U. S. Department of Commerce — Civil Aeronautics Administration

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

Supplement No. 4 — December 10, 1951

SUBJECT: Revisions to CAM 42

The purpose of this supplement is to provide holders of Civil Aeronautics Manual 42 with revised CAA rules and policies issued pursuant to Civil Air Regulation 42.32-4. This revised portion of CAM 42 was published in the Federal Register on April 12, 1951, and November 9, 1951.

Instructions for insertion of revised manual pages:

REMOVE AND DESTROY THE FOLLOWING PAGES:	INSERT IN LIEU THEREOF THE FOLLOWING PAGES:
42.32-4 "two on a four-engine aircraft installed on opposite sides." and on the back, 42.32-4	42.32-4
42.32-4 "weights be used. However, the above calendar" and on the back, 42.32-4	

Office of Aviation Safety — E. S. HENSLEY, Director

two on a four-engine aircraft installed on opposite sides.

Increases of time limitations for individual components or systems must be predicated upon the service experience of the involved component and not upon its relation to another component which may receive approval for an increase.

(c) WEIGHT CONTROL. The maintenance manual must include complete information covering the methods and procedures for maintaining the aircraft weights and c.g. within the approved limits. The operator may elect to establish or use any system which fulfills the safety requirements of the applicable Civil Air Regulations and which is in accordance with the following provisions:

(1) DEFINITIONS OF TERMS AS SPECIFICALLY RELATED TO WEIGHT AND BALANCE CONTROL.

(i) APPROVED WEIGHT CONTROL SYSTEM. A system of continuous recordation of weight changes on individual aircraft or fleet which will provide an accurate weight and c.g. location value for all aircraft at all times. Under an approved system the responsibility is delegated to the operator.

(ii) OPERATING OR BASIC WEIGHT. The operating or basic weight is the take-off gross weight excluding the following:

Drainable fuel,
Drainable oil (when the oil load is variable),
Crew and their baggage (when variable),
Payload (including nonrevenue load),
Food,
Other items of load or equipment that are variable from trip to trip.

NOTE: Due to variations in drainable oil, crew and their baggage required for specific operations, the operating or basic weight may not be directly comparable for different air carriers.

(iii) OPERATORS' EMPTY WEIGHT. The operators' empty weight is the operating or basic weight excluding the following items:

Passenger service,
Emergency equipment (including portable fire extinguishers and emergency radio),
Navigation equipment,
Flight spares,
Washing and drinking water,
Crew,
Crew baggage,
Drainable oil.

NOTE: This empty weight is corrected so that it will be comparable among the air carriers.

(iv) DRAINABLE FUEL OR OIL. That fuel or oil which, in normal ground attitude, drains with all drain cocks opened.

(2) OPERATORS' RESPONSIBILITY:

(i) NOT UNDER AN APPROVED SYSTEM.

(*a*) Each aircraft shall be weighed annually in the presence of a CAA representative[4] to determine the operators' empty weight and corresponding c.g. position.

(*b*) All weight and balance data (including loading schedules, overlays, equipment lists, etc.) shall be submitted for CAA approval and file.

(ii) UNDER AN APPROVED SYSTEM.

(*a*) It is not necessary for the operator to submit weight and balance data for individual aircraft for CAA approval and file. He will be expected, however, to be prepared at any time to show that he is complying with the procedures for which he has obtained CAA approval, as well as with current Civil Air Regulations. Weight manifests shall be retained in the operator's files for a period of at least 30 days.

(*b*) A continuous record should be kept for each aircraft, listing all changes affecting the weight, c.g. location, and equipment included, in order that a computed weight and c.g. location may be established at any time.

(*c*) Each aircraft shall be weighed every two years, or at shorter intervals if the operator prefers, to determine the empty weight and the corresponding c.g. (If a fleet weight system is used, aircraft may be weighed on a fleet weight basis, established in accordance with the procedure outlined herein.)

(*d*) It is necessary to show the actual c.g. location on the weight manifest, except when a schedule has been prepared which in-

[4] CAA representative may be defined as a CAA employee, air carrier employee, or designee, who is authorized by the Administrator to approve weight and balance of aircraft.

sures that the c.g. will remain within approved limits under operating conditions, in which case it should be shown that the airplane is loaded in accordance with the proper schedule.

(*e*) The presence of a CAA representative will not be necessary during the routine weighing of aircraft.

(3) APPLICATION FOR APPROVAL OF WEIGHT CONTROL SYSTEMS:

(i) GENERAL. The air carrier should submit the application to the Regional Office of the region in which his principal maintenance base is located, through the assigned maintenance agent. The application should be submitted in letter form. A report (in quadruplicate) should be attached, outlining in detail the system employed to control the weight and balance of the aircraft. For the purpose of approving the system, actual operating data for specific aircraft need not be included. This report should include the following information where such information is necessary to properly substantiate the proposed system:

(*a*) Description of procedures established for reporting and recording changes affecting weight and balance, with copies of all printed forms and instructions to personnel.

(*b*) Description of loading devices used and instructions for their proper use.

NOTE: When a mechanical computor is used for loading, the operating instructions should be furnished. It may be necessary for the operator to submit the computor for examination, in which case the computor will be returned to the operator upon completion of the examination.

(*c*) Copies of all printed forms (including load manifests) and instructions to personnel with regard to the proper load distribution. This should include information pertaining to filling of fuel and oil tanks, passenger seating, restriction of passenger movement, distribution of cargo, etc.

(*d*) Description of procedures established to determine conformity with approved loading instructions to insure the operation of the aircraft within the approved c.g. range.

(*e*) Description of procedures established to inform the pilot of the loaded condition of the airplane.

(*f*) Information indicating the degree of responsibility of all ground and flight personnel (by title) and specific duties of each, relative to the various phases of the weight control system.

(ii) ADDITIONAL AIR CARRIER RESPONSIBILITIES. Aircraft equipment lists must be prepared by the air carrier, but need not be submitted with the application. These are:

(*a*) List of fixed equipment standard for each model or type aircraft and included in the operating or basic weight.

(*b*) List of all removable equipment (including commissary, buffet equipment, meal services, etc.) and the weight and moment of each. It is satisfactory to establish an over-all weight and c.g. location for each group or list.

NOTE: Changes which alter the methods of the currently approved weight control system should be approved in the same manner as used for the original system. However, revisions which do not affect the method do not require approval.

Example: A change from a tabular to an index type loading chart would require approval, but a revision to an index unit chart, already in use, would not require approval.

(4) PASSENGER AND CREW WEIGHTS.

(i) GENERAL. These weights apply to operators with or without an approved weight control system. Consideration will be given to a different average of weights for crew and passengers, provided the operator can substantiate these weights based on an average of actual weights for each group.

(ii) PASSENGER WEIGHTS. The actual passenger weights may be used in all computations and are preferable from the standpoint of accuracy. In addition, the use of average weights is approved as a means of expediting load manifest calculations. The use of average weights, however, does not relieve the operator of responsibility for compliance with the weight and c.g. location limitations as specified in the appropriate aircraft specification and the operating limitations prescribed in Part 42. In other words, if there is obvious evidence that the use of average weights will result in erroneous computations and possible violation of applicable CAR, the

total weight and c.g. location should be recomputed using actual weights. This condition is most likely to arise in cases where the major portion of a passenger load consists of a specialized group such as athletic teams or of a specific racial group which does not conform with the U. S. average. In all cases of such non-average groups actual weights must be used.

The approved averages are as follows:

(a) An average passenger weight (summer) of 160 pounds may be used during the calendar period of May 1 through October 31.

(b) An average passenger weight (winter) of 165 pounds may be used during the calendar period of November 1 through April 30.

(c) An average passenger weight of 80 pounds may be used at any time for children between the ages of 3 and 12.

In all computations, either the actual or average weights indicated above will be used; in no case will a combination of average and actual weights be used. However, the above calendar periods may be varied where climatic conditions warrant, upon specific approval of the CAA.

(iii) CREW WEIGHTS. Actual or average weights may be used in the case of crew members under conditions as set forth for passenger weights. The approved averages are as follows:

(a) Male cabin attendants 150 pounds; female cabin attendants 130 pounds

(b) All other crew members 170 pounds.

(5) PASSENGER AND CABIN ATTENDANT MOVEMENT.

(i) GENERAL. Consideration must be given to the effect of passenger and cabin attendant movement on the balance of the aircraft. The movement of a number of passengers and cabin attendants equal to the placarded capacity of the lounges and/or lavatories must be considered. If the capacity is one, the movement of either a passenger or a cabin attendant, whichever most adversely affects the c.g. condition shall be used. When the capacity of the lavatory and/or lounge is two or more, the movement of passengers and/or cabin attendants evenly distributed throughout the aircraft, equal to the placarded capacity of the lounge and/or lavatory, shall be considered. Where seats are blocked off, the movement of passengers and/or cabin attendants evenly distributed throughout the actual loaded section of the aircraft may be used. The extreme movements of the cabin attendants carrying out their assigned duties should be considered. The various conditions shall be combined so that the most adverse effect on the c.g. will be obtained and so accounted for in the development of the loading device to assure the aircraft of being loaded within the approved limits at all times.

(ii) FUEL USE AND LANDING GEAR RETRACTION. Consideration must be given to the effect on the balance of the aircraft of fuel used down to the CAA minimum of $\frac{1}{12}$ gallon per METO (or maximum continuous) hp. in addition to the unusable fuel and landing gear retraction. No consideration need be given to oil use.

(6) FLEET WEIGHTS. An average operating or basic fleet weight may be utilized for a fleet, or group of aircraft, of the same model. When the basic or operating weights and c.g. positions remain within the limits established in subparagraph (vii) below. Such weights will be calculated on the following basis:

(i) The operator will determine the empty fleet weight by weighing aircraft according to the following table:

The first three aircraft must be weighed.
Fifty percent of the next six aircraft must be weighed.
Ten percent of the remaining aircraft must be weighed.

In choosing the aircraft to be weighed, a representative number should be picked from each age group of the fleet (the number of the same model delivered during each calendar year). This is to insure that the aircraft weighed as representative of the fleet will reflect the accuracy of the operator's weight records and expose any "service pick-up" or unaccountable weights not shown in the weight ledger.

(ii) The operator will establish the empty weight and c.g. position for each aircraft that has been weighed.

(iii) The operator will establish the empty fleet weight and c.g. position for each fleet or group of the same model aircraft by averaging

the operator's empty weights of the weighed aircraft in each fleet or group.

(iv) The operator will establish the empty weight and c.g. position by calculation for each aircraft in each group not weighed.

(v) The operator will establish the basic or operating fleet weight and c.g. position for each fleet by adding the following items to the empty fleet weight for each fleet: normally removable equipment, i. e., passenger service equipment, emergency equipment (including portable fire extinguishers), navigation equipment, flight spares, washing and drinking water, crew and crew baggage (when not variable), and drainable oil (when the oil load is not variable).

(vi) The operator will establish an operating or basic weight for each aircraft in each fleet by adding items designated in (v) above to the operator's empty weight of each aircraft.

(vii) If the basic or operating weight of any aircraft weighed or the calculated 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 basic or operating fleet weight or the c.g. position varies more than plus or minus one-half of one percent of the MAC from the fleet average c.g. that airplane must be omitted from that group and operated on its actual or calculated basic or operating weight and c.g. position. If it falls within the limits of another fleet or group, it may then become part of the basic or operating fleet weight of that fleet.

(viii) Re-establishment of the operator's empty fleet weight and the basic or operating fleet weight may be accomplished between weighing periods by calculation based on the current operator's empty weight and operating or basic weight of the aircraft previously weighed.

(ix) In cases where the basic or operating fleet weight does not vary more than the tolerance allowed, but the c.g. position varies in excess of the tolerance allowed, the aircraft may be operated utilizing a basic or operating fleet weight with individual c.g. positions.

If all aircraft are weighed, the same general procedure as outlined above shall be followed if a fleet weight is to be used.

Other methods of computing aircraft loading are permissible if it can be shown that the approved weight and c.g. limits are not exceeded.

(7) INDIVIDUAL AIRCRAFT WEIGHTS.

(i) GENERAL. When the accumulated changes to the operating or basic weight and/or c.g. position exceed plus or minus one-half of one percent of the maximum landing weight or the MAC, respectively, the loading data must be revised accordingly.

(*a*) FUEL ALLOWANCE FOR TAXIING. A compensating weight allowance of 3 pounds of fuel for each 100 horsepower METO (or maximum continuous), available to the aircraft from all of its engines may be added to the maximum weight of the aircraft.

(8) 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, shall prevail. Any nationally recognized scales may be used for weighing provided they are properly calibrated, zeroed, and used in accordance with the manufacturer's instructions. Each scale should have a calibration chart, either furnished by the manufacturer or by a civic Department of Weights and Measures. This calibration chart should not be more than 1 year old unless the particular scales have had insufficient use and have been properly stored and cared for, thereby warranting a longer period between calibrations. In case of necessity, the scales may be calibrated on the spot. In any case, the calibration of the scales and the weight procedure must be acceptable to the CAA [5] representative.

(d) DELETION OF IRRELEVANT INFORMATION The portion of the Maintenance Manual which requires approval by the Administrator shall not include information which does not have a direct bearing on safety of the aircraft. Such material as organization procedures, employee conduct, rates of compensation, working hours, etc., if included in the Maintenance Manual shall be confined within a separate section.

42.32-5 COPY OF MAINTENANCE MANUAL IN AIRCRAFT. ***(CAA policies which apply to section 42.32 (d) (2).)***

This manual shall contain such maintenance instructions as are necessary for the type of operations and aircraft concerned, and interpreting the air carrier's procedures to be followed in complying with the maintenance requirements of Part 42 and CAM 42 and the Operations Specifications. The foregoing shall not be construed as requiring an air carrier to carry in the aircraft complete maintenance and overhaul instructions for a particular type of aircraft. It is essential, however, that the manual contain such maintenance information as will provide adequate guidance for routine and emergency maintenance procedures, in addition to the air carrier's policy relative to their accomplishment.

42.32-6 MANDATORY REVISIONS. ***(CAA rules which apply to section 42.32 (d) (3).)***

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