International Civil Aviation Organization

Middle East Air Navigation Planning and Implementation Regional Group

Fifteenth Meeting (MIDANPIRG/15)
(Bahrain, 8 – 11 June 2015)

Agenda Item 5.2.2: Specific Air Navigation issues

SEARCH AND RESCUE

(Presented by the Secretariat)

SUMMARY

This paper presents the global and regional developments related to Search and Rescue and seeks support for the improvement of SAR services in the MID Region.

Action by the meeting is at paragraph 3.

REFERENCES

- ANSIG/1 Report
- ATM SG/1 Report
- DGCA-MID/3 Report
- HLSC 2015

1. INTRODUCTION

1.1 The Standards, Recommended Practices and Procedures and guidance material related to the implementation of Search and Rescue (SAR) are contained in ICAO Annex 12, International Aeronautical and Maritime Search and Rescue Manual (IAMSAR - Doc 9731).

1.2 It is to be highlighted that the updating process of the IANSAR-Doc 9731 is ongoing and the new amendment is expected to be released in 2016.

2. DISCUSSION

2.1 The meeting may wish to note that the Third meetings of the Directors General – Middle East (DGCA-MID/3) (Doha, Qatar, 27-29 April 2015) was apprised of the global and regional developments related to the SAR.

Regional SAR Issues

2.2 The DGCA-MID/3 meeting underlined that many deficiencies related to Search and Rescue (SAR) have not been eliminated since many years. The meeting noted that the SAR deficiencies in the MID Region concern mainly the following:

a) lack of signature of SAR agreements;
b) lack of plans of operations for the conduct of SAR operations and SAR exercises;
c) training of SAR personnel and SAR inspectorate staff;
d) lack of provision of required SAR services; and
e) non-compliance with the carriage of Emergency Locator Transmitter (ELT) requirements.

2.3 Based on the above, the DGCA-MID/3 meeting urged States to take necessary measures to ensure the implementation of the ICAO provisions related to SAR.

2.4 The ANSIG/1 meeting noted that the ATM SG/1 meeting established a MID SAR Action Group (SAR AG) composed of SAR Experts from volunteer States and ICAO to develop a draft simplified SAR bilateral Arrangements Template to be used by the adjacent ACCs in the MID Region. The meeting agreed to attach the Template developed by the SAR AG to the ACC Letter of Agreement Template, which will be presented to MIDAMIPRG/15 for endorsement.

2.5 The DGCA-MID/3 meeting was apprised of the outcome of the ICAO/International Maritime Organization (IMO) Search and Rescue-Global Maritime Distress and Safety System Conference (ICAO/IMO SAR GMDSS Conference), which was successfully held in Bahrain 21-22 October 2014, for the Gulf Cooperation Council (GCC) States. The Conference provided a forum for sharing experiences and discussing relevant matters to SAR between Civil/Military Aeronautical and Maritime representatives.

2.6 The DGCA-MID/3 meeting urged States to take into consideration the Recommendations, at **Appendix A**, emanating from the ICAO/IMO SAR GMDSS related to civil aviation, when planning for or implementing SAR services.

2.7 The DGCA-MID/3 meeting noted that ACAC and ICAO were planning to organize a joint SAR Workshop in Morocco, in May 2015, back-to-back with a full scale exercise. However, due to unforeseen reasons, ICAO was informed that the Workshop could not be organized jointly. Accordingly, it was agreed that the ICAO MID Regional Office schedule a SAR Regional Workshop in 2016, which might be held jointly with the International Maritime Organization (IMO) to foster the implementation of SAR provisions in the MID Region and enhance cooperation between concerned stakeholders. In this respect, the DGCA-MID/3 meeting encouraged States to actively participate in the planned workshop and ensure that their delegations are composed of Civil/Military Aeronautical and Maritime representatives involved in SAR.

2.8 The DGCA-MID/3 meeting recognized the importance of the conduct of regional/sub-regional SAR training exercises and noted that the ANSIG/1 agreed to propose the following Draft Decision to MIDANPIRG/15:

Why	To foster the implementation of SAR provisions in the MID Region and enhance cooperation between concerned stakeholders
What	Action plan for the conduct of regional/sub-regional SAR training exercises
Who	ATM SG/2 meeting
When	December 2015

DRAFT DECISION 1/8: MID REGIONAL/SUB-REGIONAL SEARCH AND RESCUE TRAINING EXERCISES

That, the ATM Sub-Group develop an action plan for the conduct of regional/sub-regional SAR training exercises

Global Flight Tracking

2.9 The DGCA-MID/3 meeting was apprised of the developments related to global flight tracking, which were initiated following the disappearance of the Malaysia Airlines Flight MH370. The meeting noted that the Air Navigation Commission, at the third meeting of its 198th Session held on 29 January 2015, considered a proposal for amendment of Annex 6 — *Operation of Aircraft*, Part I — *International Commercial Air Transport — Aeroplanes*, to develop a performance-based aircraft tracking requirement, and authorized its transmission to Contracting States and relevant international organizations, for comment.

2.10 The proposed amendments, which are aligned with the Global Aeronautical Distress and Safety System (GADSS) concept of operations and the performance criteria identified in the Aircraft Tracking Task Force (ATTF) Report, have been prepared as a matter of urgency, as recommended by the HLSC 2015. The GADSS and ATTF Report are available as attachments to the HLSC 2015-WP/2 and WP/11, respectively, on the HLSC 2015 website: (http://www.icao.int/Meetings/HLSC2015/Pages/WorkingPapers.aspx).

2.11 The proposed amendments were circulated by ICAO through State Letter Ref.: AN 11/1.1.29-15/12 dated 25 February 2015, requesting States to provide their comments on the proposed amendments, not later than 15 May 2015. The applicability date of the proposed amendments is 10 November 2015.

2.12 The DGCA-MID/3 meeting noted the concerns raised by States related to the installation cost of the technologies supporting the flight tracking and their associated costs such as training, new regulations, etc. In the same vein, it was highlighted that other alternatives should be explored in case some air operators were unable to equip their aircraft with flight tracking capabilities, such as compulsory position reporting, civil/military coordination, etc.

2.13 Based on the above, the DGCA-MID/3 meeting urged States to:

a) review the proposed amendments and provide their comments to ICAO by 15 May 2015; and

b) take necessary measures to implement the recommendations/requirements included in the GADSS and ATTF Report.

2.14 The DGCA-MID/3 meeting noted Sudan's concerns related to the installation and maintenance of equipment and the challenges they are facing due to the embargo imposed on Sudan.

2.15 The meeting may wish to note that a proposal for amendment to Annex 6, Parts I, II and III relating to carriage requirements of flight recorders was circulated to States through the ICAO State Letter Ref.: SP 55/4-15/15 dated 15 May 2015. The amendment proposals to Annex 6, at **Appendix B**, introduce:

a) **automatic deployable flight recorders (ADFRs)**: to provide a definition for ADFRs and provisions for the carriage of ADFRs. The amendment proposal includes a performance-based alternative for the carriage of ADFRs. Guidance material is included in Attachment XX on flight data recovery to assist States approve equipage variations for performance-based alternate means of compliance;

b) **extended duration cockpit voice recordings**: to provide provisions to extend the duration of CVR recordings to twenty-five hours to increase the availability of CVR recordings for accident and incident investigations; and

c) **location of an aeroplane in distress**: to include performance-based provisions in Annex 6, Part I for means to locate an aeroplane in distress. The proposal includes an amendment to the provisions for emergency locator transmitters (ELT) and guidance material (Attachment YY refers) for the implementation of the location of an aeroplane in distress. Additionally, with reference to Table XX-1 on events that activate the autonomous transmission of position information in Appendix XX, a current draft of the EUROCAE Minimum Aviation System Performance Specification (MASPS) ED-237, being developed by EUROCAE WG-98, is provided in English as Attachment E to the electronic version of this State letter.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) encourage Sates and Users to:

   i. take into consideration the Recommendations emanating from the ICAO/IMO SAR GMDSS Conference related to Civil Aviation at **Appendix A** and the Montréal Declaration on Planning for Aviation Safety Improvement (February 2015)- Recommendation 1/2 related to SAR;

   ii. attend the ICAO SAR Workshop planned for 2016;

   iii. provide ICAO with their comments to the proposed amendment to annex 6, at **Appendix B** (State Letter Ref.: SP 55/4-15/15 dated 15 May 2015 refers);

b) review and update:

   i. the Status of SAR agreements between ANSPs at **Appendix C**;

   ii. the list of SAR Point of Contact (SPOC) for the reception of the COSPAS-SARSAT messages at **Appendix D**; and

   iii. the list of SAR focal points in the MID Region at **Appendix E**; and

c) agree to the Draft Decision at para 2.8, to support the conduct of regional/sub-regional SAR training exercises.

APPENDIX A

THE MAIN RECOMMENDATIONS EMANATING FOR THE ICAO/IMO SAR GMDSS CONFERENCE RELATED TO CIVIL AVIATION, INVITING GCC STATES TO:

- provide IMO and ICAO with information related to the availability of SAR services, including information on the areas of responsibility, taking into account IMO's and ICAO provisions, as soon as possible if not already done so, and keep the information up to date on a regular basis;
- noting that close cooperation between maritime and aeronautical SAR services is essential, establish a national SAR Coordinating Committee;
- develop a national SAR Plan, to the extent possible, ensuring harmonization with SAR Plans of the neighboring States, for the benefit of effective and efficient SAR cooperation;
- consider the development of a multilateral agreement on the cooperation of aeronautical and maritime SAR and the establishment of a Regional SAR Coordinating Committee, in the framework of the GCC;
- sign the SAR Letters of Agreement (LoAs) to facilitate and expedite the efficient conduct of SAR operations;
- evaluate SAR and GMDSS facilities and identify actions to be taken to improve the existing situation, including the establishment of Rescue Coordination Centres, as appropriate;
- keep record of all SAR activities and as such built up statistics for national use as well to be used in communication with IMO and ICAO, as appropriate;
- share lessons learned related to SAR activities;
- develop a short and long term programme for training of SAR personnel, including those involved in the oversight of SAR;
- conduct national, bilateral and multilateral SAR exercises and use lessons learned to identify capacity building needs; and
- request, as appropriate, either individually or in cooperation with other GCC States, IMO and/or ICAO to provide technical assistance, in particular to:

  a) assess the existing situation and provide recommendations for improvement; and

  b) support the training of personnel involved in SAR.

International Civil Aviation Organization | Organisation de l'aviation civile internationale | Organización de Aviación Civil Internacional | Международная организация гражданской авиации | منظمة الطيران المدني الدولي | 国际民用航空组织

Tel.: +1 514-954-8219 ext. 6260

Ref.: SP 55/4-15/15 15 May 2015

Subject: Proposals for the amendment to Annex 6, Parts I, II and III relating to carriage requirements of flight recorders

Action required: Comments to reach Montréal by 14 August 2015

Sir/Madam,

1. I have the honour to inform you that the Air Navigation Commission, at the third meeting of its 198th Session held on 29 January 2015, considered proposals developed by the Secretariat with the assistance of the seventh meeting of the Flight Recorder Panel (FLIRECP/7) to amend the Standards and Recommended Practices (SARPs) in Annex 6 — *Operation of Aircraft*, Part I — *International Commercial Air Transport — Aeroplanes*, Part II — *International General Aviation — Aeroplanes* and Part III — *International Operations — Helicopters*, relating to flight recorders, and authorized their transmission to Contracting States and appropriate international organizations for comments.

2. The proposed amendments are aligned with the Global Aeronautical Distress and Safety System (GADSS) concept of operations. Additional background information concerning the proposals is provided in Attachment A. The GADSS report is available as HLSC/15-WP/2 on the HLSC 2015 website (http://www.icao.int/Meetings/HLSC2015/Pages/WorkingPapers.aspx).

3. The proposed amendments, contained in Attachments B, C and D herein, introduce new Standards and Recommended Practices on automatic deployable flight recorders (ADFR), extended duration of cockpit voice recordings (CVR) and location of an aeroplane in distress.

4. In examining the proposed amendments, you should not feel obliged to comment on editorial aspects as such matters will be addressed by the ANC during its final review of the draft amendments.

5. May I request that any comments you wish to make on the amendment proposals be dispatched to reach me not later than 14 August 2015. The Air Navigation Commission has asked me to specifically indicate that comments received after the due date may not be considered by the Commission

and the Council. In this connection, should you anticipate a delay in the receipt of your reply, please let me know in advance of the due date.

6. For your information, the proposed amendments to Annex 6, Parts I, II and III are envisaged for applicability on 10 November 2016. Any comments you may have thereon would be appreciated.

7. The subsequent work of the ANC and the Council would be greatly facilitated by specific statements on the acceptability or otherwise of the proposals. Please note that for the review of your comments by the ANC and the Council, replies are normally classified as “agreement with or without comments”, “disagreement with or without comments” or “no indication of position”. If in your reply the expressions “no objections” or “no comments” are used, they will be taken to mean “agreement without comment” and “no indication of position”, respectively. In order to facilitate proper classification of your response, a form has been included in Attachment F which may be completed and returned together with your comments, if any, on the proposals in Attachments B, C and D.

Accept, Sir/Madam, the assurances of my highest consideration.

Raymond Benjamin
Secretary General

Enclosures:

A — Background
B — Proposed amendment to Annex 6, Part I
C — Proposed amendment to Annex 6, Part II
D — Proposed amendment to Annex 6, Part III
E — Draft EUROCAE ED-237
F — Response form

BACKGROUND

1. The seventh meeting of the Flight Recorder Panel (FLIRECP/7) reconsidered automatic deployable flight recorders, extended duration of cockpit voice recorder recordings and the location of accident site proposals. At the request of the Air Navigation Commission (ANC), the Secretariat, supported by an ad-hoc working group of flight recorder and aircraft systems experts, developed additional proposals for performance-based ADFR provisions.

2. The proposed amendments, as modified by the discussions of the Commission, are contained in Attachments B, C and D. The amendment proposals to Annex 6 introduce:

a) **automatic deployable flight recorders (ADFRs)**: to provide a definition for ADFRs and provisions for the carriage of ADFRs. The amendment proposal includes a performance-based alternative for the carriage of ADFRs. Guidance material is included in Attachment XX on flight data recovery to assist States approve equipage variations for performance-based alternate means of compliance;

b) **extended duration cockpit voice recordings**: to provide provisions to extend the duration of CVR recordings to twenty-five hours to increase the availability of CVR recordings for accident and incident investigations; and

c) **location of an aeroplane in distress**: to include performance-based provisions in Annex 6, Part I for means to locate an aeroplane in distress. The proposal includes an amendment to the provisions for emergency locator transmitters (ELT) and guidance material (Attachment YY refers) for the implementation of the location of an aeroplane in distress. Additionally, with reference to Table XX-1 on events that activate the autonomous transmission of position information in Appendix XX, a current draft of the EUROCAE Minimum Aviation System Performance Specification (MASPS) ED-237, being developed by EUROCAE WG-98, is provided in English as Attachment E to the electronic version of this State letter.

3. These issues were considered in the light of recent accidents, including the disappearance of Malaysia Airlines flight MH370. Considering ADFRs and location of an aeroplane in distress, a multidisciplinary ad-hoc working group was tasked to develop a draft concept of operations on flight tracking with a clear definition of the objectives of flight tracking, ensuring that information is provided in a timely fashion to the correct persons to support search and rescue, recovery and accident investigation activities. The concept should also include the roles and responsibilities of all stakeholders. As a result, the Global Aeronautical Distress and Safety System (GADSS) was developed.

4. Some costs may be incurred by aircraft operators/owners as they may have to equip new aircraft with updated flight recorder or other systems. However, these costs will be off-set by search and rescue (SAR) costs.

5. The proposals are followed by rationales supporting the amendments and are intended to facilitate their consideration by States and international organizations.

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ATTACHMENT B to State letter SP 55/4-15/15

PROPOSED AMENDMENT TO ANNEX 6, PART I

NOTES ON THE PRESENTATION OF THE PROPOSED AMENDMENT

The text of the amendment is arranged to show deleted text with a line through it and new text highlighted with grey shading, as shown below:

1.	~~Text to be deleted is shown with a line through it.~~	text to be deleted
2.	New text to be inserted is highlighted with grey shading.	new text to be inserted
3.	~~Text to be deleted is shown with a line through it~~ followed by the replacement text which is highlighted with grey shading.	new text to replace existing text

PROPOSED AMENDMENT TO

**INTERNATIONAL STANDARDS
AND RECOMMENDED PRACTICES**

OPERATION OF AIRCRAFT

**ANNEX 6
TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION**

**PART I
INTERNATIONAL COMMERCIAL AIR TRANSPORT — AEROPLANES**

CHAPTER 1. DEFINITIONS

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Flight recorder. Any type of recorder installed in the aircraft for the purposes of complementing accident/incident investigation.

Automatic deployable flight recorder (ADFR). A flight recorder installed on the aircraft which is capable of automatically deploying from the aircraft.

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CHAPTER 6. AEROPLANE INSTRUMENTS, EQUIPMENT AND FLIGHT DOCUMENTS

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6.3 Flight recorders

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6.3.2 Cockpit voice recorders and cockpit audio recording systems

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6.3.2.3 *Duration*

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6.3.2.3.4 All aeroplanes of a maximum certificated take-off mass of over 27 000 kg for which the individual certificate of airworthiness is first issued on or after 1 January 2021 shall be equipped with a CVR capable of retaining the information recorded during at least the last twenty-five hours of its operation.

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Origin:	**Rationale:**
FLIRECP/7	The value of CVR recordings for the analysis of human factors and different sounds cannot be emphasized enough and the technology exists to increase the

	duration of recordings. Several safety recommendations have been addressed to ICAO to extend the duration of CVRs beyond the present two-hour duration. An incident might occur during take-off but due to the flight being longer than two hours, the CVR recordings would not cover the take-off phase, which would be a valuable tool for the investigations. A robust solution would be to extend the CVR recording duration to twenty-five hours, which would include a long-haul flight, its pre-flight and post-flight crew activities. It is expected that long-haul flights may extend to nineteen hours. It was estimated that a CVR with a recording duration of twenty-five hours would cover all flights in the foreseeable future, including the pre-flight activities and post-flight activities. Furthermore, the proposed amendment allows for harmonization with FDR duration requirements.

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6.3.4 Flight recorders — general

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6.3.4.5 *Combination recorders*

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6.3.4.5.3 All aeroplanes of a maximum certificated take-off mass of over 27 000 kg and authorized to carry more than nineteen passengers for which the application for type certification is submitted to a Contracting State on or after 1 January 2021, shall be equipped with a combination recorder as close to the cockpit as practicable and an automatic deployable flight recorder (ADFR) located as far aft as practicable in accordance with Appendix 8.

Note 1.— A combination recorder that includes a FDR meets the requirements of 6.3.1.

Note 2.— A combination recorder that includes a CVR meets the requirements of 6.3.2.

6.3.4.5.4 **Recommendation.—** *All aeroplanes of a maximum certificated take-off mass of over 27 000 kg and authorized to carry more than nineteen passengers for which the individual certificate of airworthiness is first issued on or after 7 November 2019, should be equipped with a combination recorder as close to the cockpit as practicable and an automatic deployable flight recorder (ADFR) located as far aft as practicable in accordance with Appendix 8.*

6.3.4.5.5 Notwithstanding the provisions in 6.3.4.5.3 and 6.3.4.5.4, the State of the Operator may, based on the results of a specific performance assessment conducted by the operator which demonstrates how an equivalent level of performance will be maintained, specifically approve equipage variations to recover, at a minimum, CVR and mandatory FDR data for the mandated duration in a timely manner. The specific performance assessment shall include at least the following:

a) the capabilities of the operator;

b) overall capability of the aeroplane and its systems;

c) the reliability of the means to recover the appropriate CVR channels and FDR data in a timely manner and avoiding the need for underwater retrieval;

d) the capability to establish the location where an aircraft terminates controlled flight;

e) the ability to contribute with finding the location of an accident site; and

f) specific mitigation measures.

Note 3.— Guidance on the specific performance assessment, appropriate CVR data and FDR parameters, duration of recordings and timely recovery of CVR and FDR data is contained in Attachment XX.

Note 4.— The specific approval for an equipment variation should be included in the Operation Specification template contained in Appendix 6 under "Other".

Editorial note: *Renumber* subsequent paragraphs and *Note*.

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6.17 Emergency locator transmitter (ELT)

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6.17.3 All aeroplanes authorized to carry more than 19 passengers for which the individual certificate of airworthiness is first issued after 1 July 2008 shall be equipped with at least two ELTs, one of which shall be automatic, unless the aeroplane meets the requirements of 6.18.

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Editorial note.— Insert new paragraph 6.18 as follows:

6.18 Location of an aeroplane in distress

6.18.1 All aeroplanes of a maximum certificated take-off mass of over 27 000 kg for which the individual certificate of airworthiness is first issued on or after 1 January 2021, shall autonomously transmit information from which a position can be determined by the operator at least once every minute, when in distress, in accordance with Appendix XX.

6.18.2 **Recommendation.—** *All aeroplanes of a maximum certificated take-off mass of over 5 700 kg for which the individual certificate of airworthiness is first issued on or after 1 January 2021, should autonomously transmit information from which a position can be determined at least once every minute, when in distress, in accordance with Appendix XX.*

6.18.3 The operator shall make position information of a flight in distress available to the appropriate organizations, as established by the State of the Operator.

Note.— Refer to 4.2.1.3.1 for operator responsibilities when using third parties.

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APPENDIX 8. FLIGHT RECORDERS

(Note — See Chapter 6, 6.3, 6.18)

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4. Automatic deployable flight recorder (ADFR)

4.1 Operation

The following requirements shall apply to an ADFR:

- deployment shall take place when the aeroplane structure has been significantly deformed;
- deployment shall take place when an aeroplane sinks in water;
- ADFR shall not be capable of manual deployment;
- the ADFR shall be able to float on water;
- the ADFR shall contain an integrated ELT, which shall activate automatically during the deployment sequence. Such ELT may be of a type that is activated in-flight and provides information from which a position can be determined; and
- the integrated ELT of an ADFR shall satisfy the same requirements as an ELT required to be installed on an aeroplane. The integrated ELT shall at least have the same performance as the fixed ELT to maximize detection of the transmitted signal.

Note.— Refer to Attachment XX for more information on ADFR.

Editorial note: *Renumber* subsequent paragraphs.

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Origin:	**Rationale:**
FLIRECP/7	Since 1996 until 2009, thirty-eight accidents involving large aeroplanes occurred over water. Currently, eight recorders have not yet been recovered. From 2009, thirteen accidents have occurred over water. In studies undertaken during the Air France 447 investigation (the Flight Data Recovery Working Group and the Triggered Transmission of Flight Data Working Group reports accessible at http://www.bea.aero/en/enquetes/flight.af.447/reports.php), cost/benefit was considered and it was determined that ADFR is one of the effective methods of recovery of flight data after an accident. The cost for these type of recoveries on the average is approximately one to two million dollars. A multidisciplinary Ad-Hoc Working Group (AHWG) was formed after Malaysia 370 went missing in May 2014. The AHWG considered a global aeronautical distress and safety system (GADSS) and produced a concept of operations (CONOPS) which refers to emergency flight tracking with the last element being the ADFR. In the GADSS, the ADFR was included to provide for redundancy to determine the location of the accident site and that flight data would be quickly available for investigation purposes. An automatic deployable flight recorder (ADFR) is a combination recorder fitted into a crash-protected container that would deploy from an aircraft during

	significant deformation of the aircraft in an accident scenario. Considering the design and deployment features of a deployable recorder, the recorder is usually fitted externally, flush with the outer skin towards the tail of the aircraft. To find a deployed ADFR, an emergency locator transmitter (ELT) is integrated in the ADFR. This ELT has the added advantage to assist in locating the accident site and facilitate search and rescue efforts. In the case of a new generation ELT being fitted, the ELT will provide emergency tracking data before the impact. Furthermore, if the wreckage becomes submerged in water, the traditional ELT signal will be undetectable, but with the deployable recorder being floatable, the ELT signal would still be detectable and the deployable recorder would be recovered quicker. As the ADFR is floatable, there is no requirement for an underwater locating device. In terms of cost benefit, if the ADFR installation can be included into a newly designed aircraft, it would be approximately cost neutral in the sense that one of the two combination recorders would be a deployable recorder. Having an integral ELT, one less ELT may be installed with the associated cost saving of an ELT mounting bracket. A further benefit would be the availability of critical flight data soon after the accident to direct the accident investigation and initiate safety actions. This could have large saving implications in terms of not calling for maintenance inspections when the safety of the aircraft systems is suspected and having the data available to put these suspicions to rest. The specifications for ADFRs are contained in the EUROCAE ED-112A MOPS that was revised after the AF447 accident. The specifications include the robustness of the ADFR attachment and define that the overall quantitative probability (per flight hour) of the failure event “non-commanded deployment” shall be less than 10^{-7}. Provisions for the container of ADFRs were included in Amendment 38 of Annex 6, Part I, which became applicable on 13 November 2014. In this working paper, a definition of an ADFR and a recommendation for the carriage of ADFRs on large aeroplanes is proposed for Annex 6, Part I. Due to the ADFR being a special type of combination recorder, the recommendation for the carriage of ADFRs is proposed to be included in 6.3.4.5 of the provisions for flight recorders and has no retrofit implications, only forward fit.

Editorial note.— Insert new Appendix XX and new Attachment XX as follows:

APPENDIX XX. LOCATION OF AN AEROPLANE IN DISTRESS

(Note — See Chapter 6, 6.18)

1. Purpose and scope

Location of an aeroplane in distress aims at establishing, to a reasonable extent, the location of an accident site within a 6 NM radius.

2. Operation

2.1 An aeroplane in distress shall automatically activate the transmission of information from which its position can be determined by the operator and the position information shall contain a time stamp. It shall also be possible for this transmission to be activated manually. The system used for the autonomous transmission of position information shall be capable to transmit that information in the event of aircraft electrical power loss, at least for the expected duration of the entire flight.

2.2 Autonomous transmission of position information shall be activated automatically when events in Table XX-1 occur. The initial transmission of position information shall commence immediately or no later than five seconds after the detection of the activation event.

2.3 **Recommendation.**— *Autonomous transmission of position information should be able to be activated manually from the ground (e.g. ATSU, operator).*

2.4 When an aircraft operator or an Air Traffic Service Unit (ATSU) has reason to believe that an aircraft is in distress, coordination shall be established between the ATSU and the aircraft operator.

2.5 The State of the Operator shall identify the organizations that will require the position information of an aircraft in an emergency phase. These shall include, as a minimum:

a) Air Traffic Service Unit(s) (ATSU); and

b) SAR Rescue Coordination Centre (s) (RCC) and sub-centres.

Note 1.— Refer to Annex 11 for emergency phase criteria.

Note 2.— Refer to Annex 12 for required notifications in the event of an emergency phase.

Table XX-1. Events that activate the autonomous transmission of position information

Event
Urgency or distress code in transponder, ADS-B or ADS-C
Activation of an ELT
Aircraft behaviour events such as unusual attitudes, unusual speed conditions, loss of power on all engines and ground proximity warnings.

Note 3.— Triggering criteria for aircraft behaviour events are detailed in the EUROCAE Minimum Aviation System Performance Specification (MASPS) ED –XX.

2.6 When autonomous transmission of position information has been activated, it shall only be able to be de-activated using the same mechanism that activated it or, in any case, from the ground (e.g. ATSU, Operator).

2.7 The accuracy of position information shall, as a minimum, meet the position accuracy requirements established for ELTs.

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ATTACHMENT XX. FLIGHT DATA RECOVERY

Supplementary to Chapter 6, 6.3.4.5.5

Guidance for flight data recovery

1. Purpose and scope

1.1 As indicated in Standard 6.3, crash protected flight recorders may include one or more of the following systems: a FDR, CVR, AIR and/or DLR. A combination recorder includes at least a CVR and FDR and any combination of other systems in a single flight recorder. The flight recorder provisions aim at improving the overall probability of timely recovery of flight data needed for accident investigation. The systems and related procedures should significantly improve the overall probability of recovering flight data when compared to conventional flight recorders with 30 day underwater location device (ULD) batteries.

1.2 Standard 6.3.4.5.2 requires two combination recorders (FDR/CVR) to be included in the design specifications when the application for type certification is submitted after 1 January 2016. Additionally, to address the timely recovery of flight data, a Standard and Recommendation applicable in 2021 and 2019, 6.3.4.5.3 and 6.3.4.5.4 respectively, require/recommend replacing the rear combination recorder with an automatic deployable flight recorder (ADFR). An ADFR as defined in Appendix 8, Section 4, is a technology that is believed to provide the desired level of increased probability of recovering flight data and can contribute to locating an accident site.

1.3 Standard 6.3.4.5.5 is a performance base alternative to the prescriptive Standards described in 1.2 above. Scenarios for maintaining an equivalent level of performance when applying 6.3.4.5.5 may be the following:

On an aeroplane that is required to have a combination recorder (FDR/CVR) and an ADFR, the ADFR could be substituted by:

a) A means of making the full dataset available, as it would be recorded on a combination recorder, in a timely manner after an accident, as what would have been the case with an ADFR. The aeroplane would also need to be equipped with a means of contributing to the location of an accident site such as a system for locating an aeroplane in distress.

b) Having two combination recorders (FDR/CVR), a system for locating an aeroplane in distress and a means of making a set of flight data available in a timely manner after an accident, as what would have been the case with an ADFR. The dataset could be limited to a subset of FDR and CVR data because the full dataset will be available from at least one of the two combination recorders when recovered.

1.4 Other technologies may be brought to bear to meet the performance improvement goal . This Attachment provides guidance to aid in the evaluation of systems and procedures intended to support this means of flight data recovery.

2. Background

2.1 When an accident occurs over water it is beneficial for the investigation to recover critical flight data in a timely manner. Once recovered, flight recorders have been highly reliable. However, there have been instances in which the search for recorders has been very long, flight data has never been recovered or where data were lost due to damage from exposure to severe fire or underwater conditions. Examples of these scenarios may be found in the GADSS CONOPS, Appendix C: Concept Scenario.

2.2 When an aeroplane has an accident in water and becomes submerged, deployable recorders are a technology that can be used to recover flight data without the delay of a long underwater recovery. However, in many cases an underwater search and recovery of wreckage may still be required to determine the cause of an accident. Also, ADFR, if installed will complement a fixed combination recorder (FDR/CVR) to improve the probability that at least one recorder is recovered successfully.

2.3 Other technologies based on transmission of flight data, prior to an accident may be useful to recover some CVR and FDR data quickly without any search required. Furthermore, such data streamed from an aircraft in a distress situation or streamed continuously throughout the flight may enable near real time trend analysis on the ground that could potentially allow early detection and mitigation of factors that might lead to an accident. Such streaming technology is evolving and already exists to some degree on some airframes. As the performance of datalink technology improves, these practices are expected to be more widely adopted due to the potential economic and safety benefits that result from the availability of near real time flight data.

2.4 The CVR/FDR data required for timely flight data availability depends on the configuration and the impact on the overall probability of meeting the needs of accident investigation in a timely manner. In the scenario where the ADFR replaces one of two combination recorders (FDR/CVR), the ADFR should meet all the requirements for data recording as defined in Standards 6.3.1 and 6.3.2 (i.e. the full dataset). For flight data systems that stream data and operate in addition to two installed combination recorders (FDR/CVR), a subset of the required parameters over a specified duration may be provided as described in the following sections. The objective is to provide flight data that allows a timely determination of the cause of the accident to the extent possible. In many cases the ultimate root cause of an accident can only be definitively determined after physical examination of the wreckage.

2.5 The requirements for CVR information are detailed in Standard 6.3.2. Systems that provide timely flight data recovery in addition to two combination recorders, should at a minimum include CVR recorded data from the time the airplane enters the distress phase (refer to table for distress events as per Table XX-1 in Appendix XX) to the end of the flight. To the extent possible historical data prior to the declaration of distress should also be provided. In cruise the crew is not wearing the headset with the microphones and in such case most of the time all useable audio data from the CVR is contained on the Cockpit Area Microphone (CAM) Channel. The subset data from a CVR then could be limited to the audio from the CAM channel. Data streaming in support of timely flight data recovery may also support accident site location and consequently shorten the duration of any subsequent underwater search and recovery that may be required.

2.6 The list of mandatory FDR parameters depends on the date of individual certificate of airworthiness of each aircraft and are listed in Standard 6.3.1 “Flight data recorders and aircraft data recording systems”. Systems for the timely recovery of flight data in addition to two combination recorders should at a minimum provide all the mandatory parameters from the time the airplane enters the distress phase to the end of the flight. A subset of parameters may be used if that subset is shown to provide a high likelihood of supporting initial accident investigation needs with respect to identifying the cause of the accident. Also to the extent possible, historical data prior to the time the flight enters the distress phase should be provided. The availability of a subset parameters soon after an accident, with enough information to provide an indication of malfunctions that may have led to the accident, could support immediate safety recommendations. For example, soon after one of the major accidents over the ocean, aircraft monitoring parameters provided enough information to introduce recommendations that led to maintenance actions and training actions well in advance of recovery of the aircraft’s recorders. The following is the subset of parameters that should be transmitted during the distress phase of flight:

- Time;
- Altitude (pressure or radio);
- Airspeed (indicated or calibrated);
- Heading (primary flight crew reference);
- Acceleration (normal, lateral and longitudinal);
- Attitude (pitch, roll, yaw or sideslip angle);
- Manual radio transmission keying (for CVR/FDR synchronization reference);
- Engine thrust/power on each engine;
- Autopilot/auto throttle/AFCS mode or engagement status;
- Primary flight control surface position and/or primary flight control pilot input (pitch, roll, yaw);
- Red or master warnings; and
- Angle of attack (if available).

2.7 In accordance with Annex 13, the operator collecting CVR and FDR data via data streaming for the purpose of an investigation should make the data available to the appropriate accident investigation authorities without delay. Procedures for retrieval, packaging and transmission of data to the appropriate authorities should be established in advance with due consideration for data security, confidentiality and authenticity.

3. Performance Assessments

3.1 As stated in Standard 6.3.4.5.5, a specific performance assessment must be conducted to demonstrate that the system maintains an equivalent level of performance. The specific performance assessment should consider the entire system including operational procedures, airborne equipment and ground based infrastructure. The assessment must include at least the following elements which are discussed in the following sections:

a) *Capabilities of the operator*: The assessment should take into account the capabilities of the operator or an agent thereof to collect, archive, protect, and disseminate CVR/FDR data collected from an airplane that was involved in an accident. The assessment should include an evaluation of the operators total use of datalink for near real time collection of maintenance data, or other relevant operational data. The overall sophistication of the operator with respect to tracking of aircraft under normal and distress situations should be included in the assessment as well as the operators established processes and procedures for handling data streamed from aircraft.

b) *Capability of the aeroplane and its systems*: The assessment should include the total airplane equipage with respect to:

   1) **Number and location of FDRs/CVRs and their historical reliability.** At a minimum, two combination recorders (FDR/CVR) should be installed where one may optionally be of a deployable type. The historical reliability can be derived based on in-service use of similar devices. Consideration should be given to the history or aircraft accidents where similar equipment was deployed in order to determine the probability of recovery of at least one working combination recorder (FDR/CVR);
   2) **Number and location of Underwater Location Devices (ULD).** At a minimum an ULD should be attached to each fixed combination recorder (FDR/CVR). Additionally a third ULD operating at 8.8 kHz may be included to increase the probability of finding the wreckage underwater;
   3) **Overall Communication and Navigation Capabilities.** The assessment should take into account the complete suite of navigation and communications capabilities that are available for aircraft tracking under normal, abnormal or distress situations. The operator's Standard Operational Procedures (SOP) for aircraft tracking should be considered;
   4) **ELT Transmitters:** Type, availability and performance of ELT transmitters that may improve accident site location. The historical reliability can be derived based on in-service use of similar devices. Consideration should be given to the history of aircraft accidents where similar equipment is used in order to determine the probability of recovery of at least one operational combination recorder (FDR/CVR); and
   5) **System to locate an aeroplane in distress:** Type, availability and performance of the system to locate an aeroplane in distress that may improve accident site location. Consideration should be given to the solution reliability and any interdependencies with the data streaming capabilities.

c) *Reliability of the means to recover the appropriate CVR channels and FDR data in a timely manner and avoiding the need for underwater retrieval:* The assessment should include an evaluation of the reliability of each component of the system to provide timely flight data recovery. For example, the reliability of any satcom link used to transmit data should be evaluated including the joint reliability of multiple datalinks. The reliability of various datalinks under the condition of unusual aircraft attitudes or aircraft power outages should be considered. Ultimately, the joint reliability of all datalinks used for data streaming, the reliability of ULD and reliability or each fixed combination recorder (FDR/CVR) should be assessed.

d) *The capability to establish the location where an aircraft terminates controlled flight:* The assessment should include all aeroplane systems and other systems that may be used to locate an accident site. For example, the role that space based ADS-B may someday play in accident site location should be considered as well as the potential for ATS surveillance. The expected performance of any installed system to locate an aeroplane in distress should be included in the analysis.

e) *The ability of the data recovery mechanism to contribute to finding the location of an accident site:* When flight data is streamed during a distress situation, the data may include aeroplane position information at a relatively high rate. This data may lead to even more accurate accident site location than would be provided by any ELT or a system to locate an aeroplane in distress . The ability of such improved accuracy of accident site location to reduce the duration of an underwater search should be considered.

f) *Other specific mitigation measures:* Where streaming of flight data is used in a system to do trend monitoring that may reduce the probability of an accident, this capability should also be included in the evaluation.

3.2 Overall performance evaluations should be a combination of quantitative and qualitative criteria. A quantitative analysis which aims to show the overall improvement in the probability of recovering flight data should be included. However, some value may also be given to qualitative criteria such as relative improvements in overall safety that may be achieved through the implementation of timely flight data recovery systems

4. Example Performance Assessments

4.1 **Quantitative assessments**: Quantitative assessments may be instructive in that they illustrate the relative improvement afforded by elements used to achieve timely flight data recovery. However, accurate quantitative assessments are problematic because reliabilities and probabilities of certain types of events can only be estimated based on historical experience from operational use of similar equipment. The number of accidents where FDR/CVR data was not recovered are few and therefore, statistical uncertainty in the implied probability of occurrence is quite high. The following sections provide an example of a quantitative assessment for ADFR. The quantitative assessment is based on a fault tree analysis aimed at quantifying the top level probability of recovering the flight data.

4.2 No validated baseline quantitative performance assessment for ADFR currently exists. The example below is based on current expectations of the performance of ADFR in civil applications. As no operational experience in civil applications exists, the inputs to this analysis are based on experience with military applications of ADFR.

4.3 A Fault Tree Analysis used to derive the overall probability of recovering flight data for an aeroplane that includes ADFR is illustrated in Figure XX-1. Note that the overall probability of successfully recovering the CVR/FDR data is the combined probability of recovering the data without an underwater search (i.e. ADFR is successfully deployed, recovered and is readable) and the probability of recovering the data with an underwater search (i.e. assuming ADFR fails somehow, but accident site location and a search for ULDs is successful). In turn each event is broken down into the other constituent events as needed until the model has inputs that can be quantified based on specifications or inferred from historical operational experience.

Note.— The figures employed in Figure XX-1 are for illustration purposes only and do not represent any validated assessment of the probabilities for individual events.

(See Figure XX-1 on next page)

4.4 **Qualitative Assessment**: As noted above, strict quantitative assessment of options for recovery of flight data are difficult due to uncertainties in the probability of certain kinds of events. Other more qualitative considerations should be included in the assessment such as:

- Cost effectiveness of an option
- Potential unintended consequences or safety implications of the options (e.g. risks due to deployment of additional lithium batteries)
- Privacy and data security issues
- Practicality of solutions for deployment in retrofit or forward fit vs. integration during development of a new type design
- Sustainability and scalability of solutions

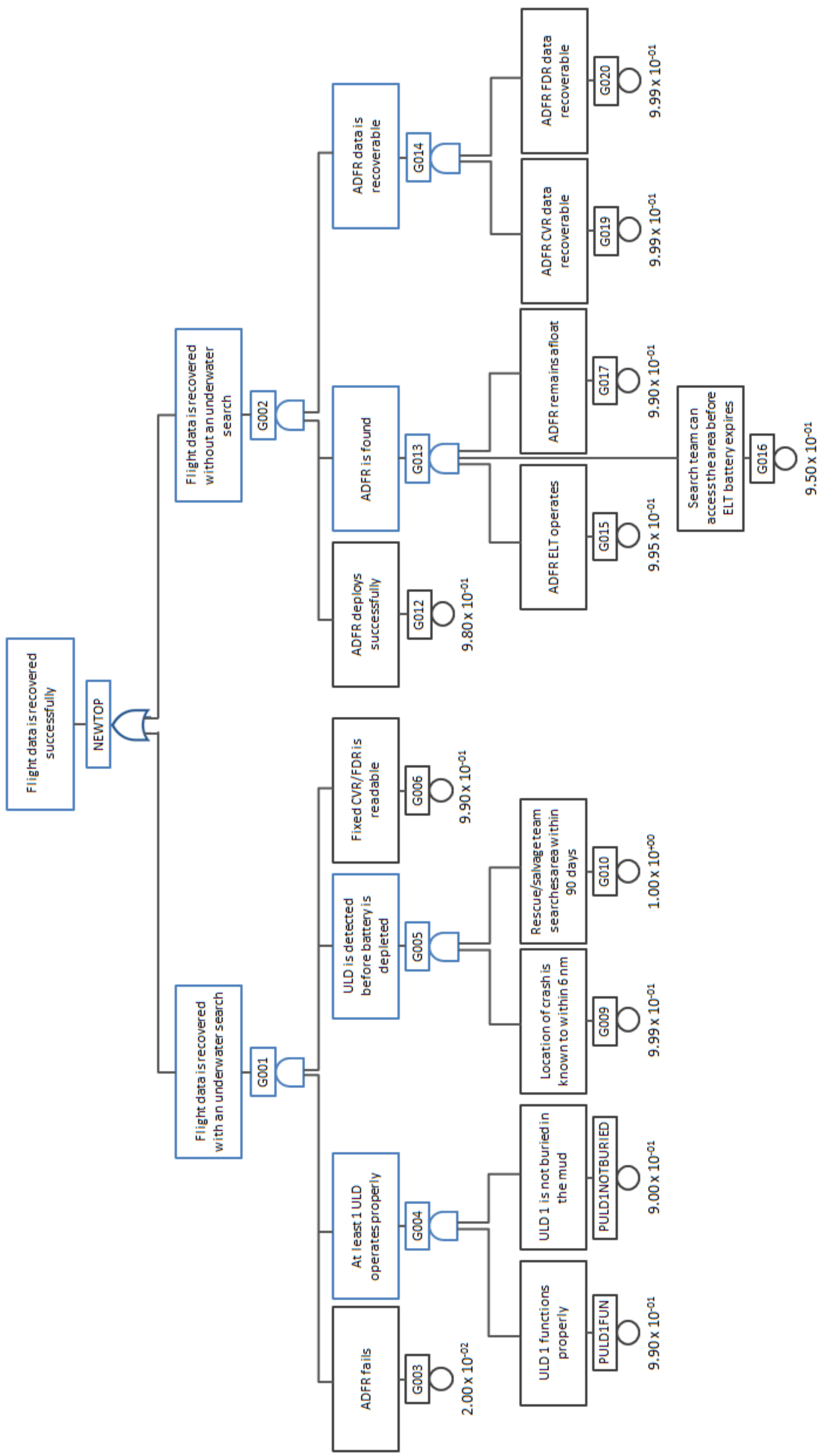

Figure XX-1. Example of Fault Tree Analysis for overall probability of data recovery for a system that includes ADFR

ATTACHMENT YY. LOCATION OF AN AEROPLANE IN DISTRESS

Supplementary to Chapter 6, 6.18

Guidance for Location of an Aeroplane in Distress

1. Introduction

1.1 The following material provides guidance on locating an aeroplane in distress. The Triggered Transmission of Flight Data Working Group (TTFDWG) reviewed 42 accidents to determine an indication of the distance from a last known aeroplane position to the location of an accident site. The report concluded that in approximately 95 per cent of the cases, when the aircraft position was known one minute prior to the accident, the accident site location was within a 6 NM radius of that position. (The TTFDWG Report is accessible at http://www.bea.aero/en/enquetes/flight.af.447/reports.php).

1.2 When an aeroplane has an accident into water and becomes submerged, the location of the accident site within a 6 NM radius on the surface becomes more important. Starting the initial search area beyond a 6 NM radius reduces the amount of time available to search for and locate the aeroplane. At current estimated underwater search capabilities of 100 km^2/day, an area with a 6 NM radius could be searched in 4 days. Allowing for naval assets to reach the search area and conduct the search, it is estimated that an area of 2 300 km^2, equivalent to a radius of 14 NM, will be able to be searched before the ULB battery degrades. Starting at an area of more than 6 NM radius reduces the probability of a successful location during an initial search, whilst extending the location requirement beyond 6 NM radius reduces the time available to search with no appreciable gain in the probability of recovery.

2. Clarification of purpose of equipment

2.1 Information from which a position can be determined: Information from an aircraft system which, when automatically or manually activated, can provide position information which includes a time stamp. This is a performance-based requirement which is not system specific and may also bring operational benefits.

2.2 Emergency locator transmitter (ELT): The current generation of ELTs were designed to provide the position of impact for a survivable accident. The next generation of ELTs may have the capability to activate a transmission in flight when any of the conditions detailed in Table XX-1 are met. When an ELT sinks below the surface of water, its signal is not detectable.

2.3 Automatic deployable flight recorder (ADFR): The purpose of an ADFR is to have flight data available soon after an accident, in particular for accident over water. The integrated ELT provides for both locating the accident site for accident investigation and search and rescue purposes. Being floatable, it will assist locating the accident site by providing an ELT signal when the wreckage sinks below the surface of the water. It also ensures redundancy for one ELT.

2.4 Underwater locator beacon (ULB): A low frequency ULB is attached to the airframe to locate aeroplane wreckage below the surface of water when an ELT signal is not possible to detect. The high frequency ULBs are used for locating the flight recorders under water.

3. Equipage compliance

3.1 The advent of technology has made it possible to meet the equipage requirements by different means. Table YY-1 below provides examples of compliance. In such potential installations, the cost will be minimized and the effectiveness of the current installation improved.

Table YY-1. Examples of compliance

Current	**After 7 November 2019**	**After 1 January 2021**
In-service	**Individual certificate of airworthiness is first issued**	**Application for type certification is submitted to a Contracting State**
Two ELTs Two fixed recorders	Example: A system from which a position can be determined and one ELT and two fixed recorders or one fixed combined recorder and one ADFR with an integrated ELT of a type that is activated in flight and provides information from which a position can be determined and one ELT	Example: A system from which a position can be determined; and one ADFR with an integrated ELT; and one combined recorder or A system from which a position can be determined and one ELT and two fixed recorders and an additional means to retrieve flight data in timely manner

Note.— A system from which a position can be determined (e.g. ADFR with integrated ELT or an ELT of a type that is activated in flight and provides information from which a position can be determined) used to comply with 6.18, may replace one of the ELTs required by 6.17.

Origin:	Rationale:
FLIRECP/7	Locating an aeroplane in distress is essential to determine whether the distress situation has been resolved, or in the case of an accident, to facilitate the location of the wreckage and possible survivors; for accident investigation purposes, to recover flight data. The flight data becomes available by either finding the flight recorders or, in the case of an ADFR, recovering it using the integrated ELT's signal as a means to locate it. During the Air France 447 (AF447) investigation, the Triggered Transmission of Flight Data Working Group (TTFDWG), consisting of more than 150 international experts, studied the viability of locating an accident site by means of transmission of a basic package of flight data which contains positional elements (TTFDWG Report is accessible at http://www.bea.aero/en/enquetes/flight.af.447/reports.php). The data of forty-two accidents were considered and it was determined that, if the rate of position information is transmitted once per minute, the accident site could be located in

	approximately 95 per cent of the cases within a 6 NM radius. This was calculated for current sub-sonic aircraft. Furthermore, the first signal should be transmitted within five seconds from the activation of the distress tracking system. In cases where the accident happened over water, locating the accident site within a 6 NM radius on the surface of the water was essential for the search operation to reach the low-frequency underwater locator beacon in time. After MH370, a multi-disciplinary meeting was held so as to assess flight tracking possibilities. An Ad-Hoc Working Group (AHWG) was tasked to develop a concept of operations (CONOPS) for a Global Aeronautical Distress and Safety System (GADSS). The main system components identified were: aircraft tracking systems (normal and abnormal operations); autonomous distress tracking system; and automatic deployable flight recorders. The autonomous distress tracking contains triggers for activation, autonomy and failure-mode capability and reception of data on the ground. Currently, approximately sixty per cent of aircraft crossing the Atlantic are equipped to transmit enough information to determine their location should they enter a distress situation. In some cases, a software modification may be required to include the system triggering criteria and to include position information in messages that are currently transmitted. The position information of an aeroplane, at a specific time and at a certain accuracy, is important. To be performance-based, the provision for the location of the aeroplane in distress, should refer to an accuracy level and rate of providing the position. During the emergency phase, the aircraft systems are used to provide the information, but in the distress phase the autonomous system is needed, according to the CONOPS. The reference to "location of an aeroplane in distress" was preferred as opposed to "autonomous distress tracking" so that the aeroplane systems may be used to trigger the distress tracking system and to keep providing position information. If the distress tracking system needs to be fully autonomous, then the system needs to operate independently of the aircraft systems and to incorporate such functions as power supply, navigation, transmission and triggering, all of which have a cost implication. In the case where the aircraft has suffered an electrical power failure, the system will need power for, in some cases, an extended flight. Triggering the distress tracking system needs to be automatic but may also be manual. It is proposed to have the triggering criteria contained in the appendix to this provision. The triggering criteria would best be in a EUROCAE Minimum Aviation System Performance Specifications (MASPS) and reference needs to be made to such MASPS in Table XX-1 of the proposed Appendix XX to address this issue. Concurrent to this amendment proposal, EUROCAE are working on Minimum Aviation System Performance Specification (MASPS) ED–XX which will be available prior to the adoption of the proposed provisions. The contents of the table will be inserted as soon as the EUROCAE MASPS is published, which is scheduled for January 2016. The operator shall make position information available to search coordination centres. Reference is made to Annex 11 — *Air Traffic Services* regarding the definition of an aircraft being in distress. It also makes reference to information

	flow and ground-based facilities. The current automatic fixed ELTs are not considered to be an acceptable means in locating a wreckage, mainly due to their design to operate after a survivable accident when lives need to be saved. On the other hand, should the aircraft sink below the water surface, the ELT's signal is unable to be received. In the case of manual deployment of a deployable ELT, by experience, it was found that in some cases the ELT was manually deployed and the wreckage located some distance away.

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ATTACHMENT C to State letter SP 55/4-15/15

PROPOSED AMENDMENT TO ANNEX 6, PART II

NOTES ON THE PRESENTATION OF THE PROPOSED AMENDMENT

The text of the amendment is arranged to show deleted text with a line through it and new text highlighted with grey shading, as shown below:

1.	~~Text to be deleted is shown with a line through it.~~	text to be deleted
2.	New text to be inserted is highlighted with grey shading.	new text to be inserted
3.	~~Text to be deleted is shown with a line through it~~ followed by the replacement text which is highlighted with grey shading.	new text to replace existing text

PROPOSED AMENDMENT TO

**INTERNATIONAL STANDARDS
AND RECOMMENDED PRACTICES**

OPERATION OF AIRCRAFT

**ANNEX 6
TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION**

**PART II
INTERNATIONAL GENERAL AVIATION — AEROPLANES**

**SECTION 3
LARGE AND TURBOJET AEROPLANES**

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CHAPTER 3.6 AEROPLANE INSTRUMENTS, EQUIPMENT AND FLIGHT DOCUMENTS

. . .

3.6.3.2.2 *Duration*

3.6.3.2.2.1 All aeroplanes of a maximum certificated take-off mass of over 27 000 kg for which the individual certificate of airworthiness is first issued on or after 1 January 2021 shall be equipped with a CVR capable of retaining the information recorded during at least the last twenty-five hours of its operation.

. . .

Origin:	**Rationale:**
FLIRECP/7	The value of CVR recordings for the analysis of human factors and different sounds cannot be emphasized enough and the technology exists to increase the duration of recordings. Several safety recommendations have been addressed to ICAO to extend the duration of CVRs beyond the present two-hour duration. An incident might occur during take-off but due to the flight being longer than two hours, the CVR recordings would not cover the take-off phase, which would be a valuable tool for the investigations. A robust solution would be to extend the CVR recording duration to twenty-five hours, which would include a long-haul flight, its pre-flight and post-flight crew activities. It is expected that long-haul flights may extend to nineteen hours. It was estimated that a CVR with a recording duration of twenty-five hours would cover all flights in the foreseeable future, including the pre-flight activities and post-flight activities. Furthermore, the proposed amendment allows for harmonization with FDR duration requirements.

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ATTACHMENT D to State letter SP 55/4-15/15

PROPOSED AMENDMENT TO ANNEX 6, PART III

NOTES ON THE PRESENTATION OF THE PROPOSED AMENDMENT

The text of the amendment is arranged to show deleted text with a line through it and new text highlighted with grey shading, as shown below:

1.	~~Text to be deleted is shown with a line through it.~~	text to be deleted
2.	New text to be inserted is highlighted with grey shading.	new text to be inserted
3.	~~Text to be deleted is shown with a line through it~~ followed by the replacement text which is highlighted with grey shading.	new text to replace existing text

PROPOSED AMENDMENT TO

INTERNATIONAL STANDARDS
AND RECOMMENDED PRACTICES

OPERATION OF AIRCRAFT

ANNEX 6
TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION

PART III
INTERNATIONAL OPERATIONS — HELICOPTERS

SECTION II
INTERNATIONAL COMMERCIAL AIR TRANSPORT

APPENDIX 4. FLIGHT RECORDERS

. . .

4. Airborne image recorder (AIR) and airborne image recording system (AIRS)

4.1 Classes

4.1.1 A Class A AIR or AIRS captures the general cockpit area in order to provide data supplemental to conventional flight recorders.

. . .

Note 2.— There are no provisions for Class A AIRs or AIRS in this document.

4.1.2 A Class B AIR or AIRS captures data link message displays.

4.1.3 A Class C AIR or AIRS captures instruments and control panels.

Note.— A Class C AIR or AIRS may be considered as a means for recording flight data where it is not practical or is prohibitively expensive to record on an FDR, or where an FDR is not required.

4.2 Operation

The AIR or AIRS shall ~~will~~ start to record prior to the helicopter moving under its own power and record continuously until the termination of the flight when the helicopter is no longer capable of moving under its own power. In addition, depending on the availability of electrical power, the AIR or AIRS shall ~~will~~ start to record as early as possible during the cockpit checks prior to engine start at the beginning of the flight until the cockpit checks immediately following engine shutdown at the end of the flight.

. . .

Origin:	**Rationale:**
FLIRECP/7	Amendment to Appendix 4, Section 4 is proposed in order to align the text with Parts I and II.

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

MINIMUM AVIATION SYSTEM PERFORMANCE SPECIFICATION

FOR IN-FLIGHT EVENT DETECTION AND TRIGGERING CRITERIA

The following provides an overview and selected extracts of draft EUROCAE Document ED-237 'Minimum Aviation System Performance Specification for in-flight event detection and triggering criteria', currently under development by EUROCAE WG-98 'Aircraft Emergency Locator Transmitters'.

The draft is expected to be submitted to the EUROCAE Open Consultation in September 2015, and finalized before the end of the year. EUROCAE Council approval and publication are expected in January/February 2016

<u>ED-237</u>

[Month Year]

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ED-237

[Month Year]

FOREWORD

1. This document was prepared jointly by EUROCAE Working Group 98 “Aircraft Emergency Locator Transmitters” <and RTCA SC-229 ‘Aircraft Emergency Locator Transmitters’, and was approved by the Council of EUROCAE on [Day Month Year].
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 and in collaboration with RTCA Inc, Washington D.C., through their appropriate committees.
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:

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CHAPTER 1

INTRODUCTION

1.1 PURPOSE AND SCOPE

This document defines the minimum specification to be met for all aircraft required to carry a system which can be used to trigger, from on-board equipment in-flight, the transmission of sufficient information for the purpose of locating an accident site.

This document contains minimum aviation system performance specifications for in-flight event detection and triggering criteria. They specify characteristics that 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 system and each subsystem will perform its intended function(s) satisfactorily 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 (i.e. antenna disconnected from the ELT or not oriented properly e.g, aircraft upside down), have been destroyed during the crash or just after due to a post-crash fire or have been submerged into water. Such situations strongly jeopardize the efficiency of the Rescue mission as no distress position is provided by the ELTs. Given the unpredictable nature of aircraft accidents and the inherent difficulty of reliably providing a distress signal once an aeroplane or helicopter has impacted a surface, the transmission of a distress signal prior to the accident has therefore been considered as a way to significantly improve the reliability of ELTs.
- It has taken a significant amount of time to recover flight recorders, or they have been unrecoverable. This delay in recovery or loss of recorders greatly reduces the likelihood of the actual cause of these accidents being discovered. For this reason, in order to improve the recovery of wreckage and flight recorders following an accident or incident, the concept of in-flight event detection and triggered transmission of sufficient information to locate the accident site is deemed worthwhile.

1.2.1 ICAO ACTIVITIES

In 2015, 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 1 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, the GADSS shall be capable of transmitting aircraft tracking data from the aircraft under all circumstances and assist the Search And Rescue services and accident investigation authorities in locating the wreckage and flight data recorders.

One of the main system components is the development of Autonomous Distress Tracking (ADT) System. The intent of this ADT System is to use on board systems that can broadcast 4D position, or distinctive distress signals from which the 4D 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 de-activated, however, the deactivation can only be done by the activating mechanism.

Autonomous Distress Tracking (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 ED-237.

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 event detection and triggering of transmission of flight information consists of:

- Detecting, using flight parameters, 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 triggered transmission.

This MASPS is intended to define in-flight 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.

1.2.2 SECOND GENERATION ELT

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 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 better take 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 therefore 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 RCCs and SPOC prior to an aircraft accident i.e. using FOA and TOA measurements and via the transmission of an encoded location. This could significantly reduce the False Negative Rate of ELTs and enhance SAR and recovery operations in many aviation related distress events.

A revision of ED-62A standard for first generation beacons and the creation of specifications for second generation beacons are required in order to ascertain if it is sufficient for application to all aircraft or is under- or over-prescriptive.

A number of recommendations resulted from the studies, 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.

GNSS technology allows ELTs to provide accurate accident positioning to first responders. Development of standardized GNSS requirements for use in ELTs will be addressed.

In parallel to these requirements the ED-62A Minimum Operational Performance Specifications have been improved to detail specifications for second generation ELT.

1.3 DESCRIPTION OF CONTENT

Chapter 1 of this document describes the in-flight activation criteria and provides information helpful to understand 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 event detection and triggering criteria system.

Chapter 3 contains the minimum performance specifications for in-flight 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 test procedures to verify system performance compliance and that subsystem performance meets the minimum performance requirements in Chapters 2 and 3.

The word “subsystem” as used in this document includes all components that make up a major independent, necessary and essential functional part of the system so that the system can properly perform its intended function(s).

1.4 OPERATIONAL APPLICATIONS

In addition to supporting Search And Rescue operations and accident investigations, triggered or regular transmission of flight information can also assist aircraft operators to improve their flight operations procedures, increase efficiency and save cost.

The benefit for airlines of such systems may be to establish location of the aircraft almost instantaneously while in distress.

1.5 TRIGGERING SYSTEM

The list of systems that could potentially transmit the flight information could include but are not limited to second-generation ELT or other systems (e.g. ACARS, ADS-C…).

The system use to transmit the flight information while an aircraft is in distress may have to comply with requirements defined in regulatory documents like 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 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

Normal EUROCAE statements

1.8 COMMON DEFINITIONS AND ABBREVIATIONS

The definitions and abbreviations of ICAO Annex 5, Annex 6 and Annex 10 are applicable.

1.8.1 DEFINITION OF TERMS

List of definition included

1.8.2 ABBREVIATIONS

List of abbreviations included

1.8.3 LIST OF REFERENCE DOCUMENTS

List of EUROCAE RTCA and ICAO documents

1.8.4 RELATED DOCUMENTS

BEA Triggered Transmission of Flight Data Report dated 18 March 2011

ICAO Global Aeronautical Distress & Safety System (GADSS), 2015

CHAPTER 2

OVERALL SYSTEM

2.1 INTRODUCTION

This chapter identifies general specifications and design considerations for the in-flight event detection and triggering criteria logic.

The model description below does not imply any particular system architecture employed on board the aircraft.

2.2 MODEL DESCRIPTION

The components of an in-flight event detection and triggering criteria system can be broken down into individual functional blocks that have unique inputs and outputs. Each functional block is depicted in Figure 2-1 and is defined in paragraph 2.2.1. This MASPS deals primarily with the "In-flight event detection and triggering criteria" functional block.

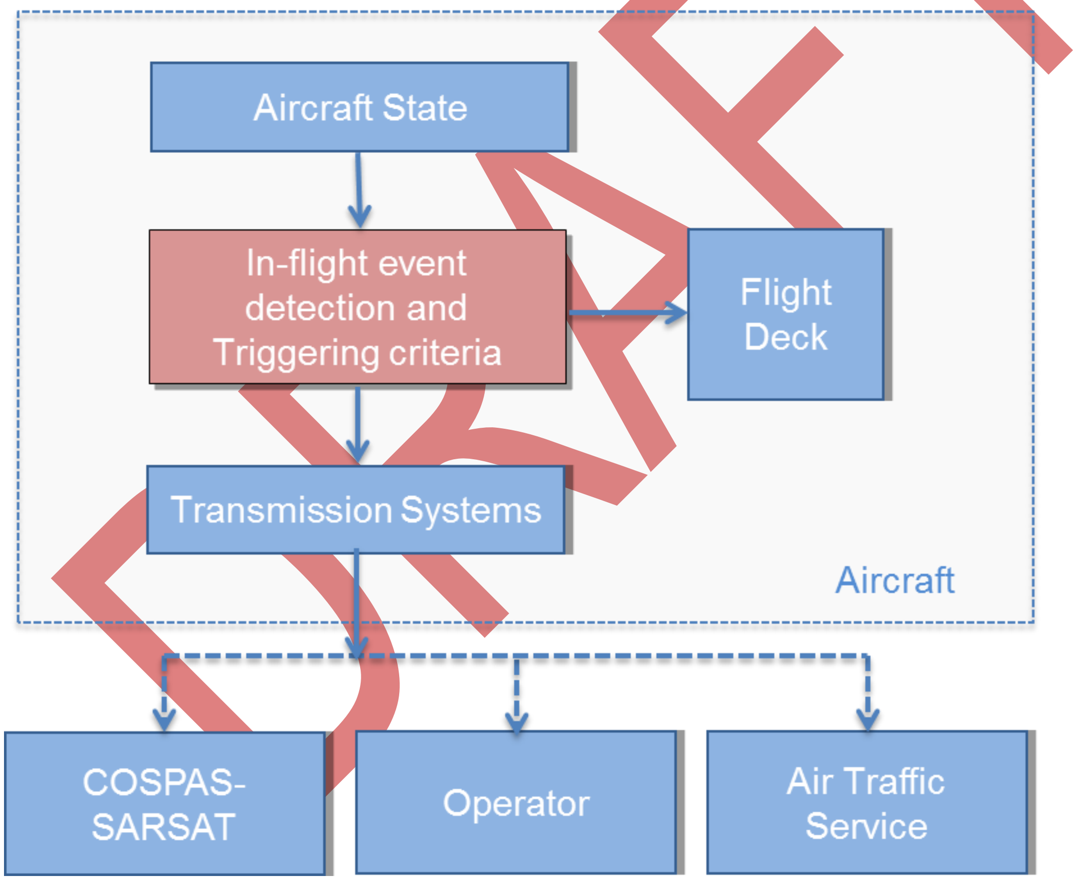

Figure 2-1: In-flight event detection and triggering criteria System Model

2.2.1 DESCRIPTION OF THE FUNCTION BLOCKS

2.2.1.1 Aircraft State

This block includes inputs to the triggering logic which can be used to identify a change of state of the aircraft. These can include, but are not limited to, airspeed or attitude. Sources of the inputs are on-board avionic/electronic systems.

2.2.1.2 In-Flight Event Detection and Triggering Criteria

This block comprises the algorithms which perform logic operations to apply the triggering criteria upon the information received pertaining to the aircraft state. The result is to trigger activation of transmission, to trigger the notification of deactivation of transmission, or to take no action.

2.2.1.3 Flight Deck

These include all flight crew indications which inform the crew of the trigger activation status and/or transmission status.

2.2.1.4 Transmission Systems

This block represents the various communication systems which may exist on the aircraft that are used to communicate with the outside world. It may include, but is not limited to HF, ELT, VHF, Satcom,...

CHAPTER 3

TRIGGERING LOGIC PERFORMANCE

3.1 INTRODUCTION

The purpose of this section is to define the in-flight event detection and triggering criteria logic performance. Compliance with this specification is recommended as one means of assuring the logic will perform its intended function satisfactorily under normal operating conditions.

The in-flight event detection and triggering criteria logic shall be designed to process data pertaining to aircraft status and provide output(s) information to transmission system(s). The specification provides a minimum set of scenarios to be detected by a triggering logic.

Automatic cancellation triggering criteria system logic shall be designed to stop transmitting information to transmission system(s).

3.2 TRIGGERING CRITERIA

The set of triggering criteria should maximize the detection of potential accidents, while limiting nuisance triggering during normal flight conditions. Examples of parametric conditions are detailed in Appendix 2.

The following set of scenarios is an estimation of what may constitute an impending accident. Manufacturers may decide to create additional scenarios. Nuisance triggers shall be evaluated for each of them and these scenarios should not impair the overall efficiency and/or reliability of the system which may discredit the system.

3.2.1 SCENARIO

A scenario can be defined by one or more criteria.

A wide range of situations can be precursors to accidents.

The scenarios listed below represent the minimum set of situations which should be detected by an algorithm, individually and/or in combination, and used to trigger the transmission of sufficient information for the purpose of locating an accident site.

Each scenario can be identified by a set of conditions that, if left uncorrected, would likely result in an accident. Persistence time for each condition shall be assessed to help limit nuisance triggers.

Different parametric value maybe selected depending of the type of aircraft.

Scenario 1: Unusual attitude beyond which the recovering of a safe attitude is unlikely: This scenario may comprise excessive roll value or excessive pitch value or yaw rate or combination of roll/pitch value and roll/pitch rate.

Scenario 2: Unusual speed conditions: this scenario may comprise excessive vertical speed or stall condition or low airspeed or overspeed or combination of various speed condition.

Scenario 3: Unusual Altitude: Inadvertent closure to terrain that, if left uncorrected, would likely result in an accident.

Scenario 4: Total loss of thrust/propulsion on all engines.

Scenario 5: in-flight inhibition of the event detection and triggering criteria logic.

3.2.2 PERSISTENCE TIME

The persistence time is the duration for which the condition is true before triggering a transmission signal.

The persistence time for each criteria should be balanced to trigger a transmission in the greatest number of accidents possible while limiting the number of nuisance triggers.

3.2.3 AUTOMATIC CANCELLATION TRIGGER

Work in progress

3.2.4 NUISANCE TRIGGER

Work in progress

3.2.5 INTEGRITY AND AVAILABILITY

Work in progress

3.2.6 SOFTWARE AND HARDWARE DESIGN

Work in progress

3.3 INTERFACE WITH TRIGGERED SYSTEM

3.3.1 INFORMATION IN THE TRIGGER

Work in progress

3.3.2 AUTOMATIC CANCELLATION

Work in progress

CHAPTER 4

PROCEDURES FOR PERFORMANCE REQUIREMENT VERIFICATION

4.1 INTRODUCTION

Work in progress

4.2 PERFORMANCE VERIFICATION OF TRIGGERING CRITERIA

Work in progress

4.2.1 VERIFICATION OF INTEGRITY AND AVAILABILITY

Work in progress

4.2.2 DATABASE

A database of flight datasets from commercial air transport aeroplanes that contains real accidents and incidents datasets will be available. Accident datasets are referenced in the database as A<number> and incident flights as I<number>.

The accident datasets were provided by official investigation authorities.

The datasets were de-identified, as no date or latitude/longitude parameters were provided. Information about aircraft type, phase of flight and occurrence is available for each file of the database. See Appendix 1 for details

APPENDIX1

DATABASE INFORMATION

Num	Flight Phase	Occurrence Category ID	Occurrence Description
A001	Approach	LOC-I	Loss of Control In Flight
A002	Approach	CFIT	Controlled Flight Into Terrain
A003	Climb	CFIT	Controlled Flight Into Terrain
A004	Approach	CFIT	Controlled Flight Into Terrain
A005	Climb	LOC-I	Loss of Control In Flight
A006	Cruise	LOC-I	Loss of Control In Flight
A007	Approach	CFIT	Controlled Flight Into Terrain
A008	Climb	ICE	Icing
A009	Climb	F-NI	Fire/Smoke (Non-Impact)
A010	Climb	SCF-NP	System/Component failure or malfunction (non-powerplant)
A011	Cruise	ICE	Icing
A013	Cruise	SCF-NP	System/Component failure or malfunction (non-powerplant)
A014	Climb	SCF-PP	System/Component failure or malfunction (powerplant)
A015	Climb	CFIT	Controlled Flight Into Terrain
A016	Approach	LOC-I	Loss of Control In Flight
A018	Cruise	LOC-I	Loss of Control In Flight
A019	Climb	LOC-I	Loss of Control In Flight
A020	Climb	LOC-I	Loss of Control In Flight
A021	Climb	LOC-I	Loss of Control In Flight
A022	Cruise	MAC	Airprox/TCAS/Loss of Separation/Mid-Air Collision
A023	Climb	CFIT	Controlled Flight Into Terrain
A024	Takeoff	ICE	Icing
A025	Approach	LOC-I	Loss of Control In Flight
A026	Climb	MAC	Airprox/TCAS/Loss of Separation/Mid-Air Collision
A027	Approach	LOC-I	Loss of Control In Flight
A028	Approach	CFIT	Controlled Flight Into Terrain
A029	Cruise	LOC-I	Loss of Control In Flight
A030	Cruise	LOC-I	Loss of Control In Flight
A031	Approach	LOC-I	Loss of Control In Flight
A032	Climb	CFIT	Controlled Flight Into Terrain
A033	Approach	AMAN	Abrupt Maneuvre
A034	Approach	CFIT	Controlled Flight Into Terrain
A035	Cruise	SCF-NP	System/Component failure or malfunction (non-powerplant)
A036	Approach	CFIT	Controlled Flight Into Terrain
A037	Climb	CFIT	Controlled Flight Into Terrain
A038	Approach	CFIT	Controlled Flight Into Terrain
A039	Climb	LOC-I	Loss of Control In Flight
A040	Approach	LOC-I	Loss of Control In Flight

Num	Flight Phase	Occurrence Category ID	Occurrence Description
A041	Cruise	LOC-I	Loss of Control In Flight
A042	Cruise	LOC-I	Loss of Control In Flight
A043	Climb	LOC-I	Loss of Control In Flight
A044	Cruise	SCF-NP	System/Component failure or malfunction (non-powerplant)
A045	Approach	LOC-I	Loss of Control In Flight
A046	Approach	CFIT	Controlled Flight Into Terrain
I001	Approach	LOC-I	Loss of Control In Flight
I002	Climb	ICE	Icing
I003	Cruise	LOC-I	Loss of Control In Flight
I004	Cruise	TURB	Turbulence Encounter
I005	Cruise	LOC-I	Loss of Control In Flight
I006	Cruise	LOC-I	Loss of Control In Flight
I007	Approach	LOC-I	Loss of Control In Flight
I008	Climb	SCF-NP	System/Component failure or malfunction (non-powerplant)
I009	Approach	ICE	Icing
I010	Approach	FUEL	Fuel related
I011	Approach	ICE	Icing
I012	Approach	TURB	Turbulence Encounter
I013	Approach	LOC-I	Loss of Control In Flight
I014	Cruise	SCF-NP	System/Component failure or malfunction (non-powerplant)
I015	Climb	SCF-NP	System/Component failure or malfunction (non-powerplant)
I016	Cruise	SCF-NP	System/Component failure or malfunction (non-powerplant)
I017	Approach	LOC-I	Loss of Control In Flight
I018	Cruise	ICE	Icing
I019	Approach	LOC-I	Loss of Control In Flight
I020	Approach	UNK	Unknown or undetermined
I021	Approach	UNK	Unknown or undetermined
I022	Approach	MAC	Airprox/TCAS/Loss of Separation/Mid-Air Collision
I023	Climb	MAC	Airprox/TCAS/Loss of Separation/Mid-Air Collision
I024	Cruise	ICE	Icing

APPENDIX 2

EXAMPLES OF SET OF CRITERIA

The Triggered Transmission of Flight Data WG performed a study proving that criteria based on a limited set of recorded flight parameters can detect 100% of accidents and incidents from the database.

The study also showed that these same criteria can be adjusted so that close to no nuisance transmission would be generated.

Two sets of set of criteria dedicated to fixed-wing commercial air transport aircraft are inserted in this document. The complete study can be downloaded at the following address: http://www.bea.aero/en/enquetes/flight.af.447/reports.php .

An example of set of criteria was provided by a Helicopter manufacturer.

TABLE 1.1: AEROPLANES

Criteria Type	Criteria Name	Equation	Persistence time
Unusual attitude	Excessive Bank	{|Roll|>50°} **OR** {|Roll|>45° **AND** |Roll rate|>10°/s}	2 sec
	Excessive Pitch	{Pitch>30°} **OR** {Pitch<-20°} **OR** {Pitch>20° **AND** Pitch rate>3°/s} **OR** Pitch<-15° **AND** Pitch rate<-3°/s}	2 sec
Unusual speed	STALL	STALL Warning=TRUE	1 sec
	Low CAS	{CAS<100kt(*) **AND** Radio altitude>100 ft} *(*) 60 kt for DHC-6*	2 sec
	Excessive Vertical speed (V/S)	{|V/S|>9000 ft/min}	2 sec
	Overspeed	{IAS>400kt} **OR** {OVERSPEED Warning = TRUE **AND** Alt<15000 ft}	2 sec
Excessive accelerations	Unusual load factors	{ nz>2.6g OR nz<-1.1g } **OR** {|ny|>0.25g}	2 sec
Control command inputs	Excessive roll command	{|Captain Roll cmd|>50 **OR** |F/O Roll cmd|>50 } **AND** {IAS>80 kt}	2 sec
	Excessive use of rudder	{|Rudder position|>6° **AND** IAS>240 kt}	2 sec
Ground Proximity	TAWS warning	TAWS warning/alert = TRUE	1 sec

	Too low altitude (poor altitude gain after takeoff)	{40<Radio Altitude<100 **AND** Eng1N1>80% **AND** Eng2N1>80%}	10 sec
Others	TCAS	TCAS RA = TRUE	1 sec
	Cabin Altitude Warning	CABIN ALT WARNING = TRUE	10 sec

TABLE 1.2: AEROPLANES

Unsafe event	Corresponding criteria approach
Excessive pitch	{Pitch>30°} **OR** {Pitch<-20°} **OR** {Pitch>20° **AND** Pitch rate>3°/s} **OR** Pitch<-15° **AND** Pitch rate<-3°/s}
Excessive roll	{roll>60°} **OR** {Roll>45° **AND** Roll rate>10°/s} **AND** Roll*RollRate >0
Stall	STALL Warning=TRUE
Low speed	{CAS<100kt(*) **AND** A/C in flight
Excessive Vertical Speed	{|V/S|>10000 ft/min}
Overspeed	{CAS>Diving Speed} **OR** {MACH>Diving Mach}
Excessive accelerations	{nz>2.6g OR nz<-1.1g} **OR** {|ny|>0.4g}
Ineffective command	Captain or F/O Roll (resp pitch) full order recorded for more than 3 s with no associated roll (resp pitch) rate
Undue use of rudder	Rudder Pedal max deflection AND no engine failure
Ground Proximity	TAWS warning/alert = “PULL UP”
Others	TCAS RA = TRUE

TABLE 1.3: HELICOPTERS

Work in progress

APPENDIX 3

HISTORY AND TERMS OF REFERENCE OF WG-98

4.3 BACKGROUND AND SCOPE

A number of fatal accidents have occurred overwater, including Air France flight 447, in which flight data and cockpit voice recorders have been very long to recover. As the long or non-recovery of recorders greatly reduces the likelihood of the actual cause of these accidents being discovered, and in order to improve the recovery of wreckage and flight recorders following an accident or incident, ED-62A has defined a performance standard for ELTs. The application and requirement specified in this standard have yet be applied by EASA or industry.

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 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.

A review and possible revision of ED-62A standard for first generation beacons and the creation of specifications for second generation beacons are required in order to ascertain if it is sufficient for application to all aircraft used in commercial operations or is under- or over-prescriptive.

A number of recommendations resulted from the studies, in particular it was recommended that EASA and ICAO define the regulatory requirements for a new generations of ELTs.

GNSS technology allows ELTs to provide accurate accident positioning to first responders. Development of standardized GNSS requirements for use in ELTs will be addressed.

Improvement in technology allows the committee to consider specifications for next generation ELTs able to operate on 406 MHz for the homing device to support search and rescue authorities,

Analysis of recent aircraft accidents shows a trend of ELTs breaking free from flexible mounting designs during accidents, preventing the ELT from performing its intended function.

Prior to these requirements there is a need to improve the ED-62A Minimum Operational Performance Specifications and to create a MASPS defining the triggering criteria.

4.4 WORKING GROUP OBJECTIVES

The working group is to provide a draft revision of ED-62A Minimum Operational Performance Specification for Aircraft Emergency Locator Transmitters as applicable.

A MASPS covering the function that would trigger ELT transmission, defining some high level concepts and the typical functional interface requirements between the ELT and the emergency triggering element.

During the development of these documents, the following areas should be addressed:

- Invite participation from interested parties, specifically including manufacturers, Search and Rescue Satellite Aided Tracking (SARSAT) agencies, and aircraft operators,
- Review Cospas-Sarsat beacon requirements, and from an aviation perspective, develop technical standards for both first and second generation Cospas-Sarsat 406MHz beacon systems,
- Introduce next generation ELTs specifications,
- GNSS specifications,
- In-flight activation/deactivation specifications,
- Power source specifications,
- Crash safety specifications,
- Return link services specifications,
- Second generation homing specifications Improved Antenna and Cabling Specifications,
- Develop aviation-based 406 MHz MEOSAR distress alerting and location proposals/papers for consideration by Cospas-Sarsat Task Groups and/or Joint committee covering topics related to second generation 406 MHz ELTs as required.
- Define the frequency of transmission of data and applicable parameters.

APPENDIX 4

WG-98 MEMBERSHIP

Will be updated just before the publication of the document

ATTACHMENT F to State letter SP 55/4-15/15

RESPONSE FORM TO BE COMPLETED AND RETURNED TO ICAO TOGETHER WITH ANY COMMENTS YOU MAY HAVE ON THE PROPOSED AMENDMENTS

To: The Secretary General
International Civil Aviation Organization
999 University Street
Montréal, Quebec
Canada, H3C 5H7

(State) ____

Please make a checkmark (✓) against one option for each amendment. If you choose options "agreement with comments" or "disagreement with comments", **please provide your comments on separate sheets**.

	Agreement without comments	*Agreement with comments**	*Disagreement without comments*	*Disagreement with comments*	*No position*
Amendment to **Annex 6** — *Operation of Aircraft*, Part I (Attachment C refers)					
Amendment to **Annex 6** — *Operation of Aircraft*, Part II (Attachment D refers)					
Amendment to **Annex 6** — *Operation of Aircraft*, Part III (Attachment E refers)					

*"Agreement with comments" indicates that your State or organization agrees with the intent and overall thrust of the amendment proposal; the comments themselves may include, as necessary, your reservations concerning certain parts of the proposal and/or offer an alternative proposal in this regard.

Signature: ________________________________ Date: ____________________________________

APPENDIX C

MID REGION SAR AGREEMENT STATUS BETWEEN ANSPS/ACCS
February 2015

STATE	CORRESPONDING STATES			REMARKS
BAHRAIN	☐ IRAN ☐ SAUDI ARABIA	☐ KUWAIT ☐ UAE	☐ QATAR	0/5
EGYPT	☒ CYPRUS ☐ JORDAN ☐ SUDAN	☐ GREECE ☒ LYBIA	☐ Israel ☐ SAUDI ARABIA	1/7
IRAN	☐ ARMENIA ☐ BAHRAIN ☐ OMAN ☐ TURKMANISTAN	☐ AZERBAIJAN ☐ IRAQ ☐ PAKISTAN ☒ UAE	☐ AFGHANISTAN ☐ KUWAIT ☐ TURKEY	1/11
IRAQ	☐ IRAN ☒ JORDAN	☐ KUWAIT ☐ SAUDI ARABIA	☐ SYRIA ☐ TURKEY	1/6
JORDAN	☐ EGYPT ☒ IRAQ	☐ ISRAEL ☐ SAUDI ARABIA	☐ SYRIA	1/5
KUWAIT	☐ BAHRAIN ☐ IRAN	☐ IRAQ	☐ SAUDI ARABIA	0/4
LEBANON	☒ CYPRUS	☐ SYRIA		1/2
LIBYA	☐ ALGERIA ☐ CHAD ☐ EGYPT	☐ MALTA ☐ NIGER	☐ SUDAN ☐ TUNIS	0/7
OMAN	☐ INDIA ☐ IRAN	☒ SAUDI ARABIA ☐ PAKISTAN	☐ UAE ☐ YEMEN	1/6
QATAR	☐ BAHRAIN	☐ SAUDI ARABIA	☐ UAE	0/3
SAUDI ARABIA	☐ BAHRAIN ☐ IRAQ ☒ OMAN ☐ UAE	☐ EGYPT ☐ JORDAN ☐ Qatar ☐ YEMEN	☐ ERITREA ☐ KUWAIT ☐ SUDAN	1/11
SUDAN	☐ CENTRAL AFRICAN ☐ CHAD ☐ EGYPT	☐ ERITREA ☐ ETHIOPIA ☐ LIBYA	☐ SAUDI ARABIA ☐ SOUTH SUDAN	0/8
SYRIA	☐ IRAQ ☐ JORDAN	☐ LEBANON ☒ CYPRUS	☒ TURKEY	2/5
UAE	☐ BAHRAIN ☒ IRAN	☐ OMAN ☐ SAUDI ARABIA	☐ QATAR	1/5
YEMEN	☐ DJIBOUTI ☐ ERITREA ☐ ETHIOPIA	☐ INDIA ☐ OMAN ☐ SAUDI ARABIA	☐ SOMALIA	0/7

☒ Agreement Signed ☐ Agreement NOT Signed Signed Agreements / Total No. of required Agreements

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APPENDXI D

MID REGION SAR POINT OF CONTACT (SPOC) – COSPAS-SARSAT

STATE	SPOC NAME	ADDRESS	EMAIL	TEL	FAX	AFTN	ASS. MCC/ STATE[1]	LAST REVISION	REMARK
Bahrain	RCC ATC Bahrain	Bahrain CAA, Air Navigation Directorate P.O. Box 586 Kingdom of Bahrain	Bahatc@caa.gov.bh	(973) 17321081 17321080	(973) 17321905	OBBISARX	SAMCC Saudi Arabia	16-April-2013	
Egypt	SAR Centre	SAR Centre Almaza Air Base Heliopolis, Cairo, Egypt	jrcc136@afmic.gov.eg mmc@saregypt.net nahedh@tra.gov.eg	(202) 24184537 24184531	(202) 24184537 24184531	HECCYCYX	ALMCC Algeria	22-OCT-2013	TELEX: (91) 21095 RCCC RUN
Iran	RCC Tehran	Civil Aviation Organization SAR Coordination Centre Mehrabad Airport Tehran, Iran	SAR@cao.ir IRAN-SAR@airport.ir rcc.IRAN@airport.ir	(9821) 44544107 44544116 44544060	(9821) 44544117 44544106	OIIIZRZX	TRMCC Turkey	1-Jan-2013	
Iraq	RCC ATC Baghdad’	Baghdad ACC, Baghdad International Airport	atc_iraqcaa@yahoo.com	(964) 7901654653	(974) 15430764		TRMCC Turkey	18-Mar.-2015	
Jordan	RCC ATC Amman	RCC Civil Aviation Authority Amman Airport, Jordan		(9626) 4451672	(9626) 4451667	OJACZQZX	SAMCC Saudi Arabia	16-Apr-2013	
Kuwait	RCC ATC Kuwait	RCC DGCA Kuwait International Airport, P.O.Box 17, Kuwait		(965) 24760463 24762994	(965) 24346515 24346221	OKBKZQZX OKBKNSAR	SAMCC Saudi Arabia	16-Apr-2013	
Lebanon	RCC Beirut	RCC, DGCA Lebanon, Hariri Int’l Airport- Beirut, Lebanon		(961) 1628161	(961) 1628186 1629035	OLBIZQZX	SAMCC Saudi Arabia	16-Apr-2013	
Libya	CAA	CAA, Tripoli Int’l Airport, Libya	info@sar.caa.ly	(218.21) 5632332 4446799 3606868	(218.21) 563 0257 360 6868	HLLTYCYX	ALMCC Algeria	16-May-2013	TELEX (218.21) 5632332
Oman	RCC Muscat Air Force	RCC, HQ RAFO P.O.Box 730 Central Post Office Muscat Int’l		(968) 24519209	(968) 24334776	OOMSYAYX	SAMCC Saudi	16-Apr-2013	

[1] Associated COSPAS-SARSAT Mission Control Center / State where it is located

STATE	SPOC NAME	ADDRESS	EMAIL	TEL	FAX	AFTN	ASS. MCC/ STATE[1]	LAST REVISION	REMARK
		Airport, Oman		24519332	24338692		Arabia		
Qatar	DJRCC	P.O. Box 37 Doha, Qatar	qatsar@yahoo.com	(974) 44980384		OTBDZTZX	SAMCC Saudi Arabia	02-Apr-2015	
Saudi Arabia*	SAMCC	KSA.GACA / Air Navigation services P.O.Box 929 Jeddah 21421 Saudi Arabia	samcc@gaca.gov.sa	(96612) 6150170 6855812 (96650) 4601445	(96612) 6150171 6402855	OEJNJSAR	SAMCC Saudi Arabia	28-Jun-2013	TEL 3 & FAX 2 for Head of SAMCC
Sudan	ACC Khartoum	Khartoum Airport, Sudan		(249.183) 788192 784925	(249.183) 528323	HSSSYCYX	ITMCC Italy	16-Apr-2013	Thuraya +8821655524 296
Syria	RCC ATC	General Civil Aviation Authority		(963.11) 5400540	(963.11) 5400312	OSDIZQZX	SAMCC Saudi Arabia	16-Apr-2013	
UAE*	AEMCC	SAR Coordination Center P.O.Box 906 GHQ Armed Forces UAE	aemcc@uae-jrcc.ae	(971.2) 4056144 4496866	(971.2) 4496844	OMADYCYX	AEMCC UAE	23-Sep-2011	
Yemen	RCC Sanaa	RCC Department of Civil Aviation Sanaa, Yemen		(967) 1344673	(967) 1345916	OYSNYCYX	SAMCC Saudi Arabia	16-April-2013	

APPENDIX E

MID REGION SAR FOCAL POINTS CONTACT DETAILS

STATE	NAME	TITLE	ADDRESS	EMAIL/AFS	FAX	TEL	MOBILE
Bahrain	ACC Duty Supervisor	ACC Duty Supervisor	Bahrain CAA P.O.Box – 586 Kingdom Of Bahrain	bahatc@caa.gov.bh	+973 17321029	+97317321081 +97317321080	
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Iran							
Iraq	Ali Muhsin Hashim	Director ATS	ANS Building, BIAP	Atc_iraqcaa@yahoo.com		964 7815762525	964 7815762525
Jordan	Mr. Khalaf Al-Shawabka	Chief Amman TACC and SAR	Queen Alia Airport	kshowbki@yahoo.co.nz	+962 445132	+ 962 4451672	96) 77790 4724
Kuwait							
Lebanon							
Libya							
Oman	RCC HQ RAFO		P.O.Box 722 Muscat P.C. 111, Oman	Hq.rafo.@rafo.gov.om AFS:- OOMSYCYX	+968 24334776	+968 24334211 +968 24334212	

STATE	NAME	TITLE	ADDRESS	EMAIL/AFS	FAX	TEL	MOBILE
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Sudan	Hashim Mohamed Ahmed	RCC Head	Sudan CAA PO BOX 165	BEGER124@gmail.com	249183528323	249183528323	24912327797 249912382433
Syria	Mr. Monif Abdulla	Head of S.A.R. Department Syrian Civil Aviation Authority	Damascus Airport	monif77@hotmail.com	963-11 540 0312	963-11 540 0312	963 932 710351
UAE	UAE ATC Duty Supervisor			atc@szc.gcaa.ae	971 2 599 6850	971 2 599 6969	
Yemen							

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