



WORKING PAPER

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COMMITTEE A

Agenda Item 4: Implementing the global air navigation system and the role of planning and implementation regional groups (PIRGs)

4.4: Implementing search and rescue (SAR) processes and procedures

IMPLEMENTING SEARCH AND RESCUE (SAR) PROCESSES

(Presented by Austria on behalf of the European Union and its Member States and the other Member States² of the European Civil Aviation Conference³ and by EUROCONTROL)

EXECUTIVE SUMMARY

This paper presents the last amendment of Annex 6 — *Operation of Aircraft* with implementation of new Standards in support of the Global Aeronautical Distress and Safety System (GADSS) and their consequences in terms of Search and Rescue (SAR) effectiveness. It highlights that the new Standards if improving the situation for accidents over water, provide less accuracy than the previous automatic emergency locator transmitters (ELTs) in case of an accident over terrain especially in mountainous areas. And urges for a review of Annex 6 so as to include a performance-based Standard for adequate crash localisation capability to ensure a more accurate localization of the wreckage and survivors after an accident occurring over terrain.

Action: The Conference is invited to agree to the recommendation in paragraph 3.2.

1. INTRODUCTION

1.1 Search and Rescue (SAR) processes are effective if the location of an accident site is determined with accuracy. The implementation of new Standards relating to the location of an aeroplane in distress in support of the Global Aeronautical Distress and Safety System (GADSS) will significantly improve the capability to search for and locate an aircraft after an accident occurring above water.

¹ English, Arabic, Chinese, French, Russian and Spanish versions provided by Austria.

² Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

³ Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Iceland, Moldova, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland, The former Yugoslav Republic of Macedonia, Turkey and Ukraine.

1.2 This new Standard has replaced the Standard for automatic emergency locator transmitter (ELT), which has been shown to be relatively ineffective in case of an aircraft accident into water. However, an automatic ELT remains a highly effective means to precisely locate survivors after an accident occurring over terrain, even when the new means to locate an aeroplane in distress which is still in-flight are activated. Annex 6 — *Operation of Aircraft, Part I — International Commercial Air Transport — Aeroplanes* should be amended with a performance based Standard to precisely locate survivors, which allows the same or better level of performance, reliability and interoperability than ELT during SAR operations.

2. DISCUSSION

2.1 Post Flight Localization in the GADSS Concept

2.1.1 One of the main components of the GADSS concept is Post Flight Localization. When an accident occurs, a phase immediately begins at the end of flight where the rescue of possible survivors has the immediate and highest priority. When technically feasible, and in particular when the aircraft is not in water, accurate aircraft position information allowing to determine accurately the point of end of flight was historically provided by means of the post flight localization function of an ELT (including homing signal) to guide SAR services on site. To assist in the localization of survivors after an accident, the post flight localization function specified a number of requirements for ELTs included in previous ICAO Annex 6 provisions.

2.2 Amendment of Annex 6

2.2.1 Annex 6 was amended in 2016 with new Standards for location of aeroplane in distress resulting from the GADSS concept. At the same time, the Standard for the installation of an automatic ELT was downgraded to a Recommendation status. The new Standard for the location of an aeroplane in distress mandates the transmission of sufficient information to determine the position of the aeroplane once a minute when in-distress and still in-flight. Based on the results of the work of an international WG led by the BEA in the scope of the AF447 Rio-Paris safety investigation, this one-minute interval transmission may permit location of an aeroplane wreckage within 6 NM from the last reported position in 95% of the cases. This new Annex 6 Standard covers the issue raised by AF447 and MH370 but is less demanding than the previous Standard concerning ELTs to precisely locate survivors after an accident on ground. With such amendments, the Annex 6 Standard for Post Flight Localization, which required an automatic ELT no longer exists. The capability to locate the wreckage and survivors, with very high accuracy when the aircraft is not in water, is significantly diminished. The performance of SAR depends largely on the organization of SAR services and preparations undertaken before any SAR operations take place but the crucial issue is to accurately determine the location of the end point of the flight and allow efficient consecutive SAR operations

2.2.2 These Annex 6 amendments, with the removal of the automatic ELT Standard, were proposed by the Air Navigation Commission in 2015 in the aftermath of the MH370 disappearance, during the final review after a letter to States. The focus was on developing new provisions to prevent cases such as the MH370 disappearance.

2.2.3 The European Aviation Safety Agency (EASA) submitted WP/12 to the last Flight Operations Panel (FLTOSP/WG/5 at Montréal from 7 to 11 May 2018) with the same aim to amend Annex 6, Part I. It was also considered by EASA that the means to locate an aeroplane in distress may improve the likelihood that an alert is transmitted (e.g. when the ELT antenna is destroyed during the accident). However, in the case of survivable accidents, its 6 NM accuracy is insufficient to ensure timely

assistance to survivors whereas the automatic ELT could provide a much more accurate location. Removing the carriage requirement for automatic ELTs reduces the probability that occupants surviving a crash are rescued in a timely manner, unless another system on-board the aircraft offers adequate performance for search and rescue purposes.

2.3 Analysis of past events

2.3.1 It is often thought that ELTs do not work during a public transport accident sequence. It should be remembered that these ELTs were designed to allow SAR services to find the site of an accident with survivors. These ELTs do not work, as per design, in non-survivable high impact force accidents. Nevertheless, ELTs have proved their usefulness, as illustrated in the table below. In addition, ELT integral/internal antennas authorize the transmission of the 406 MHz signal and homing even if the cable to the external antenna is broken. This type of antenna has shown the robustness of the ELT on the MH17 event over Ukraine.

2.3.2 A list of accidents for which accident investigation authorities issued a number of safety recommendations addressed to ICAO for the installation of automatic ELTs or for which ELT activation assisted in finding the accident site is provided herewith. The ELTs are designed to precisely locate survivors by combining satellite based localization and a ground homing capability. This capability could not be replaced by a system transmitting a signal once a minute while in-flight and providing a position within 6 NM. This 6 NM precision will not be satisfactory enough in mountainous areas.

Aircraft type	Registration	Operator	Location	Date	Fatal	Survivors	Information on accident and ELT activation
Airbus A320	F-GGED	Air Inter	Mont Saint Odile (France)	20/01/1992	87	9	9 survivors found in mountains 4 hours after the crash. 6 lives could have been saved if rescue had been on site in 30 minutes (2 lives in 2 hours). Crash site located ~1 Km from last reported point. Search area was 21 km ² . No ELT installed.
Avro-146 RJ85	CP2933	LaMia	9 NM from Medellin airport (Colombia)	26/11/2016	71	6	Fuel exhaustion, 10 NM from the airport. Heavy fog prevented air SAR. ELT detected and located.
Boeing 737-800	TC-JGE	Turkish Airlines	1.5 km from Schiphol airport (Netherlands)	25/02/2009	9	120	ELT detected and located.
Boeing 777-28EER	HL7742	Asiana Airlines	San Francisco airport (US)	06/07/2013	3	214	ELT detected and located.
Boeing 777-2H6ER	9M-MRD	Malaysia Airlines	Over Ukraine	17/07/2014	298		ELT detected and located. The ELT was triggered during the in-flight break-up sequence and on-ground later on thanks to the ELT internal antenna.

2.4 Increased survivability of ELTs and MEOSAR detection capabilities

2.4.1 Cospas-Sarsat is implementing a new MEOSAR (Medium Earth Orbit for SAR) 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 provides near-instantaneous detection of ELTs and significantly improves the timeliness and accuracy of alerts provided by ELTs. Improved specifications for new generation ELTs are currently being developed by the joint EUROCAE/RTCA WG (ED-62B/DO-204B). Thanks to NASA studies and trials, the specifications include increased survivability of ELTs during an impact sequence. The specifications permitted the development of new ELT(DT), compliant with the location of an aeroplane in distress Standards, with improved crash survivability, homing and integral/internal antenna. The EUROCAE WG has already published the specifications document for *Criteria to Detect In-Flight Aircraft Distress Events to Trigger Transmission of Flight Information* (ED-237). This document is already referenced by Annex 6 to start the in-distress sequence of the flight.

3. CONCLUSION AND RECOMMENDATION

3.1 The new Annex 6 Standard for the location of an aeroplane in distress covers the issue raised by AF447 and MH370 but provides a lower accuracy than the previous Standard on ELTs to precisely locate survivors after an accident occurring over terrain..

3.2 Annex 6, Part I should then be reviewed to include a performance-based Standard for adequate crash localisation capability to ensure a more accurate localization of the wreckage and survivors after an accident occurring over terrain in support of effective and efficient SAR operations.

Recommendation 4.4/xx: Search And Rescue (SAR) and the Global Aeronautical Distress and Safety System (GADSS)

That the Conference request ICAO to review aircraft equipment related Standards, in order to ensure that aeroplanes are equipped with robust and automatic means to accurately determine the location of the end of flight point for an effective SAR response following an accident over terrain.

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