EUROCAE	**WG-88**	**Onboard Weight and Balance Systems**

TERMS OF REFERENCE – *REVISION N°TOR WG-88/REV3*

Approved by EUROCAE Technical Advisory Committee on 26 April 2017

BACKGROUND AND SCOPE

General:

There have been a number of accidents and serious incidents that have resulted in fatalities in which aircraft failed to rotate, to achieve the correct climb rates or to achieve the proper descent profile or landing flare. One of the primary causes of such accidents and serious incidents has been attributed to incorrect weight and balance. The aircraft were either overweighted or an incorrect Centre of Gravity position was calculated. To date there are no requirements or standards prescribing the installation and specifying performances of systems to provide weight and balance information and warnings to the flight crew.

Two accidents (BEA 3X-GDO - 25 December 2003 and NLR TC-ONP – 17 June 2003) resulted in recommendations to EASA to provide regulatory materials. As a result WG 88 was set up by the EUROCAE council in 2011 to develop EUROCAE documents dealing with Weight and Balance On board Systems.

Note: By 2011,96 accidents were reported, 39 improper centre of gravity, 44 overloaded and 13 cargo shift for large airplanes and a study of occurrences for rotorcrafts shows that erroneous weight and/or centre of gravity computation is the root cause for around 2% of those accidents.

Scope:

In order to perform safe flight and landing (including for example, setting the stabilizer and Take Off Thrust correctly), precise and accurate weight data is required. This means that the procedures for the calculation of the centre of gravity and the aircraft weight must be executed in a correct manner by the flight crew supported by ground staff, based on the information provided. An error in determination of weight and CG could result in erroneous Take-Off performance calculation (V-speeds and stabilizers setting) and degraded handling qualities of the aircraft.

It has been noted by a number of accident and investigation teams that the current generation of aircraft are equipped with several safety systems that protect against hazard, such as

- stall speed warning system,
- ground proximity warning system (GPWS),
- landing gear warning systems
- etc.

Yet there are no requirements for a system that provides actual weight and balance information and warnings to the flight crew. After a review of the accident and investigation teams' recommendations, EASA has concluded that such a system would result in a positive safety benefit.

WG-88 was requested to perform a review of the currently available technology to evaluate the feasibility of developing standards for OBWBS. Based on the outcome of this analysis, WG88 will prepare MOPS. The MOPS should be such to enable the introduction of onboard weight and balance systems. It is anticipated that it will contain the required standard for the equipment, installation, information presentation and operational criteria necessary to ensure safe and reliable operations of the system.

The working group should also take into consideration during its discussions:

- Fixed Wing and Rotorcraft operations including their potential different objectives towards an onboard Weight and Balance system
- the technical aspects introduced by both retrofit and new production possibilities
- other flight phases, for example: cruise, descend and landing
- data communication from and to other systems (e.g. FMS)
- recording of those data
- Both direct measurement and indirect techniques ("virtual" sensing: e.g. deriving the CG location from the horizontal stabilizer position).

WORKING GROUP OBJECTIVES

WG-88 is tasked to develop the Minimum Operational Performance Specifications for Onboard Weight and Balance Systems for civil aviation.

Work process and methodology

It is anticipated that the Working Group would consist of members from industry, installation and certification experts, plus regulatory participation. Other organisations such as military and civil operators may be interested in and may benefit from this group's activity.

In addition coordination with SAE S-7 'Flight Deck & Handling Quality Standards for Transport Aircraft', SAE AGE-2 'Air Cargo & Aircraft Ground Equipment & Systems Steering Group', as well as with the Society of Allied Weight Engineers (SAWE) is recommended.

4 meetings per year, with a normal duration of 3 days, as well as regular teleconferences are foreseen.

Initial Documentation

Documents	Source	Abstract	Intended Use
AC 120-27E (2005)	FAA	establish weight and balance control program	Review
ARP 1409C (2003)	SAE	requirements for the function, characteristics, and installation of an OBWBS	Review
ARP 4102/1 (1988)	SAE	criteria for flight deck display for OBWBS	Review
AC 20-161 (2008)	FAA	AMC for installation, operation, and airworthiness requirements for OBWBS	Review
accident reports	NTSB/NLR/BEA …	weight and balance related accident and serious incident	Review

WORKING GROUP RESULTS AS OF FEBRUARY 2017

Document type	Document title	Due date
EUROCAE EUR120-13/WG88-13	Feasibility Report of OBWBS standardisation (Internal EUROCAE deliverable)	finalised

Conclusion of this Feasibility Report:

This report concludes that standardization of On-Board Weight and Balance Systems specification is feasible and recommended.

DELIVERABLES

Note: see APPENDIX 1: EUROCAE document types.

Document type	Document title	Due date
ED-XXX	MOPS for Onboard Weight and Balance Systems (supporting the target date for ToR of EASA-RMT.0116, Q2/2018)	Q2/2018

The MOPS document will define the minimum specification to be met for primary and secondary onboard weight and balance systems.

The MOPS for On Board Weight and Balance Systems is foreseen to provide:

a) the definition of the functions that must be performed by a OBWBS

b) the possible modes of operation, the operational credit that can be foreseen (e.g. suppression of weight and trim sheet) and the required accuracy and reliability, depending on the mode of operation.

c) means to determine the required accuracy; for example, based on impact of erroneous weight and CG data on the take-off performances and handling qualities.

d) guidance to take into account the influence of environmental conditions (as e.g. wind, slope, temperature, and local gravity…) on the accuracy.

e) guidance on the display of information to the crew.

ENVISAGED USE OF DELIVERABLE(S)

The specification should define the required standard for the equipment necessary to establish the aircraft's weight and balance, to be used as a possible ETSO standard.

PARTNERSHIP AND COLLABORATION

The group may either work alone or in collaboration with an SAE committee and other groups as mentioned above.

Note: see APPENDIX 2 for co-ordination principles.

INPUT FOR CONSIDERATION

None.

SPECIFIC GUIDANCE AND MANDATORY REQUIREMENT(S);

WG-88 Chairperson and/or Secretary are required:

a. to provide the EUROCAE Secretary General and the Technical Programme Manager, within two weeks following each WG's meeting, a short summary (10 to 15 lines, bullet point presentation accepted) on the WG's progress including schedule elements;

b. to use the webspace provided by EUROCAE;

c. to specifically invite the EUROCAE General Secretariat (eurocae@eurocae.net) to the "comment resolution meeting" following the Open Consultation of documents planned for publication; and

d. to inform without delay the EUROCAE General Secretariat (eurocae@eurocae.net) of the WG's intentions when diverging from the TORs and provide reasons for such intention.

COMPLEMENTARY

As required.

WG TERMINATION

The sole deliverable of the WG will be development of MOPS. WG-88 is currently expected to be closed after the completion and publication of the document.

APPENDIX 1:

EUROCAE Documents (ED) categories and definitions

1. Minimum Aviation System Performance Specification (MASPS)

Describes and specifies the operational and/or functional requirements of a complete end-to-end system, which may include airborne, on-ground and space segments. It should provide a high level architecture describing the individual components, and should allocate between those components the performance, safety and interoperability requirements.

2. Operational Services and Environment Definition (OSED)

A standalone document equivalent to the part of a MASPS dedicated to the operational concept description: it provides the definition of the considered services and of the environment in which they have to be provided.

3. Safety and Performance Requirements (SPR) specification

A standalone document equivalent to the part of a MASPS dedicated to operational safety and performance issues: it provides an allocation of the requirements between the segments for the different approval types.

4. Interoperability (INTEROP) requirements specification

A standalone document equivalent to the part of a MASPS dedicated to interoperability issues between the different segments: for each of them, it identifies the technical interface and related functional requirements.

5. Process Specification **(PS)**

Specifies generic methods which are not specific to individual components, e.g. software or hardware development, environmental testing...

6. Minimum Operational Performance Specification (MOPS)

Specifies the performance of a component (piece of equipment, protocols, exchange formats,…) which is

the minimum necessary performance to satisfy a regulatory requirement. In particular, it specifies the tests to be made to ensure that the specified performance is achieved. Intended to be referenced by an ETSO

7. Technical Specification (TS)

Specifies performances of a component which reflects the best industrial practice.

8. Guidance Document (GD)

Amplifies the information contained in the types of documents described above. Usually illustrative information amplifying another EUROCAE document.

9. Report **(R)**

Describes results of Working Groups which are of general interest but not appropriate to publish in the form of a specification or similar document of the types described above.

APPENDIX 2:

Coordination principles

Liaison with other EUROCAE WGs

This type of "internal" collaboration is organized and harmonized at the General Secretariat level.

NOTE: To be considered that, through the inter-WGs collaboration, communication may be extended to EUROCAE standardization bodies' partners through existing coordination or joint partnership (in other words, work on specific domains may be conducted by a network including EUROCAE WGs and RTCA and/or SAE Committees).

Co-operation with other Standardization bodies.

Co-operation means working together, exchanging ideas and information … but not having at the end a word to word equivalent document (some differences could be acceptable in final developed documents as far as they are clearly identified (i.e. in documents Foreword) and not contradictory.

Joint EUROCAE WG and RTCA SC or SAE committees.

The partnership is complete and must result in a full equivalent document (only editorial differences such as document reference, Forward, Group membership …
With RTCA in particular, the objective is to conduct all specific development phases jointly and to address key milestones at the same time (Kick Off, Final TOR approval, Final initial draft validation, Open consultation and FRAC, approval by respective EUROCAE Council and RTCA PMC).

NOTE: EUROCAE and its partners must first agree on Intellectual and Copy Rights when co-developed documents have to be provided to other bodies (i.e. ICAO).