



The European Organisation for Civil Aviation Equipment
L'Organisation Européenne pour l'Équipement de l'Aviation Civile

MINIMUM AVIATION SYSTEM PERFORMANCE SPECIFICATION FOR CRITERIA TO DETECT IN-FLIGHT AIRCRAFT DISTRESS EVENTS TO TRIGGER TRANSMISSION OF FLIGHT INFORMATION

This document is the exclusive intellectual and commercial property of EUROCAE.

It is presently commercialised by EUROCAE.

This electronic copy is delivered to your company/organisation for internal use exclusively.

In no case it may be re-sold, or hired, lent or exchanged outside your company.

ED-237

February 2016

102 rue Etienne Dolet
92240 MALAKOFF, France
Web Site: www.eurocae.net

Documents
Te: 33 1 40 92 79 30
Fax: 33 1 46 55 62 65
Email: eurocae@eurocae.net
Document Sharing Hub

MINIMUM AVIATION SYSTEM PERFORMANCE SPECIFICATION FOR CRITERIA TO DETECT IN-FLIGHT AIRCRAFT DISTRESS EVENTS TO TRIGGER TRANSMISSION OF FLIGHT INFORMATION

This document is the exclusive intellectual and commercial property of EUROCAE.

It is presently commercialised by EUROCAE.

This electronic copy is delivered to your company/organisation for internal use exclusively.

In no case it may be re-sold, or hired, lent or exchanged outside your company.

ED-237

February 2016

FOREWORD

1. This document was prepared by EUROCAE Working Group 98 “Aircraft Emergency Locator Transmitters”, and was approved by the Council of EUROCAE on 22 February 2016.
2. EUROCAE is an international non-profit making organisation in Europe. Membership is open to manufacturers and users of equipment for aeronautics, trade associations, national civil aviation administrations, and, under certain conditions, non-European organisations. Its work programme is principally directed to the preparation of performance specifications and guidance documents for civil aviation equipment, for adoption and use at European and world-wide levels.
3. The findings of EUROCAE are resolved after discussion amongst Members of EUROCAE.
4. EUROCAE performance specifications and other documents are recommendations only. EUROCAE is not an official body of the European Governments. Its recommendations are valid as statements of official policy only when adopted by a particular government or conference of governments.
5. Copies of this document may be obtained from:

EUROCAE
102, rue Etienne Dolet
92240 MALAKOFF
France

Telephone: 33 1 40 92 79 30
Fax: 33 1 46 55 62 65
Email: eurocae@eurocae.net
Website: www.eurocae.net

TABLE OF CONTENTS

FOREWORD		1
CHAPTER 1 INTRODUCTION		1
1.1	PURPOSE AND SCOPE	1
1.2	GENERAL	1
1.2.1	BACKGROUND	2
1.3	DESCRIPTION OF CONTENT	3
1.4	OPERATIONAL APPLICATIONS	3
1.5	TRIGGERING SYSTEM	3
1.6	VERIFICATION PROCEDURES	4
1.7	MANDATING AND RECOMMENDATION PHRASES	4
1.8	COMMON DEFINITIONS AND ABBREVIATIONS	4
1.8.1	DEFINITION OF TERMS	4
1.8.2	ABBREVIATIONS	6
1.8.3	LIST OF REFERENCE DOCUMENTS	7
1.8.4	RELATED DOCUMENTS	7
CHAPTER 2 OVERALL SYSTEM		8
2.1	INTRODUCTION	8
2.2	MODEL DESCRIPTION	8
2.2.1	DESCRIPTION OF THE FUNCTION BLOCKS	9
CHAPTER 3 IN-FLIGHT DISTRESS EVENT DETECTION AND TRIGGERING CRITERIA PERFORMANCE		10
3.1	INTRODUCTION	10
3.2	TRIGGERING CRITERIA	10
3.2.1	SCENARIOS	10
3.2.2	PERSISTENCE TIME	10
3.2.3	AUTOMATIC CANCELLATION TRIGGER	11
3.2.4	NUISANCE TRIGGER	11
3.3	INTERFACE WITH TRIGGERED SYSTEM	11
3.3.1	INFORMATION IN THE TRIGGER	11
CHAPTER 4 PROCEDURES FOR PERFORMANCE REQUIREMENT VERIFICATION		12
4.1	INTRODUCTION	12
4.2	PERFORMANCE VERIFICATION OF TRIGGERING CRITERIA	12
4.2.1	VERIFICATION OF EVENT DETECTION RATE	12
4.2.2	VERIFICATION OF NUISANCE TRIGGER RATE	13
4.2.3	VERIFICATION OF CANCELLATION CASES AND ERRONEOUS CANCELLATIONS	13
APPENDIX 1 DATABASE INFORMATION		14
APPENDIX 2 BEA COMMITMENT TO MAKE AVAILABLE		19
APPENDIX 3 WG-98 MEMBERSHIP		21
IMPROVEMENT SUGGESTION FORM		24

LIST OF FIGURES

FIGURE 2.1: IN-FLIGHT EVENT DETECTION AND TRIGGERING CRITERIA SYSTEM MODEL		8
--	-------	---

CHAPTER 1

INTRODUCTION

1.1 PURPOSE AND SCOPE

This document defines the minimum specification to be met for criteria which can be used to detect an in-flight aircraft distress event and to trigger the transmission of sufficient information for the purpose of locating an accident site. It only specifies characteristics that are relevant to the logic used for event detection and trigger activation/cancellation. These characteristics should be useful as guidance material to regulatory authorities, designers, installers, manufacturers, service providers and users of systems intended for operation.

Compliance with these specifications is recommended as one means of assuring that the criteria will meet the intended function(s) satisfactorily under the specific conditions encountered in distress conditions, as well as under conditions normally encountered in routine aeronautical operations for the environments intended. The MASPS may be implemented by one or more regulatory documents and/or advisory documents (for example certifications, authorisations, approvals, commissioning, advisory circulars, notices) and may be implemented in part or in total. Any regulatory application of this document is the sole responsibility of appropriate governmental authorities.

1.2 GENERAL

A number of fatal accidents have occurred in which:

- ELTs have not operated efficiently, have been destroyed during the impact or just after due to a post-impact fire or have been submerged into water strongly jeopardizing the efficacy of the rescue missions.
- It has taken a significant amount of time to locate wreckage, and thus recover flight recorders, or they have been unrecoverable, greatly reducing the likelihood of the actual cause of these accidents being discovered.

Given the unpredictable nature of aircraft accidents and the inherent difficulty of reliably providing a distress signal once an aircraft has impacted the Earth, the concept of in-flight detection of an imminent accident, and transmission of a distress signal and/or flight data prior to the impact, is considered as a way to significantly improve the determination of the location of the accident site and the effectiveness of the rescue mission.

The triggered transmission of flight information based on real-time analysis of flight parameters by on-board equipment is a well-established mechanism. Such systems have already been developed and deployed with airlines for maintenance and monitoring purposes.

The concept of in-flight aircraft distress event detection and triggering of transmission of flight information consists of:

- Using flight parameters to detect whether an accident situation is likely. If so,
- Broadcasting aircraft position, or distinctive distress signals from which the position can be derived, until either the emergency situation ends, or the aircraft impacts the surface, to localize the position of the aircraft in distress.

The overall objective of this specification is to make sure that the criteria used to trigger in-flight transmission maximises the probability of in-flight detection of an upcoming catastrophic event and minimises the probability of nuisance activation.

This MASPS is intended to define in-flight aircraft distress event detection and triggering criteria that can be used to activate the transmission of information used to locate an aircraft that is experiencing an event that, if left uncorrected, would likely result in an accident. Similar logic also applies to the detection of the return to normal flight and triggering the notification of the end of the distress condition.

However, this MASPS does not define the mechanism or technology used to perform the transmission, or the content of that information. It is performance-based and does not preclude the development of new architecture.

This MASPS focuses on transport category aeroplanes above 27,000 kg. Therefore, using this MASPS for aircraft in other categories will require evaluation of the applicability of the specifications in this document.

1.2.1 **Background**

1.2.1.1 ICAO Activities

ICAO published a Concept of Operations (ConOps) document that specifies the high level requirements and objectives for a Global Aeronautical Distress and Safety System (GADSS). It was intended to apply to commercial air transport operations (Annex 6, Part I applicability) initially. However, the GADSS document takes an overall system approach and consequently is not restrictive to a particular type of operation. The implementation of this target concept has implications for the provision of services such as air traffic control, Search And Rescue and accident investigation.

Responding to the requirements and objectives, the GADSS specifies a high level system with a description of users and usages of flight track information during all phases of flight, both normal and abnormal flight conditions including timely and accurate positioning of an aircraft in distress. The GADSS does not prescribe specific technical solutions for aircraft tracking but provides a framework of scenarios that can be used to verify whether a specific solution complies with the Concept. The GADSS includes a roadmap outlining the steps necessary to move from today's system to the target concept.

The implementation of this GADSS shall in particular enhance the ability to rescue survivors and ensure that the location of an accident site can be identified to a degree of accuracy, in a timeframe and to a level of confidence acceptable to the stakeholders.

As a consequence, aircraft in compliance with the GADSS concept shall have the capability to transmit information that can be used to derive the aircraft position and assist the Search And Rescue services and accident investigation authorities in locating the wreckage and flight recorders.

One of the main system components is the development of an Autonomous Distress Tracking (ADT) System. The intent of this ADT System is to use on-board systems that can detect an emergency situation and broadcast position, or distinctive distress signals from which the position can be derived, on protected frequencies and, depending on its application on each aircraft, to be automatically activated or manually activated at any time.

In case of false alarm or recovery from a distress phase, the ADT needs to be deactivated. However, the deactivation can only be done by the activating mechanism.

ADT operates independently from aircraft tracking and may be activated in case of failure, or risk of failure, of the related aircraft tracking systems.

The performance specifications for the in-flight event detection and triggering criteria to be used are detailed in this MASPS.

1.2.1.2 COSPAS-SARSAT Activities

Cospas-Sarsat is implementing a new MEOSAR system based on the use of Search And Rescue transponders on new GPS, GLONASS, and GALILEO satellites and accompanied by a new ground segment. This new MEOSAR system will significantly improve the timeliness and accuracy of alerts provided by ELTs and allow for new services to be provided (e.g. return link services). In conjunction with the new MEOSAR system, Cospas-Sarsat is developing a new second-generation beacon specification which would be designed to take better advantage of the new MEOSAR system. The new location determination methodology used for the MEOSAR System will also allow revisiting some of the current beacon requirements such as first burst delay, burst repetition rates and antenna characteristics, to take advantage of the enhanced capability of MEOSAR to provide an early location.

The MEOSAR system will provide several possible transmission paths for relaying data to the ground segment and therefore be less susceptible to ELT antenna orientation. Furthermore, an ELT transmission containing an encoded location would have a high probability of being relayed to the ground system via at least one of the many satellite paths available even if the aircraft is in an unusual orientation.

Effectively, this means that the MEOSAR system might be able to offer two robust independent methods for forwarding an aircraft position to Rescue Coordination Centre (RCCs) prior to an aircraft accident i.e. using triangulation measurements and via the transmission of an encoded location. This could significantly reduce the nuisance rate of ELTs and enhance SAR and recovery operations in many aviation-related distress events.

A number of recommendations resulted from the studies conducted by accident investigation bodies. In particular, it was recommended that EASA and ICAO define the regulatory requirements for a new generation of ELTs that can be triggered in-flight.

In parallel to the development of this document, the ED-62A Minimum Operational Performance Specifications have been improved to detail the specifications for second generation ELTs.

1.3 DESCRIPTION OF CONTENT

Chapter 1 of this document describes the in-flight aircraft distress event detection and triggering criteria system and provides information helpful to understanding the rationale for the system characteristics. This chapter describes typical applications, operational goals and establishes the basis for the specifications provided in Chapters 2 through 4 of the document. Definitions and assumptions essential to a proper understanding of this document are also provided in this chapter.

Chapter 2 describes the overall in-flight aircraft distress event detection and triggering criteria system.

Chapter 3 contains the minimum performance specifications for in-flight aircraft distress event detection and triggering criteria logic and the list of potential in-flight triggering criteria. These specifications specify the required performance under the standard environmental conditions described.

Chapter 4 describes the verification procedures to verify that criteria performance compliance meets the minimum performance requirements in Chapters 2 and 3.

1.4 OPERATIONAL APPLICATIONS

The in-flight aircraft distress event detection and triggering criteria logic intend to support Search And Rescue operations and accident investigations.

The benefit for airlines of such systems may be to establish the existence of a distress condition and determine location of the affected aircraft almost instantaneously.

1.5 TRIGGERING SYSTEM

The triggering system may consist of one or more physical devices. At least one of these devices must host the in-flight aircraft distress event detection and triggering criteria logic described within this MASPS. The triggering system should make the result of the triggering logic available to systems that would transmit information to be used to locate an aircraft that has experienced an accident.

Systems that can potentially transmit flight information include but are not limited to second-generation ELT or other systems (e.g. ACARS, ADS-B...). The system used to transmit the flight information while an aircraft is in a distress condition may have to comply with requirements defined in regulatory documents such as ICAO Annex 6.

1.6 VERIFICATION PROCEDURES

The verification procedures specified in this document are intended to be used as guidance for demonstrating that the in-flight aircraft distress event detection and triggering logic meets the performance requirements. Although specific test procedures are cited, it is recognised that other methods may be used. Alternate procedures may be used if it can be demonstrated that they provide at least equivalent performance.

1.7 MANDATING AND RECOMMENDATION PHRASES

- a. "Shall"
The use of the word "Shall" indicates a mandated criterion; i.e. compliance with the particular procedure or specification is mandatory and no alternative may be applied.
- b. "Should"
The use of the word "Should" or "May" (and phrases such as "It is recommended that...", etc.) indicates that although the procedure or criterion is regarded as the preferred option, alternative procedures, specifications or criteria may be applied, provided that the manufacturer, installer or tester can provide information or data to adequately support and justify the alternative.

1.8 COMMON DEFINITIONS AND ABBREVIATIONS

The definitions and abbreviations of ICAO Annex 5, Annex 6, Annex 8, Annex 10 and Annex 13 are applicable at the time this document is published.

1.8.1 DEFINITION OF TERMS

The following definitions are provided for the terms that are used in this document.

- | | |
|----------|---|
| Accident | <p>(ICAO Annex) An occurrence associated with the operation of an aircraft which, in the case of a manned aircraft, takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to move with the purpose of flight until such time as it comes to rest at the end of the flight and the primary propulsion system is shut down, in which:</p> <ol style="list-style-type: none"> a) a person is fatally or seriously injured as a result of: <ul style="list-style-type: none"> — being in the aircraft, or — direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or — direct exposure to jet blast, <p>except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew; or</p> b) the aircraft sustains damage or structural failure which: <ul style="list-style-type: none"> — adversely affects the structural strength, performance or flight characteristics of the aircraft, and — would normally require major repair or replacement of the affected component, |
|----------|---|

except for engine failure or damage, when the damage is limited to a single engine, (including its cowlings or accessories), to propellers, wing tips, antennas, probes, vanes, tires, brakes, wheels, fairings, panels, landing gear doors, windscreens, the aircraft skin (such as small dents or puncture holes), or for minor damages to main rotor blades, tail rotor blades, landing gear, and those resulting from hail or bird strike (including holes in the radome); or

c) the aircraft is missing or is completely inaccessible.

NOTE 1: *For statistical uniformity only, an injury resulting in death within thirty days of the date of the accident is classified, by ICAO, as a fatal injury.*

NOTE 2: *An aircraft is considered to be missing when the official search has been terminated and the wreckage has not been located.*

NOTE 3: *The type of unmanned aircraft system to be investigated is addressed in 5.1 of ICAO Annex 13.*

NOTE 4: *Guidance for the determination of aircraft damage can be found in ICAO Annex 13 Attachment F.*

Aircraft	Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface (ICAO Annex).
Certification	Legal recognition by a Certification Authority that a product, service, organisation or person complies with the applicable requirements. Such certification comprises the activity of technically checking the product, service, organisation or person and the formal recognition of compliance with the applicable requirements by issue of a certificate, licence, approval or other documents as required by national laws and procedures. In particular, certification of a product involves: a) the process of assessing the design of a product to ensure that it complies with a set of standards applicable to that type of product so as to demonstrate an acceptable level of safety, b) the process of assessing an individual product to ensure that it conforms with the certificated type design, c) the issue of a certificate required by national laws to declare that compliance or conformity has been found with applicable standards in accordance with items (a) or (b) above.
Certification Authority	The organization or person responsible within the state or country concerned with the certification of compliance with applicable requirements.
In-flight distress event	A situation which, if left uncorrected, is likely to result in an accident.