CHAPTER 56

EVALUATE OPERATOR' S MASS AND BALANCE CONTROL PROGRAMME

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1.0 OBJECTIVE

This section provides guidance for evaluating an operator/applicant's mass and balance control programme. Section 12 provides guidance for aircraft certificated with 9 or less passenger seats. Reference: ICAO Document 9389 - AN/919 Chapter 6, Attachment 6 - C.

2.0 GENERAL

A. Approved mass and balance control procedures are the only means for an operator/applicant to authorize the use of other than known masses for crew, passengers, baggage, or cargo. The mass and balance control programme, including loading schedules and charts, is approved on operations specifications by the assigned Maintenance Inspector. This programme must be included in the operator/applicant's policies and procedures manual.

B. The operator/applicant may develop and submit for approval any method or procedure by which it can show that an aircraft:

- Is properly loaded according to approved configuration (loading schedules or charts).
- Will not exceed authorized mass and balance limitations during all ground and flight operations.
- Will be periodically re-weighed and its data reevaluated.
- Will have its data recalculated, if changes necessitate.

C. The operator/applicant's mass and balance control procedures may either be an independently controlled document which includes all the instructions and procedures for maintenance, operations, and baggage/cargo control, or it may be included in the manual.

3.0 ESTABLISHED MASS AND CENTRE OF GRAVITY (CG) LIMITS

A. During type certification, the aircraft manufacturer must flight test mass and balance under all conditions and establish center of gravity limits. These limits are approved by the regulatory authority of the country where the aircraft is manufactured.

B. If an operator/applicant proposes an unusual or complex mass and balance programme, or a programme substantially different from Approved Aircraft Flight Manual (AFM) or Pilot Operating Handbook. The operator/applicant must be able to substantiate that the proposed programme provides an equivalent level of safety to that of the AFM or Pilot Operation Handbook.

4.0 LOADING PROCEDURES

A. Use of Average Passenger Masses. For aircraft operated under the CARs, average passenger and baggage masses may be authorized.

(1) Average masses may be determined by actually weighing passengers and baggage and documenting the mass. Average masses must be based on acceptable data collection during actual operations.

(2) Generally, average masses for operations in warm climates are lighter than those in colder climates. In establishing average passenger and baggage masses, operating environment must be considered. For example, clothing worn or carried in colder climates may affect the established weight.

NOTE: The average passenger and baggage masses in US-FAA Advisory Circular 120-27 "Aircraft Weight and Balance Control" as amended, do not comprise a regulatory requirement or authorization. This information is guidance only and must be evaluated for applicability to individual operators.

B. Non-Standard Mass Groups. Average masses are not suitable or groups that tend to be heavier or lighter than the average. The operator/applicant must use actual masses for loading non-standard mass groups and their baggage (such as athletic squads, military personnel, and children's groups).

C. Carry-on Baggage. Procedures must be provided for controlling carry-on baggage.

(1) Carry-on baggage must be limited to articles that may be placed in overhead compartment that causes the mass limit of the compartment to be exceeded.

(2) Carry-on baggage mass must either be accounted for in the same manner as checked baggage or be added to the passenger mass.

(3) Operators using average masses for computing mass and balance should re-evaluate carry-on baggage mass at least once per year.

5.0 AIRCRAFT WEIGHTS

A. Weighing of Aircraft

(1) Aircraft must be weighed to determine their basic weight and the corresponding Centre of Gravity (C of G) position when all manufacturing processes have been completed. Aircraft exceeding 5700 kg (12500 lb) MTMA must be re-weighed 2 years after the date of manufacture and their after at intervals not exceeding 3 years and at such times as the Authority may require. Aircraft not exceeding 5700 kg (12500 lb) shall be weighed at intervals not exceeding 5 years and at such times as the Authority may require.

(2) In making the decision on weighing the aircraft the inspector should consider the history of the aircraft, its flying performance, and the probable effects on the weight after a major overhaul, or embodiment of a modification, repair, or replacement.

(3) Certain types of aircraft may be weighed on a sampling basis i.e. a representative aircraft as weighed would be acceptable for the others of the same standard in the operators fleet. However, such an arrangement requires prior Authority approval as in B below.

(4) When an aircraft is weighed, the equipment and other item of load such as fluids in the tanks must be recorded. This recorded load should not differ significantly from the standard Basic Equipment List associated with the Centre of Gravity Schedule.

B Use of Fleet Masses. A fleet generally is considered to be three or more aircraft of the same model and configuration. This allows realistic averages to be determined.

(1) Aircraft operating under fleet masses must be weighed in accordance with the operator/applicant's instructions. The operating masses and centre of gravity position must be within established limits. The use of fleet masses is authorized by operations specifications.

(2) An operator's empty fleet mass is determined by averaging aircraft masses as follows:

Fleet Size	Weighing Policy
3 aircraft	Weigh all aircraft
4 - 9 aircraft	Weigh 3 aircraft plus at least 50 percent of over 3
Over 9 aircraft	Weigh 6 aircraft plus at least 10 percent of the number over 9

C. Scales used to weigh passengers, aircraft, cargo, and baggage must be calibrated and traceable to a national standard. Calibration must be performed in accordance with the civil authority for weights and measures having jurisdiction over the area in which the scales are used. The frequency of testing depends on use and handling.

6.0 CONTRACTORS

An operator/applicant may use a contractor to weigh items required to be weighed. However, the operator/applicant is responsible for ensuring the contractor complies with the operator/applicant's approved mass and balance control programme. This includes ensuring scales are calibrated and tested in accordance with the operator/applicant's Maintenance Manual.

7.0 COORDINATION

This task requires close coordination between airworthiness and operation inspectors.

8.0 REFERENCES

- FAA Advisory Circular 91-23, Pilot's Weight and Balance Handbook, as amended
- FAA Advisory Circular 120-27, Aircraft Weight and Balance Control, as amended
- Approved Flight Manuals
- Approved Mass and Balance Manuals
- Type Data Sheets and Aircraft Specifications
- Supplemental type Certificates
- Aircraft Equipment Lists
- Aircraft Maintenance Records (Mass and Balance Records)

9.0 PROCEDURES

A. The assigned team of inspectors coordinates with the Operator/Applicant. Operator/applicant must submit the following for review:

- Manual or revision
- Mass and Balance Programme document (if not part of a manual)
- Pertinent company procedures
- Instructions for completing forms used in aircraft mass control and aircraft loading
- Mathematical justification for loading provisions or schedules

B. Review the Operator/Applicant's Manual/Programme Document. The manual must include procedures, levels of authority, and information appropriate to the Nig. CARs. In addition, the following must be included:

(1) Manual introduction, to include:

- Description of the philosophy and the goals of the manual
- Description of division of contents between volumes, if more

than one volume

- List of effective pages, including dates

(2) Manual revision and distribution procedures, to ensure:

- Current information is provided to all manual holders
- Manuals are available to maintenance, operations, and ground personnel and are furnished to the NCAA.

(3) Definitions of all significant terms used in the programme. The definitions must reflect their intended use and include any acronyms or abbreviations unique to the manual.

(4) Description of the organizational unit responsible for the control and maintenance of the mass and balance programme, to include:

- Definitions of lines of authority
- Description of the support structure

(5) Job descriptions for all elements

(6) Training programme that include the following:

- Maintenance personnel
- Operations and dispatch personnel
- Ground handling personnel

(7) A means of documenting and retaining individual training records

(8) Procedures for:

- Determining standards and schedules for calibration of aircraft scales
- Pre-weighing instruction and requirements
- Determining which aircraft are to be weighed
- Establishing and maintaining equipment lists for each aircraft
- Recording the type and serial number for each scale used, aeroplane's , mass, residual fluids, and scale tare masses.

- Initial weighing of aircraft
- Monitoring and adjusting individual aircraft or fleet, empty weight and center of gravity
- Periodic re-weighing of aircraft
- Ensuring aircraft are configured in accordance with approved data.

(9) A loading schedule consisting of graphs/tables or a special loading schedule for a calculator or computerized programme. These schedules must ensure that pertinent data is available concerning all probable mass and balance conditions of the aircraft.

(10) A load manifest on which all required loading information shall be entered by personnel responsible for mass and balance control, including procedures for:

- Completing the load manifest
- Ensuring load manifest is carried on the aircraft
- Retaining the load manifest for the time periods specified in the CARs
- Distribution of the load manifest in accordance with the operator's manual and the CARs.

(11) Procedures to be used by crewmembers, cargo handlers, and other personnel concerned with aircraft loading, for the following:

- Distribution of passengers
- Distribution of fuel
- Distribution of cargo
- Verification and acceptance of actual cargo mass as listed on a bill of lading
- Restriction of passenger movement during flight, if applicable
- Hazardous material requirements, if applicable

(12) A drawing of each cargo and/or passenger configuration to include emergency equipment locations

(13) Mathematical justification for loading provisions or schedules. This may be included under separate cover and not as part of the company manual.

(14) An alternate procedure for allowing manual computations, if a computerized mass and balance programme is utilized.

(15) Procedures for a mass range system, if applicable, that ensures:

(a) The range is typical of passengers carried on similar operations.

(b) Computations for critical load considerations support the ranges.

(c) Personnel responsible for loading the aircraft are required to prepare appropriate loading records.

(d) The system included methods for loading passengers whose mass are outside the range.

(e) Loading records indicate the number of passengers within the stated range and account for passengers that do not fall within the range.

(16) A system of loading nonstandard mass groups such as athletic squads or military groups and their baggage, which must utilize actual mass for both passengers and baggage.

(17) Procedures to verify actual mass of cargo.

(18) Standards and schedules for calibration of commercial scales used to determine baggage/cargo masses.

(19) Procedures to ensure that carryon baggage is limited to articles which may be placed in overhead compartments or under seats. Carry-on baggage mass must be accounted for in the same manner as checked baggage or added to the average passenger mass.

C. Review the Operator/Applicant's Operations Specifications. Review the draft operations specifications to ensure that operations specifications Paragraph E included the following:

(1) Aircraft make/model/series

(2) Type of loading schedule

(3) Loading schedule instructions for:

- Passenger and crew (average or actual mass)
- Baggage (average or actual mass) and cargo (actual)
- Nonstandard mass groups

(4) Mass and balance control procedures

NOTE: The above items must be referenced by indicating the locations in the operator/applicant's manuals, e.g., volume, chapter, etc.

D. Analyze the Results. Upon completion of review, analyze the results and determine whether the operator/applicant's manual and operations specifications meet all requirements.

E. Meet With Operator/Applicant. Discuss any discrepancies with the operator/applicant and advise what areas need corrective action.

10. TASK OUTCOMES

A. Approve operations specifications in accordance with Operations Specifications Chapter 2, Part E.

11. FUTURE ACTIVITIES

Normal surveillance.

12. AIRCRAFT WITH NINE PASSENGERS OR LESS

A. GENERAL

1. The Nig. CARs require nine or less operator/applicants to develop their own mass and balance procedures. The operator/ applicant has the option of using the procedures developed by the manufacturer, available in the approved Aircraft Flight Manual or Pilot Operating Handbook. Under these circumstances, the Aviation Safety Inspector's (ASIs) responsibilities are to ensure that the aircraft continue to be operated in accordance with these procedures.

2. It is the operator /applicant's privilege to revise these procedures or develop procedures tailored to the specific needs of the operation. Under these circumstances, it is the ASI's responsibility to evaluate the procedures to ensure regulatory compliance and suitability to the operation.

B. MANUFACTURER-DEVELOPED PROGRAMME

1. If an operator/applicant decides to use the manufacturer's mass and balance programme, it is the operator/applicant's responsibility to ensure that the programme will meet the need of the proposed/current operation.

2. To ensure an operator/applicant's compliance with a manufacturer's mass and balance programme, an ASI will have to verify that the operation or proposed operation will not conflict with the programme.

C. OPERATOR/APPLICANT-DEVELOPED PROGRAMME

1. The operator/applicant can submit any method or procedure by which it can show that all aircraft are properly loaded and will not exceed authorized mass and balance limitations during all operations.

   (a) These procedures can be provided in the operator's manual or they may be an independently controlled document that includes all instructions and procedures for maintenance, operations, and baggage handling personnel.

   (b) The mass and balance document must include company procedures and instructions for completing aircraft mass control and aircraft loading forms. Mathematical justification for loading provisions or schedules should be included in the submitted information.

2. Programme Acceptance. The mass and balance procedures, including loading schedules and charts, must be accepted by the Maintenance Inspector.

3. Unusual or Complex Programmes. If the operator/applicant proposes an unusual or complex mass and balance programme, or that programme is substantially different from the Approved Airplane Flight Manual or Pilot Operating Handbook the operator/applicant must be able to substantiate that the proposed programme provides an equivalent level of safety to that of the AFM or Pilot Operating Handbook.

NOTE: The use of actual mass is mandatory for reciprocating powered aircraft of nine or less passengers seats.

4. Load Schedules. The load schedule must include a manageable system for aircraft loading under all loading situations, including alternate procedures for nonstandard mass persons or groups. The operator's procedures must provide all necessary information (charts, graphs, tables, etc.), with related instructions for the loading.

5. Approval Requirements. There may be instances when an operator/applicant request approval to operate an aircraft with an increase in gross mass and/or change in center of gravity range. This constitutes a major design change, and requires data and approval from the manufacturer or other approved engineering source.

D. COORDINATION

This task requires close coordination between airworthiness and Operation Aviation Safety Inspectors (ASIs).

E. PROCEDURES

1. Review Operator/Applicant's Data. Review the following:

   (a) Type of equipment

   (b) Data to ensure that multiengine aircraft were weighed within the preceding 36 calendar months.

   (c) Operator/applicant's proposed/current method of record keeping

   (d) Specific mass and balance information pertaining to operator's/applicant's aircraft to include:

      (i) Type certificate data sheets for basic mass and balance data for individual aircraft.

      (ii) Existing alteration records that could affect the accuracy of approved mass and balance data

      (iii) Equipment list, to confirm that list matches installed equipment. Verify that list correlates with actual location on aircraft.

      (iv) Past records in sufficient detail to determine the validity of current mass and balance information, if applicable.

NOTE: If aircraft mass and balance records are unavailable or inaccurate, the only acceptable method of determining the actual mass and balance is to weigh the aircraft.

(e) Previous inspection reports, correspondence, and other documents in the office files are determine if there are any open items or if any areas were identified that require special attention.

2. Review Manufacturer's Programme

(a) Verify that the mass and balance information in the Aircraft Flight Manual/Rotorcraft Flight Manual includes current mass and balance information such as:

- Empty mass and centre of gravity
- Loading graphs
- Center of gravity envelopes
- Loading schedules
- Index tables

NOTE: The manual may refer to a mass and balance plotter. If so, ensure that this device is available

(b) Ensure that the manufacturer's procedures cover all aspects of the operator/applicant's intended operation.

(c) Review load manifest requirements for multiengine aircraft

3. Review Mass and Balance Revisions

(a) Determine who is responsible for updating mass and balance information

NOTE: The operator/applicant is ultimately responsible for the current status of mass and balance after any major repair or alteration, or equipment change.

(b) Ensure that revised mass and balance information has been entered in the Aircraft Flight Manual/Rotorcraft Flight Manual, or applicable aircraft mass and balance record, following any major change that may affect the mass and balance.

4. Inspect Equipment and Facilities

(a) If the operator/applicant has aircraft weighing equipment available, inspect calibration records to ensure that scale(s) calibration is traceable to the national standards.

(b) Ensure that operator/applicant has a draft free area or hangar in which the aircraft can be weighed.

(c) Ensure that loaded aircraft are still within manufacturer specified centre of gravity limits.

5. Evaluate Mass and Balance Training. Ensure that operator/applicant's flight training curriculum reflects the basic mass and balance procedures. The curriculum must also include any special mass and balance considerations for special use aircraft, e.g., all cargo.

6. Analyze Results. Upon completion of the evaluation, analyze the results and determine whether the aircraft and/or programme meet all requirements.

7. Meet With Operator/Applicant. Discuss discrepancies with the operator/applicant and advise what need corrective action.

F. TASK OUTCOMES

1. Successful completion of this task will result in accepting the mass and balance manual procedures or revision.

2. Document the Task. File all supporting paperwork in the operator/applicant's office file.

G. FUTURE ACTIVITIES

Normal surveillance.