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DTR Functional Specification

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Functional Specification - **DRAFT**

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# Distress Tracking Data Repository (DTR)

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**Draft Version 1.1**

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## **Status of this document**

The DTR functional Specification has been developed by the Autonomous Distress Tracking Repository Task Force (ADTR-TF) of ICAO. This document remains draft and subject to further changes as the work progresses.

## EXECUTIVE SUMMARY

ICAO Annex 6 — *Operation of Aircraft, Part I — International Commercial Air Transport — Aeroplanes* requires that, as of 1 January 2021, all new production aeroplanes of a maximum certificated take-off mass of over 27 000 kg shall autonomously transmit information from which a position can be determined by the operator at least once every minute when an aircraft is in a state that, if the aircraft behaviour event is left uncorrected, it can result in an accident. Annex 6 also recommends that this requirement be applicable to all new aeroplanes after 1 Jan 2021 of a maximum certificated take-off mass of over 5 700 kg. The operator is responsible to make that position information of a flight in distress available to Air Traffic Services Units (ATSUs), Rescue Coordination Centres (RCCs) and any additional entity as established by the State of the Operator.

The ICAO Global Aeronautical Distress and Safety System (GADSS) - Concept of Operations (CONOPS) identified a need to collect, store and provide access to Autonomous Distress Tracking (ADT) position information to aid appropriate stakeholders in locating an aircraft in distress, and enhance Search and Rescue (SAR) and recovery capabilities. When an operator detects a potential problem with an aircraft such as a missed position report or suspected distress situation, it will need to inform the appropriate ATSU and other stakeholders.

A centrally managed position data repository was considered the preferred means to provide access to the required distress tracking data.

The Distress Tracking Data Repository (DTR), a secure web-based storage facility, will house position/location information of aircraft in distress or potentially in distress and will be the means to make the last known position of an aircraft in distress available to stakeholders in a timely manner.

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## **DEFINITIONS**

All terms used in this document are consistent with the *GADSS – Concept of Operations*, Version 6.0.

## **REFERENCE DOCUMENTS**

*Annex 6 — Operation of Aircraft, Part I — International Commercial Air Transport — Aeroplanes*

*Annex 10 — Aeronautical Telecommunications*

*Annex 11 – Air Traffic Services*

*Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services (Doc 8585)*

*Location Indicators (Doc 7910)*

*Manual on System Wide Information Management (SWIM) Concept (Doc 10039)*

*Manual on Location of Aircraft in Distress and Flight Recorder Data Recovery (Doc 10054)*

*ICAO Global Aeronautical Distress Safety System – Concept of Operations (GADSS - CONOPS), Version 6.0*

## 1.0 BACKGROUND

1.0.1 On 2 March 2016, the ICAO Council adopted Amendment 40-A to Annex 6, Part I which included, among other elements, Standards and Recommended Practices (SARPs) related to the location of an aeroplane in distress (Chapter 6, 6.1.8, refers). These SARPs address the Global Aeronautical Distress Safety System (GADSS) Autonomous Distress Tracking (ADT) concept and became effective on 11 July 2016, with an applicability date of 1 January 2021. Amendment 40-A was issued in July 2016.

1.0.2 The SARPs are applicable to aeroplanes with take-off mass greater than 27 000 kg for which the certificate of airworthiness is first issued as of 1 January 2021, and establish the requirement to autonomously transmit information from which a position can be determined by the operator at least once every minute when in a distress condition. The same is recommended for new aeroplanes for which the certificate of airworthiness is first issued as of 1 January 2021 with take-off mass greater than 5 700 kg. An aircraft is considered in distress when it is in a state that can, if the behaviour event is left uncorrected, result in an accident.

1.0.3 The SARPs state that autonomous transmission of position information needs to be active when an aircraft is in a distress condition. This will provide a high probability of locating an accident site to within a 6 NM radius. Annex 6, Part I, Appendix 9, also specifies that this transmission can be activated manually. Annex 6 is not technology-specific and will allow for various solutions, including triggered transmission systems. The autonomous transmission of position information needs to be capable of occurring in the event of aircraft electrical power loss, at least for the expected duration of the entire flight. For further details regarding the requirements for an ADT system, refer to the *Manual on Location of Aircraft in Distress and Flight Recorder Data Recovery* (Doc 10054).

1.0.4 The SARPs also establish the requirement for making this information available to authorities such as: Rescue Coordination Centres (RCCs); Air Traffic Services Units (ATSUs); and others as determined by the State of the Operator.

1.0.5 Performance-based standards for ADT systems allow industry to come up with different degrees of innovation. The challenge, however, is to make the ADT position information available in a standard format for the primary intended audience, the RCCs and ATSUs. To accomplish this, the GADSS CONOPS identified a need to store and provide access to ADT position information by means of a centrally managed repository, commonly referred to as the Distress Tracking Data Repository (DTR) and implemented in accordance with the guidelines provided in the *Manual on System Wide Information Management (SWIM) Concept* (Doc 10039).

## 1.1 SCOPE

1.1.1 The scope of this document is to provide details on a solution to meet the requirement of making the last known position of an aircraft in distress situation available to stakeholders in a timely manner applying a global standard.

1.1.2 The proposed Distress Tracking Repository (DTR) is intended to serve as a central location for storing and accessing the last known position of an aircraft in distress. This position may be made available from a number of different proprietary systems which meet the requirements of the Standards in Annex 6. The DTR will provide a single point of access and standard format for this information. Additional functionality, for example the issuing of a

notification to accredited users of the arrival of new data, may also be included but are not considered fundamental to the basic function of the DTR.

1.1.3 The DTR does not provide alerting of distress conditions, this will be done by operators and Air Traffic Service Units (ATSUs) using the existing provisions of Annex 6 and Annex 11.

1.1.4 In due course the DTR may host or serve as a SWIM-based conduit for additional information that may be of use to SAR. This specification identifies the minimum dataset required to make the location of an aircraft in a distress condition (aircraft identification details, latitude, longitude and time) available to ATSUs, RCCs and others as established by the State of the Operator. Additional elements which may optionally be provided by an ADT are also defined in order to ensure the information is received in a standard format.

1.1.5 The DTR scope is limited to position data from an activated ADT device caused by the aircraft reporting a *distress condition*. This should not be confused with an aircraft being designated as in a *distress phase* by ATC, as described in Annex 11, Chapter 5 (Alerting Service).

## **2.0 HIGH LEVEL OBJECTIVES OF THE DOCUMENT**

2.0.1 To ensure that ATSUs, RCCs and others, as established by the State of the Operator, have available timely access to the last known location of an aircraft in distress, as described in the GADSS - CONOPS, Section 3.4. The system should be capable of processing the position information such that it is available for use within a few minutes after transmission from the aeroplane

2.0.2 This paper defines the general DTR profiles for contributors and users of the system.

2.0.3 The DTR functionality begins when data, submitted by a contributor, is received by the DTR and ends after a period when the data is no longer held in the repository. Users, based on their profile and selections, may have access to the data and be notified when a new source of data commences data transfer to the DTR.

## **3.0 OPERATIONAL FRAMEWORK FOR THE USE OF THE DTR**

3.0.1 The DTR is a system that will allow accredited contributors, as defined in Section 6, to submit position information of an aircraft in distress or potentially in distress. The system will store information (i.e. data that meets the input format guidelines) and provide filters allowing users to access information based on their profile.

3.0.2 The available filters will be presented as flags to be selected in the user profile.

3.0.3 The system will allow users, based on the selected flags, to be notified when submitted information is stored in the DTR.

## **4.0 DTR PERFORMANCE**

4.0.1 The DTR will be subject to a quality/maintenance process that ensures that when data is submitted, it is accurately processed.

## 4.1 Database capacity

4.1.1 The repository should have sufficient capacity to accommodate all distress events and potential events where activation of the ADT occurs. In order to estimate storage requirements for the DTR, Table 1 provides an indication of the storage needed under the following scenario:

- i. ADT message size of 200 bytes, uncompressed;
- ii. DTR is receiving information at one-minute intervals from an aircraft through a DTR contributor; and
- iii. data is retained for the duration specified in the header.

| Message size (bytes) | 200         |           |          |            |  |
|----------------------|-------------|-----------|----------|------------|--|
| No. Aircraft         | Minute (Kb) | Hour (Mb) | Day (Gb) | Month (Tb) |  |
| 1                    | 2           | 0.12      | 0.003    | 0.0001     |  |
| 10                   | 20          | 1.20      | 0.03     | 0.001      |  |
| 50                   | 100         | 6.00      | 0.14     | 0.004      |  |
| 100                  | 200         | 12.00     | 0.29     | 0.01       |  |
| 500                  | 1,000       | 60.00     | 1.44     | 0.04       |  |
| 1000                 | 2,000       | 120.00    | 2.88     | 0.09       |  |

Table 1

4.1.2 Although 1 minute reporting is defined as the *minimum* reporting rate and many systems may in practice use a higher rate, the figures in Table 1 also provide estimates for substantially higher numbers of aircraft in a distress condition than is considered likely. They can therefore be used to determine the maximum capacity needed regardless of transmission rate.

4.1.3 Using as a basis the ATS data retention requirements in Annex 10 — *Aeronautical Telecommunications*, the DTR will retain ADT data for a period of at least thirty days from its submission. When ADT data is pertinent to inquiries or investigations, it will be retained for longer periods until it is evident that it is no longer required. A mechanism would need to be included to permit such data to be identified and subsequently preserved.

4.1.4 The intent is that the repository will be continuously available, within reasonable limits. Operation of the DTR will also be supported by adequate technical support to provide assistance and meet the requirements of the administrator role defined in section 6.1.

## 4.2 Maximum response time

4.2.1 The maximum response time for return of data requested by a user will not exceed thirty seconds.

## 4.3 Database security

4.3.1 The DTR will provide the appropriate level of security, and only allow approved contributors to submit information and approved users to access read-only information based on their profile. The security requirements will also keep contributor and user profiles secure.

4.3.2 Details of accreditation for approved users can be found in Section 6.



## 4.4 Denial of service protection

4.4.1 The repository will provide protection from malicious attempts to interfere with normal operation and authorized access (e.g. high volume repetitive access).

## 4.5 Virus protection

4.5.1 The repository will be designed to minimize the threat posed by computer viruses.

## 4.6 Password encryption

4.6.1 Password information received or transmitted by the repository over the Internet will be protected using standard Internet encryption technology.

## 4.7 Intrusion detection

4.7.1 The DTR will detect and report on intrusions. Intrusion attempts will be:

- a) successfully detected;
- b) reported in such a way that DTR operator personnel are immediately alerted;  
and
- c) terminated whenever possible.

4.7.2 Reports on attempted intrusions will be generated and made available to the originators of the data stored in the DTR.

## 5.0

5.0.1 As described in above Section 1.1, the DTR is a means to make the last known position of an aircraft in distress available to relevant stakeholders in a timely manner applying a global standard. The required information, per Annex 6, Part I, is the latitude and longitude with a time stamp.

5.0.2 The provisions in Annex 6 specify that the position of an aircraft in a distress condition needs to be made available to ATSU's, RCCs and others as established by the State of the Operator (Stakeholders). The DTR needs to provide functionalities to make that information available to the appropriate Stakeholders. To allow for this functionality the DTR needs additional fields.

## 5.1 Required Data

5.1.1 Table 2 provides an overview of the minimum data set with information for each field with regards to the DTR functionality.

| Field                | Format              | DTR Functionality                         | Example          |
|----------------------|---------------------|---|------------------|
| Latitude             | N/S DD°<br>MM''SS'  | Establish domain by geo referencing       | N45°<br>28''12'  |
| Longitude            | E/W DDD°<br>MM''SS' | Establish domain by geo referencing       | W073°<br>44''30' |
| Date of Transmission | DD/MM/YYYY          | Sequencing of messages and data retention | 07/12/2017       |

|   |            |   |            |
|---|------------|---|------------|
| Date of Receipt                               | DD/MM/YYYY | Sequencing of messages and data retention (for corrupted/incomplete data) | 07/12/2017 |
| Time of Transmission                          | HH:MM:SS   | Sequencing of messages  | 10:25:45   |
| Time of Receipt                               | HH:MM:SS   | Sequencing of messages (for corrupted/incomplete data)                    | 10:26:43   |
| 3LD   | TTT        | Establish State of the Operator domain                                    | MXA        |
| Aircraft Registration (with Nationality Mark) | TTTTTTT    | Particular aircraft identification  | AB12345    |
| Contributor Code                              | NNN        | Establish contributor domain for data validation.                         | 001        |

**Table 2**

## 5.2 Optional Data

5.2.1 An ADT system may be configured to provide additional data which could be of use to SAR or post flight location and recovery. The following fields should be available for use in the DTR but remain optional. Where used, the format of the data supplied must match the indicated format to ensure consistency and usability of the data.

| Field                     | Format           | DTR Functionality | Example |
|---------------------------|------------------|-------------------|---------|
| Altitude (ft)             | NNNNN            | Optional field    | 35000   |
| Altitude (m)              | NNNNN            | Optional field    | 10000   |
| Indicated Airspeed (kt)   | NNN              | Optional field    | 350     |
| Indicated Airspeed (km/h) | NNN              | Optional field    | 550     |
| Heading                   | DDD <sup>o</sup> | Optional field    | 090     |

## 5.3 SWIM compliance for information exchanges

5.3.1 The DTR needs to accept and store DTR data and exchange it with users as a SWIM information service. In a SWIM environment, information services are the means through which organizations provide and consume information via “publish/subscribe” or “request/reply” messaging patterns. More information on SWIM can be found in ICAO Doc 10039.

## 5.4 DTR data source – reliability of data/source

5.4.1 The DTR will accept and store any data that is appropriately formatted in conformance with the specifications and will notify the relevant contributor for appropriate action when:

- a) the message is not complete;
- b) the DTR is incapable of processing all submitted data in the message; and

c) the DTR suspects duplication of submitted data or messages.

5.4.2 Transmissions which are incomplete or corrupted should be identified and a flag attached. This data should be retained in the DTR in a ‘quarantined’ area. Users viewing data transmitted from an ADT should be made aware that ‘quarantined’ data exists which is associated with this ADT data, and should be able to view such data to determine if there is anything which may be useable in the corrupted or incomplete submission.

5.4.3 The DTR will flag suspected duplication of submitted data, as “possible duplicate data” when stored.

5.4.4 Contributors and users will be aware that incomplete messages may hinder the DTR notification functionality.

5.4.5 Contributors will be responsible for the data they submit to the DTR. They will need to have policy and procedures in place to verify the integrity of submitted data and to take action, as appropriate, when receiving a message from DTR regarding a message or data submitted.

5.4.6 Initial verification will be done as part of the accreditation process (see Section 6). Changes to the ADT system subsequently will need to be validated to ensure that they still meet the requirements of the DTR.

5.4.7 The DTR will have a development area so that DTR submitting tests can be run without interfering with the DTR functionality.

5.4.8 The development area is intended to be used by developmental submitters (see 6.2.2) to become accredited for DTR access, and for changes to existing ADT systems by accredited users.

## **5.5 DTR access restrictions**

5.5.1 The data will be physically stored at least at two geographically independent sites to provide redundancy in case of natural disasters or other factors adversely impacting the operational readiness.

5.5.2 Access to the repository will be provided through a dedicated user interface and granted to authorized individuals only. Sufficiently safe and secure access control mechanisms will be put in place to prevent unauthorized access.

## **6.0 DTR STAKEHOLDERS**

6.0.1 There will be three main categories of DTR stakeholders:

- i. DTR administrator;
- ii. contributors (data providers to DTR);
  - a) to include *developmental submitters*, see 6.2.2; and
- iii. DTR data users.

6.0.2 An individual entity may fit into one or more of the above stakeholders (e.g. an airline may be a contributor and also a DTR data user).

## **6.1 DTR administrator**

6.1.1 The DTR administrator will be ICAO. Effective daily activities for accreditation, monitoring, maintenance and any other working aspects may be delegated to an organization authorized by ICAO which will “host” all above activities on the organization’s behalf.

6.1.2 The DTR administrator, or delegated responsible organization, will be contactable 24/7 and be required to address issues related to availability of the repository and access by accredited users. Actual response times for issues and database unavailability will need to be defined in a service level agreement with the delegated responsible organization, once this has been decided.

6.1.3 The DTR administrator will establish criteria to approve contributors and determine the information available to each user profile.

## **6.2 DTR contributors**

### **6.2.1 Criteria for becoming a DTR contributor**

6.2.1.1 Contributors for DTR will be those organizations which:

- a) have ADT solutions which have been approved for use by a Contracting State;
- b) are able to provide data to the DTR in accordance with the requirements defined by the DTR administrator; and
- c) have been properly accredited.

6.2.1.2 Potential contributors will be designated as *developmental submitters* until they can demonstrate that appropriate quality systems ensure verification of accuracy and integrity of provided data.

6.2.1.3 Contributors will need to have policies and procedures to ensure that the data they submit is received and processed by the DTR. These include appropriate actions when notification of a “rejected”, “incomplete” or “duplicate” message is received from the DTR. The policies and procedures will also include periodic verification that submitted information is being processed correctly by the DTR.

### **6.2.2 Contributor accreditation**

6.2.2.1 A DTR contributor will need to provide evidence that it supports an ADT system approved by a Contracting State and that it meets the DTR requirements. The accreditation process may follow the following sequence of events:

- a) a Member State informs ICAO that it is in the approval process of an ADT system and wishes that the DTR establishes the organization as a developmental submitter;
- b) the DTR administrator provides all necessary documentation to fully specify the required data, formats and procedures for ADT data submissions;

- c) the DTR administrator runs a verification test to ensure that the contributor, in developmental submitter mode, meets the DTR requirements for data submissions;
- d) once the verification tests are successfully completed, the DTR administrator will set the system up to allow the contributor to submit data and monitor data submissions; and
- e) once all requirements are met to the satisfaction of the DTR administrator, it informs the respective Member State of the suitability of the ADT system. The DTR administrator will also issue an accreditation to the ADT provider as a contributor.

6.2.2.2 Contributors will automatically have User Status.

### 6.2.3 Contributor ongoing accreditation

6.2.3.1 Initial accreditation is granted based on meeting the requirements of the DTR and successful testing and verification. Subsequent changes to an ADT system that impact the connection to the DTR would need to be documented and submitted for re-accreditation, demonstrating the results of testing that has been conducted to ensure ongoing compatibility.

## 6.3 DTR data users

### 6.3.1 Criteria for becoming a DTR user

6.3.1.1 Users are individuals that are associated with a DTR accredited entity. All user access to the DTR will be read-only. User access and available information will be subject to the entity type profile (see Table 3) and the privileges granted by the particular accredited entity.

| Entity (user) type profile                          | Domain of data available to users  |
|---|--|
| Air Operator  | All ADT data for aircraft, identified by the operators three letter designator   |
| Air navigation services provider (ANSP)             | All ADT data for aircraft within the flight information region (FIR) managed by the ANSP, and within an area 80 NM outside of the FIR boundary |
| RCC   | All ADT data in the DTR  |
| Others, as established by the State of the Operator | Partial or all ADT data for aircraft associated with air operators of the particular State of the Operator                                     |
| Contributor   | All ADT data submitted by the particular contributor   |

**Table 3**

6.3.1.2 An accredited entity will have one or more Super Users and as many users as deemed appropriate. Super Users will manage their own users and will be able to establish criteria, within the domain of the entity type profile, and options that their users can flag to get notifications.

6.3.1.3 An accredited entity will need to have at least one Super User that will act as the focal point for the DTR administrator.

6.3.1.4 Users will be approved and registered in the DTR by the Super User. Users will be able to see the ADT data based on the corresponding entity type profile.

6.3.1.5 When submitted data is stored in the DTR, the data will be subject to the filters established by user flags to be acted upon by the DTR accordingly.

6.3.1.6 The DTR will have the functionality to issue a notification to the user when ADT data that meets a user’s criteria, as defined with flags in the user’s profile, is stored in the DTR. This notification should be triggered on the first entry from an activated ADT and should not subsequently send notifications for each position report received from the device. The functionality is optional and a user may choose to either receive or not receive such notifications.

6.3.1.7 The DTR will have the following options for the delivery of flagged notifications to users:

- email
- SMS
- Automated SWIM notification (to be defined)

6.3.1.8 There is no requirement at this moment for a push-pull message exchange pattern for DTR notifications (i.e. “pushing data”). However, based on comments from the ATS community, there may be a requirement in this regard in the near future.

## 6.3.2 User (entity) accreditation

6.3.2.1 ICAO will accredit entities that will, in turn, accredit users. When an entity seeks ICAO accreditation to access the DTR, it will need to nominate at least one Super User that will serve as the DTR focal point.

6.3.2.2 The table 4 below contains the entities that are eligible for accreditation by the DTR administrator and the eligibility requirements for each entity.

| Entity       | Requirement  |
|--------------|--|
| Air Operator | <ul style="list-style-type: none"> <li>• Be listed in ICAO Doc 8585 - <i>Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services</i></li> <li>• Maintain updated agency (operator) operational control contact information with ICAO</li> </ul> |
| ANSP         | <ul style="list-style-type: none"> <li>• Manage at least one ATSU</li> <li>• Have ATSUs listed in ICAO Doc 7910 - <i>Location Indicators</i></li> <li>• Maintain updated ATSU operational control contact information with ICAO</li> </ul>                                 |

|  |   |
|--|---|
| RCC  | <ul style="list-style-type: none"> <li>• Be listed in the Cospas-Sarsat RCC database</li> <li>• Maintain updated RCC operational control contact information with ICAO</li> </ul>   |
| Others, as determined by the State of the Operator | <ul style="list-style-type: none"> <li>• The State of the Operator will coordinate with the Air Operator.</li> <li>• Other users within the Air Operator will be managed by a single focal point within the Air Operator.</li> <li>• Additional users which the State of the Operator requires to have access will need to be specifically identified by the State of the Operator</li> </ul> |

**Table 4**

6.3.2.3 An entity, which meets the requirements in Table 4, seeking ICAO DTR accreditation, will need to submit an official request to the DTR administrator. The request will indicate the contact details of the Super User (focal point) and as applicable, assurance that the relevant ICAO operational contact database is up to date.

6.3.2.4 An entity and all users associated with that entity will retain accreditation for as long as the eligibility requirements in Table 4 remain valid.

