thrust approximately parallel to the longitudinal axis of the airplane.

"Provisional airport. A provisional airport is an airport approved for use by an air carrier for the purpose of providing service to a community when the regular airport serving that community is not available.

"Rating. Rating is an authorization issued with a certificate, and forming a part thereof, delineating special conditions, privileges, or limitations pertaining to such certificate.

"Refueling airport. A refueling airport is an airport approved as an airport to which flights may be dispatched only for refueling.

"Regular airport. A regular airport is an airport approved as a regular terminal or intermediate stop on an authorized route.

"Route. A route is the airspace on either side of a course joining those points on the surface of the earth between which an air carrier provides air transportation in accordance with the terms of its certificate of public convenience and necessity issued by the Board.

"Route segment. A route segment is a portion of a route each terminus of which is identified by: (1) A continental or insular geographic location, or (2) a point at which a definite radio fix can be established.

"Runway. A runway is clearly defined area of an airport suitable for the safe landing or take-off of airplanes.

"Scheduled for duty aloft. Scheduled for duty aloft shall mean the assignment of a flight crew member on the basis of the flight time established in the operations schedules rather than the actual flight time.

"Show. Show shall mean to demonstrate or prove to the satisfaction of the Administrator prior to the issuance of the air carrier operating certificate and at any time thereafter required by the Administrator.

"Synthetic trainer. A synthetic trainer is a device the use of which is approved to simulate certain operating conditions.

"Take-off safety speed, V_2. The take-off safety speed is the airplane speed used in the determination of the take-off flight path at which the climb-out following take-off can be safely executed with one engine inoperative and with the airplane in the take-off configuration. (See the pertinent airworthiness requirements for the manner in which such speed is determined.)

"Time in service. Time in service, as used in computing maintenance time records, is the time from the moment an airplane leaves the ground until it touches the ground at the end of a flight.

"Transport category airplane. A transport category airplane is an airplane which has been type certificated in accordance with the requirements of Part 4b of this subchapter or the transport category requirements of Part 4a of this subchapter.

"Type. With regard to airman qualifications, type shall mean all airplanes of the same basic design, including all modifications thereto except those modifications which the Administrator has found result in a substantial change in characteristics pertinent to the airman concerned.

"V F R. VFR is the symbol used to designate visual flight rules.

"Vs_o. Vs_o is the symbol used to designate the true indicated stalling speed or the minimum steady flight speed in the landing configuration.

"Visibility. Visibility is the greatest distance at which conspicuous objects can be seen and identified.

"(1) Flight Visibility. Flight visibility is the average range of visibility forward from the cockpit of an airplane in flight to see and identify prominent unlighted objects by day and prominent lighted objects by night.

(2) Ground Visibility. Ground visibility is the visibility at the earth's surface as reported by the United States Weather Bureau or by a source approved by the Weather Bureau.

"Week. Week shall mean that period of time extending from the first day of any week as delineated by the calendar through the last day thereof.

"Year. Year shall mean that period of time extending from the first day of any year as delineated by the calendar through the last day thereof."

Certification Rules and Operations; Specifications Requirements

"40.10 *Certificate required.* No person subject to the provisions of this part shall operate an airplane in scheduled interstate air transportation without, or in violation of the terms of, an air carrier operating certificate issued by the Administrator."

"40.11 *Contents of certificate.* An air carrier operating certificate shall specify the points to and from which, and the routes over which, an air carrier is authorized to operate."

"40.12 *Application for certificate.* An application for an air carrier operating certificate shall be made in the form and manner and contain information prescribed by the Administrator."

40.12–1 *Application for air carrier operating certificate. (CAA rules which apply to 40.12.)*

(a) *General*

(1) The holder of a certificate of convenience and necessity shall apply to the appropriate Regional Administrator for an air carrier operating certificate at least 30 days prior to the date proposed for beginning scheduled interstate air transportation within the continental limits of the United States. The application shall be prepared in loose-leaf form, on white paper of approximately 8″ x 10½″ in size, and using one side of the sheet only. The application shall be executed by a duly authorized officer or employee of the applicant having knowledge of the matters set forth therein, and shall have attached thereto two copies of the appropriate written authority issued to such officer or employee by the applicant.

(2) Two copies of the application, and of subsequent amendments thereto, shall be filed with the Regional Administrator having jurisdiction over the area in which the principal office of the air carrier is located. When any facility or service directly affecting the operation of the air carrier concerned is furnished by other than the applicant or the Federal Government, at least two copies of the contract or working agreement concerning such facilities or service shall be submitted with the application. In this connection, if formal contracts covering such facilities or service have not been completed, letters showing agreement between the contracting parties will be accepted until copies of the formal contract are obtainable.

(b) *Format of application.* The application shall be in the form of a letter and shall contain the information outlined below:

TO: Regional Administrator,
Civil Aeronautics Administration

In accordance with section 604 of the Civil Aeronautics Act of 1938, as amended, and the Civil Air Regulations, application is hereby made for an Air Carrier Operating Certificate.

Give exact name and full post office address of applicant.

Give the name, title and post office address of the official or employee to whom correspondence in regard to the application is to be addressed.

SECTION I. *Operations.*

A. State whether the type of service proposed is for the carriage of passengers, goods, or mail, or a particular combination thereof. If the type of service is not the same for each route or portion thereof, specify the type of service for each route or portion of a route.

B. State whether the type of operation proposed is day or night, visual flight rules, instrument or over-the-top, or a particular combination thereof. If the type of operation is not the same for each route or route segment, specify the type of operation for each route or route segment.

SECTION II. *Schedule.*

A. Submit a proposed schedule plan (or plans if seasonal changes or differences in equipment are involved) indicating the following:

1. Block to block time and mileage between scheduled stops.

2. Ground time at each intermediate and terminal stop.

B. Specify the basis upon which the proposed schedule has been computed, indicating the following:

1. Cruising speed and altitude.

2. Percentage of horsepower.

3. Direction and velocity of prevailing winds.

SECTION III. *Route.*

A. Submit a map suitable for aerial navigation on which are shown the exact geographical track of the proposed routes, and information

with respect to terminal and intermediate stops, available landing areas, and radio navigational facilities. This material will be indicated in a manner that will facilitate identification. The applicant may use any method that will clearly distinguish the information, such as different colors, different types of lines, etc. For example, if different colors are used, the identification will be accomplished as follows:

1. Airway routes: Black.

2. Direct routes: Green.

3. Terminal and regular intermediate stops: Orange circle.

4. Alternate landing fields or areas: Purple circle.

5. Other available landing fields or areas: Yellow circle.

6. Indicate the location and normal operating range of all radio navigational facilities to be used in connection with the proposed operation.

B. *Airports.* Furnish the following information with regard to each regular, alternate, refueling, and provisional airport to be used in the conduct of the proposed operation:

1. Name of airport.

2. Location (by coordinates, and by name of nearest city or town, and direction and distance thereto).

3. Class of airport or landing area (municipal, commercial, military, private, or marked auxiliary).

4. Altitude above sea level.

5. Dimensions in linear feet of landing space available.

6. If hard-surfaced runways are provided, give number, direction, length and width of each and indicate type of surfacing.

7. Obstructions (list adjacent obstructions giving height and location, or attach appropriate C. G. A. L. charts if available).

8. Airport lighting (include beacon, auxiliary beacon, boundary lights, floodlights, etc., and any emergency lighting equipment; and by whom operated).

9. List refueling facilities available.

10. Is airport control tower provided and by whom?

11. Itemize radio navigational facilities provided and indicate the operating agency.

12. Does runway gradient exceed 2%? If so, state gradient.

13. What provisions are made for protection of passengers during loading and unloading at scheduled stop airports?

14. Prevailing winds?

15. Where necessary, are adequate snow removal facilities available?

C. *Weather reporting.*

1. Outline the weather service proposed to be used for dispatching over each route; the source, if other than a United States Weather Bureau Station; list in detail the location and agency in control of stations furnishing reports for each service; the frequency and method of collection and dissemination of weather information. Outline available terminal and route forecasting services, the type of maps and the intervals at which they are made each day.

2. Where it has been determined that additional weather reporting services will be required of the U. S. Weather Bureau for the type of operation involved, the air carrier will apply in writing to the appropriate Weather Bureau Regional Office. The request for the weather reporting services considered essential should be made coincidental with this application to the Civil Aeronautics Administration.

3. For operations within the continental limits of the United States, if other than a U. S. Weather Bureau Station, show proof of U. S. Weather Bureau approval of the service and specify the meteorological facilities available, the number of personnel and the duties of each, such as the making of weather maps, forecasts, observations, etc.

D. *Airway lighting.* List in detail all airway lighting on the routes other than those airway lighting facilities owned and operated by the Civil Aeronautics Administration if application includes request for night VFR operation.

SECTION IV. *Radio Facilities.*

A. *Communications.* List company radio ground communication facilities installed, proposed to be installed, and those available to, but not owned by applicant, for each route. The expected communication coverage of all MF and HF ground facilities should be provided in map form. In the case of VHF, the expected coverage at exemplary altitudes should be out-

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lined. Aircraft reporting and general change points, and frequencies should be specified either on the maps or as an attachment. (If owned by other than applicant, attach 2 certified copies of operating agreement.) List the following details for each station:

Transmitters. List the following information in regard to each transmitter:

1. Make and model number.
2. Remotely or locally controlled.
3. Types of emission and antenna power for each type of emission.
4. Number of frequency channels provided and actual frequencies in kilocycles proposed to be used.
5. Method of frequency change (quick shift or manual tuning.)
6. Primary power source, voltage, phase, etc., and whether commercial source or locally generated.
7. Auxiliary power source.
8. Functional purpose of transmitter. If transmitter is used for more than one function, list in order of primary and secondary functions as:

a. Radiotelephone plane to ground primary purpose and radiotelephone point to point secondary purpose, or

b. Radiotelephone point to point primary purpose and standby radiotelephone plane to ground secondary purpose, etc.

Receivers.

1. List each receiver by type of model number and state its primary function, i. e., plane-to-ground guard, point-to-point C. W. or point-to-point radiotelephony.
2. List frequency range of each receiver and state which frequencies in each receiver are crystal controlled, if any.
3. Describe receiver installation to show number of receivers locally controlled and number remotely controlled.

B. *Radio navigational facilities.* List each ground radio navigational facility, other than those operated by the United States Government, to be used in the conduct of the proposed operations (if privately owned ground radio navigational facilities are to be used and are owned by other than the applicant, attach two certified copies of the operating agreement pertaining to the use of such facilities). List the following information with respect to each facility:

1. Type of facility, i. e., ILS, GCA, Non-Directional Radio Beacon, L. F. and VHF Radio Ranges, Loran, etc.
2. Estimated effective range (in miles).
3. Coordinates and location with respect to field or landing area.
4. Power supply; i. e., commercial or locally generated.
5. Auxiliary power supply.
6. Operating frequency or frequencies.

C. *Aircraft radio equipment.* List and describe the aircraft radio equipment installed in each aircraft by:

1. Type number.
2. Manufacturer.
3. Frequency range.
4. Operating frequencies.
5. Emergency power supply.
6. Antenna system.

SECTION V. *Weather minimums.*

A. Submit in detail the proposed ceiling and visibility limitations for take-off for instrument flight and let-down-through at each regular, alternate, refueling, and provisional airport. Differentiate between daylight and darkness in the listing, and where more than one type of aircraft is to be utilized, and a differential of limitations exists, indicate proposed limitations for each type of aircraft.

B. Submit for each proposed scheduled stop and alternate airport a detailed flight procedure for instrument approach and let-down-through and where specific procedures are necessary because of terrain or traffic conditions, submit a detailed flight procedure for take-off and climb (such procedure should be set up on the basis of the ceiling and visibility minimums proposed).

C. The above information may be submitted on Forms ACA–511 of the air carrier's proposed operations specifications.

SECTION VI. *Aircraft.*

A. List the following information, as applicable, for each aircraft to be used in the proposed operations:

1. The name of the manufacturer.
2. Certification basis and category.
3. Manufacturer's model number.
4. Name of the manufacturer and type number of engines.

5. Name of manufacturer and type number of propellers.

6. N registration number and aircraft designation.

7. Type of service in which aircraft will be used (carriage of persons, property, mail, or combination thereof).

8. Will aircraft be used in regular or reserve service?

9. What type of operation (day, night, visual flight rules, instrument (over-the-top)), will be conducted with this aircraft?

10. List each route or portion thereof over which this aircraft is to be operated and the maximum gross weight proposed for each route or portion thereof.

11. What is the service ceiling of each type aircraft with one engine inoperative?

12. List and describe installation and location of all lifesaving equipment and emergency supplies carried aboard each aircraft, such as life rafts, life preservers, portable emergency transmitters, Very pistols and emergency rations. (If the same equipment is not carried during all seasons of the year, and on all routes, list and explain the difference.)

SECTION VII. *Maintenance: Aircraft, engines, and accessories.*

A. Furnish an organization chart indicating the authority and the duties of the maintenance and inspection personnel employed by the applicant and/or any other person with whom arrangements have been made for the performance of maintenance and inspection functions.

B. Furnish a schedule of overhauls, inspections and checks and the time limitations for such functions which will be performed on each type of aircraft to include the airframes, powerplants, propellers and appliances. The schedule should be sufficiently detailed to indicate all of the overhauls, inspections and checks which will be performed on all components of each type of air carrier aircraft. The schedule should be listed under the following general headings:

1. Aircraft components:
   - a. Wings.
   - b. Fuselage.
   - c. Empennage.
   - d. Landing gear.
   - e. Wheels and brakes.
   - f. Center section. (When applicable.)
   - g. Nacelles.
   - h. Control system.
   - i. Hydraulic system.
   - j. Accessories (aircraft).
   - k. Fuel and oil system (aft of firewall).
   - l. Fuel tanks.
   - m. Cabin pressurizing and heating systems.
2. Engine components:
   - a. Engine.
   - b. Accessories (engine).
   - c. Propellers.
   - d. Fuel and oil system (forward of firewall).
   - e. Oil tanks.
3. Instruments:
   - a. Flight instruments.
   - b. Aircraft and engine instruments.

(If any of the components listed are overhauled on an "on condition" overhaul basis, describe the procedures used to control the continued airworthiness of such components.)

When maintenance functions are performed by outside agencies, copies of the maintenance agreement regarding the extent of such services to be furnished should be attached to the application, as provided for in subparagraph (a) (2) of this section. The agreement should specify that services furnished should conform to the standards approved for the operator, the air carrier operations specifications, aircraft maintenance and complies with all requirements of the Civil Air Regulations.

C. Indicate and define the type of maintenance operations (overhauls, inspections and checks) that will be accomplished at each terminal, intermediate and overnight stop, relative to the following:

1. Disassembly and overhaul of aircraft components, engines, propellers, instruments and accessories (aircraft and engine).

2. Periodic inspection and check of aircraft components, engine, propellers, instruments and accessories (aircraft and engine).

3. Routine inspection of aircraft components, engines, propellers, instruments and accessories (aircraft and engine).

4. Spare part and component replacements at intermediate and overnight stops.

5. Refueling.

D. Indicate the number of certificated, non-

certificate airmen (repairmen/mechanics), and helpers, etc., including their company designation (foreman, inspectors, crew chiefs, etc.) located at the main overhaul base and each terminal and intermediate stop.

E. Indicate the distribution of the following items of spare equipment:

1. Aircraft (list quantity, make and model).

2. Engines (list quantity, make and model).

3. Propellers (list quantity, make and model).

4. Instruments (list quantity, make and model).

F. For each terminal, and intermediate stop at which refueling operation will be performed, describe the following:

1. Number, type (elevated or underground) and capacity of each fuel and oil storage tank.

2. List octane ratings of fuels available.

3. List S. A. E. rating or viscosity of oil available.

4. List facilities and methods for the detection and prevention of fuel contamination.

5. Outline method and procedure with reference to recording water checks.

6. Type of covered container used to convey oil from storage tank to aircraft.

7. Outline method and procedure of grounding aircraft in protection of fire.

G. For each terminal and intermediate stop, describe the following facilities:

1. Hangars and/or work docks provided for the protection from the elements for aircraft and personnel performing maintenance operations:

a. Number, size and type.

b. Dimensions and number of square feet available for aircraft storage.

c. Dimensions and number of square feet available for shop space.

d. Dimensions of hangar doors and/or capacity of work docks.

e. Number of largest sized aircraft of applicant which may be housed.

2. Equipment for ground handling of aircraft, as may be required for the proposed operation.

3. Tools, fixtures, test equipment and other necessary shop apparatus necessary for the maintenance operations performed.

SECTION VIII. *Maintenance: Electrical and Electronic Equipment.*

A. Briefly, describe the functional operation of the electrical/electronic maintenance organization, indicating the number and scope of responsibility of supervisory personnel and the number and distribution of qualified mechanics and inspectors. Indicate the number, company designation (foreman, inspectors, lead men, etc.) and location of all certificated airmen (certificated repairmen or certificated mechanics) who are directly in charge of electrical/electronic maintenance activities.

B. Indicate the following with respect to aircraft radio equipment maintenance procedures:

1. Overhaul or bench check periods of aircraft radio equipment and station at which accomplished.

2. Periodic inspection and check periods of aircraft radio equipment and stations at which accomplished.

3. Equipment replacement at intermediate and overnight stops.

C. Indicate whether overhaul, periodic inspection and routine inspection of aircraft electrical equipment are under the jurisdiction of the radio maintenance department or other department such as aircraft, engine or accessories maintenance department.

D. Indicate the following with respect to aircraft electrical equipment procedures:

1. Overhaul or bench check periods of aircraft electrical equipment and stations at which accomplished.

2. Periodic inspection and check periods of aircraft electrical equipment and stations at which accomplished.

3. Routine inspection periods of aircraft electrical equipment and stations at which accomplished.

E. Indicate the distribution of the following items of spare equipment:

1. Radio equipment (list quantity, make and model).

2. Electrical equipment (list quantity, make and model).

3. Other electronic equipment (list quantity, make and model).

F. If "on conditions" overhaul of electrical/electronic is utilized, describe the bench check or major inspection procedures used to control

performance tolerances and fixed period overhaul of components subject to wear and deterioration as a function of time in service.

(c) *Operations Specifications.* The operations specifications proposed by the carrier as required by Section 40.18 applicable to the intended operation shall be attached to the above letter of application for an air carrier operating certificate. (See section 40.18–1.)

"40.13 *Issuance of certificate.*

"(a) An air carrier operating certificate shall be issued by the Administrator to an applicant having a certificate of public convenience and necessity issued by the Civil Aeronautics Board when the Administrator finds, after investigation, that such person is properly and adequately equipped and able to conduct a safe operation in accordance with the requirements of this part and with the operations specifications authorized in this part.

"(b) Whenever, upon investigation, the Administrator finds that the general standards of safety required for air carrier operations in airplanes of 12,500 pounds or less maximum certificated take-off weight, or for air carrier operations conducted pursuant to a temporary authorization issued under Title IV of the Civil Aeronautics Act of 1938, as amended, require or permit a deviation from any specific requirement for a particular operation or class of operations for which an application for an air carrier operating certificate has been made, he may issue operations specifications prescribing requirements which deviate from the requirements of this part. The Administrator shall promptly notify the Board of such deviations in the operations specifications and the reasons therefor."

"40.14 *Amendment of certificate.*

"(a) The Administrator shall, after notice and opportunity for hearing to the carrier concerned, amend an air carrier operating certificate when he finds that such amendment is reasonably required in the interest of safety.

"(b) Upon application by an air carrier the Administrator shall amend an air carrier operating certificate when he finds that the general standards of safety permit such an amendment."

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

"40.16 *Duration of certificate.*

"(a) An air carrier operating certificate shall remain in effect until termination of the certicate of public convenience and necessity or other economic authorization issued by the Board held by the air carrier, or until surrendered, suspended, revoked, or otherwise terminated by order of the Board. After suspension or revocation it shall be returned to the Administrator.

"(b) Nothing in this section shall be construed to deny or to defeat the jurisdiction of the Federal courts, the Administrator, or the Board to impose any authorized sanction, including revocation of the certificate, for a violation of the Civil Aeronautics Act of 1938, as amended, regulations in this subchapter, or the air carrier operating certificate occurring during the effective period of such certificate."

"40.17 *Transferability of certificate.* An air carrier operating certificate is not transferable, except with the written consent of the Administrator."

"40.18 *Operations specifications required.*

"(a) On and after the effective date of this part all air carrier operations specifications currently in force relating to interstate air transportation shall cease to be a part of any air carrier operating certificate and shall be deemed to be operations specifications issued under this part. Thereafter new or amended specifications shall be issued by the Administrator for operations subject to this part in a form and manner prescribed by him and in accordance with the provisions of this part.

"(b) No person subject to the provisions of this part shall operate as an air carrier without, or in violation of, operations specifications issued by the Administrator."

40.18–1 *Original issuance and amendment of operations specifications.* (*CAA rules which apply to 40.18 (a).*)

(a) *Original issuance of operations specifications.* The air carrier's original application for the issuance of operations specifications shall be included with its letter of application for an air carrier operating certificate (See Section 40.12–1). Details concerning appropriate forms, number of copies, etc., will be furnished either by the local CAA Air Carrier District Office or by the CAA Regional Office having jurisdiction over the area in which the air carrier will establish its principal operations base.

(b) *Amendment of operations specifications.* Applications to amend operations specifications shall be submitted by the air carrier to the appropriate local Aviation Safety Agent at least 15 days prior to the proposed effective date of such amendment, unless the Aviation Safety Agent approves a shorter filing period. The information required by Section 40.12–1 in connection with the original application for an air carrier operating certificate shall, insofar as applicable, be furnished in support of an application to amend an air carrier's operations specifications.

40.18–2 *Form of application for issuance of initial or revised Operations Specifications, Aircraft Maintenance.* (*CAA rules which apply to 40.18 (a).*) Applications by the air carrier for new or amended Operations Specifications, Aircraft Maintenance, shall be made on Operations Specifications Form ACA–1014 or equivalent.

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

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

Four copies of the application [1] and attachments shall be submitted to the assigned agents, the first copy of the application bearing the signature of a duly authorized representative of the air carrier. Approval or disapproval shall be indicated on the first and second copies of the application and attachments which will be returned to the air carrier. The air carrier shall, in turn, indicate receipt in the space provided on the second copy and return it to the assigned agent.

40.18–3 *Form of application for issuance of initial or revised Operations Specifications, Aircraft Weight and Balance Control.* (*CAA rules which apply to 40.18 (a).*) Applications by the air carrier for new or amended Operations Specifications, Aircraft Weight and Balance Control,[2] shall be made on Operations Specifications Form ACA–1014 or equivalent.

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

40.18–4 *Policies, procedures, and limitations*

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

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

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

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

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

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

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

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

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

The initial time limitations for overhaul of

an engine model which has received substantial air carrier service experience, but not by the applicant, will tentatively be established at 1000 hours. An engine model will not be considered as having substantial air carrier service experience unless it has been satisfactorily operated by another carrier on an approved 1000 hour or higher overhaul period. However, the Operations Specifications will require that the basic 1000 hour overhaul period be substantiated on the same basis as outlined for a new engine except that sample overhauls of a representative number of engines will be accomplished in increments of 100 hour periods beginning at 900 hours. The initial time limitations for overhaul of accessories which are a part of the power package, including propellers, will be established at the overhaul period fixed for the engine itself, unless service experience permits or requires higher or lower overhaul periods.

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

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

(2) *Powerplants and associated mechanical appliances—revision of time limitations.* Increases in engine overhaul periods will not be approved in increments greater than 100 hours. Increases in time limitations above the 1000 hour basic engine overhaul period will be considered on the basis of satisfactory operation of a specified number of engines of the same type or model. The operator may make application for a supplemental amendment to the currently approved time limitation indicating the desired time limitations and the particular engines to be operated to the new time limitations. This supplemental amendment will be applicable to 3 to 5 engines as deemed necessary by the assigned CAA agent, in order to determine the ability of the engine to operate satisfactorily at the desired new overhaul period. The engines so operated will be identified on the supplemental amendment by make, model, and serial number. Upon satisfactory completion of the 100 hours additional operation, and satisfactory disassembly and inspection of the engines and related components listed on the supplemental specification, the air carrier may then submit an application for an amendment in the routine manner, requesting a 100 hour extension of the overhaul period on the entire fleet of engines and related components of the same type and model in their operation. Experience may justify a request for the operation of some engine accessories to double or triple the approved engine overhaul limitations. Such amendments may be submitted if previous satisfactory service and overhaul experience, including the service to be performed at each engine change period, can justify the increase as not adversely affecting the continuous condition of airworthiness of the component involved. Installation of engines being operated in accordance with provisions of a supplemental specification will be limited to one per twin engine aircraft and two per four engine aircraft installed on opposite sides.

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

of known or evident trends toward malfunctioning. When electrical/electronic appliances are overhauled on an on condition basis, special consideration will be given to the continued airworthiness of mechanical components of such equipment.

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

"40.19 *Contents of specifications.* The Operations Specifications shall contain the following:

"(a) Types of operations authorized.

"(b) Types of airplanes authorized for use.

"(c) En route authorizations and limitations.

"(d) Airport authorizations and limitations.

"(e) Time limitation for overhauls, inspections, and checks of airframes, engines, propellers, and appliances, or standards by which such time limitations shall be determined.

"(f) Procedures used to maintain control of weight and balance of airplanes.

"(g) Interline equipment interchange requirements, if pertinent, and

"(h) Such additional items as the Administrator determines, under the enabling provisions of this part, are necessary to cover a particular situation."

40.19–1 *Content of Operations Specifications, Aircraft Maintenance. (CAA policies which apply to 40.19 (e).)* The Administrator will issue Operations Specifications, Aircraft Maintenance, which have the following minimum contents:

(a) The Operations Specifications, Aircraft Maintenance, will contain a listing of the components of airframes, engines, propellers, and appliances, and the time limitations for checks, inspections and overhauls applicable to each listed component. The list of components will be complete and inclusive except that subcomponents which are subject to check, inspection, and overhaul at the same time limitations as the components to which they are related may be omitted from the listing (e. g., that form commonly called the "short form"). When this is done, the Operations Specifications will bear a statement to the effect that parts and subcomponents not listed will be checked, inspected, and overhauled at the same time limitations specified for the component or assembly to which such components are related.

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

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

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

40.19–2 *Content of Operations Specifications, Aircraft Weight and Balance Control. (CAA policies which apply to 40.19 (f).)* The

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

"40.20 *Utilization of operations specifications.* The air carrier shall keep its personnel informed with respect to the contents of the operations specifications and all amendments thereto applicable to the individual's duties and responsibilities. A set of specifications shall be maintained by the air carrier as a separate and complete document. Pertinent excerpts from the specifications or references thereto shall be inserted in the manual issued by the air carrier."

"40.21 *Amendment of operations specifications.* Any operations specification may be amended by the Administrator if he finds that safety in air transportation so requires or permits. Except in the case of an emergency requiring immediate action in respect to safety in air transportation or upon consent of the air carrier concerned, no amendment shall become effective prior to thirty days after the date the air carrier has been notified of such amendment. Within thirty days after either the receipt of such notice or the refusal of the Administrator to approve an air carrier's application for amendment, the air carrier may petition the Board to review the action of the Administrator. Except with regard to emergency amendments by the Administrator, the effectiveness of any amendment concerning which the carrier has petitioned for review shall be stayed pending the Board's decision."

"40.22 *Inspection authority.* An authorized representative of the Board or the Administrator shall be permitted at any time and place to make inspections or examinations to determine an air carrier's compliance with the requirements of the Civil Aeronautics Act of 1938, as amended, the regulations in this subchapter, the provisions of the air carrier's operating certificate, and the operations specifications."

"40.23 *Operations and maintenance base and office.* Each air carrier shall give written notice to the Administrator of his principal business office, his principal operations base, and his principal maintenance base. Thereafter, prior to any change in any such office or base, he shall give written notice to the Administrator."

Requirements for Services and Facilities

"40.30 *Route requirements; demonstration of competence.* The air carrier shall show that it is competent to conduct scheduled operations over any route or route segment between any regular, provisional, or refueling airport and that the facilities and services available are adequate for the type of operation proposed. The Administrator shall not require actual flight over a route or route segment, if the air carrier shows that such flight is not essential to safety. The air carrier may thereafter conduct operations between regular, provisional, or refueling airports on any approved route or routes on which the operational facilities and procedures are substantially similar: *Provided,* That high-altitude operations may be conducted over any route."

40.30–1 *Route requirements; demonstration of competence. (CAA policies which apply to 40.30.)* In determining the competence of an air carrier to operate over a route or route segment, the Administrator will require the carrier to show that it can conduct the proposed operation in compliance with the applicable provisions of the Civil Air Regulations and the air carrier's operations specifications. The Administrator's determination may be based on a proving flight or, in a proper case, a determination may be based on written justification from the carrier as to why a proving flight is unnecessary. The Administrator's determination in any event will be predicated upon the adequacy of the facilities provided by or available to the

air carrier including, but not limited to aircraft, airports, lighting facilities, maintenance facilities, communication and navigation facilities, fueling facilities, ground and aircraft radio facilities, and the competency of personnel to be used in the proposed operation.

40.30–2 *Proving flight requirements.* (*CAA policies which apply to 40.30.*)

(a) *Application.* When the Administrator has determined that a route proving flight is necessary, the carrier shall comply with the following: At least 15 days prior to the scheduling of route proving flights, officials of the air carrier shall submit to the Civil Aeronautics Administration office handling its operations specifications, a written request for the assignment of Civil Aeronautics Administration personnel to observe the flights. This request must be accompanied by an original application and copies of pertinent proposed amendments to the operations specifications, and must include sufficient data pertaining to the route to satisfy the Administrator that the air carrier is prepared for the route proving flights. This will allow sufficient time for making any necessary additions or corrections, thus preventing delays or misunderstandings.

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

(c) *Duration.* Route proving flights shall continue until the air carrier has demonstrated to the satisfaction of the Administrator that it is competent to conduct a safe operation over the entire route to be flown in air transportation.

"40.31 *Width of routes.* A route or route segment shall include the navigable airspace on each side of an approved course or courses, and it shall have a width designated by the Administrator consistent with terrain, available navigational aids, traffic density, and air traffic control procedures: *Provided,* That for high-altitude operations, courses need not be approved, and the width of navigable airspace on each side thereof need not be designated by the Administrator."

"40.32 *IFR routes outside of control areas.* IFR routes outside of control areas shall be approved if the air carrier shows that the navigational and communications facilities are adequate for the operations proposed, unless the Administrator finds that because of traffic density an adequate level of safety cannot be insured in a particular area: *Provided,* That for high-altitude operations IFR routes need not be approved."

"40.33 *Airports.* The air carrier shall show that each route has sufficient airports found by the Administrator to be properly equipped and adequate for the type of operations to be conducted. Consideration shall be given to items such as size, surface, obstructions, facilities, public protection, lighting, navigation and communications aids, and traffic control."

40.33–1 *Airports.* (*CAA policies which apply to 40.33.*) An airport shall be deemed as properly equipped and adequate; when it meets the following minimum standards:

(a) *Size.* The landing area shall be of sufficient length to permit compliance with the airplane performance operating limitations of the transport category or non-transport category requirements of this part appropriate to the type of aircraft used.

(b) *Surface.* The landing area and taxiway areas shall be clearly defined. They may be unpaved or hard surfaced or a combination of both. These areas shall be sufficiently smooth and firm to permit an airplane of the type used to traverse them safely. Shoulders of runways and taxiways shall be graded to the extent that they will not constitute a hazard to the aircraft operating thereon.

(c) *Obstructions.* Obstructions on and in the vicinity of the airport shall be obstruction marked and lighted as applicable for day or night operations. In determining obstructions to air navigation, the criteria contained in Civil Aeronautics Administration Technical Standard Order N–18 will be used, insofar as practicable.

(d) *Facilities.*

(1) At each airport utilized, weather reports prepared from observations made and released by the U. S. Weather Bureau or a source approved by it shall be available.

(2) Ramp equipment such as battery carts, fire bottles, loading stands, steps, etc., must be provided and shall be suitable to service the type aircraft being utilized.

(3) Satisfactory means of determining wind direction for day and/or night operations shall be provided, i. e., tetrahedron, wind tee, control tower, remote microphone, etc.

(e) *Public Protection.* Safety measures for the protection of the public shall be provided at each airport utilized. Such measures shall be designated to restrict unauthorized personnel and vehicles from the loading ramp, runways, taxiways, etc. They may consist of fences, gates, chains, airport guards, etc., so long as they are sufficient to accomplish the intended result.

(f) *Lighting.* At airports where night operations are conducted, the minimum facilities and equipment shall be required as follows:

(1) Lights defining the boundaries of the usable area including threshhold lights and/or runway lights identifying the outer limits of the runways including threshhold lights as prescribed in Civil Aeronautics Administration Technical Standard Order N–1b. Lights of the open flame type (flare pots) are not considered satisfactory runway lights except in an emergency or when required by other extenuating circumstances.

(2) Lights either of a permanent or portable type shall be provided and operated to illuminate the ramp, apron, and passenger loading area.

(3) Obstructions on and in the vicinity of the airport shall be obstruction lighted insofar as practicable in accordance with the criteria contained in Civil Aeronautics Administration Obstruction Marking Manual.[3]

(4) An airport beacon either of a rotating or combination of rotating beacon and flashing code beacon shall be provided and operated continuously from sunset to sunrise. In this respect, the criteria contained in Civil Aeronautics Administration Technical Standard Order N–19 shall apply.

(g) *Navigation, Communication Aids and Traffic Control.* These facilities shall be suitable for the type of operations to be conducted.

"40.34 *Communications facilities.* The air carrier shall show that a two-way air/ground radio communication system is available at such points as will insure reliable and rapid communications over the entire route, either direct or via approved point-to-point circuits for the following purposes:

"(a) Communications between airplanes and the appropriate dispatch office, in which case such systems shall be independent of systems operated by the Federal Government, and

"(b) Communications between airplanes and the appropriate air traffic control unit, in which case the Administrator may permit the use of communications systems operated by the Federal Government."

"40.35 *Weather reporting facilities.* The air carrier shall show that sufficient weather reporting services are available at such points along the route as are necessary to insure such weather reports and forecasts as are necessary for the operation. Weather reports used to control flight movements shall be those prepared and released by the U. S. Weather Bureau, or by a source approved by the Weather Bureau. Forecasts used to control flight movements shall be prepared from such weather reports."

"40.36 *En route navigational facilities.* The air carrier shall show that nonvisual ground aids to air navigation are available along each route, that they are so located as to permit navigation to any regular, provisional, refueling, or alternate airport within the degree of accuracy necessary for the operation involved, and that they are available for the navigation of airplanes within the degree of accuracy required for air traffic control: *Provided,* That no nonvisual ground aids to navigation are required for day VFR operations where the characteristics of the terrain are such that navigation can be conducted by pilotage."

"40.37 *Servicing and maintenance facilities.* The air carrier shall show that com-

[3] TSO N–2a, when published, will contain the obstruction lighting criteria.

petent personnel and adequate facilities and equipment, including spare parts, supplies, and materials, are available at such points along the air carrier's routes as are necessary for the proper servicing, maintenance, repair, and inspection of airplanes and auxiliary equipment."

40.37–1 *Servicing and maintenance facilities. (CAA policies which apply to 40.37.)*

(a) *General.* In demonstrating or proving to the satisfaction of the Administrator that housing, facilities, equipment, and materials are adequate, the air carrier may be guided by Civil Aeronautics Manual 52, section 52.21 and sections 52.30 through 52.36, insofar as applicable to his aircraft and maintenance system.

(b) *Facilities provided by other agencies.* The air carrier will be required to show that agencies contracting to perform major overhauls, repairs, or alterations for the air carrier are those specified under section 18.10 (b), (d), or (e).

"40.38 ***Location of dispatch centers.*** **The air carrier shall show that it has a sufficient number of dispatch centers adequate for the operations to be conducted and located at such points as are necessary to insure the proper operational control of each flight."**

Manual Requirements

"40.50 *Preparation of manual.* The air carrier shall prepare and keep current a manual for the use and guidance of flight and ground operations personnel in the conduct of its operations."

"40.51 *Contents of manual.*

(a) The manual shall contain instructions, information, and data necessary for the personnel concerned to carry out their duties and responsibilities with a high degree of safety. It shall be in a form to facilitate easy revision, and each page shall bear the date of the last revision thereof. The contents of such manual shall not be contrary to the provisions of any Federal Regulations, Operations Specifications, or the operating certificate. The manual may be in two or more separate parts (e. g., flight operations, ground operations, maintenance communications, etc.) to facilitate use by the personnel concerned, but each part shall contain so much of the information listed below as is appropriate for each group of personnel:

"(1) General policies,

"(2) Duties and responsibilities of each crew member and appropriate members of the ground organization,

"(3) Reference to appropriate regulations in this subchapter and Civil Aeronautics Manuals,

"(4) Flight dispatching and control,

"(5) En route flight, navigation, and communication procedures, including procedures for the dispatch or continuance of flight, if any item of equipment required for the particular type of operation becomes inoperative or unserviceable en route,

"(6) Appropriate information from the en route operations specifications, including for each approved route the types of airplanes authorized, their crew complement, the type of operation (i. e., VFR, IFR, day, night) and other pertinent information,

"(7) Appropriate information from the airport operations specifications, including for each airport its location, its designation (i. e., regular, alternate, provisional, etc.), types of airplanes authorized, instrument approach procedures, landing and take-off minimums, and other pertinent information,

"(8) Take-off, en route, and landing weight limitations,

"(9) Procedures for familiarizing passengers with the use of emergency equipment during flight,

"(10) Emergency procedures and equipment,

"(11) The method of designating succession of command of flight crew members,

"(12) Procedures for determining the usability of landing and take-off areas and for dissemination of pertinent information to operations personnel,

"(13) Procedures for operation during periods of icing, hail, thunderstorms, turbulence, or any potentially hazardous meteorological conditions,

"(14) Airman training programs, including appropriate ground, flight, and emergency phases,

"(15) Instructions and procedures for maintenance, repair, overhaul and servicing,

"(16) Time limitations for overhaul, inspection, and checks, of airframes, engines, propellers, and appliances, and standards by which such time limitations shall be determined,

"(17) Procedures for refueling airplanes, elimination of fuel contamination, protection from fire including electrostatic protection, and the supervision and protection of passengers during refueling,

"(18) Inspection for airworthiness, including instructions covering procedures, standards, responsibilities, and authority of the inspection personnel,

"(19) Methods and procedures for maintaining the airplane weight and center of gravity within approved limits,

"(20) Pilot and dispatcher route and airport qualification procedures,

"(21) Accident notification procedures, and

"(22) Other data or instructions related to safety.

"(b) At least one complete master copy of the manual containing all parts thereof shall be retained at the appropriate operations base of the air carrier."

40.51–1 *Contents of manual—Methods and procedures for maintaining weight and balance control. (CAA policies which apply to 40.51 (a) (19).)*

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

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

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

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

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

(i) All fuel and oil, excepting system fuel and oil.[4]

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

(iii) Crew and baggage.

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

(v) Removable passenger service equip-

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

ment, food, magazines, etc., including drainable washing and drinking water.

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

(vii) Other equipment, variable for flights.

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

(2) *Operating weight.* The basic operating weight established by the air carrier for a particular model aircraft will include the following standard items of the operator in addition to the empty weight of the aircraft unless otherwise specified:

(i) Normal oil quantity.

(ii) Anti-detonant injector and de-icing (winter) fluids.

(iii) Crew and baggage.

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

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

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

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

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

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

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

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

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

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

basis unless shorter periods are desired by the air carrier.

(3) *Establishing initial weight before use in air carrier service.* Prior to being used in air carrier service, each aircraft will be weighed and the empty weight and center of gravity location established. New production transport category aircraft delivered to air carriers normally are weighed at the factory and are eligible for air carrier operations without reweighing if the weight and balance records have been adjusted for alterations or modifications to the aircraft. Aircraft transferred from one air carrier to another need not be weighed prior to utilization by the latter unless more than twenty-four calendar months have elapsed since last weighing.

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

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

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

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

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

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

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

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

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

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

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

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

(2) All other crew members 170 pounds.

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

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

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

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

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

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

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

(k) *Weight of fluids.* The weight of all fluids used in aircraft may be established on the basis of actual weight, a standard volume conversion, or a volume conversion utilizing appropriate temperature correction factors to accu-

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rately determine the weight by computation of the quantity of fluid on board.

"40.52 *Distribution of manual.*

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

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

"(2) Flight crew members,

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

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

Airplane Requirements

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

"40.61 *Airplane certification requirements.*

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

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

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

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

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

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

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

"40.63 *Proving tests.*

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

"(b) A type of airplane which has been previously proved shall be tested for at least 50 hours of which at least 25 hours shall be flown over authorized routes when the airplane:

"(1) Is materially altered in design, or

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

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

40.63–1 *Materially altered in design.* (*CAA interpretations which apply to 40.63 (b) (1).*) A type of airplane will be considered to be materially altered in design when the alterations include, but are not necessarily limited to:

(a) Installation of powerplants other than the powerplants of a type similar to those with which the aircraft is certificated.

(b) Major alteration to the aircraft or its components which materially affects the flight characteristics.

Airplane Performance Operating Limitations; Transport Category

"40.70 *Transport category airplane operating limitations.*

"(a) In operating any passenger-carrying transport category airplane the provisions of sections 40.71 through 40.78 shall be complied with, unless deviations therefrom are specifically authorized by the Administrator on the ground that the special circumstances of a particular case make a literal observance of the requirement unnecessary for safety.

"(b) For transport category airplanes the performance data contained in the Airplane Flight Manual shall be applied in determining compliance with these provisions. Where conditions differ from those for which specific tests were made, compliance shall be determined by interpolation or by computation of the effects of changes in the specific variables where such interpolations or computations will give results substantially equaling in accuracy the results of a direct test.

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

40.70–1 *Deviations.* (*CAA rules which apply to section 40.70 (a).*) An application for any deviation shall include all supporting data and shall be forwarded to the CAA Aviation Safety District Office charged with the over-all inspection of the air carrier's operations.

40.70–2 *Accuracy of data.* (*CAA policies which apply to 40.70 (b).*) The charts and data prepared by the air carrier for use of flight and operations personnel should be prepared with sufficient accuracy and clarity that the gross weight and runway length values for specific operating conditions can be reproduced within a tolerance of one-half of one percent by an independent recheck.

40.70–3. *Temperature accountability* (*CAA policies which apply to 40.70 (c).*) The maximum permissible weight for a given take-off should be equal to the lowest of three values determined separately by consideration of (a) accelerate-stop, (b) take-off and climb out to a 50-foot height and (c) the obstacle clearance condition. The established temperature accountability correction factors appearing in the Airplane Flight Manuals are applied to the take-off weights determined by the accelerate-stop and climb out to a 50-foot height. These values may be used individually or in combination, i. e., if a runway is considerably longer than is required to meet the accelerate-stop and climb out to 50 foot requirements at standard temperature, then at temperatures higher than standard, take-off weight need not be reduced as long as additional runway length is available. When the temperature reaches a value at which no additional runway length remains, then a reduction in weight would be necessary. These factors do not apply to weights determined by obstacle clearance considerations. If the take-off weight at standard temperature is limited by obstruction clearance rather than by the climb out to 50 feet or by the accelerate-stop distance, a weight reduction need not be made for temperatures higher than standard until the temperature reaches a high enough value to use up the existing runway between that used for standard temperature (limited to less than the full runway because of obstacles) and the actual length.

"40.71 *Weight limitations.*

"(a) No airplane shall be taken off from any airport located at an elevation outside of the altitude range for which maximum take-off weights have been determined, and

no airplane shall depart for an airport of intended destination or have any airport specified as an alternate which is located at an elevation outside of the altitude range for which maximum landing weights have been determined.

"(b) The weight of the airplane at take-off shall not exceed the authorized maximum take-off weight for the elevation of the airport from which the take-off is to be made.

"(c) The weight at take-off shall be such that, allowing for normal consumption of fuel and oil in flight to the airport of intended destination, the weight on arrival will not exceed the authorized maximum landing weight for the elevation of such airport."

40.71–1 *Weight limitations.* (*CAA policies which apply to 40.71.*) The limitations imposed by section 40.71 take into account only one operating variable, i. e., the elevation of the airport to be used as it affects the weight of the aircraft during take-off or landing. Other operating variables, such as runway length, gradient, wind and temperature, are considered in other sections of Part 40. Compliance with this section does not present a particular problem since the Airplane Flight Manual provides performance data for airports over a wide range of elevations. However, most manuals do not provide data for operations at airports below sea level. Section 40.71 should not be construed as prohibiting operations from airports below sea level, since sea level data in the Airplane Flight Manual, being conservative, may be applied to such airports.

"40.72 *Take-off limitations to provide for engine failure.* No take-off shall be made except under conditions which will permit compliance with the following requirements:

"(a) It shall be possible, from any point in the take-off up to the time of attaining the critical-engine-failure speed, to bring the airplane to a safe stop on the runway as shown by the accelerate-stop distance data.

"(b) It shall be possible, if the critical engine should fail at any instant after the airplane attains the critical-engine-failure speed, to proceed with the take-off and attain a height of 50 feet, as indicated by the take-off path data, before passing over the end of the runway. Thereafter it shall be possible to clear all obstacles, either by at least 50 feet vertically, as shown by the take-off path data, or by at least 200 feet horizontally within the airport boundaries and by at least 300 feet horizontally after passing beyond such boundaries. In determining the allowable deviation of the flight path in order to avoid obstacles by at least the distances above set forth, it shall be assumed that the airplane is not banked before reaching a height of 50 feet, as shown by the take-off path data, and that a maximum bank thereafter does not exceed 15°.

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

40.72–1 *Take-off limitations to provide for engine failure.* (*CAA policies which apply to 40.72.*)

(a) *Take-off flight path.* Diagram 1 is a pictorial representation of the relationship required between the dimensions of an airport and its surroundings, and the performance of the airplane. It illustrates the take-off flight path defined by the airworthiness requirements.

(b) *Airport data.* Complete data concerning the airport dimensions and characteristics, such as runway lengths, runway gradients, obstruction heights and location, airport elevation, and the nature and condition of airport areas other than paved runways from which take-offs might be made, are necessary for the determination of permissible take-off weights. The most nearly complete and satisfactory source of such data is the series of Airport Obstruction Plans prepared by the U. S. Department of Commerce Coast and Geodetic Survey. However, their Airport Obstruction Plan series does not yet completely cover the airports used by air carrier operators of transport category airplanes, and in addition, the Obstruction Plans do not present any data showing the nature or condition of runway

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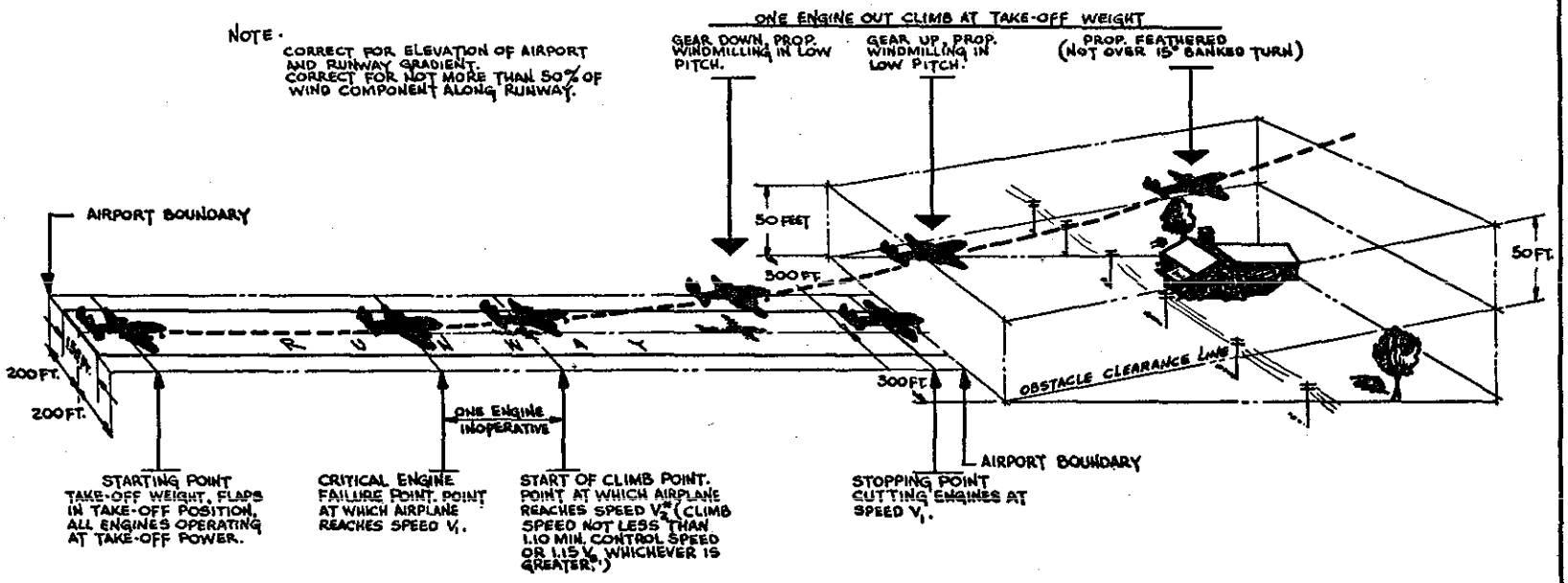


THE AIRPLANE SHALL RUN UP TO A SPECIFIED SPEED AND FROM THERE BE ABLE TO:

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

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

Diagram 1

permit a rate of climb (expressed in feet per minute), with one engine inoperative, of at least $\left(0.06-\frac{0.08}{N}\right)V_{s_0}^2$ (when N is the number of engines installed and V_{s_0} is expressed in miles per hour) at an altitude of at least 1,000 feet above the elevation of the highest ground or obstruction within 10 miles of either side of the intended track: *Provided,* That for transport category airplanes certificated under Part 4a of this subchapter, the rate of climb shall be 0.02 $V_{s_0}^2$. For the purpose of this section it shall be assumed that the weight of the airplane as it proceeds along its intended track is progressively reduced by normal consumption of fuel and oil."

"40.75 *En route limitations; two engines inoperative.* No airplane having four or more engines shall be flown along an intended track except under the following conditions: *Provided,* That this section shall not apply to transport category airplanes certificated under Part 4a of this subchapter:

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

"(b) The take-off weight is such that the airplane with two engines inoperative shall have a rate of climb (expressed in feet per minute) of at least 0.01 $V_{s_0}^2$ (when V_{s_0} is expressed in miles per hour) either at an altitude of 1,000 feet above the elevation of the highest ground or obstruction within 10 miles on either of the intended track or at an altitude of 5,000 feet, whichever is higher. The rate of climb referred to in this paragraph shall be determined by assuming the airplane's weight to be either that expected at the moment of failure of the second engine, assuming the failure to occur 90 minutes after departure, or that which may be attained by dropping fuel at the moment of failure of the second engine, assuming that sufficient fuel is retained to arrive at an altitude of at least 1,000 feet directly over the landing area."

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

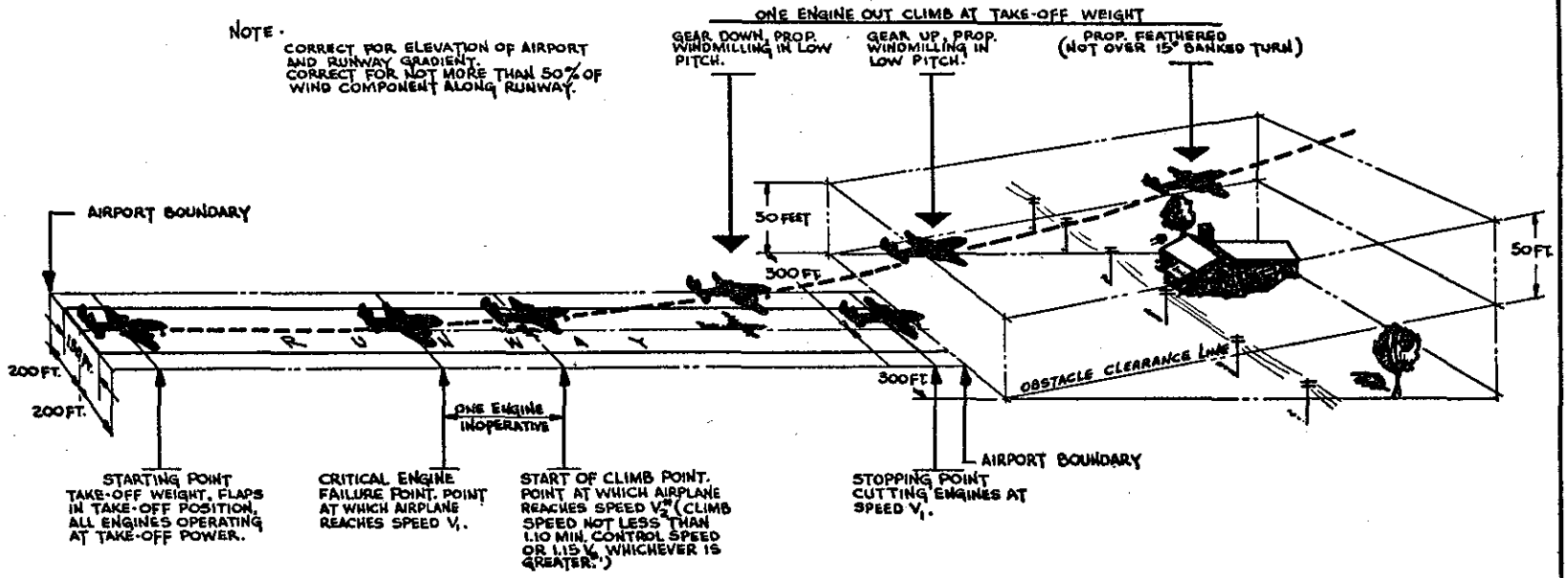
40.76–1 *Special en route limitations. (CAA policies which apply to 40.76.)* No attempt is made to classify specific types of navigational facilities as acceptable or unacceptable for the purposes of section 40.76, but each case will be examined on its own merits. In general, however, the facility should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

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

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

"(b) It shall be assumed, considering the probable wind velocity and direction, that the airplane is landed on the most suitable runway, taking due account of the ground

TAKE-OFF · AIRPORT LIMITATIONS



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

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

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

Diagram I

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

(c) *Runways.*

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

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

(d) *Turns to avoid obstructions.*

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

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

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

where V = climb speed in mph, TAS

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

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

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

(e) *Effects of runway gradient.*

(1) The gradient effect on the ground run may be calculated from the following formula:

$$S_G = S\left[\frac{1}{1-\left(\frac{2\,S\,g\,\sin\alpha}{V_2^2}\right)}\right]$$

where S_G = length of ground run with gradient.

S = length of ground run without gradient.

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

V_2 = climb out speed, feet per second, True Air Speed.

α = angle of grade with horiontal, uphill +, downhill −.

(2) The above formula is based on several simplifying assumptions, i. e., that a uniform grade exists, that the airplane is accelerated uniformly throughout the ground run, and that the speed V_2 may be used where the difference between V_1 and V_2 is not large. None of these assumptions may be exactly correct, but the errors introduced by making such assumptions are small provided the airplane acceleration and the actual point-to-point grade do not depart from the average values of those quantities by any great amount.

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

(4) For purposes of simplification in calculating the effect of runway gradient on the take-off flight path, an average gradient consisting

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

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

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

(f) *Effects of wind.*

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

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

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

$$S_w = S\left(\frac{V_2 - V_w}{V_2}\right)^{1.65}$$

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

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

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

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

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

"40.73 *En route limitations; all engines operating.* No airplane shall be taken off at a weight in excess of that which would permit a rate of climb (expressed in feet per minute), with all engines operating, of at least 6 V_{s_0} (when V_{s_0} is expressed in miles per hour) at an altitude of at least 1,000 feet above the elevation of the highest ground or obstruction within 10 miles on either side of the intended track. Transport category airplanes certificated under Part 4a of this subchapter are not required to comply with this section. For the purpose of this section it shall be assumed that the weight of the airplane as it proceeds along its intended track is progressively reduced by normal consumption of fuel and oil."

"40.74 *En route limitations; one engine inoperative.* No airplane shall be taken off at a weight in excess of that which would

permit a rate of climb (expressed in feet per minute), with one engine inoperative, of at least $\left(0.06-\frac{0.08}{N}\right)V_{s_0}^2$ (when N is the number of engines installed and V_{s_0} is expressed in miles per hour) at an altitude of at least 1,000 feet above the elevation of the highest ground or obstruction within 10 miles of either side of the intended track: *Provided,* That for transport category airplanes certificated under Part 4a of this subchapter, the rate of climb shall be 0.02 $V_{s_0}^2$. For the purpose of this section it shall be assumed that the weight of the airplane as it proceeds along its intended track is progressively reduced by normal consumption of fuel and oil."

"40.75 *En route limitations; two engines inoperative.* No airplane having four or more engines shall be flown along an intended track except under the following conditions: *Provided,* That this section shall not apply to transport category airplanes certificated under Part 4a of this subchapter:

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

"(b) The take-off weight is such that the airplane with two engines inoperative shall have a rate of climb (expressed in feet per minute) of at least 0.01 $V_{s_0}^2$ (when V_{s_0} is expressed in miles per hour) either at an altitude of 1,000 feet above the elevation of the highest ground or obstruction within 10 miles on either of the intended track or at an altitude of 5,000 feet, whichever is higher. The rate of climb referred to in this paragraph shall be determined by assuming the airplane's weight to be either that expected at the moment of failure of the second engine, assuming the failure to occur 90 minutes after departure, or that which may be attained by dropping fuel at the moment of failure of the second engine, assuming that sufficient fuel is retained to arrive at an altitude of at least 1,000 feet directly over the landing area."

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

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

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

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

"(b) It shall be assumed, considering the probable wind velocity and direction, that the airplane is landed on the most suitable runway, taking due account of the ground

handling characteristics of the airplane type involved and other conditions (e. g., landing aids, terrain, etc.) and allowing for the effect on the landing path and roll of not more than 50 percent of the wind component along the landing path if opposite to the direction of landing, or not less than 150 percent of the wind component if in the direction of landing.

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

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

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

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

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

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

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

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

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

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

Airplane Performance Operating Limitations; Nontransport Category

"40.90 *Nontransport category airplane operating limitations.* In operating any large, nontransport category airplane in passenger service after December 31, 1953, the provisions of sections 40.91 through 40.93 shall be complied with, unless deviations therefrom are specifically authorized by the Administrator on the ground that the special circumstances of a particular case make a literal observance of the requirements unnecessary for safety. Prior to that date such airplanes shall be operated either in accordance with sections 40.91 through 40.93 or in accordance with such operating limitations as the Administrator determines will provide a safe relation between the performance of the airplanes and the airports to be used and the areas to be traversed. Performance data published or approved by the Administrator for each such nontransport category airplane shall be used in determining compli-

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ance with the provisions of sections 40.91 through 40.93."

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

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

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

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

"(c) Account shall be taken of the average runway gradient when the average gradient is greater than ½ percent. The average runway gradient is the difference between the elevations of the end points of the runway divided by the total length;

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

40.91–1 *Take-off limitations.* (*CAA rules which apply to 40.91.*)

(a) Figures 1, 2, 3, 4, 8, 9 and 10 shall be used in determining take-off limitations.

(b) If the gradient of the runway exceeds ½ percent, the effect of the total gradient shall be accounted for. The effect of gradient may be calculated from the following formula, or other methods by which the effects of gradient can be accurately computed:

$$S_G = S\left[\frac{1}{1-\left(\frac{2\,S\,g\sin\alpha}{V_2^2}\right)}\right]$$

Where S_G = length of ground run with gradient. (required or available).

S = length of ground run without gradient. (required or available).

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

V_2 = climb out speed, feet per second, True Air Speed.

α = angle of grade with horizontal, uphill +, downhill −.

Where runways with gradient are of such length that the gross weight would be reduced, the following equation will be more useful in determining the zero gradient runway length to be used in determining the permissible gross weight from Figures 1, 2, 3, and 4:

$$S = \frac{S_G}{1+\left(\frac{S_G\,g\,2\sin\alpha}{V_2^2}\right)}$$

Where S_G = effective runway length available.

S = equivalent runway length due to gradient.

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

V_2 = climb out speed, feet per second, True Air Speed.

α = angle of grade with horizontal, uphill +, downhill −.

(c) The maximum allowable take-off weight from sod runways shall be the lesser gross

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

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

40.91–2 *Take-off limitations.* (*CAA policies which apply to 40.91.*)

(a) The maximum tailwind component should be 5 mph unless another value has been approved by the Administrator.

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

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

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

"(1) The critical engine is inoperative;

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

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

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

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

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

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

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

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

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

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

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

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

"(1) The airplane passes directly over

the intersection of the obstruction clearance plane and the runway at a height of 50 feet in a steady gliding approach at a true indicated air speed of at least 1.3 V_{s_0};

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

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

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

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

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

40.93–2 *Landing distance limitations (CAA policies which apply to 40.93 (a).)* The determination of the adequacy of the airport of intended destination, when complying with section 40.93, is a function of proper dispatch. If the dispatch is based on the best information available, but upon arrival, the criteria in section 40.93 cannot be met, a landing may be made provided the tailwind operating limitation for the airplane is not exceeded.

(a) The maximum tailwind component should be 5 mph, unless another value has been approved by the Administrator.

(b) If this condition cannot be met at the time of dispatch, an alternate airport which fully complies with section 40.93 should be named in the clearance.

Special Airworthiness Requirements

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

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

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

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

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

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

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

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

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

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

equipped with louvres or other means allowing air to flow between such compartments, provision convenient to the crew shall be made for closing the flow of air through the louvres or other means when such action is found necessary."

"40.115 *Fire precautions.* Each compartment shall be designed so that, when used for the purpose of storing cargo or baggage, it shall comply with all of the requirements prescribed for cargo or baggage compartments. It shall include no controls, wiring, lines, equipment, or accessories the damage or failure of which would affect the safe operation of the airplane, unless such item is adequately shielded, isolated, or otherwise protected so that it cannot be damaged by movement of cargo in the compartment, and so that any breakage or failure of such item would not create a fire hazard in the compartment. Provision shall be made to prevent cargo or baggage from interfering with the functioning of the fire-protective features of the compartment. All materials used in the construction of cargo or baggage compartments, including tie-down equipment, shall be flame-resistant or better. In addition, all cargo and baggage compartments shall include provisions for safeguarding against fires according to the following classifications:

"(a) Cargo and baggage compartments shall be classified in the "A" category, if presence of a possible fire therein can be readily discernible to a member of the crew while at his station, and if all parts of the compartment are easily accessible in flight. A hand fire extinguisher shall be available for such compartment.

"(b) Cargo and baggage compartments shall be classified in the 'B' category, if sufficient access is provided while in flight to enable a member of the crew to move by hand all contents and to reach effectively all parts of the compartment with a hand fire extinguisher. Furthermore, the design of the compartment shall be such that, when the access provisions are being used, no hazardous quantity of smoke, flames, or extinguishing agent will enter any compartment occupied by the crew or passengers. Each compartment in this category shall be equipped with a separate system of an approved type smoke detector or fire detector other than heat detector to give warning at the pilot or flight engineer station. Hand fire extinguishers shall be readily available for use in all compartments of this category. Compartments in this category shall be completely lined with fire-resistant material, except that additional service lining of flame-resistant material may be employed.

"(c) Cargo and baggage compartments shall be classified in the 'C' category, if they do not conform with the requirements for the 'A' or 'B' categories. Each compartment of the "C" category shall be equipped with: (1) A separate system of an approved type smoke detector or fire detector other than heat detector to give warning at the pilot or flight engineer station, and (2) an approved built-in fire-extinguishing system controlled from the pilot or flight engineer station. Means shall be provided to exclude hazardous quantities of smoke, flames, or extinguishing agent from entering into any compartment occupied by the crew or passengers. Ventilation and drafts shall be further controlled within each such cargo or baggage compartment to the extent that the extinguishing agent provided can control any fire which may start within the compartment. All cargo and baggage compartments of this category shall be completely lined with fire-resistant material, except that additional service lining of flame-resistant material may be employed.

"40.116 *Proof of compliance.* Compliance with those provisions of section 40.115 which refer to compartment accessibility, the entry of hazardous quantities of smoke or extinguishing agent into compartments occupied by the crew or passengers, and the dissipation of the extinguishing agent in category 'C' compartments shall be demonstrated by tests in flight. It shall also be demonstrated during these tests that no inadvertent operation of smoke or fire detectors in adjacent or other compartments within the airplane would occur as a result of fire contained in any one compartment, either during or after extinguishment, unless the extinguishing

system floods such compartments simultaneously."

"40.117 *Propeller de-icing fluid.* If combustible fluid is used for propeller de-icing, the provisions of sections 40.131 through 40.135 shall be complied with."

"40.118 *Pressure cross-feed arrangements.* Pressure cross-feed lines shall not pass through portions of the airplane devoted to carrying personnel or cargo unless means are provided to permit the flight personnel to shut off the supply of fuel to these lines, or unless the lines are enclosed in a fuel and fume-proof enclosure that is ventilated and drained to the exterior of the airplane. Such enclosures need not be used if these lines incorporate no fittings on or within the personnel or cargo areas and are suitably routed or protected to safeguard against accidental damage. Lines which can be isolated from the remainder of the fuel system by means of valves at each end shall incorporate provisions for the relief of excessive pressures that may result from exposure of the isolated line to high ambient temperatures."

"10.119 *Location of fuel tanks.* Location of fuel tanks shall comply with the provisions of section 40.132. In addition, no portion of engine nacelle skin which lies immediately behind a major air egress opening from the engine compartment shall act as the wall of an integral tank. Fuel tanks shall be isolated from personnel compartments by means of fume and fuel-proof enclosures."

"40.120 *Fuel system lines and fittings.* Fuel lines shall be installed and supported in a manner that will prevent excessive vibration and will be adequate to withstand loads due to fuel pressure and accelerated flight conditions. Lines which are connected to components of the airplane between which relative motion may exist shall incorporate provisions for flexibility. Flexible connections in lines which may be under pressure and subjected to axial loading shall employ flexible hose assemblies rather than hose clamp connections. Flexible hose shall be of an acceptable type or proven suitable for the particular application."

"40.121 *Fuel lines and fittings in designated fire zones.* Fuel lines and fittings in all designated fire zones (see section 40.131) shall comply with the provisions of section 40.134."

"40.122 *Fuel valves.* In addition to the requirements contained in section 40.133 for shutoff means, all fuel valves shall be provided with positive stops or suitable index provisions in the "on" and "off" positions and shall be supported in such a manner that loads resulting from their operation or from accelerated flight conditions are not transmitted to the lines connected to the valve."

"40.123 *Oil lines and fittings in designated fire zones.* Oil lines and fittings in all designated fire zones (see section 40.131) shall comply with the provisions of section 40.134."

"40.124 *Oil valves.* Requirements of section 40.133 for shutoff means shall be complied with. Closing of oil shutoff means shall not prevent feathering the propeller unless equivalent safety provisions are incorporated. All oil valves shall be provided with positive stops or suitable index provisions in the "on" and "off" positions, and shall be supported in such a manner that loads resulting from their operation or from accelerated flight conditions are not transmitted to the lines attached to the valve."

"40.125 *Oil system drains.* Accessible drains shall be provided to permit safe drainage of the entire oil system and shall incorporate means for positive or automatic locking in the closed position. (See also section 40.135.)"

"40.126 *Engine breather line.* Engine breather lines shall be so arranged that condensed water vapor which may freeze and obstruct the line cannot accumulate at any point. Breathers shall discharge in a location which will not constitute a fire hazard in case foaming occurs and so that oil emitted from the line will not impinge upon the pilots' windshield. The breather shall not discharge into the engine air induction system. (See also section 40.135.)"

"40.127 *Fire walls.* All engines, auxiliary power units, fuel-burning heaters, and other combustion equipment which are intended for operation in flight shall be isolated from the remainder of the airplane by means of

fire walls or shrouds, or other equivalent means."

"40.128 *Fire-wall construction.* Fire walls and shrouds shall be constructed in such a manner that no hazardous quantity of air, fluids, or flame can pass from the engine compartment to other portions of the airplane. All openings in the fire wall or shroud shall be sealed with close-fitting fireproof grommets, bushings, or fire-wall fittings. Fire walls and shrouds shall be constructed of fireproof material and shall be protected against corrosion. The following materials have been found to comply with this requirement:

"(a) Heat and corrosion resistant steel 0.015" thick;

"(b) Low carbon steel, suitably protected against corrosion, 0.018 inch thick."

"40.129 *Cowling.* Cowling shall be constructed and supported in such a manner as to be capable of resisting all vibration, inertia, and air loads to which it may normally be subjected. Provision shall be made to permit rapid and complete drainage of all portions of the cowling in all normal ground and flight attitudes. Drains shall not discharge in locations constituting a fire hazard. Cowling, unless otherwise specified by these regulations, shall be constructed of fire-resistant material. Those portions of the cowling which are subjected to high temperatures due to their proximity to exhaust system parts or exhaust gas impingement shall be constructed of fireproof material."

"40.130 *Engine accessory section diaphragm.* Unless equivalent protection can be demonstrated by other means, a diaphragm shall be provided on air-cooled engines to isolate the engine power section and all portions of the exhaust system from the engine accessory compartment. This diaphragm shall comply with the provisions of section 40.128."

"40.131 *Powerplant fire protection.* Engine accessory sections, installations where no isolation is provided between the engine and accessory compartment, also regions wherein lie auxiliary power units, fuel-burning heaters, and other combustion equipment shall be referred to as designated fire zones. Such zones shall be protected from fire by compliance with sections 40.132 through 40.135."

"40.132 *Flammable fluids.* No tanks or reservoirs which are a part of a system containing flammable fluids or gases shall be located in designated fire zones, except where the fluid contained, the design of the system, the materials used in the tank, the shutoff means, and all connections, lines, and controls are such as to provide equivalent safety. Not less than ½ inch of clear air space shall be provided between any tank or reservoir and a fire wall or shroud isolating a designated fire zone."

"40.133 *Shutoff means.* Means for each individual engine shall be provided for shutting off or otherwise preventing hazardous quantities of fuel, oil, de-icer, and other flammable fluids from flowing into, within, or through any designated fire zone, except that means need not be provided to shut off flow in lines forming an integral part of an engine. In order to facilitate rapid and effective control of fires, such shutoff means shall permit an emergency operating sequence which is compatible with the emergency operation of other equipment, such as feathering the propeller. Shutoff means shall be located outside of designated fire zones, unless equivalent safety is provided (see section 40.132), and it shall be shown that no hazardous quantity of such flammable fluid will drain into any designated fire zone after shutting off has been accomplished. Adequate provisions shall be made to guard against inadvertent operation of the shutoff means and to make it possible for the crew to reopen the shutoff means after it has once been closed."

"40.134 *Lines and fittings.* All lines and fittings for same located in designated fire zones which carry flammable fluids or gases and which are under pressure, or which attach directly to the engine, or are subject to relative motion between components, exclusive of those lines and fittings forming an integral part of the engine shall be flexible, fire-resistant lines with fire-resistant, factory-fixed, detachable, or other approved fire-resistant ends. Lines and fittings which

are not subject to pressure or to relative motion between components shall be of fire-resistant materials."

"40.135 *Vent and drain lines.* All vent and drain lines and fittings for same located in designated fire zones and which carry flammable fluids or gases shall comply with the provisions of section 40.134, if the Administrator finds that rupture or breakage of a particular drain or vent line may result in a fire hazard."

"40.136 *Fire-extinguisher systems.*

"(a) Unless it can be demonstrated that equivalent protection against destruction of the airplane in case of fire is provided by the use of fireproof materials in the nacelle and other components which would be subjected to flame, fire-extinguishing systems shall be provided to serve all designated fire zones.

"(b) Materials in the fire-extinguishing system shall not react chemically with the extinguishing agent so as to constitute a hazard."

"40.137 *Fire-extinguishing agents.* Extinguishing agents employed shall be methyl bromide, carbon dioxide, or any other agent which has been demonstrated to provide equivalent extinguishing action. If methyl bromide or any other toxic extinguishing agent is employed, provisions shall be made to prevent the entrance of harmful concentrations of fluid or fluid vapors into any personnel compartment either due to leakage during normal operation of the airplane or as a result of discharging the fire extinguisher on the ground or in flight when a defect exists in the extinguisher system. If a methyl bromide system is provided, the containers shall be charged with dry agent and shall be sealed by the fire-extinguisher manufacturer or any other party employing satisfactory recharging equipment. If carbon dioxide is used, it shall not be possible to discharge sufficient gas into personnel compartments to constitute a hazard from the standpoint of suffocation of the occupants."

"40.138 *Extinguishing agent container pressure relief.* Extinguishing agent containers shall be provided with a pressure relief to prevent bursting of the container due to excessive internal pressures. The discharge line from the relief connection shall terminate outside the airplane in a location convenient for inspection on the ground. An indicator shall be provided at the discharge end of the line to provide a visual indication when the container has discharged."

"40.139 *Extinguishing agent container compartment temperature.* Precautions shall be taken to assure that the extinguishing agent containers are installed in locations where reasonable temperatures can be maintained for effective use of the extinguisher system."

"40.140 *Fire-extinguishing system materials.* All components of fire-extinguishing systems located in designated fire zones shall be constructed of fireproof materials, except for connections which are subject to relative motion between components of the airplane, in which case they shall be of flexible fire-resistant construction so located as to minimize the possibility of failure."

"40.141 *Fire-detector systems.* Quick-acting fire detectors shall be provided in all designated fire zones and shall be sufficient in number and location to assure the detection of fire which may occur in such zones."

"40.142 *Fire detectors.* Fire detectors shall be constructed and installed in such a manner as to assure their ability to resist without failure, all vibration, inertia, and other loads to which they may normally be subjected. Detectors shall be unaffected by exposure to oil, water, or other fluids or fumes which may be present."

"40.143 *Protection of other airplane components against fire.* All airplane surfaces aft of the nacelles in the region of one nacelle diameter on both sides of the nacelle center line shall be constructed of fire-resistant material. This provision need not be applied to tail surfaces lying behind nacelles unless the dimensional configuration of the airplane is such that the tail surfaces could be affected readily by heat, flames, or sparks emanating from a designated fire zone or engine compartment of any nacelle."

"40.150 *Control of engine rotation.* All airplanes shall be provided with means for individually stopping and restarting the rotation of any engine in flight."

"40.151 *Fuel system independence.* Airplane fuel systems shall be arranged in such manner that the failure of any one component will not result in the irrecoverable loss of power of more than one engine. A separate fuel tank need not be provided for each engine if the Administrator finds that the fuel system incorporates features which provide equivalent safety."

"40.152 *Induction system ice prevention.* Means for preventing the malfunctioning of each engine due to ice accumulation in the engine air induction system shall be provided for all airplanes."

"40.153 *Carriage of cargo in passenger compartments.* When operating conditions require the carriage of cargo which cannot be loaded in approved cargo racks, bins, or compartments which are separate from passenger compartments, such cargo may be carried in a passenger compartment if the following requirements are complied with: *Provided,* That the Administrator, under a particular set of circumstances, may authorize deviations from these requirements when he finds that safety will not be adversely affected and that it is in the public interest to carry such cargo:

"(a) It shall be packaged or covered in a manner to avoid possible injury to passengers.

"(b) It shall be properly secured in the airplane by means of safety belts or other tie-downs possessing sufficient strength to eliminate possibility of shifting under all normally anticipated flight and ground conditions.

"(c) It shall not be carried aft of or directly above seated passengers.

"(d) It shall not impose any loads on seats or on the floor structure which exceed the designed loads for those components.

"(e) It shall not be placed in any position which restricts the access to or use of any required emergency or regular exit or the use of the aisle between the crew and the passenger compartments."

40.153–1 *Carriage of cargo in passenger compartments. (CAA policies which apply to 40.153.)* Normally the stowage of cargo in passenger compartments should be accomplished by utilizing the forward rows of seats in the passenger cabin. However, there may be instances where it might be desirable to carry cargo in the form of an unusually shaped object which would not lend itself to normal stowage practice. If safety is not adversely affected and the carriage of such cargo is in the public interest, the Administrator will authorize deviations from the requirements of section 40.153. The authorization for such deviation will be based solely on the merits of each individual case, and no blanket authorizations will be granted. In the event that cargo stowed in the forward end of the passenger cabin is of sufficient size or volume so as to obscure the passengers' view of the "seat belt" and "no smoking" sign, an auxiliary sign or some other means for proper notification of passengers will be provided.

Instrument and Equipment for All Operations

"40.170 *Aircraft instruments and equipment for all operations.*

"(a) Instruments and equipment required by sections 40.171 through 40.232 shall be approved and shall be installed in accordance with the provisions of the airworthiness requirements applicable to the instruments or equipment concerned.

"(b) The following instruments and equipment shall be in operable condition prior to take-off, except as provided in section 40.391 (b) for continuance of flight with equipment inoperative:

"(1) Instruments and equipment required to comply with airworthiness requirements under which the airplane is type certificated and as required by the provisions of section 40.110 and sections 40.150 through 40.153.

"(2) Instruments and equipment specified in sections 40.171 through 40.178 for all operations, and the instruments and equipment specified in sections 40.200 through 40.232 for the type of operation indicated, wherever these items are not already provided in accordance with subparagraph (1) of this paragraph."

40.170–1 *Approval of aircraft instruments and equipment for all operations. (CAA interpretations which apply to 40.170 (a).)* Instru-

ments and equipment specified in sections 40.171, 40.172, and 40.230 through 40.232 must be approved in accordance with one or more of the following methods:

(a) Instruments and equipment which are accepted as part of the aircraft on original certification.

(b) Instruments and equipment manufactured in accordance with (TSO) Technical Standard Orders and installed in accordance with approved repair and alteration procedures or on original aircraft certification.

(c) Instruments and equipment manufactured in accordance with a (CAATC) Type Certificate and installed on original aircraft certification or subsequent repair and alteration approval.

(d) Instruments and equipment approved by the Administrator in accordance with standard repair and alteration procedure.

40.170–2 *Determination of operable condition of radio equipment. (CAA interpretations which apply to 40.170 (b)).* Radio equipment specified in sections 40.230 through 40.232 which is of such complex nature that it cannot be accurately checked for operable condition prior to take-off, except by special ramp or shop performance check procedures, may be deemed to have been determined operable if equipment in this category is comprehensively checked for satisfactory operational performance during the last comprehensive performance check specified in the Operations Specifications, Aircraft Maintenance (other than pre-flight or daily), of the air carrier using such equipment coupled with frequent in-flight checks by pilots during regular operations.

"40.171 *Flight and navigational equipment for all operations.* The following flight and navigational instruments and equipment are required for all operations:

"(a) An air-speed indicating system with heated Pitot tube or equivalent means for preventing malfunction due to icing.

"(b) Sensitive altimeter.

"(c) Clock (sweep-second).

"(d) Free-air temperature indicator.

"(e) Gyroscopic bank and pitch indicator (artificial horizon).

"(f) Gyroscopic rate-of-turn indicator combined with a slip-skid indicator (turn and bank indicator).

"(g) Gyroscopic direction indicator.

"(h) Magnetic compass.

"(i) Vertical speed indicator (rate-of-climb indicator)."

"40.172 *Engine instruments for all operations.* The following engine instruments are required for all operations:

"(a) Carburetor air temperature indicator for each engine.

"(b) Cylinder head temperature indicator for each air-cooled engine.

"(c) Fuel pressure indicator for each engine.

"(d) Fuel flowmeter or fuel mixture indicator for each engine not equipped with an automatic mixture control.

"(e) Means for indicating fuel quantity in each fuel tank.

"(f) Manifold pressure indicator for each engine.

"(g) Oil pressure indicator for each engine.

"(h) Oil quantity indicator for each oil tank when a transfer or separate oil reserve supply is used.

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

"(j) Tachometer for each engine.

"(k) On and after December 31, 1953, an independent fuel pressure warning device for each engine or a master warning device for all engines with means for isolating the individual warning circuits from the master warning device."

"40.173 *Emergency equipment for all operations.*

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

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

cargo compartments in accordance with the following requirements:

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

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

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

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

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

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

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

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

"(a) If protective fuses are used, spare fuses of a number approved for the particular airplane and appropriately described in the air carrier manual,

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

"(c) A power supply and distribution system capable of producing and distributing the load for all required instruments and equipment using an external power supply in the event of failure of any one power source or component of the power distribution system: *Provided,* That the Administrator may authorize the use of common elements in the power distribution system when he finds that such elements are so designed as to be reasonably protected against malfunction. Engine-driven sources of energy, when used, shall be on separate engines.

"(d) Means for indicating the adequacy of the power being supplied to required flight instruments.

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

"(f) Means for locking all companionway doors which separate passenger compartments from flight crew compartments. Keys for all doors which separate passenger compartments from other compartments having emergency exit provisions shall be readily available to all crew members. Any door which is the means of access to a required passenger emergency exit shall be placarded to indicate that it must be open during take-off and landing. All doors which lead to compartments normally ac-

cessible to passengers and which are capable of being locked by passengers shall be provided with means for unlocking by the crew in the event of any emergency.

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

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

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

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

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

"40.177 *Passenger information for all operations.* All airplanes shall be equipped with signs visible to passengers and cabin attendants to notify such persons when smoking is prohibited and when safety belts should be fastened. These signs shall be capable of on-off operation by the crew."

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

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

"(b) The exterior areas of the fuselage of an airplane shall be marked to indicate the location of mechanisms of access and those areas suitable for cutting to facilitate the escape and rescue of occupants in the event of an accident."

Instruments and Equipment for Special Operations

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

"(a) Flashing position lights,

"(b) Two landing lights,

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

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

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

"(f) A sensitive altimeter."

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

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

"(b) A sensitive altimeter, and

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

"40.202 *Supplemental oxygen.*

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

"(b) *Crew members.*

"(1) At altitudes above 10,000 feet to and including 12,000 feet oxygen shall be provided for, and used by, each member of the flight crew on flight deck duty, and provided for all other crew members during the portion of the flight in excess of 30 minutes within this range of altitudes.

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

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

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

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

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

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

"(a) *For crew members.* When operating such airplanes at flight altitudes above 10,000 feet, the air carrier shall provide sufficient oxygen for all crew members for the duration of the flight at such altitudes: *Provided,* That not less than a 2-hour supply of oxygen shall be provided for the flight crew members on flight deck duty. The oxygen supply required by 40.205 may be considered in determining the supplemental breathing supply required for flight crew members on flight deck duty in the event of cabin pressurization failure.

"(b) *For passengers.* When operating such airplanes at flight altitudes above 8,000 feet, the air carrier shall provide the following amounts of oxygen:

"(1) When an airplane is not flown at a flight altitude of over 25,000 feet, a supply of oxygen sufficient to furnish oxygen for

30 minutes to 10 percent of the number of passengers carried shall be considered adequate, if at any point along the route to be flown the airplane can safely descend to a flight altitude of 14,000 feet or less within 4 minutes.

"(2) In the event that such airplane cannot descend to a flight altitude of 14,000 feet or less within 4 minutes, the following supply of oxygen shall be provided:

"(i) For the duration of the flight in excess of 4 minutes at flight altitudes above 15,000 feet a supply sufficient to comply with section 40.202 (c) (3);

"(ii) For the duration of the flight at flight altitudes above 14,000 feet to and including 15,000 feet, a supply sufficient to comply with section 40.202 (c) (2); and

"(iii) For flight at flight altitudes above 8,000 feet to and including 14,000 feet, a supply sufficient to furnish oxygen for 30 minutes to 10 percent of the number of passengers carried.

"(3) When an airplane is flown at a flight altitude above 25,000 feet, sufficient oxygen shall be furnished in accordance with the following requirements to permit the airplane to descend to an appropriate flight altitude at which the flight can be safely conducted. Sufficient oxygen shall be furnished to provide oxygen for 30 minutes to 10 percent of the number of passengers carried for the duration of the flight above 8,000 feet to and including 14,000 feet and to permit compliance with section 40.202 (c) (2) and (c) (3) for flight above 14,000 feet.

"(c) For purposes of this section it shall be assumed that the cabin pressurization failure will occur at a time during flight which is critical from the standpoint of oxygen need and that after such failure the airplane will descend, without exceeding its normal operating limitations, to flight altitudes permitting safe flight with respect to terrain clearance."

"40.204 *Equipment standards.* The oxygen apparatus, the minimum rates of oxygen flow, and the supply of oxygen necessary to comply with the requirements of section 40.202 shall meet the standards established in section 4b.651 of this subchapter, effective July 20, 1950: *Provided,* That where full compliance with such standards is found by the Administrator to be impractical, he may authorize such changes in these standards as he finds will provide an equivalent level of safety."

"40.205 *Protective breathing equipment for the flight crew.*

"(a) *Pressurized cabin airplanes.* Each required flight crew member on flight deck duty shall have easily available at his station protective breathing equipment covering the eyes, nose, and mouth, or the nose and mouth where accessory equipment is provided to protect the eyes, to protect him from the effects of smoke, carbon dioxide, and other harmful gases. Not less than a 300-liter STPD supply of oxygen for each required flight crew member on flight deck duty shall be provided for this purpose.

"(b) *Nonpressurized cabin airplanes.* The requirement stated in paragraph (a) of this section shall apply to nonpressurized cabin airplanes, if the Administrator finds that it is possible to obtain a dangerous concentration of smoke, carbon dioxide, or other harmful gases in the flight crew compartments in any attitude of flight which might occur when the airplane is flown in accordance with either the normal or emergency procedures approved by the Administrator."

40.205–1 *Requirement of protective breathing equipment in nonpressurized cabin airplanes. (CAA rules which apply to 40.205 (b).)* Protective breathing equipment for the flight crew shall be required in nonpressurized cabin airplanes having built-in carbon dioxide fire extinguisher systems in fuselage compartments (for example, cargo or combustion heater compartments); except that protective breathing equipment will not be required where:

(a) Not more than five pounds of carbon dioxide will be discharged into any one such compartment in accordance with established fire control procedures, or

(b) The carbon dioxide concentration at the flight crew stations has been determined in accordance with CAM 4b.484–1 and found to be less than 3 percent by volume (corrected to standard sea-level conditions).

40.205–2 *Protective breathing equipment and installation. (CAA policies which apply to 40.205.)*

(a) *Oxygen systems.* The 300-liter oxygen supply per flight crew member required by this requirement is intended to be used with a demand type oxygen system or a diluter-demand type oxygen system with the lever of the diluter-demand regulator set at "100% OXYGEN" (Automix "OFF"). A continuous flow protective breathing system with a suitable mask may also be used for protective breathing purposes providing an oxygen flow rate of 60 liters per minute at 8,000 feet (45 liters per minute at sea level) is suplied to the mask and providing a supply of 600 liters of free oxygen at 70° F. and 760 mm Hg pressure is provided to each required flight crew member. See section 4b.651 (h) and associated manual material.

(b) *Portable equipment.* Portable protective breathing units of one of the types mentioned in paragraph (a) may be used to meet this requirement. Portable units which are also intended to be used to meet the fire protection requirements of section 4b.380 (c) should be of one of the demand types; continuous flow types are not suitable for fighting fires in Class A or B cargo compartments since any unused oxygen escaping from around the face mask might aggravate the existing fire.

"40.206 *Equipment for overwater operations.* (a) The following equipment shall be required for all extended overwater operations:

"(1) Life preserver or other adequate individual flotation device for each occupant of the airplane,

"(2) Lifesaving rafts sufficient in number to adequately carry all occupants of the airplane,

"(3) Suitable pyrotechnic signalling devices,

"(4) One portable emergency radio signalling device, capable of transmission on the appropriate emergency frequency or frequencies, which is not dependent upon the airplane power supply and which is self-buoyant and water-resistant, and

"(b) Rafts and life preservers referred to in paragraph (a) (1) and (2) of this section shall be installed so as to be available to the crew and passengers."

"40.207 *Equipment for operations in icing conditions.*

"(a) For all operations in icing conditions each airplane shall be equipped with means for the prevention or removal of ice on windshields, wings, empennage, propellers, and other parts of the airplane where ice formation will adversely affect the safety of the airplane.

"(b) For operations in icing conditions at night means shall be provided for illuminating or otherwise determining the formation 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."

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 section 40.231 and section 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. (CAA interpretations which apply to 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.

"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:

"(1) Permit communications with at least one appropriate ground station (as specified in section 40.34) from any point on the route and with other airplanes operated by the air carrier;

"(2) Permit communications with airport traffic control towers from any point in the control zone within which flights are intended. The means employed for compliance with subparagraph (1) of this paragraph may be used for compliance with this subparagraph; and

"(3) Receive meteorological information from any point en route by either of two independent systems. Either of the means required for compliance with subparagraphs (1) and (2) of this paragraph may be used to comply with one of the systems required by this subparagraph.

"(b) For all operations at night conducted under VFR over routes on which navigation can be accomplished by pilotage, each airplane, in addition to the equipment specified in paragraph (a) of this section, shall be equipped with at least one receiving system capable of receiving route navigational signals applicable to the route to be 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, in addition to the equipment required by section 40.231, shall be equipped with such radio equipment as is necessary 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 or one ILS receiver need be provided. Equipment provided to receive signals en route may be used to receive signals on approach, if it is capable of receiving both signals.

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

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

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 the airplanes and required equipment."

"40.241 *Maintenance and inspection requirements.*

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

and that any airframe, engine, propeller, or appliance released for flight is airworthy.

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

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

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

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

Airman and Crew Member Requirements

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

"40.261 *Composition of flight crew.*

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

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

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

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

"40.263 *Flight engineer.* An airman holding a valid flight engineer certificate shall be required on all airplanes certificated for more than 80,000 pounds maximum certificated take-off weight. Such airman shall also be required on all four-engine airplanes certificated for more than 30,000 pounds maximum certificated take-off weight where the Administrator finds that the design of the airplane used or the type of operation is such as to require engineer personnel for the safe operation of the airplane."

"40.265 *Flight attendant.* At least one flight attendant shall be provided by the air carrier on all flights carrying passengers in airplanes of 10-passenger capacity or more."

"40.266 *Aircraft dispatcher.* Each air carrier shall provide an adequate number of qualified dispatchers at each dispatch center to insure the proper operational control of each flight."

Training Program

"40.280 *Training requirements.*

"(a) Each air carrier shall establish a training program sufficient to insure that

each crew member and dispatcher used by the air carrier is adequately trained to perform the duties to which he is to be assigned. The initial training phases shall be satisfactorily completed prior to serving in scheduled operations.

"(b) Each air carrier shall be responsible for providing adequate ground and flight training facilities and properly qualified instructors. There also shall be provided for flight checking a sufficient number of check airmen holding the same airman certificates and ratings as are required for the airman being checked.

"(c) The training program for each flight crew member shall consist of appropriate ground and flight training including proper flight crew coordination. Procedures for each flight crew function shall be standardized to the extent that each flight crew member will know the functions for which he is responsible and the relation of those functions to those of other flight crew members. The initial program shall include at least the appropriate requirements specified in sections 40.281 through 40.286.

"(d) The crew member emergency procedures training program shall include at least the requirements specified in section 40.286.

"(e) The appropriate instructor, supervisor, or check airman responsible for the particular training or flight check shall certify to the proficiency of each crew member and dispatcher upon completion of his training, and such certification shall become a part of the individual's record."

"40.281 *Initial pilot ground training.* Ground training for all pilots shall include instruction in at least the following:

"(a) The appropriate provisions of the air carrier operations specifications and appropriate provisions of the regulations of this subchapter with particular emphasis on the operation and dispatching rules and airplane operating limitations;

"(b) Dispatch procedures and appropriate contents of the manuals;

"(c) The duties and responsibilities of crew members;

"(d) The type of airplane to be flown, including a study of the airplane, engines, all major components and systems, performance limitations, standard and emergency operating procedures, and appropriate contents of the approved Airplane Flight Manual;

"(e) The principles and methods of determining weight and balance limitations for take-off and landing;

"(f) Navigation and use of appropriate aids to navigation, including the instrument approach facilities and procedures which the air carrier is authorized to use;

"(g) Airport and airways traffic control systems and procedures, and ground control letdown procedures if pertinent to the operation;

"(h) Meteorology sufficient to insure a practical knowledge of the principles of icing, fog, thunderstorms, and frontal systems;

"(i) Procedures for operation in turbulent air and during periods of ice, hail, thunderstorms, and other potentially hazardous meteorological conditions."

"40.282 *Initial pilot flight training.*

"(a) Flight training for all pilots shall include at least take-offs and landings, during day and night, and normal and emergency flight maneuvers in each type of airplane to be flown by him in scheduled operations, and flight under simulated instrument flight conditions.

"(b) Flight training for a pilot qualifying to serve as pilot in command shall include flight instruction and practice in at least the following maneuvers and procedures:

"(1) In each type of airplane to be flown by him in scheduled operations:

"(i) At the authorized maximum take-off weight, take-off using maximum take-off power with simulated failure of the critical engine. For transport category airplanes the simulated engine failure shall be accomplished as closely as possible to the critical engine failure speed (V_1) and climb-out shall be accomplished at a speed as close as possible to the take-off safety speed (V_2). Each pilot shall ascertain the proper values for speeds, V_1 and V_2;

"(ii) At the authorized maximum landing weight, flight in a four-engine air-

plane, where appropriate, with the most critical combinations of two engines inoperative, or operating at zero thrust, utilizing appropriate climb speeds as set forth in the Airplane Flight Manual;

"(iii) At the authorized maximum landing weight, simulated pull-out from the landing and approach configurations accomplished at a safe altitude with the critical engine inoperative or operating at zero thrust;

"(iv) Suitable combinations of airplane weight and power less than those specified in subdivisions (i), (ii), and (iii) of this subparagraph may be employed if the performance capabilities of the airplane under the above conditions are simulated.

"(2) Conduct of flight under simulated instrument conditions, utilizing all types of navigational facilities and the letdown procedures used in normal operations. If a particular type of facility is not available in the training area, such training may be accomplished in a synthetic trainer."

"40.284 *Initial flight engineer training.*

"(a) The training for flight engineers shall include at least paragraphs (a) through (e) of section 40.281.

"(b) Flight engineers shall be given sufficient training in flight to become proficient in those duties assigned them by the air carrier. Except for emergency procedures, this training may be accomplished during scheduled flight under the supervision of a qualified flight engineer."

"40.286 *Initial crew member emergency training.*

"(a) The training in emergency procedures shall be designed to give each crew member appropriate individual instruction in all emergency procedures, including assignments in the event of an emergency, and proper coordination between crew members. At least the following subjects as appropriate to the individual crew member shall be taught: The procedures to be followed in the event of the failure of an engine, or engines, or other airplane components or systems, emergency decompression fire in the air or on the ground, ditching, evacuation, the location and operation of all emergency equipment, and power setting for maximum endurance and maximum range.

"(b) Synthetic trainers may be used for training of crew members in emergency procedures where the trainers sufficiently simulate flight operating emergency conditions for the equipment to be used."

40.286–1 *Initial crew member emergency training—synthetic trainers.* (*CAA interpretations which apply 40.286 (b).*) Synthetic trainers will be deemed to sufficiently simulate flight operating emergency conditions if the trainer is so designed as to accurately reproduce the placement of flight station instruments and controls of the particular type and model of aircraft for which the training is given, and the operation of such trainer permits accurate reproduction of the instrument and control characteristics found in the emergency conditions simulated.

"40.288 *Initial aircraft dispatcher training.*

"(a) The training program for aircraft dispatchers shall provide for training in their duties and responsibilities and shall include a study of the flight operation procedures, air traffic control procedures, the performance of the airplanes used by the air carrier, navigational aids and facilities, and meteorology. Particular emphasis shall be placed upon the procedures to be followed in the event of emergencies, including the alerting of proper Governmental, company, and private agencies to render maximum assistance to an airplane in distress.

"(b) Each aircraft dispatcher shall, prior to initially performing the duty of an aircraft dispatcher, satisfactorily demonstrate to the supervisor or ground instructor authorized to certify to his proficiency, his knowledge of the following subjects:

"(1) Contents of the air carrier operating certificate,

"(2) Appropriate provisions of the air carrier operating specifications, manual, and regulations of this subchapter,

"(3) Characteristics of the airplanes operated by the air carrier,

"(4) Cruise control data and cruising speeds for such airplanes,

"(5) Maximum authorized loads for the airplanes for the routes and airports to be used,

"(6) Air carrier radio facilities,

"(7) Characteristics and limitations of each type of radio and navigational facility to be used,

"(8) Effect of weather conditions on airplane radio reception,

"(9) Airports to be used and the general terrain over which the airplanes are to be flown,

"(10) Prevailing weather phenomena,

"(11) Sources of weather information available,

"(12) Pertinent air traffic control procedures, and

"(13) Emergency procedures."

"40.289 *Recurrent training.*

"(a) Each air carrier shall provide such training as is necessary to insure the continued competence of each crew member and dispatcher and to insure that each possesses adequate knowledge and familiarity with all new equipment and procedures to be used by him.

"(b) Each air carrier shall, at intervals established as part of the training program, but not to exceed 12 months, check the competence of each crew member and dispatcher with respect to procedures, techniques, and information essential to the satisfactory performance of his duties. Where the check of the pilot in command requires actual flight, such check shall be considered to have been met by the checks accomplished in accordance with section 40.302.

"(c) The appropriate instructor, supervisor, or check airman shall certify as to the proficiency demonstrated, and such certification shall become a part of the individual's record. In the case of pilots other than pilots in command, a pilot in command may make such certification."

Flight Crew Member and Dispatcher Qualification

40.300 *Qualification requirements.*

"(a) No air carrier shall utilize any flight crew member or dispatcher, nor shall any such airman perform the duties authorized by his airman certificate, unless he satisfactorily meets the appropriate requirements of section 40.280 or section 40.289, and sections 40.301 through 40.310. All pilots serving as pilot in command shall hold appropriate airline transport pilot certificates and ratings. All other pilots shall hold at least commercial pilot certificates and instrument ratings.

"(b) Check airmen shall certify as to the proficiency of the pilot in command being examined, as required by sections 40.302 and 40.303, and such certification shall become a part of the airman's records."

"40.301 *Pilot recent experience.* No air carrier shall schedule a pilot to serve as such in scheduled air transportation unless within the preceding 90 days he has made at least 3 take-offs and 3 landings in the airplane of the particular type on which he is to serve."

"40.302 *Pilot checks.*

"(a) Line check: Prior to serving as pilot in command, and at least once each 12 months thereafter, a pilot shall satisfactorily accomplish a line check in one of the types of airplanes normally to be flown by him. This check shall be given by a check pilot who is qualified for the route. It shall consist of at least a scheduled flight between terminals over a route to which the pilot is normally assigned during which the check pilot shall determine whether the individual being checked satisfactorily exercises the duties and responsibilities of pilot in command.

"(b) Proficiency check.

(1) An air carrier shall not utilize a pilot as pilot in command until he has satisfactorily demonstrated to a check pilot or a representative of the Administrator his ability to pilot and navigate airplanes to be flown by him. Thereafter, at least twice each 12 months at intervals of not less than 4 months or more than 8 months, a similar pilot proficiency check shall be given each such pilot. Where such pilots serve in more than one airplane type, the pilot proficiency check shall be given in the larger airplane type at least once each 12 months.

"(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,

"(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.

"(c) Prior to serving as pilot in command in a particular type of airplane, a pilot shall have accomplished during the preceding 12 months either a proficiency check or a line check in that type of airplane."

40.302–1 *Pilot check—proficiency requirements.* (*CAA rules which apply to 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) *Run-up.* Attention to detail in the use of cockpit checklist and cockpit procedure shall be observed on all proficiency flights.

(d) *Take-off.* For those air carriers authorized take-off minimums of less than 300–1, the pilot being examined shall whenever practicable execute a take-off solely by reference to instruments, or at the option of the check pilot, a contact take-off 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 take-off run, his proficiency in handling power, flap and gear operation during the critical period between take-off (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 forty-five 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 thirty 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 airspeed to maintain altitude and heading, and to avoid unintentional approaches to stalls.

(h) *Approach to stalls.* Approach to stalls shall be demonstrated from straight flight and turns, with and without power. An approach to stall shall be executed in landing or approach configuration. The extent to which the approach to stall will be carried and the method of recovery utilized shall be dictated by (1) the type of aircraft being flown, (2) its reaction to stall conditions, and (3) the limitation established by the air carrier. Performance shall be judged on ability to recognize the approaching stall, prompt action in initiating recovery, and prompt execution of proper recovery procedure for the particular make and model of aircraft involved.

(i) *Propeller feathering.* Propeller feathering or the assimilation thereof shall be accomplished in accordance with instructions set forth by the air carrier and be exercised at sufficient altitude to insure adequate safety for the performance of the operation. The pilot's ability to maintain altitude, directional control, and satisfactory airspeed shall be the desired prerequisites in accomplishing this maneuver. The manner in which the pilot manages his cockpit during propeller feathering shall also be noted.

(j) *Maneuvers (one or more engines out.)* When performing maneuvers (one or more engines out) the aircraft shall be maneuvered with a loss of fifty percent of its power units, such loss to be concentrated on one side of the aircraft. The loss of these power units may be simulated either by retarding throttles or by following approved feathering procedures. The pilot-in-command shall be required to maintain headings and altitude and to make moderate turns both toward and away from the dead engine or engines. Proficiency shall be judged on the basis of the pilot's ability to maintain engine-out airspeed, heading and altitude; to trim the airplane; and to adjust necessary power settings.

(k) *Rapid descent and pull-out.* This maneuver shall consist of the following steps: While the aircraft is in the appropriate holding configuration and being flown at a predetermined altitude, it will be assumed that the aircraft has arrived at a navigational fix and is cleared to descend immediately to a lower altitude. (The lower altitude shall be one which permits a descent of at least 1,000 feet.) Upon reaching the lower altitude, the aircraft shall be recovered from the rapid descent and flown on a predetermined heading and altitude for a predetermined period of time. At the end of the time interval, an emergency pull-out shall be executed which will involve a change of direction of at least 180°. Performance shall be judged on the basis of ability to establish a rapid descent at constant airspeed, stopping the descent at the minimum altitude specified without going below it, holding heading and altitude, and smooth pull-up and climb.

(l) *Ability to tune radio.*[6]

(m) *Orientation.*[6]

(n) *Beam bracketing.*[6]

(o) *Cone identification.*[6]

(p) *Loop orientation.*[6]

(q) *Approach procedures.* An approach procedure shall be made in the aircraft on the let-down aid for which the lowest minimums on a system-wide basis are authorized and include, where possible, holding patterns and air traffic control instructions which might be used by the pilot in day-to-day operations. If at the time of the proficiency flight the let-down aid affording the lowest minimums is not in operation at the point the check is given, the landing aid which affords the next lowest minimums on a

[6] Paragraphs (l), (m), (n), (o), and (p) shall be accomplished in a satisfactory manner either during (1) a routine line check under the supervision of an authorized company check pilot, (2) in a simulated or synthetic trainer, or (3) during the proficiency flight. A record shall be maintained in the pilot's file which shall indicate the date, method utilized, and grade received in the performance of these items.

checks are given. In the event that the line and proficiency checks are not both given in the same calendar month, the base check month shall be the month in which the first of such initial qualifying checks was given. In the case of pilots who were currently qualified as pilots in command on January 1, 1954, such base check month shall be the month in which the last six month check required under section 61.112 was given.

(b) The subsequent line checks required by section 40.302 (a) must be given not later than the end of the same calendar month as the base month in each succeeding calendar year.

(c) The first of the two proficiency checks required by section 40.302 (b) shall be given not sooner than the first day of the fourth full month following the month in which the last proficiency check was given and shall be given not later than the end of the eighth full month following the month in which the last proficiency check was given. The second of the two proficiency checks required by section 40.302 (b) must be given not later than the end of the same calendar month as the base month each succeeding calendar year. In no event shall a pilot be eligible to serve as pilot-in-command unless he has been given such a proficiency check within the last eight months.

(d) When a pilot for any reason has not met the pilot check requirements of this section, he must be given re-qualifying line and proficiency checks prior to being used as pilot-in-command. In this case, the base check month shall be re-established the same as though such pilot was a new pilot-in-command.

Example 1.—A pilot took a proficiency check on August 30, 1953. His base month, therefore, is August 1953. The earliest date for his next proficiency check is December 1, 1953, and the latest date for the second proficiency check in the twelve month period is August 30, 1954. However, instead of December, this pilot could have taken a proficiency check in January, February, March or April, provided the second proficiency check is taken in August 1954.

Example 2.—A pilot was not currently qualified with respect to proficiency checks on January 1, 1954. His initial proficiency check qualification date is January 3, 1954, and January 1954 becomes his base month. The earliest date on which he can take the first of the two required proficiency checks is May 1, 1954, but not later than September 30, 1954. If he is given a proficiency check in May 1954, the earliest possible time for his second check will be September 1954 and the latest permissible time, January 1955. However, if he takes his second check in September 1954, then his next proficiency check must come within eight months of that period or not later than the end of May 1955.

40.302–3 *Pilot checks use of synthetic trainer.* (*CAA policies which apply to 40.302 (b) (2) (ii).*) An air carrier using a flight simulator in its pilot's training program may be approved to utilize such a device for certain maneuvers in conducting proficiency checks provided that (a) the training device accurately simulates the flight characteristics and the performance of the applicable aircraft through all ranges of normal and emergency operation, (b) the maneuvers to be conducted in the simulator other than those specifically authorized in section 40.302–1, paragraphs (l), (m), (n), (o), (p), and (q), are submitted to the Washington Office for approval by the region in which the headquarters of the air carrier is located, (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 take-off and landings, with engine failures as outlined in section 40.302–1, paragraphs (g), (q), (u), and (v), respectively.

"40.303 *Pilot route and airport qualification requirements.*

"(a) An air carrier shall not utilize a pilot as pilot in command until he has been qualified for the route on which he is to serve in accordance with paragraphs (b), (c), and (d) 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 accom-

plished in a synthetic trainer which contains the radio equipment and instruments necessary to simulate the navigational and let-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 a landing and take-off at each regular, provisional, and refueling airport into which he is scheduled to fly, unless impracticable, such landing and take-off shall be made under day VFR to permit the qualifying pilot to observe the airport and surrounding terrain, including any obstructions to landing and take-off. The qualifying pilot shall be accompanied by a pilot who is qualified at the airport.

"(d) Where an en route operation 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 by not less than two one-way trips as pilot or additional member of the crew over the route under VFR to permit the qualifying pilot to observe terrain along the route."

40.303–1 *Pilot route and airport qualification requirements. (CAA interpretations which apply to 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 514–A or a civil 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.

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 pilot in command, within the preceding 12-month period, shall have made at least one trip as pilot or other member of the crew between terminals into which he is scheduled to fly and one actual entry or one simulated entry utilizing a synthetic trainer into each regular, provisional, and refueling airport into which he is scheduled to fly, and shall have complied with the provisions of section 40.303 (d), if applicable.

"(b) In order to reestablish pilot route and airport qualifications after absence from a route or an airport thereon for a period in excess of 12 months, a pilot shall comply with the appropriate provisions of section 40.303: *Provided,* That in the event a pilot who is qualified over a route has not made an actual or simulated entry into an airport thereon during the preceding twelve months, he may serve as pilot in command and land at such airport if the reported weather conditions are at least three miles visibility and a ceiling at or above the lowest initial approach altitude for that airport."

"40.305 *Competence check; other pilots.* Prior to serving as pilot, and at least twice each 12 months thereafter at intervals of not less than 4 months nor more than 8 months, each pilot not being utilized as pilot in command shall demonstrate that he is capable of flying by instruments. This demonstration may be made to a pilot serving as pilot in command or a check pilot of the air carrier during scheduled flight."

"40.307 *Flight engineer qualification for duty.* A flight engineer shall not be assigned to nor perform duties for which he is required to be certificated as a flight engineer unless, within the preceding 6-month period, he has had at least 50 hours of experience as

a flight engineer on the type airplane on which he is to serve, or until the air carrier or an authorized representative of the Administrator has checked such flight engineer and determined that he is familiar with all essential current information and operating procedures relating to the type of airplane to which he is to be assigned and is competent with respect to such airplane."

"40.310 *Aircraft dispatcher qualification for duty.*

"(a) Prior to dispatching airplanes over any route or route segment, an aircraft dispatcher shall be familiar, and the air carrier shall determine that he is familiar, with all essential operating procedures for the entire route and with the airplanes to be used: *Provided,* That where he is qualified only on a portion of such route, he may dispatch airplanes, but only after coordinating with dispatchers who are qualified for the other portions of the route between the points to be served.

"(b) An aircraft dispatcher shall not dispatch airplanes in the area over which he is authorized to exercise dispatch jurisdiction unless within the preceding 12 months he has made at least one round trip over the particular area on the flight deck of an airplane. The trip selected for qualification purposes shall be one which includes entry into as many points as practicable, but it shall not be necessary for the aircraft dispatcher to make a flight over each route in the area."

Flight Time Limitations

"40.320 *Flight time limitations.*

"(a) An air carrier shall not schedule any flight crew member for duty aloft in scheduled air transportation or in other commercial flying if his total flight time in all commercial flying will exceed the following flight time limitations:

"(1) 1,000 hours in any year,

"(2) 100 hours in any month,

"(3) 30 hours in any week.

"(b) An air carrier shall not schedule any flight crew member for duty aloft for more than 8 hours during any 24 consecutive hours, unless he is given an intervening rest period at or before the termination 0–8 scheduled hours of duty aloft. Such rest period shall equal twice the number of hours of duty aloft since the last preceding rest period, and in no case shall the rest period be less than 8 hours.

"(c) When a flight crew member has been on duty aloft in excess of 8 hours in any 24 consecutive hours he shall, upon completion of his assigned flight or series of flights, be given at least 16 hours for rest before being assigned any further duty with the air carrier.

"(d) Time involved in transportation, not local in character, required of a flight crew member by an air carrier and provided by the air carrier for the purpose of transporting the flight crew member to an airport at which he is required to serve on a flight as a crew member, or from the airport at which he was relieved from duty as a crew member to return to his home station, shall not be considered as part of any required rest period.

"(e) Each flight crew member engaged in scheduled air transportation shall be relieved from all duty with the air carrier for at least 24 consecutive hours during any seven consecutive days.

"(f) No flight crew member shall be assigned any duty with an air carrier during any rest period prescribed by this part.

"(g) A flight crew member shall not be considered to be scheduled for duty in excess of prescribed limitations, if the flights to which he is assigned are scheduled and normally terminate within such limitations, but due to exigencies beyond the air carrier's control, such as adverse weather conditions, are not at the time of departure expected to reach their destination within the scheduled time."

Duty Time Limitations; Aircraft Dispatcher

"40.340 *Aircraft dispatcher daily duty time limitations.*

"(a) The daily duty period for aircraft dispatchers shall commence at such time as will permit him to become thoroughly familiar with existing and anticipated weather conditions along the route prior to the dis-

patch of any airplane. He shall remain on duty until all airplanes dispatched by him have completed their flights, or have proceeded beyond his jurisdiction, or until he is relieved by another qualified aircraft dispatcher.

"(b) The following rules will govern the hours of duty for aircraft dispatchers, except when circumstances or emergency conditions beyond the control of the air carrier require otherwise:

"(1) *Maximum consecutive hours of duty.* No dispatcher shall be scheduled for duty as such for a period of more than 10 consecutive hours.

"(2) *Maximum scheduled hours of duty in 24 consecutive hours.* If a dispatcher is scheduled for duty as such for more than 10 hours in a period of 24 hours, he shall be given a rest period of not less than 8 hours at or before the termination of 10 hours of dispatcher duty.

"(3) *Dispatcher's time off.* Each aircraft dispatcher shall be relieved from all duty with the air carrier for a period of at least 24 consecutive hours during any 7 consecutive days."

Flight Operations

"40.351 *Operational control.* The air carrier shall be responsible for operational control.

"(a) *Joint responsibility of aircraft dispatcher and pilot in command.* The aircraft dispatcher and the pilot in command shall be jointly responsible for the preflight planning, delay, and dispatch release of the flight in compliance with the applicable regulations of this subchapter and operations specifications.

"(b) *Responsibility of dispatcher.* The aircraft dispatcher shall be responsible:

"(1) For monitoring the progress of each flight and the issuance of instructions and information necessary for the continued safety of the flight.

"(2) For the cancellation or redispatch of a flight, if, in his opinion or in the opinion of the pilot in command, the flight cannot operate or continue to operate safely as planned or released.

"(c) *Responsibility of pilot in command.* The pilot in command shall during flight time be in command of the airplane and crew and shall be responsible for the safety of the passengers, crew members, cargo, and airplane."

"40.352 *Operations notices.* Each air carrier shall notify the appropriate operations personnel promptly of all changes in equipment and operating procedures, including known changes in the use of navigational aids, airports, air traffic control procedures and regulations, local airport traffic control rules, and of all known hazards to flight, including icing and other potentially hazardous meteorological conditions and irregularities of ground and navigational facilities."

"40.353 *Operations schedules.* In establishing flight operations schedules, each air carrier shall allow sufficient time for the proper servicing of airplanes with fuel and oil at intermediate stops, and it shall consider the prevailing winds along the particular route and the cruising speed of the type of airplane to be flown which shall not exceed the specified cruising output of the airplane engines."

"40.354 *Flight crew members at controls.* All required flight crew members shall remain at their respective stations when the airplane is taking off or landing, and while en route except when the absence of one such flight crew member is necessary in connection with his regular duties. All flight crew members shall keep their seat belts fastened when at their respective stations."

"40.355 *Manipulation of controls.* No person other than a qualified pilot of the air carrier shall manipulate the flight controls during flight, excepting that any one of the following persons may, with the permission of the pilot in command, manipulate such controls:

"(a) Authorized pilot safety representatives of the Administrator or the Board who are qualified on the airplane and are engaged in checking flight operations, or

"(b) Pilot personnel of another air carrier properly qualified on the airplane and authorized by the operating carrier."

40.355–1 *Manipulation of controls.* (*CAA interpretations which apply to 40.355 (a) and (b).*) The phrase "qualified on the airplane" means a certificated pilot holding a type rating for the aircraft utilized, or a co-pilot, not holding a type rating if he has met the qualification requirements of the Civil Air Regulations: *Provided*, That a certificated pilot with at least a commercial rating may, at the discretion of the pilot in command, manipulate the controls except during take-off and landing.

"40.356 *Admission to flight deck.* For purposes of this section the Administrator shall determine what constitutes the flight deck of an airplane.

"(a) In addition to the crew members assigned to a particular airplane, CAA aviation safety agents and authorized representatives of the Board while in the performance of official duties shall be admitted to the flight deck of an airplane.

***Note.*—Nothing contained in this paragraph shall be construed as limiting the emergency authority of the pilot in command to exclude any person from the flight deck in the interest of safety.**

"(b) The persons listed below may be admitted to the flight deck when authorized by the pilot in command.

"(1) An employee of the Federal Government or of an air carrier or other aeronautical enterprise whose duties are such that his presence on the flight deck is necessary or advantageous to the conduct of safe air carrier operations,[4] or

"(2) Any other person specifically authorized by the air carrier management and the Administrator.

"[4] Federal employees who deal responsibly with matters relating to air carrier safety and such air carrier employees as pilots, dispatchers, meteorologists, communication operators, and mechanics whose efficiency would be increased by familiarity with flight conditions may be considered eligible under this requirement. Employees of traffic, sales, and other air carrier departments not directly related to flight operations cannot be considered eligible unless authorized under sub-paragraph (2) of this paragraph."

"(c) All persons admitted to the flight deck shall have seats available for their use in the passenger compartment except:

"(1) CAA Aviation Safety agents or other authorized representatives of the Civil Aeronautics Administration or the Civil Aeronautics Board engaged in checking flight operations,

"(2) Air traffic controllers who have been authorized by the Administrator to observe ATC procedures,

"(3) Certificated airmen of the air carrier,

"(4) Certificated airmen of another air carrier who have been authorized by the air carrier concerned to make specific trips over the route."

40.356–1 *Admission to pilot compartment.* (*CAA interpretations which apply to 40.356.*) The term "flight deck" as used in section 40.356 is interpreted to mean all of the area forward of the door or window required by Parts 4a and 4b of the Civil Air Regulations to be located between the pilot compartment and the passenger compartment.

"40.357 *Use of cockpit check procedure.* The cockpit check procedure shall be used by the flight crew for each procedure as set forth in section 40.176."

"40.358 *Personal flying equipment.* The pilot in command shall insure that the following equipment is aboard the airplane for each flight.

"(a) Appropriate aeronautical charts containing adequate information concerning navigational aids and instrument approach procedures.

"(b) A flashlight in good working order in the possession of each crew member."

"40.359 *Restriction or suspension of operation.* When conditions exist which constitute a hazard to the conduct of safe air carrier operations, including airport and runway conditions, the air carrier shall restrict or suspend operations until such hazardous conditions are corrected."

"40.360 *Emergency decisions; pilot in command and aircraft dispatcher.*

"(a) In emergency situations which require immediate decision and action, the pilot in command may follow any course of action which he considers necessary under the circumstances. In such instances the pilot in command, to the extent required in the interest of safety, may deviate from prescribed operations procedures and methods, weather

minimums, and the regulations of this subchapter.

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

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

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

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

"40.363 *Engine failure or precautionary stoppage.*

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

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

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

"(2) The availability of the feathered engine for use,

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

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

"(5) The air traffic congestion,

"(6) The type of terrain, and

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

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

"40.364 *Instrument approach procedures.* When an instrument approach is necessary, the instrument approach procedures and weather minimums authorized in the operations specifications shall be adhered to."

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

"40.365 *Requirements for air carrier equipment interchange.*

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

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

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

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

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

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

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

Dispatching Rules

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

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

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

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

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

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

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

"40.388 *Alternate airport for departure.*

"(a) If the weather conditions at the airport of take-off are below the approved landing minimums for that airport, no airplane shall be dispatched from that airport unless an alternate airport located with respect to

the airport of take-off as follows is specified in the dispatch release: *Provided,* That such alternate need not be selected if the ceiling at the take-off airport is at least 300 feet and the visibility at least 1 mile:

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

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

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

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

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

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

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

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

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

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

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

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

"40.391 *Continuance of flight; flight hazards.*

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

"(b) If any item of equipment required pursuant to the regulations of this subchapter for the particular operation being conducted becomes unserviceable en route, the

visibility is less than specified below: *Provided,* That where a local surface restriction to visibility exists, such as smoke, dust or blowing snow or sand, the visibility for both day and night operations may be reduced to one-half mile, if all turns after take-off and prior to landing and all flight beyond a mile from the airport boundary can be accomplished above or outside, the area so restricted.

"(a) For day operations: 1,000-foot ceiling and one-mile visibility;

"(b) For night operations: 1,000-foot ceiling and two-mile visibility."

"40.406 *Take-off and landing weather minimums; IFR.*

"(a) Except as provided in paragraphs (c) and (d) of this section, irrespective of any clearance which may be obtained from air traffic control, no aircraft shall take off or land under IFR when the reported ceiling or ground visibility is less than that approved for the airport when used as a regular airport.

"(b) Except as provided in paragraphs (c) and (d) of this section, no instrument approach procedure shall be executed when the latest weather report furnished by a source authorized in accordance with the provisions of section 40.35 indicates the ceiling or visibility is less than the landing minimum approved for the airport when used as a regular airport.

"(c) An instrument approach procedure may be executed when the weather report indicates that the ceiling or visibility is less than approved minimum for landing, if the airport is served by ILS and GCA in operative condition and both are used by the pilot, and thereafter a landing may be made, if weather conditions equal to or better than the prescribed minimums are found to exist by the pilot in command upon reaching the authorized landing minimum altitude.

"(d) If an instrument approach procedure is initiated when the current U. S. Weather Bureau report indicates that the prescribed ceiling and visibility minimums exist and a later weather report indicating below minimum conditions is received after the airplane (1) is on an ILS final approach and has passed the outer marker, or (2) is on a final approach using a radio range station or comparable facility and has passed the appropriate facility and has reached the authorized landing minimum altitude, or (3) is on GCA final approach and has been turned over to the final approach controller, such ILS, Range, or GCA approach may be continued and a landing may be made in the event weather conditions equal to or better than the prescribed minimums for the airport are found to exist by the pilot in command of the flight upon reaching the authorized landing minimum altitude."

40.406–1 *Take-off and landing weather minimums.* (*CAA rules which apply to 40.406* (*b*).) Whenever the latest U. S. Weather Bureau Weather Report furnished by the U. S. Weather Bureau, or a source approved by the Weather Bureau contains a visibility value specified as a runway visibility for a particular runway of an airport, such visibility shall be used for straight-in instrument approach and landing or take-off for that runway only. The terminal visibility as reported in the main body of such weather report shall be used for instrument approach and landing or take-off for all other runways.

The ceiling value reported in the main body of such weather report shall constitute the ceiling for both circling and straight-in instrument approach and landing or take-off for all runways.

40.406–2 *Ceiling and visibility minimums—IFR.* (*CAA policies which apply to 40.406.*)

(a) *General.* The policies set forth in this section will be used by the Civil Aeronautics Administration in authorizing the ceiling and visibility minimums contained in the operations specifications issued to scheduled air carriers. Specific deviations from these policies may be approved in instances where CAA and industry representatives concur that the safety of the operation would not be prejudiced.

(1) *Military airports.* When an air carrier is authorized to use a military airport, the ceiling and visibility minimums approved for take-off and landing at that airport will not be less than those agreed upon by the military authorities having jurisdiction over the airport.

(b) *Take-off minimums.*

(1) *Regular, refueling, and provisional airports.*

(i) *General; all aircraft.* In approving take-off minimums for scheduled air carriers, consideration will be given to the following factors:

(*a*) Obstructions and terrain in the vicinity of the airport.

(*b*) Effective length of each runway to be used by the air carrier.

(*c*) The performance characteristics of each type aircraft to be used by the air carrier at the airport.

(*d*) IFR departure procedures in use at the airport.

(*e*) Runway lighting facilities and runway pavement marking available at the airport.

(*f*) Radio navigation facilities serving the airport.

(ii) *Two-engine aircraft.* The lowest take-off minimums for two-engine aircraft normally will be 300–1. However, minimums as low as 200–½ may be approved in accordance with certain specific conditions and limitations prescribed in the air carrier's operations specifications.

(iii) *Four-engine aircraft.* The lowest take-off minimums for four-engine aircraft will normally be 200–½. However, take-off minimums as low as 200–¼ may be approved in accordance with certain specific conditions and limitations prescribed in the air carrier's operations specifications.

(2) *Alternate airports.* Take-off minimums for both two and four-engine aircraft may be approved as low as 300–1 when the air carrier is authorized to use a particular airport as an alternate airport only. When an airport is used as an alternate airport and such airport is also authorized in the air carrier's operations specifications as a regular, refueling, or provisional airport, the take-off minimums shown on the applicable Form ACA–511 may be used; *Provided*, That the pilot-in-command is currently qualified into the airport in accordance with the applicable Civil Air Regulations, otherwise, take-off minimums of 300–1 or the take-off minimums shown on the Form ACA–511, whichever are greater, will be applicable.

(c) *Landing minimums, regular, refueling, or provisional airports.*

(1) *Circling approach.* When it is necessary to circle an airport to effect a landing, higher landing minimums are required for aircraft with higher maneuvering, approach, and landing speeds than are required for slower type aircraft. The stall speed at maximum certificated landing weight with full flaps, landing gear extended and power-off will be used to differentiate between the two types of aircraft. Circling approach minimums are normally the same for all instrument approach procedures without regard to the type of radio navigational facility used to conduct the instrument approach, and will be established in accordance with the following:

(i) *Aircraft with stall speed in excess of 75 MPH.* The minimum ceiling will be, (*a*) at least 500 feet above the established elevation of the airport, (*b*) not less than 300 feet above all obstructions within a radius of two miles from the airport boundary and (*c*) 300 feet above all obstructions within a distance of two miles on each side of the final approach course from the radio facility to the airport. The minimum visibility that will be authorized for such aircraft will normally be one and one-half miles. However, a minimum visibility of not less than one mile may be authorized by application of the sliding scale authorized in the air carrier's operations specifications. A minimum visibility of one mile may also be authorized for those two-engine aircraft having a stall speed in excess of 75 MPH, which can be safely maneuvered within a radius of not more than one-half mile.

(ii) *Aircraft with stall speed of 75 mph or less.* Such aircraft will normally be authorized to operate into airports with minimums of 100—½ lower than the minimums established for the faster type aircraft. However, the ceiling will not be less than 400 feet and the visibility not less than 1 mile, except that the visibility may be reduced to ½ mile by application of the sliding scale authorized in the air carrier's operations specifications. The criteria with respect to obstruction clearance will be the same as in (i) above; except that the minimum ceiling will be at least 300 feet above all obstructions within a radius of 1½ miles from the airport boundary.

(2) *Straight-in approaches using a radio range (L/MF or VOR) or non-directional L/MF facility.* When a radio facility is within 7 miles from an airport and is so located that the magnetic bearing from the facility to the end of the runway to be used for a straight-in instrument approach procedure does not diverge more than thirty degrees from the magnetic direction of such runway, straight-in approach minimums as low as 400—1 may be authorized for all types of aircraft. By application of the sliding scale authorized in the air carrier's operations specifications, the visibility minimum may be reduced to one-half mile. The ceiling minimum will be at least 300 feet above all obstructions within a distance of 2 miles on each side of the final approach course from the radio facility to the airport. Consideration will also be given to the rate of descent required from the final approach altitude over the radio facility to the approach end of the runway at zero altitude. Normally, lower minimums for a straight-in approach will not be authorized when a rate of descent greater than 600 feet per minute in still air is required at the aircraft's normal approach speed in its approach configuration, unless it can be shown, in specific cases, that a slightly higher rate of descent will not adversely affect safety and is compensated for by other factors such as additional runway length, high intensity runway lights, approach lights, additional approach aids such as radar, and an "obstruction-free" approach area.

(3) *Straight-in approaches using non-directional L/MF facility.* When a non-directional L/MF facility is located on an airport, the ceiling and visibility minimums will be not less than 500–1.

(4) *Straight-in approaches using ASR.* The minimums for straight-in ASR instrument approach procedures will be established in accordance with subparagraph 2 above.

(5) *Straight-in approaches using TVOR.* The minimums for straight-in approaches using TVOR will be not less than 400–1.

(6) *Straight-in approaches using ILS or PAR.*

(i) *Components of an ILS.* The components which make up the instrument landing systems are (*a*) localizer, (*b*) glide slope, (*c*) outer marker, (*d*) middle marker, and (*e*) approach lights.[7] Compass locator stations may be installed at the sites of the outer and middle markers of an instrument landing system, but are not considered as components of the ILS. However, when installed and in normal operation they may be used in lieu of the outer or middle marker, provided the aircraft is equipped with dual automatic direction finding receivers. If an aircraft is equipped with a single ADF receiver, only one compass locator may be used in lieu of the marker at the corresponding position.

(ii) *Components of a PAR system.* The ground facilities used for PAR approaches include (*a*) Surveillance radar (ASR), (*b*) altitude and azimuth control radar (PAR) and (*c*) approach lights.[7]

(iii) *Demonstration of ability.* Approval of minimums for utilization of ILS or PAR will be predicated on satisfactory demonstration of ability by the air carrier to use the proposed facilities. An air carrier will have demonstrated such ability when (*a*) in the case of ILS, approved airborne navigational equipment is installed in the aircraft, (*b*) the air carrier's pilot training program includes instruction in the limitations and operation of ILS or PAR and (*c*) the pilots concerned have satisfactorily demonstrated under simulated instrument flight conditions, their ability to accomplish the ILS or PAR instrument approach procedures down to the proposed minimums.

(iv) *Approval of lower minimums.* The transition from the lowest minimums authorized using a radio range or comparable facility to lower minimums based on the use of ILS or PAR will be made in increments of 100 feet ceiling and one-fourth mile visibility. Such reduction in minimums will be based on satisfactory demonstration of ability by the air carrier as outlined under sub-paragraph (iii) above. Subsequent reduction in minimums will be based on satisfactory operation for a period of approximately six months, unless further demonstration in accordance with subpara-

[7] When the length of runway available, exceeds by 3,000 feet the runway length required by the applicable aircraft performance requirements of the CARs, and high intensity runway lights are installed and operative on the entire length of the runway, this extra length of runway may be substituted for the approach lights as a component of the ILS or PAR.

graph (iii) or under actual instrument conditions is deemed necessary.

(v) *Lowest landing minimums.* Where no adjustment to the ceiling minimums is necessary for obstruction clearance as explained in (*a*) of this subdivision, landing minimums of 200–½ are the lowest minimums which will normally be approved at the present time with all components of the ILS or PAR in operation. However, minimums lower than 200–½ may be authorized at specific locations where the installation of improved navigational aids and procedures so warrants. See subparagraph (8) of this paragraph regarding approaches when components of the ILS are inoperative.

(*a*) *Adjustment of Ceiling Minimums for Obstruction Clearance.* When the minimum obstruction clearance as described in Regulations of the Administrator 609.10 cannot be obtained in the approach area, consideration will be given to establishing ceiling minimums which will afford comparable safety. In such cases, the ceiling minimums will be determined by application of the following formula to all obstructions projecting above the established obstruction clearance slope line and located, in the case of an ILS procedure, in the approach area between the outer marker and the end of the runway, or in the case of a PAR procedure, in the approach area within a distance of five miles, outward from the end of the runway:

(*1*) Extend a line horizontally outward from the top of each obstruction and parallel with the runway center line to a point of intersection with the established obstruction clearance slope line. From that point extend a line vertically to a point of intersection with the ILS or PAR glide slope. The minimum ceiling will be the difference between the mean sea level elevation of the glide slope at such point of intersection, and the mean sea level elevation of the airport.

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

(*3*) When application of the formula, set forth in (*1*) and (*2*), to an obstruction projecting above the established obstruction clearance slope line indicates a ceiling of less than 300 feet, the ceiling will not be reduced below 300 feet until it has been determined by flight checks that such lower ceiling will provide adequate safety.

(7) *Lowest landing minimums utilizing back course of the ILS.* When the back course of an ILS is provided with all components of a complete ILS, minimums of 200½ may be authorized in accordance with subparagraph (6) (v).

(8) *Instrument approach procedures with inoperative ILS components.*

(i) *Straight-in approaches-one ILS component inoperative.* The air carrier operations specifications permit straight-in ILS approaches down to minimums of 300–¾ when any single component of the ILS, except the localizer, is inoperative or cannot be received; provided all other components and related airborne equipment are in normal operation. The following factors will be considered in approving landing minimums of 300–¾ under these conditions:

(*a*) *When glide slope inoperative.* Straight-in landing minimums of 300–¾ may be approved when approaching aircraft can clear by 300 feet all obstructions from the approach end of the ILS runway to the outer marker within the approach area described in Regulations of the Administrator 609.10 (f) (1) (i) and (iii). The ceiling minimum may be approved to the nearest 100 feet as provided by subparagraph 11 below, if a flight check has shown such ceiling minimum to be safe. The final approach altitude over the outer marker will provide at least 500 feet obstruction clearance for a distance of at least 10 miles outward from the outer marker within an area of 5 miles on each side of the center line of the localizer course.

(*b*) *When both outer marker and outer compass locator inoperative.* Straight-in landing minimums of 300–¾ may be approved when there is no fix, other than the middle marker or middle compass locator, available along the localizer course. When an instrument approach is conducted under these conditions aircraft

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

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

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

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

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

(i) *General.* Ceiling and visibility minimums for instrument approach procedures predicated on (*a*) the use of the localizer course of an ILS (either front or back course) and (*b*) a reliable fix located on the ILS localizer course, will normally be established in accordance with subparagraph (1) of this paragraph for circling approaches, and subparagraph (2) of this paragraph for straight-in approaches. Such instrument approach procedures will normally not be established when the radio fix is

located at a distance greater than seven miles from the airport. The obstruction clearance will be determined within the approach area described in Regulations of the Administrator 609.10 (f) (1) (i) and (iii). For the purpose of this subparagraph, a reliable fix is considered to be a fix formed by the intersection of the localizer course and a bearing from a radio facility located within twenty-five miles of the fix and such bearing intersects the localizer course at an angle of at least forty-five degrees.

(ii) *Lower minimums using additional or improved aids.* Straight-in approach minimums as low as 300–1 may be authorized on an ILS front course or back course when the fix located on the localizer course within 7 miles of the ILS runway is (*a*) a fan marker which provides the same degree of accuracy as an ILS outer marker installation (*b*) a radio facility which provides the same degree of accuracy as an ILS outer compass locator installation, or (*c*) surveillance radar.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

"40.409 *Altitude maintenance on initial approach.*

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

"(b) When making an initial approach on a flight being conducted in accordance with the provisions of section 40.408 (c), a pilot shall not commence an instrument approach until arrival over the radio facility has definitely been established. In executing an instrument approach procedure under such circumstances, the airplane shall not be flown at an altitude lower than 1,000 feet above the top of the lower cloud or the minimum altitude specified by the Administrator for that portion of the instrument approach procedure being flown, whichever is the lower."

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

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

Required Records and Reports

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

"40.501 *Crew member and dispatcher records.* Each air carrier shall maintain current records of every crew member and aircraft dispatcher. These records shall

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

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

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

(1) Name (full);

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

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

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

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

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

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

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

(9) Check pilot authorization where applicable.

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

"40.503 *Dispatch release form.*

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

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

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

"(3) Minimum fuel supply,

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

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

"40.504 *Load manifest.*

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

"(1) The weight of:

"(i) Airplane,

"(ii) Fuel and oil,

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

"(iv) Passengers;

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

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

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

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

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

tion therefrom except with respect to cargo and passenger distribution, the dispatch release form, and the flight plan shall be in the possession of the pilot in command and shall be carried in the airplane to its destination. Copies also shall be kept for at least 60 days."

"40.506 *Maintenance records.*

"(a) Each air carrier shall keep at its principal maintenance base current records of the total time in service, the time since last overhaul, and the time since last inspection of all major components of the airframe, engines, propellers, and, where practicable, appliances.

"(b) Records of total time in service may be discontinued when it has been shown that the service life of component parts is safely controlled by other means, such as inspection, overhaul, or parts retirement procedures. The Administrator may require the keeping of total time records for specific parts when it is found that other procedures will not safely limit the service life of such parts.

"(c) An airplane component, engine, propeller, or appliance for which complete records are not available may be placed in service, provided that:

"(1) It is of a type for which total time in service records are not required under the provisions of paragraph (b) of this section,

"(2) Parts which are limited by the Administrator or manufacturer to a specific service time are retired and replaced by new parts, and

"(3) It has been properly overhauled or rebuilt, and a record of such overhaul or rebuilding is included in the maintenance records."

"40.507 *Maintenance Log.* A legible record shall be made in the airplane's maintenance log of the action taken in each case of reported or observed failures or malfunctions of airframes, engines, propellers, and appliances critical to the safety of the flight. The air carrier shall establish an approved procedure for retaining an adequate number of such records in the airplane in a place readily accessible to the flight crew and shall incorporate such procedure in the air carrier manual. The maintenance log shall contain information from which the flight crew may readily determine the time since last overhaul of the airframe and engines."

"40.508 *Daily mechanical reports.*

"(a) Whenever a failure, malfunctioning, or other defect is detected in flight or on the ground in an airplane or airplane component which may reasonably be expected by the air carrier to cause a serious hazard in the operation of any airplane, a report shall be made of such failure, malfunctioning, or other defect to the Administrator. This report shall cover a 24-hour period beginning and ending at midnight, shall be submitted by 12 o'clock midnight of the following working day, or sooner if the seriousness of the malfunction or difficulty so warrants, and shall include as much of the following information as is available on the first daily report following such incidents.

"(1) Type and CAA identification number of the airplane, name of air carrier, and date;

"(2) Emergency procedure effected: unscheduled landing, dumping fuel, etc.;

"(3) Nature of condition fire, structural failure, etc.;

"(4) Identification of part and system involved, including the type designation of the major component;

"(5) Apparent cause of trouble: wear, cracks, design deficiency, personnel error, etc.;

"(6) *Disposition: repaired, replaced,* airplane grounded, etc.;

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

"(b) These reports shall not be withheld pending accumulation of all of the information specified in paragraph (a) (1) through (7) of this section. When additional information is obtained relative to the incident, it shall be expeditiously submitted as a supplement to the original report, reference being made to the date and place of submission of the first report."

"40.509 *Mechanical interruption summary report.* Each air carrier shall submit regularly and promptly to the Administrator a

summary report containing information on the following occurrences:

"(a) All interruptions to a scheduled flight, unscheduled changes of airplanes en route, and unscheduled stops and diversions from route which result from known or suspected mechanical difficulties or malfunctions.

"(b) The number of engines removed prematurely because of mechanical trouble, listed by make and model of engine and the airplane type in which the engine was installed.

"(c) The number of propeller featherings in flight, listed by type of propeller and type of engine and the airplane on which the propeller is installed."

"40.510 *Alteration and repair reports.* Reports of major alterations or repairs of airframes, engines, propellers, and appliances shall be made available to the Administrator promptly upon completion of such alterations or repairs."

"40.511 *Maintenance release.* When an airplane is released by the maintenance organization to flight operations, a maintenance release or appropriate entry into the maintenance log certifying that the airplane is in an airworthy condition shall be prepared and signed by a maintenance inspector or a person authorized by the inspection organization prior to release of such airplane. If a maintenance release form is prepared, a copy shall be given to the pilot in command. An appropriate record shall be kept for at least 60 days."

Appendix

Examples which explain use of figures 1 to 10, inclusive, on pages 75 to 81, inclusive

Example 1

Figure 8 is used in the following manner:

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

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

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

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

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

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

Example 2

Operating conditions for take-off:

Aircraft = DC-3 S1C3G

Airport = Elevation = 4,000′

Effective runway length = 3,300 ft. (paved)

Runway gradient = +1.2%

The equivalent runway length due to gradient =

$$S = \frac{SG}{\left[1+\left(\frac{S_G\, g\, 2 \sin \alpha}{V_2^2}\right)\right]}$$

$$= \frac{3{,}300}{1+\frac{(3{,}300\times 32.2\times 2\times .012)}{(98\times 1.467)^2}}$$

$$= 2{,}938 \text{ feet}$$

Due to the positive, or uphill, gradient effect, the zero gradient runway length is 2,938 feet. This figure, versus the airport elevation is used with Figure 3 to determine the allowable gross weight for take-off. It will be noted that this runway length/airport elevation combination is outside the range of values plotted on the chart. Therefore, under a zero wind condition, operations from the runway in question would be impracticable due to the weight restriction.

If a 25 mph headwind component exists, the use of Figure 8 indicates a zero wind runway length of 3800 feet. This figure is predicated on 1.05 V_{mc} = 92 mph. Since Figure 10 indicates 1.05 V_{mc} (92 mph TIAS) = 97.6 mphs TAS (use 98) at an elevation of 4000 feet, the distance of 3800 feet must be multiplied by a correction factor from Figure 9. The factor in this example, (25 mph headwind component and 1.05 V_{mc} = 98 mph TAS), is 1.018 giving a corrected zero wind runway distance of 3800 feet × 1.08 = 3868 feet. By referring to Figure 3, it is found that this zero wind runway length will permit a take-off at a weight of 24,200 lbs.

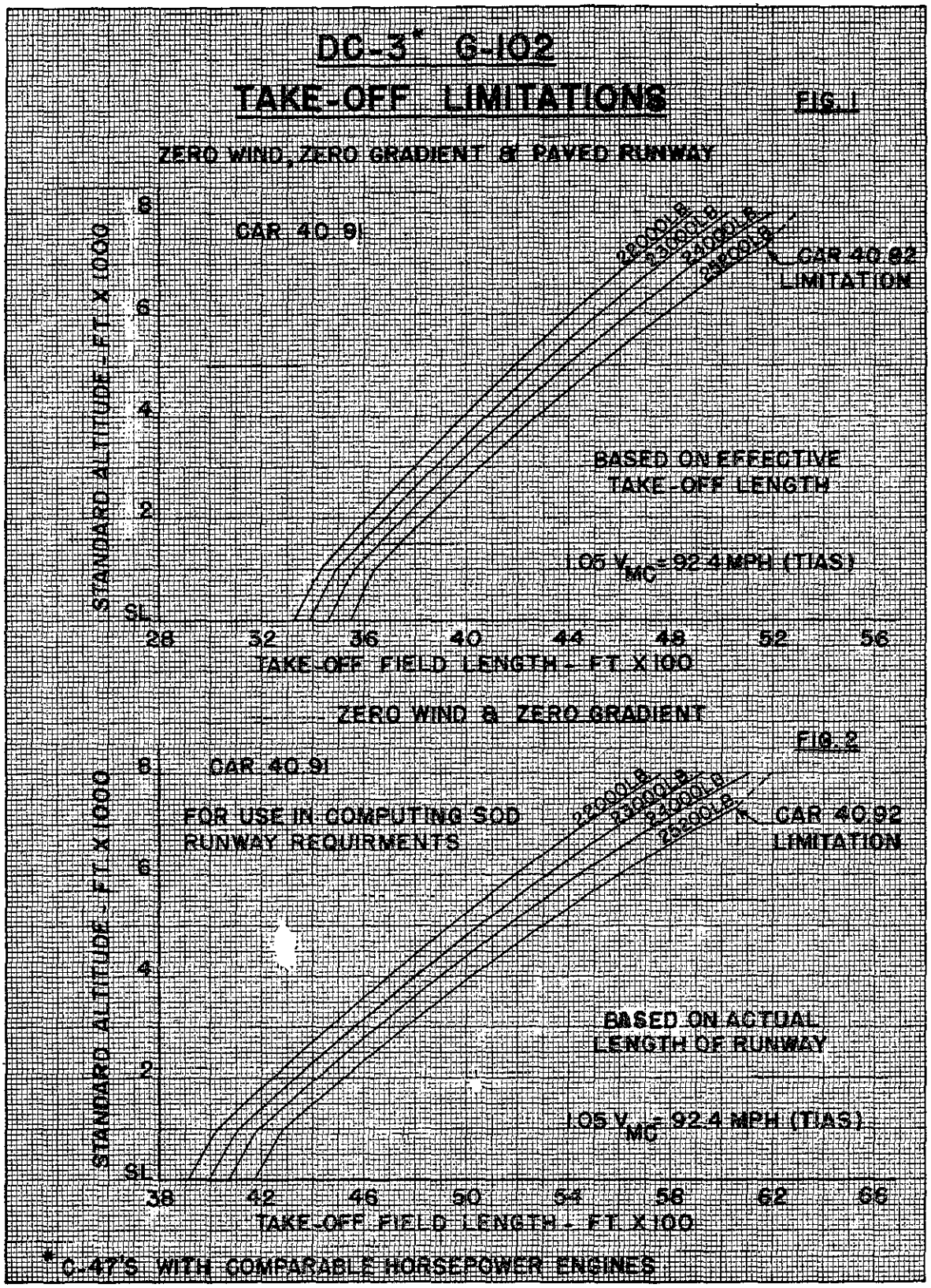
If the take-off was to be made in the opposite direction, the benefit of the downhill gradient on the accelerate distance would result in a zero gradient runway length of 3770 feet. This would permit a take-off at a weight of 24,200 lbs., with zero wind. Figure 3 indicates that 3970 feet of runway is required to permit take-off at a maximum gross weight of 25,200 lbs. Figure 8 indicates that a headwind component of 3 mph will give the desired zero wind runway length of 3970 feet to permit take-off at the maximum gross weight.

Example 3

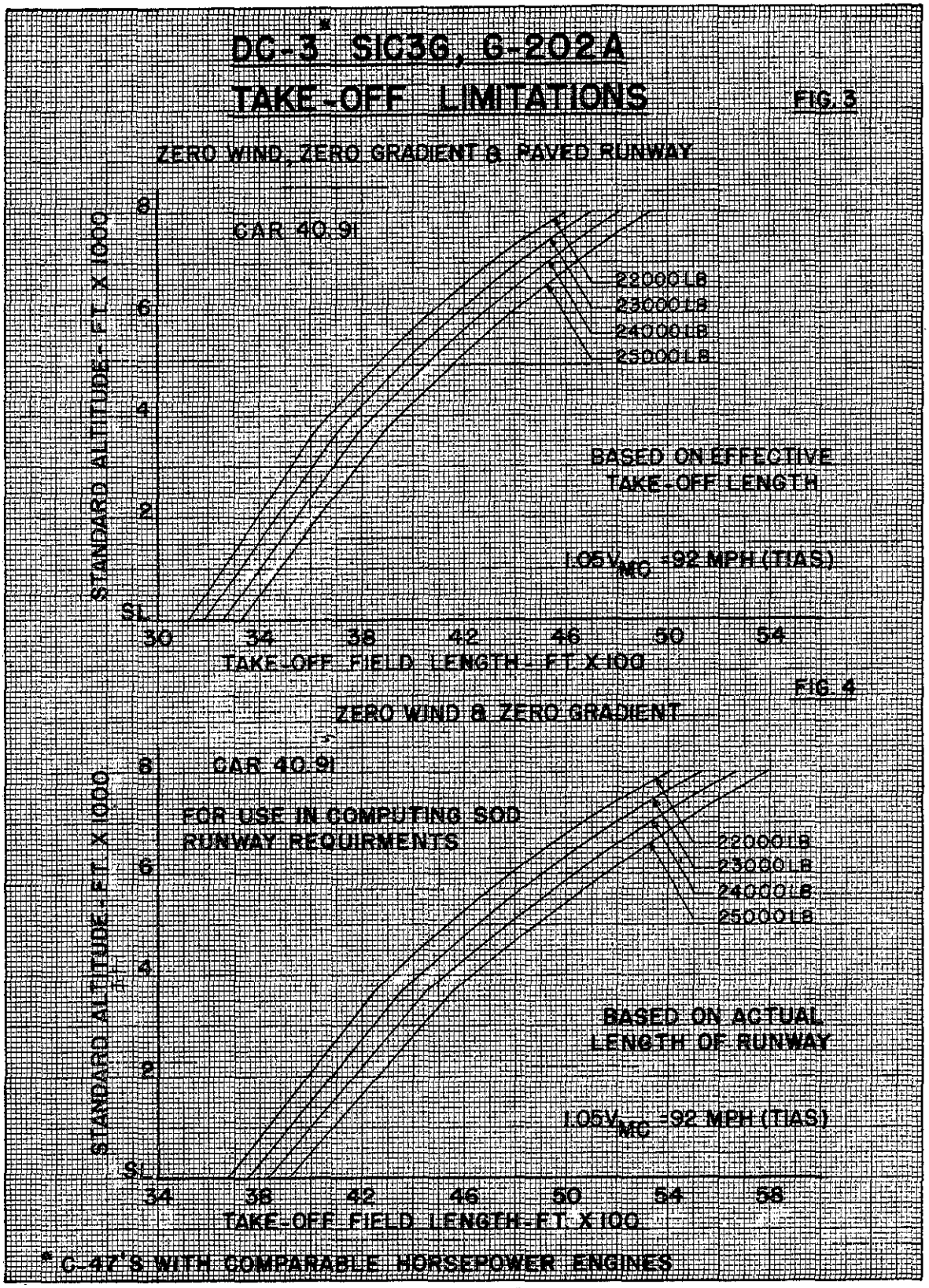
Operating conditions for Landing: Same as in Example 2, except that section 40.93 does not require consideration of gradient in detailing the landing limitations.

Referring to Figure 6, we find that a 3300-foot paved runway at an elevation of 4000 feet, permits a landing gross weight of 22,600 lbs, in

a zero wind condition. If a 25 mph headwind component is forecast, we find by reference to Figure 8 that the zero wind runway length becomes 4300 feet. In this example, the distance of 4300 feet is predicated on 1.3 V_{s_0}= 92 mph. Therefore, by reference, Figure 10, 1.3 V_{s_0} is found to be 98 mph at 4000 feet and by reference to Figure 9, it is found that the correction factor is 1.018, resulting in a zero wind runway length of 4300×1.018=4377 feet. Figure 6 indicates that this zero wind runway length will permit landing at the maximum gross weight.



Figures 1 and 2.



Figures 3 and 4.

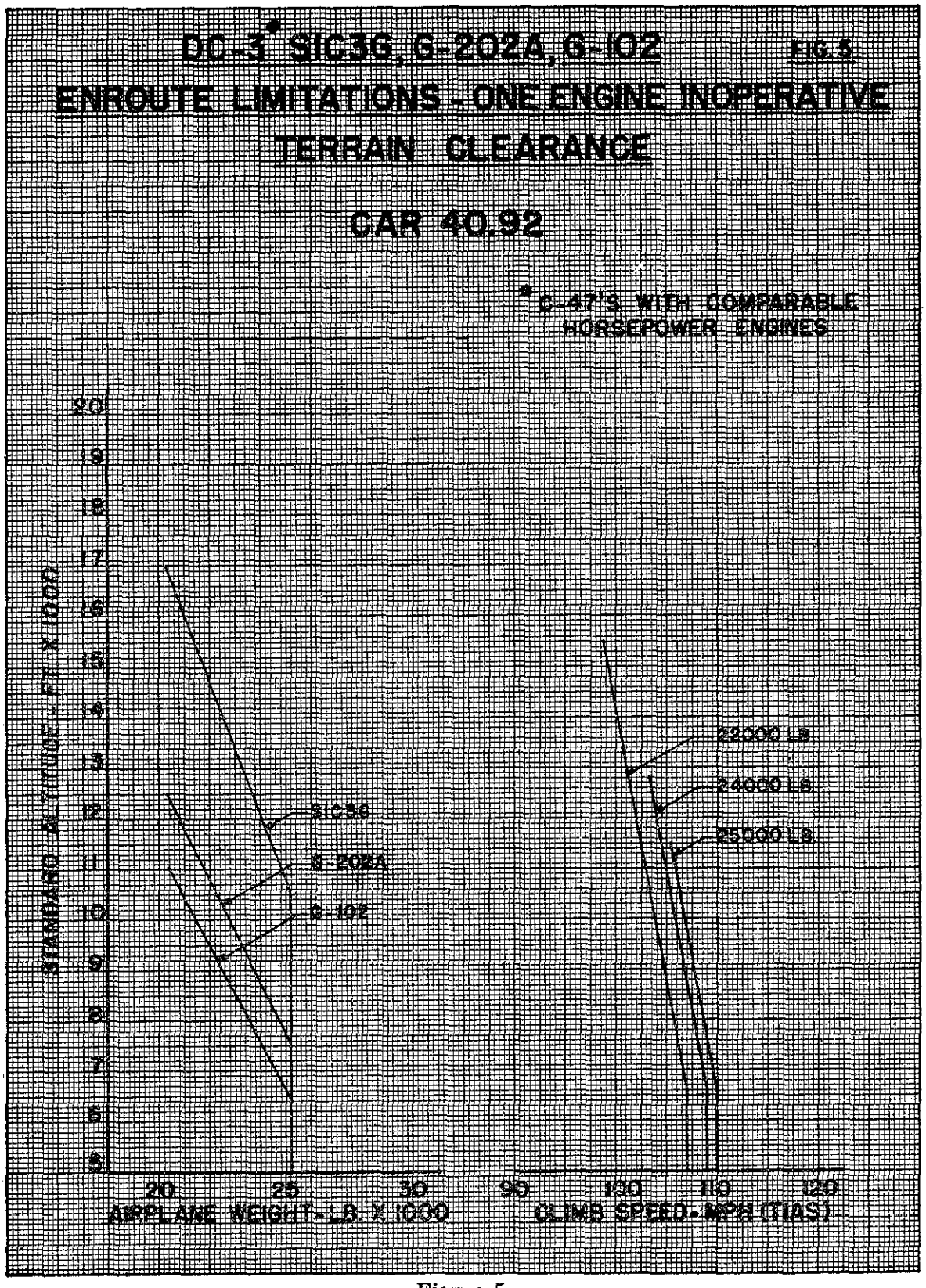
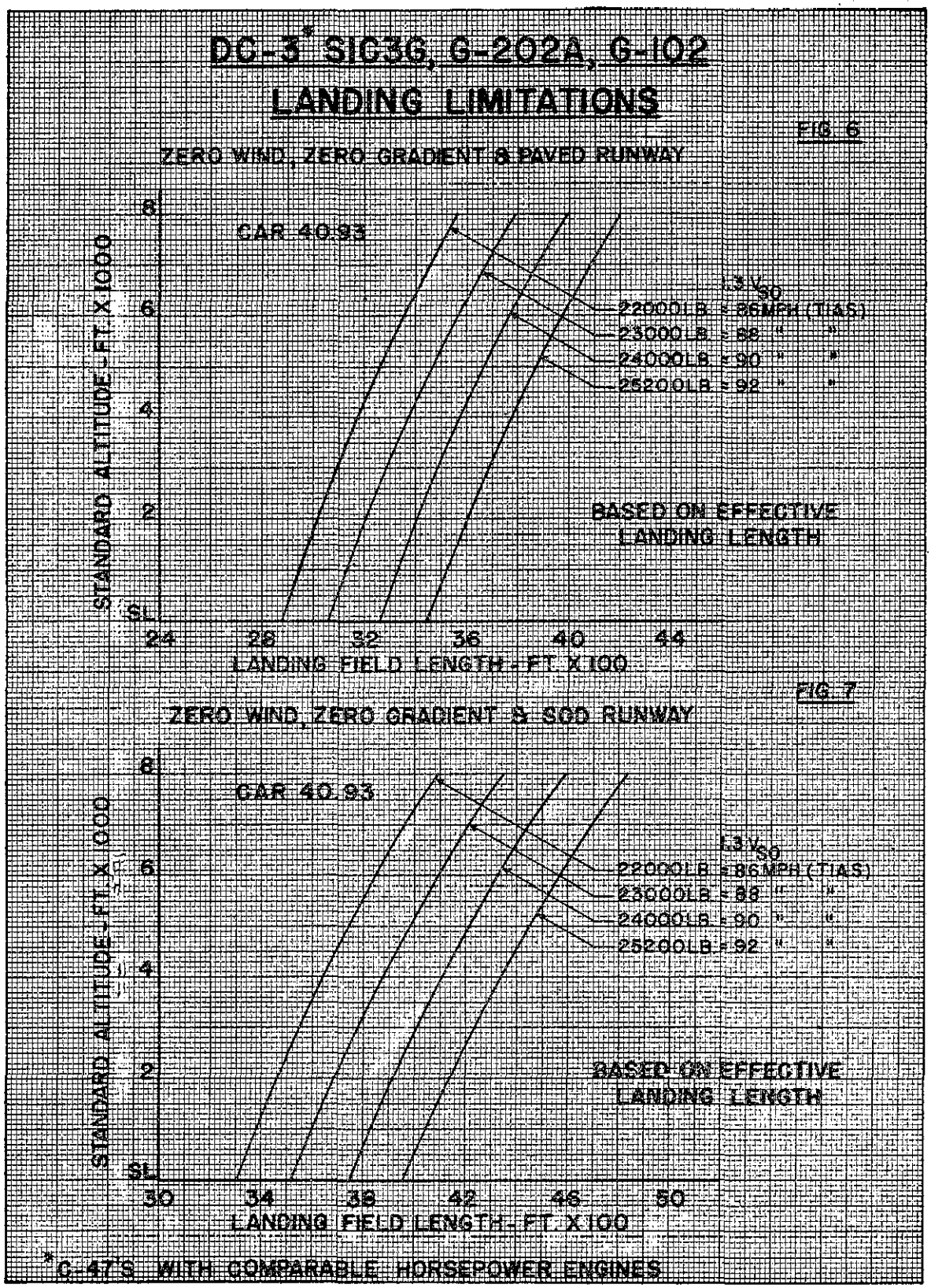

DC-3* SIC3G, G-202A, G-102 FIG. 5
ENROUTE LIMITATIONS - ONE ENGINE INOPERATIVE
TERRAIN CLEARANCE
CAR 40.92
* C-47'S WITH COMPARABLE HORSEPOWER ENGINES
STANDARD ALTITUDE - FT. X 1000
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
SIC3G
G-202A
G-102
22000 LB.
24000 LB.
25000 LB.
20
25
30
90
100
110
120
AIRPLANE WEIGHT - LB. X 1000
CLIMB SPEED - MPH (TIAS)

Figure 5.



Figures 6 and 7.

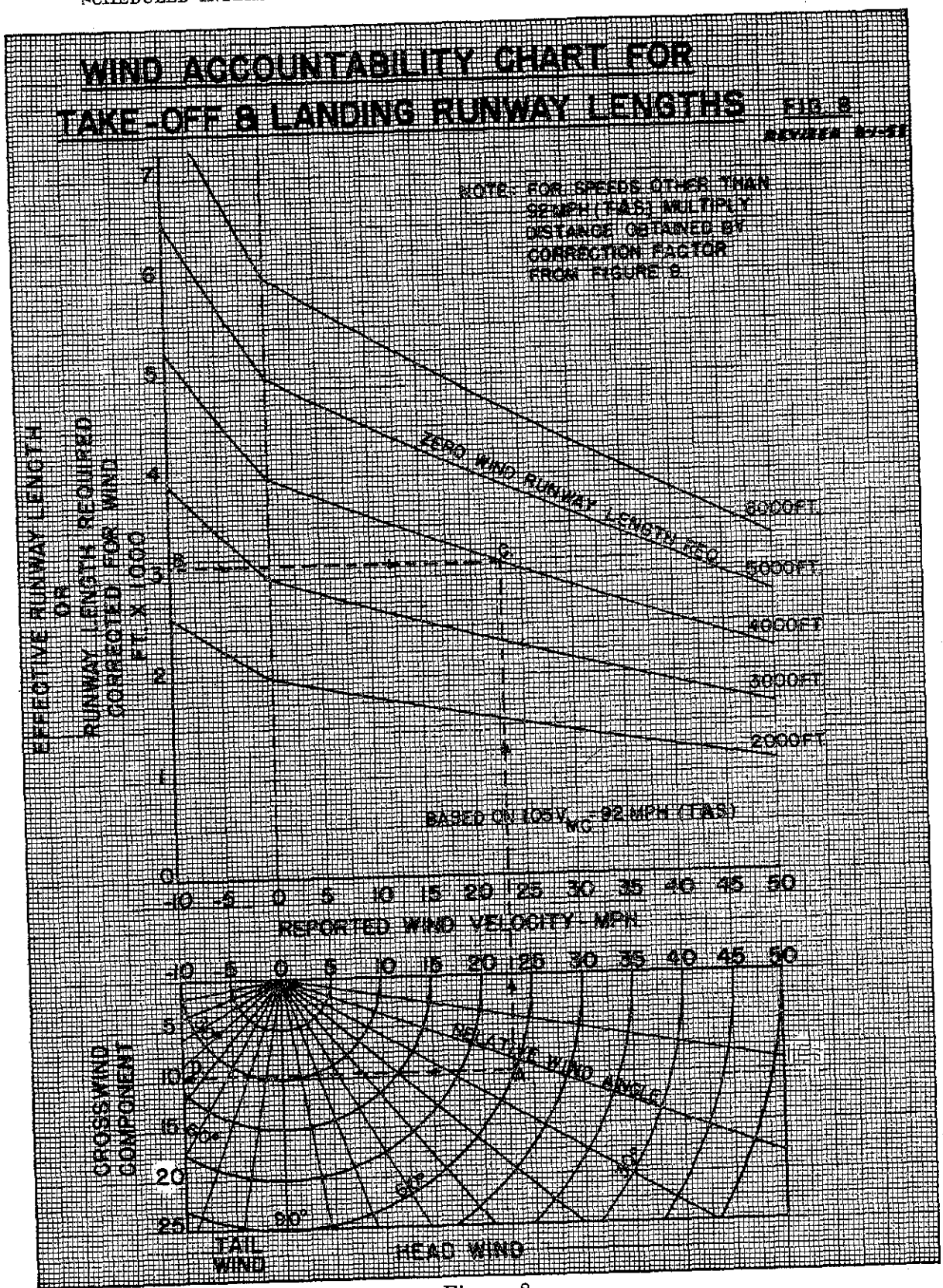

WIND ACCOUNTABILITY CHART FOR
TAKE-OFF & LANDING RUNWAY LENGTHS
FIG. 8
REVISED 8-1-61
NOTE: FOR SPEEDS OTHER THAN 92 MPH (TAS) MULTIPLY DISTANCE OBTAINED BY CORRECTION FACTOR FROM FIGURE 8
EFFECTIVE RUNWAY LENGTH OR RUNWAY LENGTH REQUIRED CORRECTED FOR WIND
ZERO WIND RUNWAY LENGTH REQ.
6000FT.
5000FT.
4000FT.
3000FT.
2000FT.
BASED ON 105 V MC = 92 MPH (TAS)
REPORTED WIND VELOCITY - MPH
CROSSWIND COMPONENT
TAIL WIND
HEAD WIND
90°
60°
30°

Figure 8.

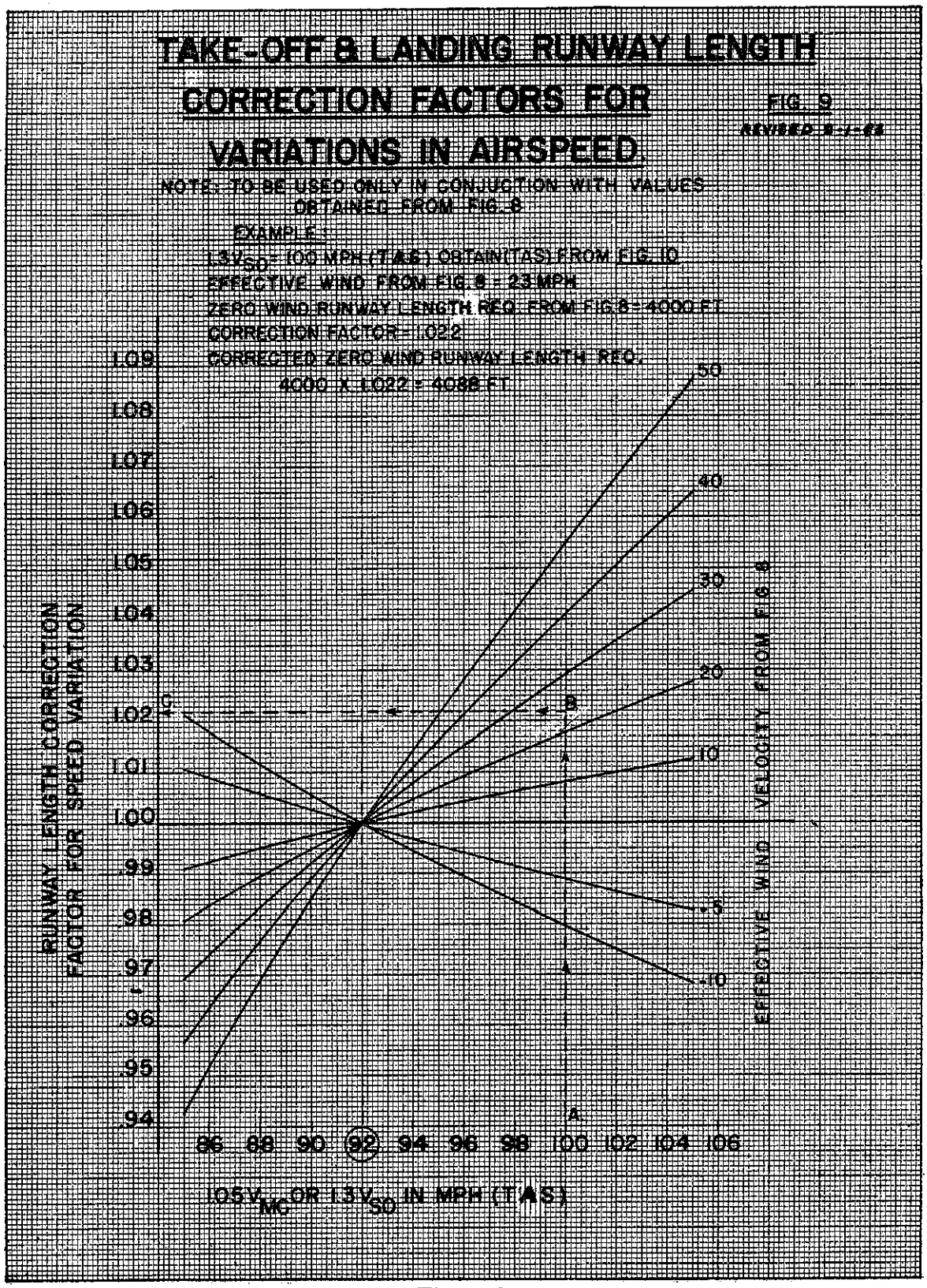

TAKE-OFF & LANDING RUNWAY LENGTH
CORRECTION FACTORS FOR
VARIATIONS IN AIRSPEED.
FIG. 9
REVISED 8-1-68
NOTE: TO BE USED ONLY IN CONJUGCTION WITH VALUES OBTAINED FROM FIG. 8
EXAMPLE:
1.3V$_{SO}$ = 100 MPH (TAS) OBTAIN (TAS) FROM FIG. 10
EFFECTIVE WIND FROM FIG. 8 = 23 MPH
ZERO WIND RUNWAY LENGTH REQ. FROM FIG. 8 = 4000 FT.
CORRECTION FACTOR = 1.022
CORRECTED ZERO WIND RUNWAY LENGTH REQ.
4000 X 1.022 = 4088 FT.
RUNWAY LENGTH CORRECTION FACTOR FOR SPEED VARIATION
1.09
1.08
1.07
1.06
1.05
1.04
1.03
1.02
1.01
1.00
.99
.98
.97
.96
.95
.94
50
40
30
20
10
5
-10
EFFECTIVE WIND VELOCITY FROM FIG. 8
86 88 90 92 94 96 98 100 102 104 106
1.05V$_{MC}$ OR 1.3V$_{SO}$ IN MPH (TAS)

Figure 9.

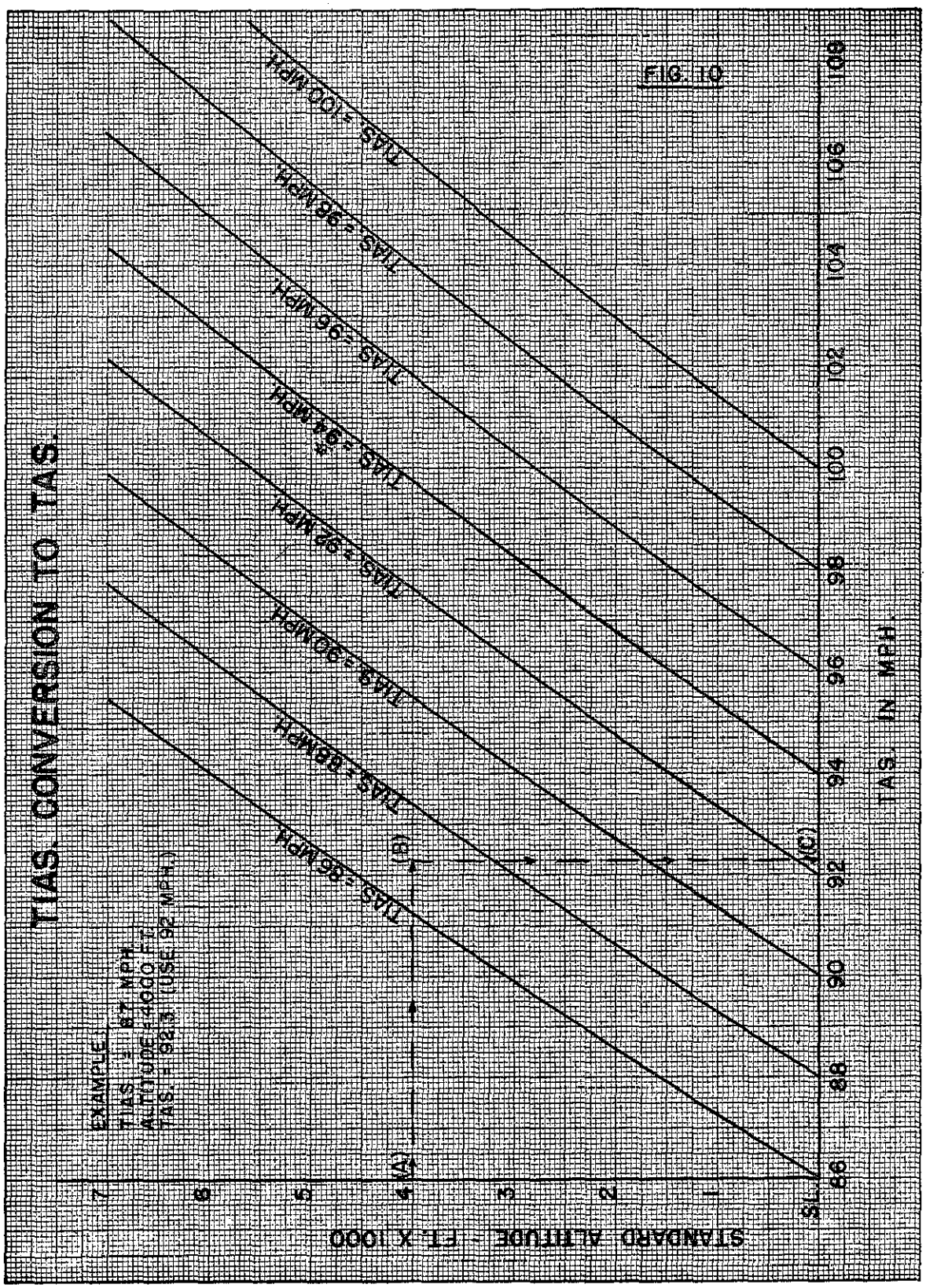


Figure 10.

AVIATION INFORMATION

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