

CIVIL AVIATION AUTHORITY, PAKISTAN

AIR NAVIGATION ORDER

NO. : 91.0033

Date : February, 2009

Issue : One

AIRCRAFT MASS & BALANCE CONTROL PROGRAM
OPERATIONAL REQUIREMENTS

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1. Authority

This Air Navigation Order (ANO) is issued by the Director General Civil Aviation Authority (CAA) in pursuance of the powers vested in him under Rule 4 read with Rules 219, 241, 242 and other relevant provisions of Civil Aviation Rules 1994 (CARs, 94).

2. Scope

- 2.1 Rule 241 of CARs, 94 states that an aircraft registered in Pakistan shall not fly for the purpose of regular air transport, or charter, or aerial work unless such requirements as may be prescribed by the Director General in Air Navigation Orders in respect of its mass and related performance are complied with.
- 2.2 Rule 242 of CARs, 94 states that an aircraft registered in Pakistan shall not fly for the purpose of regular air transport, charter, or aerial work unless the loading of the aircraft has been carried out in accordance with any instructions and conditions relating to loading and balance which are contained in the Operations Manual and Flight Manual, or equivalent certification document relating to the aircraft and any relevant instructions and conditions specified by the Director-General in Air Navigation Orders, and the load is properly secured.
- 2.3 Rule 219 of CARs, 94 states that the pilot-in-command of an aircraft shall not commence a flight unless he is satisfied, and has certified that he is satisfied inter alia that the mass of the aeroplane does not exceed the maximum mass which has been calculated in accordance with the criteria relating to the performance of the aircraft at which the aircraft can safely take off in the space available and the load carried by the aircraft is properly secured and is so distributed as to achieve a balance within the limits prescribed in the aircraft Flight Manual, or equivalent document.
- 2.4 In order to comply with the above Rules, the operator must have a program in place through which various aspects of loading and balance are monitored and controlled. This ANO prescribes the requirements on how to develop and receive operational approval for a mass and balance control program.

3. Effective Date

This ANO shall come into effect from 1st August 2009.

4. Applicability

The contents of this ANO shall be applicable to the operation of aeroplanes by operators authorized to conduct Commercial Air Transport Operations (RPT, Charter and Aerial Work) of Aircraft registered in Pakistan.

5. Reference Documents

Besides CARs, 94, the following documents have also been consulted as a reference:

- (a) Annex 6, Part I to the Convention on International Civil Aviation.
- (b) ICAO Document 9760.
- (c) JAR OPS 1.605.
- (d) FAA Advisory Circular AC 120-27E.
- (e) IATA Airport Handling Manual.
- (f) Boeing Performance Engineer - Weight and Balance Fundamentals course material.
- (g) Airbus guidance material on weight and balance.

6. Definitions

Unless the context suggests otherwise, when the following terms are used in this ANO, they will have the meanings assigned to them hereunder:

- i) **Basic empty weight.** The aircraft empty weight, adjusted for variations in standard items.
- ii) **Cargo.** Everything carried in the cargo compartments of the aircraft. This includes bags, mail, freight, express and company material. It also includes live animals, dangerous goods and hazardous materials as subcategories of the above.
- iii) **Carry-on bag.** A bag that the operator allows the passenger to carry onboard in the passenger cabin. It should be of a size and shape that will allow it to be stowed under the passenger seat or in a storage compartment. The operator establishes the exact dimensional limits based on the particular aircraft stowage limits.
- iv) **Certificated weight and CG limits.** Weight and centre of gravity (CG) limits are established at the time of aircraft certification. They are specified in the applicable aircraft flight manual (AFM).
- v) **Curtailment.** Creating an operational loading envelope that is more restrictive than the manufacturers' CG envelope, to assure the aircraft will be operated within limits during all phases of flight. Curtailment typically accounts for, but is not limited to, in-flight movement, gear and flap movement, cargo variation, fuel density, fuel burn-off, and seating variation.
- vi) **Freight.** Cargo carried for hire in the cargo compartment that is not mail or passenger bags.
- vii) **Loading envelope.** Weight and CG envelope used in a loading schedule. Loading the aircraft within the loading envelope will maintain

the aircraft weight and CG within the manufacturer's type-certificated limits throughout the flight.

- viii) **Loading schedule.** Method for calculating and documenting aircraft weight and balance prior to taxiing, to ensure the aircraft will remain within all required weight and balance limitations throughout the flight.
- ix) **Maximum landing weight.** The maximum weight at which the aircraft is certified to land during normal operations.
- x) **Maximum takeoff weight.** The maximum allowable aircraft weight at the start of the takeoff run.
- xi) **Maximum taxi weight.** The maximum allowable aircraft weight for taxiing.
- xii) **Maximum zero-fuel weight.** The maximum permissible weight of an aircraft with no disposable fuel and oil.
- xiii) **Mean Aerodynamic Chord (MAC).** The MAC is established by the manufacturer, which defines its leading edge and its trailing edge in terms of distance (usually inches) from the datum. The CG location and various limits are then expressed in percentages of the chord. The location and dimensions of the MAC can be found in the aircraft specifications, the type certificate data sheet, the AFM, or the aircraft weight and balance manual.
- xiv) **Moment.** The moment is the product of a weight multiplied by its arm. The moment of an item about the datum is obtained by multiplying the weight of the item by its horizontal distance from the datum.
- xv) **Operational empty weight (OEW).** Basic empty weight or fleet empty weight plus operational items.
- xvi) **Passenger weight.** Passenger weight is the actual weight or the approved average weight of the passenger.
 - a) An adult is defined as an individual 12 years or older.
 - b) A child is defined as an individual aged 2 to less than 12 years of age.
 - c) Infants are children who have not yet reached their second birthday.
- xvii) **Professional Engineer.** A person who holds an accredited engineering qualification and has a minimum experience of five years in the practice of engineering profession, whether working privately or in the employment of an engineering public organization and is registered as such by the Pakistan Engineering Council.(As defined in the Pakistan Engineering Council Act, 1975 Para 2(xiii)).
- xviii) **Reference Balance Arm (BA).** The horizontal distance from the reference datum to the CG of an item.
- xix) **Standard items.** Equipment and fluids not considered an integral part of a particular aircraft and not a variation for the same type of aircraft. These items may include, but are not limited to, the following:
 - a) Unusable fuel and other unusable fluids;
 - b) Engine oil;
 - c) Toilet fluid and chemical;
 - d) Fire extinguishers, pyrotechnics, and emergency oxygen equipment;
 - e) Structure in galley, buffet, and bar; and
 - f) Supplementary electronic equipment.

7. Development of Mass and Balance Control Program

7.1.1 Accurately calculating an aircraft's weight and CG before flight is essential to comply with the certification limits established for the aircraft. These limits include both weight and CG limits. By complying with these limits and operating under the procedures established by the manufacturer, an operator is able to meet the weight and balance requirements specified in the aircraft flight manual (AFM). Typically, an operator calculates takeoff weight by adding the operational empty weight (OEW) of the aircraft, the weight of the passengers, cargo payload, and the weight of fuel. The objective is to calculate the takeoff weight and CG of an aircraft as accurately as possible.

7.1.2 **All operators are required to develop a Mass and Balance Program that should be able to establish following elements:-**

- a) **Aircraft Loading Schedules.**
- b) **Aircraft Limitations-Loading Envelope.**
- c) **Loading Envelope Curtailments.**
- d) **Components of Takeoff Weight.**

7.1.3 Guidance for development of these elements is generally provided by the manufacturers in weight and balance manuals, loading schedule substantiation documents or through training courses.

7.1.4 This program will be approved by Flight Standards Directorate of CAA Pakistan. If assistance of manufacturer or a service provider is availed in development of these elements, approval will be accorded to the operator for the use of such services.

7.2 Aircraft Loading Schedules

7.2.1 A loading schedule is a means of computing and controlling weight and centre of gravity during aircraft operations. It ensures compliance with aircraft limitations, operator procedures and regulatory requirements during aircraft operations. It is used to document compliance with the certificated weight and balance limitations contained in the manufacturer's Airplane Flight Manual or Weight and Balance manual.

7.2.2 **The loading schedule is to be designed by the operator based on its specific loading calculation procedures and it should provide the operational limits for use with the operator's weight and balance program approved under this ANO.** These approved operational limits are typically more restrictive but should not exceed the manufacturer's certificated limits. This is because the loading schedule is generally designed to check only specific conditions (e.g., takeoff and zero fuel) known prior to takeoff, and must account for variations in weight and balance in flight. It must also account for factors selected to be excluded for ease of use from the calculation process. Loading the aircraft so that the calculated weight and balance is within the approved limits will maintain the actual weight and balance within the certificated limits throughout the flight.

7.2.3 Development of a loading schedule represents a trade-off between ease of use and loading flexibility. A schedule can provide more loading flexibility by requiring more detailed inputs, or it can be made easier to use by further limiting the operational limits to account for the uncertainty caused by the less detailed inputs.

7.2.4 The operator should take into account all probable loading conditions which may be experienced and show that the loading schedules may be applied to individual aircraft or to a complete fleet. When an operator uses several types or models of aircraft, the loading schedule (which may be index type, tabular type, or computer based) should indicate the type or model of aircraft for which it is designed.

7.3 Aircraft Limitations- Loading Envelope

7.3.1 **Each operator complying with this ANO must design a loading envelope applicable to each type of aircraft being operated. The envelope will include all relevant weight and balance limitations.** It will be used to ensure that the aircraft is always operated within appropriate weight and balance limitations, and will include provisions to account for the loading of passengers, fuel, and cargo; the in-flight movement of passengers, aircraft components, and other loaded items; and the usage or transfer of fuel and other consumables. The operator must be able to demonstrate that the aircraft is being operated within its certificated weight and balance limitations using reasonable assumptions that are clearly stated.

7.3.2 The construction of the loading envelope will begin with the weight and balance limitations provided by the aircraft manufacturer in the weight and balance manual, type certificate data sheet, or similar approved document. These limitations will include, at minimum, the following items, as applicable:

- a) Maximum zero-fuel weight.
- b) Maximum takeoff weight.
- c) Maximum taxi weight.
- d) Takeoff and landing CG limitations.
- e) In-flight CG limitations.
- f) Maximum floor loadings including both running and per square foot limitations.
- g) Maximum compartment weights.
- h) Fuselage shear limitations.
- j) Any other limitations provided by the manufacturer.

7.4 Loading Envelope Curtailments

7.4.1 **The operator must curtail the manufacturer's loading limitations to account for loading variations and in-flight movement that are encountered in normal operations.** For example, if passengers are expected to move about the cabin in flight, the operator must curtail the manufacturer's CG envelope by an amount necessary to ensure that movement of passengers does not take the aircraft outside its certified envelope. If the aircraft is loaded within the new, curtailed envelope, it will always be operated within the manufacturer's envelope, even though some

of the loading parameters, such as passenger seating location, are not precisely known.

- 7.4.2 In some cases an aircraft may have more than one loading envelope for pre-flight planning and loading. Each envelope must have the appropriate curtailments applied for those variables that are expected to be relevant for that envelope. For example, an aircraft might have separate takeoff, in-flight, and landing envelopes. Passengers are expected to remain seated in the cabin during take-off or landing. Therefore, the takeoff and landing envelope does not need to be curtailed for passenger movement.
- 7.4.3 Upon determination of the curtailed version of each envelope, the most restrictive points (for each condition the operator's program will check) generated by an "overlay" of the envelopes will form the aircraft operational envelopes. These envelopes must be observed. By restricting operation to these "operational envelopes," compliance with the manufacturer's certified envelope will be ensured in all phases of flight, based upon the assumptions within the curtailment process. Optionally, an operator may choose to not combine the envelopes but observe each envelope independently. However, due to calculation complexity, this is typically only possible through automation of the weight and balance calculation.
- 7.4.4 **Operator using an approved weight and balance control program must include curtailments appropriate to the operations being conducted.** Each of the items mentioned below is a single curtailment factor. The total curtailment of the manufacturer's envelope is computed by combining the curtailments resulting from each of these factors.
- a) **Passengers.** The operator must account for the seating of passengers in the cabin. The loading envelope does not need to be curtailed if the actual seating location of each passenger is known. If assigned seating is used to determine passenger location, the operator must implement procedures to ensure that the assignment of passenger seating is incorporated into the loading procedure. It is recommended that the operator take into account the possibility that some passengers may not sit in their assigned seats.
- If the actual seating location of each passenger is not known, the operator may assume that all passengers are seated uniformly throughout the cabin or a specified subsection of the cabin. If this assumption is made, the operator must curtail the loading envelope to account for the fact that the passenger loading may not be uniform. The curtailment may make reasonable assumptions about the manner in which people distribute themselves throughout the cabin. For example, the operator may assume that window seats are occupied first, followed by aisle seats, followed by the remaining seats (window-aisle-remaining seating). Both forward and rear loading conditions should be considered. That is, the passengers may fill up the window, aisle, and remaining seats from the front of the aircraft to the back, or the back to the front.
 - If necessary, the operator may divide the passenger cabin into subsections or "zones" and manage the loading of each zone individually. It can be assumed that passengers will be sitting

- uniformly throughout each zone, as long as the curtailments described in the previous paragraph are put in place.
- All such assumptions should be adequately documented.
- b) Fuel.** The operator's curtailed loading envelope must account for the effects of fuel. The following are examples of several types of fuel-related curtailments:
- **Fuel density.** A certain fuel density may be assumed and a curtailment included to account for the possibility of different fuel density values. Fuel density curtailments only pertain to differences in fuel moment caused by varying fuel volumes, not to differences in total fuel weight. The fuel gauges in most transport category aircraft measure weight, not volume. Therefore, the indicated weight of the fuel load can be assumed to be accurate.
 - **Fuel movement.** The movement or transfer of fuel in flight.
 - **Fuel usage in flight.** The burning of fuel may cause the CG of the fuel load to change. The effect of fuel burning down to the required reserve fuel or to an acceptable fuel amount established by the operator should be accounted for. A curtailment may be included to ensure that this change does not cause the CG of the aircraft to move outside of the acceptable envelope.
- c) Fluids.** The operator's curtailed CG envelope must account for the effects of galley and lavatory fluids. These factors include such things as:
- Use of potable water in flight.
 - Movement of water or lavatory fluids.
- d) In-Flight Movement of Passenger and Crew.** The operational envelope must account for the in-flight movement of passengers, crew, and equipment. This may be done by including a curtailment equal to the moment change caused by the motion being considered. It may be assumed that all passengers, crew, and equipment are secured when the aircraft is in the takeoff or landing configuration. Standard operational procedures may be taken into account. Examples of items that can move during flight are:
- **Flight deck crewmembers moving to the lavatory.** Flight deck crewmembers may move to the most forward lavatory in accordance with the security procedures prescribed for crews leaving the cockpit. An offsetting credit may be taken if another crewmember moves to the flight deck during such lavatory trip.
 - **Flight attendants moving throughout the cabin.** Operator should take their standard operating procedures into account. If procedures do not dictate otherwise, it should be assumed that the flight attendants can travel anywhere within the compartment to which they are assigned.
 - **Service carts moving throughout the cabin.** Operator should take their standard operating procedures into account. If procedures do not dictate otherwise, it should be assumed that the service carts can travel anywhere within the compartment to which they are assigned. If multiple carts are in a given compartment, and no restrictions are placed on their movement, then the

- maximum number of carts, moving the maximum distance, must be considered. The weight of the number of flight attendants assigned to each cart must also be considered. The assumed weight of each cart may be the maximum anticipated cart-load or the maximum design load, as appropriate to the operator's procedures.
- **Passengers moving throughout the cabin.** Allowances should be made for the possibility that passengers may move about the cabin in flight. The most common would be movement to the lavatory, described below. If a lounge or other passenger gathering area is provided, the operator should assume that passengers move there from the centroid of the passenger cabin(s). The maximum capacity of the lounge should be taken into account.
 - **Passengers moving to the lavatory.** Operator should account for the CG change caused by passengers moving to the lavatory. Operator should develop reasonable scenarios for the movement of passengers in their cabins and consider the CG shifts that can be expected to occur. Generally, it may be assumed that passengers move to the lavatories closest to their seats. In aircraft with a single lavatory, movement from the "most adverse" seat must be taken into account. Assumptions may be made which reflect operator's lavatory and seating policies. For example, it may be assumed that coach passengers may only use the lavatories in the coach cabin, if that is the operator's normal policy.
- e) **Movement of Flaps and Landing Gear.** If the manufacturer has not already done so, the operator must account for the movement of landing gear, flaps, wing leading edge devices, or any other moveable components of the aircraft. Devices deployed only while in contact with the ground, such as ground spoilers or thrust reversers, may be excluded from such curtailments.
- f) **Baggage and Freight.** It can be assumed that baggage and freight may be loaded at the centroid of each baggage compartment. Operators do not need to include a curtailment if procedures are used which ensure that the cargo is loaded uniformly and physically restrained (secured) to prevent the contents from becoming a hazard by shifting between zones or compartments.

7.5 Components of Takeoff Weight

- 7.5.1 Components that make up the weight of an aircraft at takeoff fall into following overall categories

$$\text{Takeoff Weight} = \text{Dry Operating Weight} + \text{Passengers} + \text{Carry-On Baggage} + \text{Checked Baggage} + \text{Freight} + \text{Total Loaded Fuel} - \text{Taxi Fuel}$$

Dry Operating Weight can be further defined as

$$\text{Dry Operating Weight (DOW)} = \text{Basic Empty Weight (BEW)} + \text{Operational Items}$$

7.5.2 Basic Empty Weight (BEW): Requirements and procedure for establishing aircraft basic empty weight are normally given in the manufacturer's Weight and Balance Manual for each aircraft type. Each new aircraft delivered from a manufacturer receives a report on the empty weight of the aircraft prior to delivery. **Operators should establish and follow instructions for weighing the aircraft that are consistent with the recommendations of the aircraft and weighing scale manufacturers. A weighing report is to be prepared for each weighing in the same format as the delivery weight report.**

7.5.2.1 Differences may exist in operator's definitions of what is included in BEW. **Operators should thoroughly define and document what is, and is not, included according to their definition of BEW.** Time interval for establishment of the basic empty weight is given in Airworthiness Notice Number 11 of Part-IV Engineering & Maintenance Issue 01 Dated 17th April, 2000.

7.5.3 Operational Items: Operational items include items that could vary with route length, route type, or number of passengers carried. They include but are not limited to the following:-

- (a) Crewmembers, supernumeraries, and their baggage
- (b) Manuals and navigation equipment
- (c) Passenger service equipment including pillows, blankets, newspapers and magazines
- (d) Removable service equipment for cabin and galley
- (e) Food and beverages
- (f) Usable fluids other than those which are part of aircraft systems
- (g) Required emergency equipment for all flights
- (h) Life rafts, life vests, and emergency transmitters
- (j) Aircraft unit load devices (ULDs)
- (k) Potable water
- (l) Drainable unusable fuel
- (m) Spare parts normally carried aboard and not accounted for as cargo.
- (n) All other equipment considered standard by the operator

7.5.3.1 **The operator is to develop for each aircraft or type of aircraft, a list of operational items providing weight and location for each item and include it in the Mass and Balance Program Document prepared in accordance with Para 10.**

7.5.4 Passengers: Following standard average per passenger weights with carry on baggage are to be used by all operators. These weights have been determined through a survey conducted in 2004 by CAA Pakistan and may change upon subsequent survey results.

Adult	75kg
Child (2 years to less than 12 years of age)	38kg
Infant	15kg

7.5.4.1 Aircraft with fewer than five passenger seats must use actual passenger and baggage weights.

7.5.5. **Checked Bags:** it is preferred that actual weight of checked bags be used where it is readily available. An operator that chooses to use standard average weights for checked bags should use a weight of at least 20kgs per passenger. An operator that requests approval to use a standard average weight of less than 20kgs per passenger for checked bags should have current, valid survey data to support a lesser weight. An operator also may conduct a study to establish different standard average bag weights for portions of its operation to account for regional, seasonal, demographic, aircraft, or route variation. For example, an operator could establish different standard average bag weights for domestic and international routes and for Hajj / Umrah flights.

7.5.6 **Freight:** Actual weight of freight must be used in all cases

7.5.7 **Total Loaded Fuel: Operator must determine the weight of the fuel loaded by using either the actual density or standard density.**

7.5.7.1 **Operator is to determine the source of weight for fuel load and include it in the Mass and Balance Program Document required vide Para 10.**

7.5.8 **Taxi Fuel:** Taxi fuel can be calculated in the form of statistical taxi time and associated burn off, fixed taxi out time and associated burn off or single value for all cases.

8. Aircraft Mass Control Organization

8.1 **Operators of aircraft having five or more passenger seats or carrying cargo only or combination of cargo and passengers on main deck must have an approved mass control organization for determination of aircraft mass and for the running of mass and balance control program.**

8.2 An aircraft mass control organization should consist of a minimum of two Professional Engineers, or one Professional Engineer and one mass control officer who is having at least two years of Load Control experience. The staff of an approved mass control organization should have adequate facilities to enable the maintenance of records of mass changes of each aircraft of the operator's fleet.

8.3 In addition to above, the organization should have a dedicated sub organization called "Load Control" which should perform the following functions:

- a) Load planning, weight and balance pre calculation and completion of loading instructions
- b) Supervising the loading of the aircraft in accordance with the loading instructions and procedures contained in Airplane Flight Manual or associated Weight and Balance Manual.

- c) Completion and checking of the load / trim sheet against the loading instructions and other related documents.
- 8.4 Application for approval of the aircraft mass control organization should be made to the Flight Standards Directorate and should include the following:
- a) The qualifications, and experience required by the operator for members of the aircraft mass control organization
 - b) Details of the method of liaison with other sections of the organization to ensure that all records of mass changes are transmitted to the aircraft mass control organization (may be submitted as an organogram) and
 - c) Details of the procedure within the organization for ensuring adequate control of the loading of all aircraft
- 8.4.1 This information should be the same as provided in the operator's Operations Manual and can also be submitted as a part of Mass and Balance Policy Document described at Para 10.1

9. Training and Qualification

In order to ensure flight safety through an acceptable level of standardization and proficiency, the following minimum requirements shall be recognised in the training and qualification of personnel engaged in load control functions.

9.1 Training

- 9.1.1 At least one Professional Engineer involved in development of loading schedule, limitations and curtailments must be given training on the subject through programs established by the manufacturer. This training requirement must be made part of induction process of the aircraft.
- 9.1.2 All trainees must attend at least one week basic weight and balance course which should cover the syllabus given at Appendix "B" followed by minimum of 2 day type course covering knowledge of all specific weight and balance aspects, loading restrictions and particularities pertaining to the aircraft type for which they are being certified.
- 9.1.3 Training should be conducted by personnel who have demonstrated competence in the subjects to be instructed and who have the skills to deliver the training effectively. These instructors will be approved by CAA for each operator.
- 9.1.4 The objective of the training is also to promote safety awareness and to provide airside workers and their management with the procedure necessary for the handling and loading of aircraft and to work safely in the airport environment. Therefore, personnel should, as appropriate to their jobs function, receive training on the applicable subjects in the following list.
 - a) Airside safety
 - b) Security regulations
 - c) Principles of aircraft loading
 - d) Irregularity/ incident/accident reporting procedures

- e) Manual handling of load
- f) Safety during aircraft fuelling
- g) Handling of loads requiring special attention
- h) Loading incompatibilities
- j) Handling of aircraft Unit Load Devices (ULDs)
- k) Operation of aircraft loading systems/securing of ULDs
- l) Identification/consequences of malfunctions of in-plane loading systems
- m) Consequences of load damage and spillage
- n) Positioning and operation of loading and servicing equipment
- o) Notification to Captain of load being carried
- p) Passenger embarkation/disembarkation procedures
- q) Standards of aircraft cleaning, lavatory and fresh water servicing
- r) Aircraft movement operations

9.2 **Qualification**

- 9.2.1 Knowledge verification will be required in the form of oral questioning and written tests throughout the training programmes.
- 9.2.2 Practical competency will be determined through instructor evaluation.
- 9.2.3 After successful completion of classroom training, personnel will be subjected to a period of practical training in the field under supervision of a qualified person.
- 9.2.4 Upon completion of the above, and subject to final assessment, personnel may be considered as qualified to fulfil their assigned duties and issued with competency certificates for each type of aircraft.
- 9.2.5 Personnel shall be continuously updated and reassessed at regular intervals. Such refresher/recurrent training shall take place at least once in any three-year period.
- 9.2.6 The operator will describe the training and qualification requirements in its Mass and Balance Policy Document.

10. **Mass and Balance Program Document**

The operator shall submit a Mass and Balance Program Document to Flight Standards Directorate for the approval. This document is to be appropriately numbered and must contain list of effective pages and signature of the persons preparing and checking it. The document should at least include following parts:

- a) Mass and Balance Policy**
- b) Loading Schedule Substantiation for each type of aircraft**
- c) Aircraft Data**

10.1 **Mass and Balance Policy**

This part should cover following broad outline

- a) Mass control organization structure
- b) Minimum qualification, duties and responsibilities of position holders
- c) Training and qualification requirements including procedure for issuance of competency certificates
- d) Instructions and procedures with regards to completion of Load and Trim Sheet
- e) Format of documents required for exchange of data between various departments
- f) Operator's data for determination of aircraft take off weight in the format provided at Appendix 'A'

10.2 Loading Schedule Substantiation

This part should describe the method of developing a loading schedule and should contain at least the following data:

- a) Equations used to develop a loading schedule
- b) Passenger cabin zones and cargo compartment definitions
- c) Cargo load limits
- d) Incremental load item index development methodology
- e) Horizontal stabilizer trim settings
- f) Development and application of curtailments to the structural center of gravity limits
- g) Load and Trim Sheet construction using the data developed in the document.
- h) Load and Trim Sheet derived from Para 10.2 g) which will be used in actual operations

10.3 Aircraft Data

This part should contain at least the following data

- (a) Numbered weight reports for each type of aircraft. The report should contain all data used for preparing the Load and Trim Sheet. A new report is to be published whenever there is any change in its data.
- (b) Latest weighting report for each aircraft of the fleet in accordance with Para 7.5.2 along with operational items list developed vide Para 7.5.3.
- (c) Definition of Basic Empty Weight in accordance with Para 7.5.2.1

10.4 Operators may issue abridged mass and balance document for the use of Load Control staff but this document must not contain any information other than that provided in the approved Aircraft Flight Manual, Manufacturer's Weight and Balance Manual and the approved Mass and Balance Control Program Document.

(M. JUNAID AMEEN)
Air Commodore (Retd.)
Director General
Civil Aviation Authority, Pakistan

Dated February, 2009

APPENDIX 'A'**Operator's Data for Determination of Aircraft Takeoff Weight**

(Tick applicable box and/or fill in the blanks)

1. Source of weight for fuel load prior to engine start
 - Fueling truck paperwork with cockpit gauge readings used as a second check
 - Cockpit gauge readings only
 - Fueling truck paperwork only

2. Source of weight for taxi fuel burned prior to takeoff
 - Statistical taxi time _____ Mins. Associated burn off _____ kg
 - Fixed taxi out time _____ Mins. Associated burn off _____ kg
 - Single value for all cases _____ kg

3. Source of checked baggage weight
 - Actual weighing of checked baggage
 - Standard allowance of 20kg/Passenger
 - Determined by operator's survey _____ kg
 - Any other combination determined from survey (specify)

4. Average passenger weight including carry on baggage (if other than Para 7.5.4.) _____ Kg. (Weights for Hajj / Umrah flights may be determined separately)

APPENDIX “B”

Basic Weight and Balance Course Syllabus

1. **General Weight and Balance Proficiency and Awareness**

Terms used in the Load Control environment (vocabulary, acronyms, operational codes and abbreviations).

Definition and composition of the design and operational weights

Aircraft balance principles

Consequence of improper loading on flight and personnel safety

2. **Aircraft Structural Load Limitations**

Linear (running load) limitation

Area limitation (spreader floors)

Limitation per compartment/section/ULD position

Monocoque (combined) limitation

Cumulative limitation

Missing restraints limitations

3. **Unit Load Devices**

Gross weight limitations and hold restraint requirements

Container / pallets build-up and tie-down limitations and rules

Tagging

4. **Bulk Hold Loading**

Load spreading rules

Load restraint rules: aircraft nets, tie-down, and volume restraint

5. **Loadsheet**

Computation, issuance and check in both manual and computerized modes

Last minute change procedure

6. **Balance Table/ Charts**

Computation, issuance and check in all conventional methods (indexed weights, graphic charts etc.)

7. Loading Instruction Report

Knowledge of the aircraft holds designation and numbering
Issuance and check in both manual and computerized modes

8. Loading Message

Reading and sending of standard loading messages: LDM and CPM

9. Dangerous Goods

Cargo IMP codes
ULD and parcels labelling and marking
Loading restrictions and compatibility rules
NOTOC completion (loading positions)
Emergency procedures in case of incidents

10. Other Special Loads (Perishable, EAT AVI, WET, OBX, LHO etc)

Cargo IMP codes
Marking and labelling
Loading restrictions and compatibility rules
NOTOC completion (loading positions)

11. Load Planning

Loading/off-loading priorities
Baggage categories and hold locations
Optimum hold loading (multi-sector flights, volume utilization, fuel conservation etc.)