

GUIDANCE MATERIAL FOR INSPECTORS

SOUTH AFRICAN



***CIVIL AVIATION
AUTHORITY***

**EVALUATE OPERATOR'S WEIGHT
AND BALANCE CONTROL
PROGRAM**



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3. TERMS AND ABBREVIATIONS:

3.1. Terms

TERM	DEFINITION
Aircraft Arms, Weights, and Moments.	The term arm, usually measured in inches, refers to the distance between the CG of an item or object and the reference datum. Arms ahead of or to the left of the datum are negative (-), and those behind or to the right of the datum are positive (+). When the datum is ahead of the aircraft, all of the arms are positive and computational errors are minimized. Weight is normally measured in pounds. When weight is removed from an aircraft, it is negative {-}, and when added, it is positive (+). A moment is a force that tries to cause rotation, and is the product of the arm, in inches, and the weight, in pounds. Moments are generally expressed in pound-inches (lb-in) and may be either positive or negative. NOTE: A number of weights must be considered in aircraft weight and balance. Terms for various weights listed here are used by the General Aviation Manufacturer's Association (GAMA).
Aircraft Specifications.	Documentation containing the pertinent specifications for aircraft certificated under the CARs.
Airplane Flight Manual (AFM).	A State of Design approved document, prepared by the holder of a TC for an airplane or rotorcraft, that specifies the operating limitations and contains the required markings, placards, and other information applicable to the regulations.
Approved Type Certificate	A certificate of approval issued by the State of Design for the design of an airplane, engine, or propeller.
Basic Empty Weight.	The empty weight of the aircraft plus the weight of the un-drainable fuel, oils, and hydraulic fluid outlined in the manufacturer's maintenance manual.
Basic Operating Index	The moment of the airplane at its basic operating weight (BOW) divided by the appropriate reduction factor.
Basic Operating Weight	The weight of an aircraft with unusable fuel, all fluids, crew, and installed equipment, as defined by the operator's program based on TC, STC, or other approved data.
Cargo.	Cargo refers to passenger-checked baggage, freight, dangerous goods, company materials, and hazmats. Cargo does not include passenger carry-on baggage.
Emergency Equipment.	Required emergency equipment must be part of the pre-weight checklist and be stored in its assigned position specified by the operator's manual.
Empty-Weight Center of Gravity (EWCG).	The CG of an aircraft when it contains only the items specified in the aircraft empty weight.
Empty-Weight Center of Gravity Range	The distance between the allowable forward and aft empty-weight CG limits.
Equipment List.	A list of items approved by the SACAA for installation (In case of major modifications) in a particular aircraft or approved by the State of Design. The list includes the name, part number, weight, and arm of the component. Installation or removal of an item in the equipment list is considered to be a minor modification.
Fleet Weight.	An average weight accepted by the SACAA for aircraft of identical make and model that have the same equipment installed. When a fleet weight control program is in effect, the fleet weight of the aircraft can be used rather than having to weigh every individual aircraft.
Flyaway Kit.	A flyaway kit would be considered part of the empty weight when it is installed. Spare parts loaded onboard must be considered as COMAT.



TERM	DEFINITION
Index point.	A location specified by the aircraft manufacturer from which arms used in weight and balance computations are measured. Arms measured from the index point are called index arms.
Manufacturer's Empty Weight	The manufacturer's empty weight contains only the basic equipment when the aircraft is delivered to the operator. The operator may install additional equipment required for its specific operation creating the basic empty weight for that operator
Maximum Allowable Gross Weight.	The maximum weight authorized for the aircraft and all of its contents as specified in the TCDS or Aircraft Specifications for the aircraft.
Maximum Landing Weight.	The greatest weight that an aircraft normally is allowed to have when it lands.
Maximum Ramp Weight.	The total weight of a loaded aircraft, including all fuel. It is greater than the takeoff weight due to the fuel that will be burned during the taxi and runup operations. Ramp weight is also called taxi weight.
Maximum Takeoff Weight.	The maximum allowable weight at the start of the takeoff run.
Maximum Zero Fuel Weight.	The maximum authorized weight of an aircraft without fuel. This is the sum of the BOW and payload.
Payload.	The weight of the passengers, baggage, and cargo that produces revenue.
Pilot's Operating Handbook (POH)	. A State of Designed-approved document published by the airframe manufacturer that lists the operating conditions for a particular model of aircraft and its engines.
Standard Empty Weight	The weight of the airframe, engines, and all items of operation weight that have fixed locations and are permanently installed in the aircraft. This weight must be recorded in the aircraft weight and balance records. The basic empty weight includes the standard empty weight plus any optional equipment that has been installed. Depending upon the part of the Federal regulations under which the aircraft was certificated, either the un- drainable oil or full reservoir of oil is included.
Supplemental Type Certificate (STC) Data.	Provided it specifically applies to the item being repaired/altered, such data may be used in whole or part as included within the design data associated with the STC.
Unit Load Device (ULD)	A device for grouping, transferring, and restraining cargo for transit. The ULD may consist of a pallet and net or may be a container.



3.2. Abbreviations:

ABBREVIATION	DESCRIPTION
AFM	Aircraft Flight Manual
AI	Airworthiness Inspector
AMT	Aviation Maintenance Technician
AOC	Air Operator Certificate
AOM	Air Operator Manual
BOW	Basic Operating Weight
CAR	Aircraft Accident Released
CASS	Continuing Analysis and Surveillance System
CAT	Civil Aviation Technical Standards
CG	Center Of Gravity
DCA	Director Of Civil Aviation
EWCG	Empty-Weight Center of Gravity
FAA	Federal Aviation Administration
FOI	Flight Operations Inspector
MEL	Minimum Equipment List
OEM	Original Equipment Manufacturer
OpSpecs	Operations Specifications
OPSS	Operations Specifications Subsystem
OPSS	Authority For Weight and Balance
POH	Pilot's Operating Handbooks
RFM	Rotorcraft Flight Manual
SACAA	South African Civil Aviation Authority
SACAR	South African Civil Aviation Regulation
SACM	
STC	Supplemental Type Certificate
STS	
TC	Type Certificate
TCDS	Approved Type Certificate Data Sheet
TSO	Technical Standard Order
ULD	Unit Load Devices



1. INTRODUCTION

1.1 GENERAL

- 1.1.1. Approved weight and balance control program procedures are the only means for an operator/applicant to authorize the use of other than known weights for crew, passengers, carry- on baggage, or cargo. This program must be included in the operator/ applicant's manual system. The weight and balance control program is approved on the OPSS by the AI. If an operator chooses to use average passenger and baggage weights, the process for establishing these weights and surveys that validate them must be approved by the FOI. Reports of the established average passenger and baggage weights and surveys are entered in OPSS.
- 1.2. The operator/applicant may develop and submit for approval any method or procedure by which they can show that an aircraft:
- 1.2.1. Is properly loaded according to approved configuration (loading schedules or charts)
- 1.2.2. Will not exceed authorized weight and balance limitations during all ground and flight operations.
- 1.2.3. Will be periodically reweighed and its data reevaluated.
- 1.2.4. Will have its data recalculated, if needed due to changes
- 1.3. The operator/applicant's weight and balance control program should be an independently controlled document that includes all the instructions and procedures for weight and balance control, or it may be included as a controlled part of another manual. The weight and balance control program should undergo periodic reviews to ensure compliance.

1.2 CRITERIA

- 1.2.1 The chapter provides guidance for evaluating an operator/applicant's weight and balance control program procedures.

1.3 APPLICATION

- 1.3.1 These instructions are intended for application to South African airports and to aircraft registered in the Republic.
- 1.3.2 Conformity with these instructions will be prerequisite for an operator intending to include CAT 11/111 operations in the operating certificate.

2. CERTIFICATION BASIS (TYPE CERTIFICATE {TC) / AMENDED TC /SUPPLEMENTAL TYPE CERTIFICATE (STC)

- 2.1. When the design of an aircraft is approved by the State of Design, an approved type certificate data sheet (TCDS) is issued. The TCDS includes all of the pertinent specifications for the aircraft. The weight and balance information is located in the TCDS under "Data Pertinent to All Models."
- 2.2. Conformity to type design is considered attained when the required and proper components are installed, and they are consistent with the drawings, specifications, and other data that are part of the TC. Conformity would include amended TCDs, applicable STCs, and field-approved modifications.
- 2.3. Before an aircraft can be properly weighed and its EWCG computed, certain information must be known. This information is furnished by the State of Design for every certificated aircraft in the TCDS or Aircraft Specifications available to all operators. (This can be accessed via the Internet at <http://avinfo.faa.gov> or at <http://www.airweb.faa.gov/rgl>, for FAA certified aircraft, for other State of Design, those states share that information via their specific websites)
- NOTE: Additionally, the equipment list that comprises the BOW of the aircraft must be validated to ensure that it is current.



3. MANUFACTURER DOCUMENTATION: AIRCRAFT FLIGHT MANUAL (AFM) / WEIGHT AND BALANCE DOCUMENT.

- 3.1. Review the manufacturer's program in the approved weight and balance control document, AFM/ RFM
 - 3.2. Verify that the weight and balance information in the weight and balance control document, AFM/RFM, includes current weight and balance information such as:
 - 3.2.1. EWCG
 - 3.2.2. Loading graphs
 - 3.2.3. Centre of gravity (CG) envelopes
 - 3.2.4. Loading schedules
 - 3.2.5. Index tables
 - 3.2.6. Load manifest
- NOTE: The manual may refer to a weight and balance plotter. If so, ensure that this device is available.
- 3.3. Ensure that the manufacturer's procedures cover all aspects of the SA-CARS 121 and 135 operator / applicant's intended operation.

4. OPERATOR / APPLICANT-DEVELOPED PROGRAM

- 4.1. Submitted Program. 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 weight and balance limitations during all operations.
 - 4.1.1. 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 cargo handling.
 - 4.1.2. The weight and balance document must include company procedures and instructions for completing forms used in aircraft weight control and aircraft loading. Mathematical justification for loading provisions or schedules should be included in the submitted information.
 - 4.1.3. The weight and balance document must indicate the source of the data used to develop the program. This data may come from the manufacturer's weight and balance documentation referenced from the TCDS, the AFM/RFM, STC information, or other SACAA approved source.
 - 4.1.4. The program shall contain the duties, responsibilities, and authority for flight, ground operations, maintenance, and management personnel.
- 4.2. Unusual or Complex Programs. If the operator/applicant proposes an unusual or complex weight and balance program, or that program is substantially different from the weight and balance document or approved AFM/RFM, request assistance from State of Design.
- 4.3. Load Schedules. The load schedule must include a manageable system for aircraft loading under all loading situations, including alternate procedures for nonstandard weight persons or groups. The operator's procedures must provide all necessary information (charts, graphs, tables, etc.), with related instructions for the loading.
- 4.4. Major Modification. Occasionally, an operator/applicant may request approval to operate an aircraft with an increase in gross weight and/or change in CG range. This constitutes a major design change and requires approval by the SACAA. This requires assistance from the State of Design if the modification is such that the CG envelope is changed considerably.
- 4.5. Determining the Loaded Mass and CG. An important part of pre-flight planning is to determine that the aircraft is loaded so its weight and CG location are within the allowable limits. There are two ways of doing this: by the computational method using weights, arms, and moments; and by the loading graph method, using weight and moment indexes.
- 4.6. Program Approval. The weight and balance control program is approved by the AI. Coordination with FOI will be necessary relative to those pertinent parts of the program, such as calculation of average passenger and baggage weights and surveys, that require FOI oversight responsibility.

5. AIRCRAFT WEIGHTS



5.1. Weighing of Aircraft.

5.1.1. Aircraft operated under part 121 and 135 are required to be weighed at least once every 5 Years. Both the operator/applicant's OPSS and manual must reflect this requirement.

a) Aircraft may be weighed individually on a fixed interval schedule such as every 5 years.

b) Aircraft may be weighed based on fleet weights, as defined in the CAR's and SA-CATS as amended.

Note: Procedures that establish BOW, establishment of zone weights and compartment weights within the aircraft, and tables or charts that depict proper weight and CG ranges and limitations are contained in the OEM weight and balance requirements, STC holder's weight and balance supplement, or other SACAA- approved data. See FAA AC 120-27, Aircraft Weight and Balance Control (current edition), for additional guidance.

6. WEIGH SCALES

6.1. Scales used to weigh passengers, aircraft, and cargo must be calibrated and traceable to a National Standards or equivalent approved by SACAA. 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 calibration testing depends on use and handling. Certification documents should be in the English language.

6.2. Periodic testing of scales using a known weight to ensure accuracy should be included in an operator's program.

7. LOADING SCHEDULE AND PROVISIONS

7.1. Loading Schedule. Loading schedules should be simple and orderly, based on sound principles, thus reducing the elements of human error. Loading schedules may be applied to individual aircraft or to a complete fleet. When an operator uses several types or models of aircraft, a loading schedule, which may be index-type, tabular-type, or a computer, should be identified in the OPSS with the type or model of aircraft for which it is designed.

7.2. Loading Provisions. All seats, compartments, and other loading stations should be properly marked and the identification used should correspond with the instructions established for computing weight and balance of the aircraft. When the loading procedures provide for blocking off seats or compartments to remain within the CG limits, the operator/applicant should provide effective means to ensure that such seats or compartments are not occupied during operations specified. In such cases, instructions should be prepared for crewmembers, load agents, cargo handlers, and other personnel concerned, giving complete information 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 should be included in these instructions. When it is possible by adverse distribution of passengers and/or cargo to exceed the approved CG limits of the aircraft, special instructions should be issued to the pilot in command and appropriate personnel so that the load distribution can be maintained within the approved limitation.

7.3. Standard Passenger Weights. Actual weights, or when appropriate, average passenger weights, are used to compute passenger loads over any segment of a certificate holder's operations. Actual weights are generally used for operations with aircraft having nine or less passenger seats and aircraft carrying nonstandard passenger loads. The loading system should readily accommodate nonstandard weight groups, and the manifest should indicate whether average or actual weights, or a combination thereof, were used in the computation. SA CAR 91.7.11 read together with SA-CATS 91.07.11. Subpart 2 and Subpart 3 provides the average mass values that should be utilized on computing masses.

Note: The intent of the FAA AC 120-27, current edition, is to provide methods and procedures for developing weight and balance control systems, not to address the entire spectrum of all possible weight configurations. Therefore, the operator will provide the SACAA with a reliable survey to establish an average passenger weight for its specific operation.

7.4. Average Passenger Weights. The standard average passenger weights listed in the SA-CATS 91.07.11. Subpart 2 read together Subpart 3 were developed for conventional airline passenger groups. They cannot be



arbitrarily adopted for operations with passenger groups that appreciably differ from the basis or where the mix of male and female passengers is known to be different than a 60 percent male/40 percent female operation. Special average weights or special ratios may be established for particular operations based on surveys that

- 7.4.1. Indicate that those weights consistently provide for loading within prescribed weight and balance limits; and
- 7.4.2. Meet the criteria for surveys and statistical analysis in Technical Standard as mentioned.
- 7.5. Average Baggage Weight or Actual Weights. An operator may establish average passenger baggage weights predicated on a study of actual baggage weights for the operations or routes involved that consider seasonal and other variables.

Note: Unless otherwise authorized by the SACAA-approved weight and balance control manual, the actual passenger and baggage weights shall be used in computing the weight and balance of charter flights and other special services involving the carriage of special groups.

- 7.6. Passenger and Crew Baggage. Procedures should be provided so that all baggage, including that carried onboard by the flight crew, is properly accounted for. If desired by the operator, a standard crew baggage weight may be used. Checked baggage average weights may be used as described below. Actual weights should be used for aircraft of nine or less passenger seats or when checked baggage noticeably exceeds the average weights.

8. OPERATOR'S PASSENGERS AND CARGO LOADING PROCEDURES TRAINING.

- 8.1. Responsibility for Weight and Balance Control. Weight and balance is one of the most important factors affecting safety of flight. An overweight aircraft, or one whose CG is outside the allowable limits, is inefficient and dangerous to fly. The responsibility for proper weight and balance control begins with the air carrier, extends to ground operations persons who load the aircraft, the AMT who maintains the aircraft, and the pilot who operates the aircraft. Normal loading of aircraft using load persons must have procedures and training to ensure proper weight and balance, with a system to direct the proper loading of the aircraft within limits. The system must comply with the load manifest requirements of CAR's Part 121 and 135.

- 8.1.1. Operator Personnel Qualification Identification. Employees involved in cargo loading must be trained, authorized, and qualified. This training must be easily identified by documentation in training records and authorization documents.

- 8.1.2. Responsibility. The operator's training program must convey to the three employee groups (maintenance, ground operations, and flight operations) that although they have different functions in an approved weight and balance control program, each group has individual responsibilities that ensure safety in air cargo operations.

- 8.2. Weight and Balance (CG control). Operators must have training programs for personnel involved with weight and balance calculations. These programs should contain the processes and procedures to maintain the weight and CG of aircraft dispatched. Topics in the training programs would include:

- 8.2.1. Notification of flight crew
- 8.2.2. Position of cargo and baggage
- 8.2.3. Calculations for average weights of both persons and baggage, seasonal changes, unusual loads such as sports teams, military, and manifest weights of cargo, etc.
- 8.2.4. Calculations for actual weights and when to use them.
- 8.2.5. Processes that take into account CG offsets for containers, both loaded into unit load devices (ULD) and loaded onto the aircraft.
- 8.2.6. Computer programs used and processes and procedures to certify personnel to calculate weight and balance.

9. TRAINING PROGRAM CURRICULUM. OPERATORS MUST PROVIDE:

- 9.1. Programs for Load Personnel. Training programs for aircraft loaders are to include:
 - 9.1.1. Basic aircraft load procedures, such as step loading containers on all-cargo aircraft, loading containers in passenger aircraft, and bulk loading in lower lobes and uppers lobes on all-cargo and combi-aircraft.



- 9.1.2. Procedures for training load contractors, and audit requirements for those contractors
- 9.1.3. Training on expectations of loaders and proper load procedures, including safety and hazmat.
- 9.1.4. Frangible load requirements for certain positions.
- 9.2. Programs for Load Supervisors. Training for persons responsible for the load on an aircraft must teach understanding of those responsibilities, to include ULD load, aircraft load, serviceability of ULDs, aircraft cargo handling, and restraint systems.
- 9.3. Training on ULD Build up. Training on recognition of proper ULD configuration, including operational standards, net attachments, container configurations and condition, CG offsets, profiling, and authorization for use on particular aircraft. Training on how to build up a ULD to comply with CG control. Personnel to receive this training include contractors and freight forwarders.
- 9.4. Programs for Freight Forwarders. Programs should include procedures for training freight forwarders on air carrier requirements, including ULD build-up with attention to CG offsets and profile.
- 9.5. Programs for Maintenance Personnel. Training for maintenance personnel must consist of:
 - 9.5.1. Aircraft weighing procedures.
 - 9.5.2. Weight and balance changes due to modifications
 - 9.5.3. Cargo loading system maintenance.
 - 9.5.4. Weight and balance control program audit function under the CASS program
 - 9.5.5. Repair of ULDs and cargo restraint systems
 - 9.5.6. Inspection requirements
 - 9.5.7. Receiving inspection requirements for components contracted out.
 - 9.5.8. Recording requirements
- 9.6. Training on Records. Programs should include procedures to retain training records for personnel trained in cargo loading and checking serviceability of ULDs. Training should address computerized recordkeeping and recurrence requirements.
- 9.7. Flight crew Awareness Training. Programs should include procedures to train flight crews in cargo loading awareness, to include examples of unserviceable ULDs, restraints, aircraft configuration, and duties and responsibilities of ground personnel.

10. PASSENGER AND CARGO LOADING PROCEDURES

- 10.1. Procedures should be written in the air carrier's manuals and be consistent throughout the company.

11. CARGO HANDLING PROCEDURES

- 11.1. Cargo. Procedures must be provided for loading/unloading freight into upper main cargo compartments on all-cargo and combi aircraft and into lower lobe compartments on all aircraft. This includes forward and/or aft compartments on regional type aircraft as well as cargo pods. Cargo handling should include procedures for:
 - 11.1.1. Loading, based on aircraft configuration, i.e., all-cargo, passenger, combi, and convertible. These procedures may vary depending on the type of cargo handling system installed, restraint equipment installed or used, and cargo door configuration.
 - 11.1.2. Loading aircraft to ensure that tail tipping is not an issue on all-cargo aircraft.
 - 11.1.3. Loading for passenger and cargo aircraft so that containers, if used, are loaded onto the aircraft and restrained.
 - 11.1.4. Ensuring that if bulk-loaded on lower lobe or forward or aft compartments or pods, that cargo or baggage is properly restrained using the restraint system required by the airplane weight and balance documents.
 - 11.1.5. Ensuring that cargo bulk-loaded on the main deck is loaded per the original equipment manufacturers and operator's weight and balance procedures.
- 11.2. ULDs are certified to a Technical Standard Order (TSO), STC, production certificate and military standard,. Uncertified ULDs are built to an industry standard and are allowed only on certain aircraft as described in the aircraft weight and balance manual or STC weight and balance supplement. Operators must have procedures for the following:
 - 11.2.1. Procedures on build-up of containers and pallets to ensure proper CG control, so as not to exceed certification



limitations for horizontal and vertical CG.

- 11.2.2. Build up procedures for palletized and bulk cargo that ensure that the load fits the fuselage profile of the aircraft being loaded.
- 11.2.3. CG offset control to ensure that loaded pallets or containers do not exceed certification limitations for horizontal and vertical CG. For bulk load procedures to ensure that the load does not exceed CG offset for the compartment being loaded. This would include ULDs loaded in double configuration with vacant adjacent positions.
- 11.2.4. Procedures to ensure that ULDs are operational before loading on an aircraft and designate a responsible person to perform these checks and validate to the flight crew on the load sheet, manifest, or other form that operational checks have been performed.
- 11.2.5. Operators should have a program to maintain ULDs in accordance with the ULD manufacturer's recommendations or procedures developed by the operator and acceptable to the FAA. This program should include serviceability limits, inspection limits, inspection frequency, and receiving inspection requirements. Control of ULDs should be shown along with reweigh procedures to establish tare weights.
- 11.2.6. Procedures to route unserviceable ULDs to repair facilities should be established, along with procedures to add repair facilities to approved vendor lists.

12. OTHER RESTRAINTS

- 12.1. Restraints such as straps, tie-downs, nets, etc., may be certified by original type design, STC, or major modification (which requires SACAA approval). The restraints that are allowed on an individual aircraft are listed in the weight and balance manual, STC weight and balance supplement, or major modification documentation for each aircraft.

13. CONTRACTORS

- 13.1. An operator/applicant may use a contractor to weigh items required to be weighed. However, the operator/applicant is responsible for ensuring that the contractor complies with the operator/applicant's approved weight and balance control program. This includes ensuring that scales are calibrated and tested in accordance with the operator/applicant's policies and procedures manual. The operator/applicant must have procedures for the following:
- 13.2. Freight Forwarders. Procedures to train freight forwarders or contract loaders to the operator's requirements. Procedures to audit forwarders or contractors.
- 13.3. Interlining. Procedures to ensure that ULDs received from other operators, whether South African or foreign, meet the gaining operators' requirements for load and serviceability.

14. CARGO HANDLING SYSTEMS

- 14.1. Cargo handling systems, both upper and lower deck, are approved by various means. They may be certified as part of the certification basis of an aircraft, by STC, or by major modification for an individual aircraft installation. These systems consist of locks, end stops, vertical side restraints, ball mats, roller sections, side guides, etc. Cargo handling systems are also designed as a conveyance for ULDs, allowing them to move easily in and out of the aircraft. In addition, some cargo handling systems are powered.
- 14.2. Repair of system components should be part of the operator's manual system, along with ability to substitute load-bearing components. Substitution should be based on approved airworthiness data. Substitution would include those subparts of a load-bearing component. The operator should show that if substitution is done that it is backed up with approved data, and the operator's manual system should show that modified configuration and how that configuration is controlled. That control may be in the form of an Engineering Order, Engineering Report, or other vehicle described in the operator's manual.
- 14.3. No matter the means of approval used, minimum equipment list concerns should be addressed. This includes operation with missing restraint devices along with weight and/or performance penalties for the missing device.



15. VERIFYING MAINTENANCE DOCUMENTATION PROCEDURES

15.1. Addition or Removal of Equipment.

15.1.1. CG Change After Repair or Modification. The largest weight changes that occur during the lifetime of an aircraft are those caused by modifications and repairs. It is the responsibility of the air carrier doing the work to accurately document the weight change and record it in the aircraft record.

- a) When air carriers make conversions, modifications, repairs, or major modifications to an aircraft that change the current weight and balance requirements and/or limitations, the SACM generally approves a weight and balance supplement or other control documents, such as STCs, SACM Form CA 43-17 Mass and Balance Approval, or other weight and balance reports. This supplementary information describes the effect of the conversion or modification on the aircraft, and the SACM generally approves it as part of an STC or Modification approval.
- b) When an air carrier makes a conversion, modification, or major modification to an aircraft that changes its weight and balance characteristics, the air carrier should have a procedure in place to ensure that all supplemental information developed, issued, and approved for that aircraft is incorporated into the air carrier weight and balance control program. An air carrier must apply the most restrictive ranges of the incorporated modifications to the operation of that aircraft. For example, if multiple STCs apply, the air carrier must use the STC with the most restrictive weight and balance limitations when incorporating the supplemental information into air carrier weight and balance control programs. In all cases of multiple STCs applied to a single aircraft, the STCs should be evaluated for effect on each other and the appropriate limitations applied. At a minimum, an air carrier should:
 - i. Include the supplemental information described above or cross-reference the supplemental information in air carrier weight and balance manual.
 - ii. Organize the supplemental information according to aircraft type or in a way that facilitates use by loading personnel.
- c) Include the supplemental information in its air carrier weight and balance manual and any charts or tables that indicate proper weight and CG range limitations.

15.2. Permanent Ballast.

15.2.1. If a repair or modification causes the aircraft CG to fall outside of its limits, permanent ballast can be installed. Permanent ballast may consist of blocks of lead or other material. It should be marked "permanent ballast/do not remove." It should be attached to the structure so that it does not interfere with any control action and attached rigidly enough that it cannot be dislodged by any flight maneuvers or rough landing.

15.2.2. Two things must first be known to determine the amount of ballast needed to bring the CG within limits: the amount the CG is out of limits, and the distance between the location of the ballast and the limit that is affected.

15.3. Temporary Ballast. Temporary ballast, in the form of lead bars or heavy canvas bags of sand or lead shot, is often carried in the baggage compartments to adjust the balance for certain flight conditions. The bags should be marked as ballast and secured. Removal may require recalculation of the aircraft BOW. Temporary ballast must be secured so it cannot shift its location in flight, and the structural limits of the baggage compartment must not be exceeded. All temporary ballast must be removed before the aircraft is weighed.

15.4. Weight and Balance Revision Record.

15.4.1. Each revision record should be identified by the date and the aircraft make, model, and serial number. The pages should be signed by the person making the revision.

15.4.2. The computations for a weight and balance revision are included on a weight and balance revision form. Appropriate fore and aft extreme loading conditions should be investigated and the computations shown. The weight and balance revision sheet should clearly show the revised empty weight, empty weight arm, and/or moment index, and the new BOW.

NOTE: BOW is defined as the weight of an aircraft with unusable fuel, all fluids, crew, and installed equipment, as defined by the operator's program based on TC, STC, or other SACAA-approved data.



16. WEIGHT AND BALANCE RECORDS SURVEILLANCE

- 16.1. Maintenance weighing records, training records, and air cargo operations audit records must reflect compliance with the weight and balance control program. Cargo handling systems and ULDs must have records of maintenance, preventive maintenance, and inspections located in the aircraft maintenance records.
- 16.2. Ground operations load manifest records, load verification sheets, and personnel training records must reflect compliance with the weight and balance control program.
- 16.3. Flight operations records (flight papers), and personnel training records must reflect compliance with the weight and balance control program.

17. AUTHORITY FOR WEIGHT AND BALANCE (OPSS)

- 17.1. The weight and balance control program is not just an isolated program for maintenance to comply with weighing the aircraft. It covers all employee disciplines that must interact together to operate the aircraft within the weight and balance limitations. Manuals must be consistent in text to provide guidance for the weight and balance system to work properly.
- 17.2. Approval of weight and balance control programs is affected on operations specifications (OpSpec). The OpSpecs will list the appropriate documents used for weight and balance control. Average passenger and baggage weights, along with surveys to validate these weights, will be entered into OPSS.

18. CONTINUOUS ANALYSIS AND SURVEILLANCE SYSTEM (CASS).

- 18.1. The CASS periodically monitors the performance of and audits the weight and balance control program to ensure constant compliance.
- 18.2. The CASS program should define how and when weight and balance control systems are audited, to include, but not limited to:
 - 18.2.1. Aircraft loading
 - 18.2.2. ULD build-up
 - 18.2.3. Personnel training
 - 18.2.4. Freight forwarders
- 18.3. System performance should be monitored to include such items as load plans, load manifests, aircraft configuration changes, cargo handling system performance, and human factors issues with loaders, load supervisors, and contractors.

19. SACAA SURVEILLANCE.

- 19.1. The AWs are to review their assigned air carrier's weight and balance control procedures. This review shall include the subject areas discussed in this chapter, along with the appropriate air carrier's manuals, OpSpecs, and wet lease agreements. It is imperative that any contractors used for cargo loading are qualified and authorized by the certificate holder to perform these functions. AWs are encouraged to review any training program their certificate holder accomplishes for personnel who supervise the loading of aircraft, prepare load manifest forms, or qualify and authorize other persons to accomplish these requirements.
- 19.2. Air carriers have a statutory mandate to perform their services with the highest possible degree of safety. Achievement of that goal requires a concerted effort between the SACAA and the carrier. Special emphasis ramp checks are to be conducted to validate the current state of weight and balance control procedures and cargo loading operations. The SACAA should make special efforts to keep all carriers apprised of the methods by which SACAA inspections are carried out and inform them of any instances of noncompliance discovered in those inspections. Air carriers are encouraged, in turn, to use such information to evaluate their own systems, programs, and operations.



NOTE: Airworthiness inspectors (AWi) assigned to an operator should be trained on the specific requirements of that operator's weight and balance control program. This should be tailored in a way that the Inspector can pickup and raise issues with the operator on their program.

**SECTION 2. PROCEDURES****1. PREREQUISITES AND COORDINATION REQUIREMENTS**

1.1. Prerequisites:

- 1.1.1. Knowledge of the regulatory requirements of CAR parts 121 and 135
 - 1.1.2. Successful completion of the Airworthiness Inspector Indoctrination course(s) or equivalent
 - 1.1.3. Previous experience with part 121 or 135 weights and balance programs, and the current program being evaluated.
- 1.2. Coordination. This task requires close coordination between airworthiness and operations inspectors.

2. REFERENCES, FORMS, AND JOB AIDS

2.1. References (current editions):

- i. Civil Air Regulations Part 121 and 135 with regards to Weight and Balance.
- ii. AC 43.13-1, Acceptable Methods, Techniques, and Practices-Aircraft Inspection and Repair
- iii. FM-H-8083-1, Aircraft Weight and Balance Handbook, as amended (replaces AC 91-23, Pilot's Weight and Balance Handbook) (For FM Type Certified aircraft)
- iv. FMAC 120-27, Aircraft Weight and Balance Control (As a guide)
- v. Approved AFMs
- vi. Approved Pilot's Operating Handbooks (POH)
- vii. Approved weight and balance manuals
- viii. TCDS and aircraft specifications
- ix. STCs
- x. Aircraft equipment lists.
- xi. Aircraft Maintenance Records (weight and balance records)

2.2. Forms:

- i. Operations Specifications as stipulated with the AOC issuance.
- ii. CA 43-17
- iii. Job Aids:
- iv. Automated OpSpecs checklists and worksheets

NOTE: This job aid is for use in evaluating an operator's weight and balance control program. The job aid recommends six (6) areas that can be used in the evaluation of the weight and balance control program. The option of using all of the parts of this job aid or any individual part is the decision of the inspector that is doing the evaluation.

3. PROCEDURES

3.1. Coordinate with the Operator/Applicant. The operator/applicant must submit the following for review:

- 3.1.1. Manual or revision
- 3.1.2. Weight and balance program document (if not part of a manual)
- 3.1.3. Pertinent company procedures
- 3.1.4. Instructions for completing forms used in aircraft weight control and aircraft loading.
- 3.1.5. Mathematical justification for loading provisions or schedules

3.2. Review the Operator/Applicant's Manual/Program Document. The manual must include procedures, levels of authority, and information appropriate to part 121 or 135. In addition, the AWi must confirm that the following are included:

- 3.2.1. Ensure that the manual, as presented, adheres to the System Safety attributes:



- 3.2.2. Responsibility and authority
- 3.2.3. Procedures
- 3.2.4. Process measurement
- 3.2.5. Control
- 3.2.6. Interface
- 3.3. Manual introduction, to include:
 - 3.3.1. Description of the philosophy and the goals of the manual
 - 3.3.2. Description of the division of contents between volumes, if more than one volume
 - 3.3.3. List of effective pages, including dates
- 3.4. Manual revision and distribution procedures, to ensure:
 - 3.4.1. Current information is provided to all manual holders.
 - 3.4.2. Manuals are available to maintenance, operations, and ground personnel and are furnished to the SACM.
- 3.5. Definitions of all significant terms used in the program. The definitions must reflect their intended use and include any acronyms or abbreviations unique to the manual.
- 3.6. Description of the organizational unit responsible for the control and maintenance of the weight and balance program, to include:
 - 3.6.1. Definitions of lines of authority
 - 3.6.2. Description of the support structure
- 3.7. Job descriptions for all elements
- 3.8. Training programs for the following:
 - 3.8.1. Maintenance personnel
 - 3.8.2. Operations and dispatch personnel
 - 3.8.3. Ground handling personnel
- 3.9. A means of documenting and retaining individual training records.
- 3.10. Procedures for:
 - 3.10.1. Determining standards and schedules for calibration of aircraft scales
 - 3.10.2. Preweighing instructions and requirements
 - 3.10.3. Determining which aircraft are to be weighed.
 - 3.10.4. Establishing and maintaining BOW equipment lists for each aircraft.
 - 3.10.5. Recording the type and serial number for each scale used airplane weight, residual fluids, and scale tare weights.
 - 3.10.6. Initial weighing of aircraft
 - 3.10.7. Monitoring and adjusting individual aircraft or fleet, empty weight, and CG
 - 3.10.8. Periodic reweighing of aircraft
 - 3.10.9. Ensuring aircraft are configured in accordance with approved data.
 - 3.10.10. Control of ULDs, including serviceability standards, CG offset, and build-up
 - 3.10.11. Control and oversight of contractors including freight forwarders.
- 3.11. A loading schedule consisting of graphs/tables or a special loading schedule for a calculator or computerized program. These schedules must ensure that pertinent data is available for all probable weight and balance conditions of the aircraft.
- 3.12. A load manifest on which all required loading information shall be entered by personnel responsible for weight and balance control, including procedures for:
 - 3.12.1. Completing the load manifest
 - 3.12.2. Ensuring the load manifest is carried on the aircraft.
 - 3.12.3. Retaining the load manifest for the time periods specified in the CARs.
 - 3.12.4. Distribution of the load manifest in accordance with .part 121 and 135.
- 3.13. Procedures to be used by crewmembers, cargo handlers, and other personnel concerned with aircraft loading, for the following:
 - 3.13.1. Distribution of passengers
 - 3.13.2. Distribution of fuel



- 3.13.3. Distribution of cargo
- 3.13.4. Verification and acceptance of actual cargo weights as listed on a bill of lading
- 3.13.5. Restriction of passenger movement during flight, if applicable
- 3.13.6. Hazmat requirements, if applicable
- 3.14. A drawing of each cargo and/or passenger configuration, to include emergency equipment locations.
- 3.15. Mathematical justification for loading provisions or schedules. This may be included under separate cover and not as part of the company manual.
- 3.16. An alternate procedure for allowing manual computations if a computerized weight and balance program is used.
- 3.17. Procedures for a weight 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 includes methods for loading passengers whose weights are outside the range.
 - e) Loading records indicate the number of passengers within the stated range and account for passengers who fall outside the range.
- 3.18. A system for loading nonstandard weight groups, such as athletic squads or military groups and their baggage, which must use actual weights for both passengers and baggage.
- 3.19. Procedures to verify actual weight of cargo.
- 3.20. Standards and schedules for calibration of commercial scales used to determine baggage/cargo weights.
- 3.21. Procedures to ensure that carry-on baggage is limited to articles which may be placed in overhead compartments or under seats. Carry-on baggage weight must be accounted for in the same manner as checked baggage or added to the average passenger weight.

4. REVIEW THE OPERATOR/APPLICANT'S OPSPECS

- 4.1. Review the draft OpSpecs to ensure that OpSpec includes the following:
 - 4.1.1. Aircraft make/model/series.
 - 4.1.2. Type of loading schedule.
 - 4.1.3. Loading schedule instructions for:
 - a) Passengers and crew (average or actual weight)
 - b) Baggage (average or actual weight) and cargo (actual)
 - c) Nonstandard weight groups
 - d) Weight 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.
- 4.2. Review draft OpSpec for accuracy of average passenger and baggage weight calculations along with weight and balance survey requirements and completion. Coordinate this activity with the FOi.
- 4.3. Analyze the Results. Upon completion of review, analyze the results and determine whether the operator/applicant's manual and OpSpecs meet all requirements.
- 4.4. Meet with Operator/Applicant. Discuss any discrepancies with the operator/applicant and advise them on areas that need corrective action.

5. TASK OUTCOMES




- 5.1. Complete the Task. Approve OpSpec.
 - 5.1.1. Document the Task. File all supporting paperwork in the operator/applicant's office file.



6. FUTURE ACTIVITIES

- 6.1. Normal surveillance to be continued to verify continued compliance.

7. DOCUMENT AUTHORISATION

DEVELOPED BY:		
	Siphamandla Mhlanga	01 March 2023
SIGNATURE OF M: FOD	NAME IN BLOCK LETTERS	DATE
REVIEWED & VALIDATED BY:		
	Eric Mataba	01 March 2023
SIGNATURE OF SM: FOD	NAME IN BLOCK LETTERS	DATE
APPROVED BY:		
	Simon Segwabe	01 March 2023
SIGNATURE OF E: ASO	NAME IN BLOCK LETTERS	DATE