ICAO

Doc 10150

Manual on the Functional Specifications for the Location of an Aircraft in Distress Repository (LADR)

First Edition, 2021

Approved by and published under the authority of the Secretary General

INTERNATIONAL CIVIL AVIATION ORGANIZATION

ICAO

Doc 10150

Manual on the Functional Specifications for the Location of an Aircraft in Distress Repository (LADR)

First Edition, 2021

Approved by and published under the authority of the Secretary General

INTERNATIONAL CIVIL AVIATION ORGANIZATION

Published in separate English, Arabic, Chinese, French, Russian
and Spanish editions by the
INTERNATIONAL CIVIL AVIATION ORGANIZATION
999 Robert-Bourassa Boulevard, Montréal, Quebec, Canada H3C 5H7

For ordering information and for a complete listing of sales agents
and booksellers, please go to the ICAO website at www.icao.int

Doc 10150, *Manual on the Functional Specifications for the Location of an Aircraft in Distress Repository (LADR)*
Order Number: 10150
ISBN 978-92-9265-317-0 (print version)
ISBN 978-92-9265-493-1 (electronic version)

AMENDMENTS

Amendments are announced in the supplements to the *Products and Services Catalogue;* the Catalogue and its supplements are available on the ICAO website at www.icao.int. The space below is provided to keep a record of such amendments.

RECORD OF AMENDMENTS AND CORRIGENDA

AMENDMENTS		
No.	Date	Entered by

CORRIGENDA		
No.	Date	Entered by
1	21/06/21	ICAO

FOREWORD

The purpose of the functional specifications for the Location of an Aircraft in Distress Repository (LADR) is to define the requirements for a centralized repository of location information resulting from activations of aircraft distress tracking systems. The Repository enables operators to meet the requirements of Annex 6 — *Operation of Aircraft,* Part I — *International Commercial Air Transport — Aeroplanes,* Chapter 6, 6.18.3 to make position information of a flight in distress available to appropriate organizations, as established by the State of the Operator, while also meeting the expectation from the search and rescue (SAR) community that such information will be held in a single place such that information from different autonomous distress tracking (ADT) systems would be collected together, thereby facilitating quick access to the last known position of the aircraft.

All previous draft versions of this document were made available in the Global Flight Tracking Section of the ICAO public website at: https://www.icao.int/safety/globaltracking/Pages/Homepage.aspx.

Version 1.0 was developed from the Distress Tracking Repository (DTR) White Paper and published after review by the Autonomous Distress Tracking Repository Task Force (ADTR-TF) in August 2018.

Version 2.0 incorporated the outcomes of the DTR Functional Workshop held at ICAO from 9 to 11 April 2019. As part of the workshop's discussion, a proposed change to the name of the repository was discussed, resulting in the renaming of the document.

Version 3.0 was updated as a result of the DTR Technical Workshop held at Cospas-Sarsat, from 1 to 3 July 2019 in Montréal. Following this workshop, the format of the functional specification was completely revised to facilitate the tendering process for development of the LADR. Changes in performance measurements and other minor amendments resulted in Version 3.1, which incorporated requirements for a basic web viewer to be included as part of the functionality and subsequently revised (Version 3.2) with additional editorial changes.

Version 4.0 was developed following the LADR prototype virtual workshop in August 2020, which provided additional information regarding the use and functionality of the LADR, based on discussions around scenarios simulating activations of distress tracking systems and subsequent submission of data to the repository. Version 4.0 was again amended to allow for the publication as an ICAO document.

On 2 March 2016, the ICAO Council adopted Amendment 40-A to Annex 6 — *Operation of Aircraft*, Part I — *International Commercial Air Transport — Aeroplanes,* 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.

The SARPs are applicable to aeroplanes with a 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 a 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.

The SARPs state that the 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).

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.

Performance-based standards for ADT systems allow the industry develop 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 Global Aeronautical Distress and Safety System (GADSS) concept of operations (CONOPS) identified the need to store and provide access to ADT position information by means of a centrally managed repository, originally referred to as the Distress Tracking Data Repository and now referred to as the LADR, and implemented in accordance with the guidelines provided in the *Manual on System Wide Information Management (SWIM) Concept* (Doc 10039).

Additional provisions have been drafted for the *Procedures for Air Navigation Services — Aircraft Operations*, Volume III — *Aircraft Operating Procedures* (PANS-OPS, Doc 8168) which will require that the information related to the position of an aircraft in distress be provided to the centrally managed repository.

———————

TABLE OF CONTENTS

GLOSSARY

LIST OF ACRONYMS

ADT	Autonomous distress tracking
AFTN	Aeronautical fixed telecommunication network
AIRAC	Aeronautical information regulation and control
ANSP	Air navigation services provider
AMQP	Advanced message queuing protocol
ATC	Air traffic control
ATS	Air traffic service
ATSU	Air traffic services unit
DNA	Data Network for Aviation
ELT	Emergency locator transmitter
FIR	Flight information region
FIXM	Flight Information Exchange Model
GADSS	Global Aeronautical Distress Safety System
GIS	Geographic information system
LADR	Location of an Aircraft in Distress Repository
RCC	Rescue coordination centre
SAR	Search and rescue
SARPs	Standards and Recommended Practices
SELCAL	Selective calling system
SMS	Short message service
SSR	SAR region
SWIM	System-wide information management
TI	Technical infrastructure
TLS	Transport layer security

DEFINITIONS

Aircraft tracking. A process, established by the operator, that maintains and updates, at standardised intervals, a ground-based record of the four dimensional position of individual aircraft in flight.

Air navigation system. A generic term for all systems as detailed in the ICAO Annexes and any related systems required to interface with these aviation systems.

Air traffic service (ATS). A generic term meaning variously, flight information service, alerting service, air traffic advisory service, air traffic control service (area control service, approach control service or aerodrome control service).

Alerting service. A service provided to notify appropriate organizations regarding aircraft in need of search and rescue aid, and assist such organizations as required.

Alerting post. Any facility intended to serve as an intermediary between a person reporting an emergency and a rescue coordination centre or rescue sub centre.

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

Autonomous distress tracking (ADT). The capability using transmission of information from which a position of an aircraft in distress can be determined at least once every minute and which is resilient to failures of the aircraft's electrical power, navigation and communication systems.

Note. — This capability is described under 'Location of an Aeroplane in Distress' in Annex 6, Part 1.

Cospas-Sarsat System. A satellite-based system designed to detect and locate activated distress beacons transmitting in the frequency band of 406.0-406.1 MHz and to distribute these alerts to RCCs.

Emergency locator transmitter (ELT). A generic term describing equipment which broadcast distinctive signals on designated frequencies and, depending on application, may be automatically activated by impact or be manually activated. An ELT may be any of the following:

Automatic fixed ELT (ELT(AF)). An automatically activated ELT which is permanently attached to an aircraft.

Automatic portable ELT (ELT(AP)). An automatically activated ELT which is rigidly attached to an aircraft but readily removable from the aircraft.

Automatic deployable ELT (ELT(AD)). An ELT which is rigidly attached to an aircraft and which is automatically deployed and activated by impact and, in some cases, also by hydrostatic sensors. Manual deployment is also provided.

Survival ELT (ELT(S)). An ELT which is removable from an aircraft, stowed so as to facilitate its ready use in an emergency, and manually activated by survivors.

Emergency locator transmitter (distress tracking). Emergency locator transmitter for ICAO-specified in-flight distress tracking.

Emergency phase. A generic term meaning, as the case may be, uncertainty phase, alert phase or distress phase.

Uncertainty phase. A situation wherein uncertainty exists as to the safety of an aircraft and its occupants.

Alert phase. A situation wherein apprehension exists as to the safety of an aircraft and its occupants.

Distress phase. A situation wherein there is reasonable certainty that an aircraft and its occupants are threatened by grave and imminent danger or require immediate assistance.

False alert. An alert received from any source, including communications equipment intended for alerting, when no distress situation actually exists, and a notification of the alert should not have resulted.

GADSS information management. The infrastructure and services used for the exchange and timely dissemination of information in support of the GADSS.

Mission control centre (MCC). A component of the Cospas-Sarsat ground segment that follows a prescribed set of data processing and distribution rules to process distress alert data from 406 MHz beacons, exchange it with other MCCs, and send it to RCCs.

Rescue coordination centre (RCC). A unit responsible for promoting efficient organization of search and rescue services and for coordinating the conduct of search and rescue operations within a search and rescue region.

Note. — The term RCC is used in this document to apply generically to an aeronautical, maritime or joint (aeronautical and maritime) rescue coordination centre (ARCC, MRCC, JRCC respectively).

Search and rescue region (SRR). An area of defined dimensions, associated with a rescue coordination centre, within which search and rescue services are provided.

Survival ELT (ELT(S)). An ELT which is removable from an aircraft, stowed so as to facilitate its ready use in an emergency, and manually activated by survivors.

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

———————

Chapter 1

INTRODUCTION

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 while applying a global standard.

1.1.2 The proposed Location of an Aircraft in Distress Repository (LADR) 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 LADR 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 LADR.

1.1.3 The LADR does not provide the alerting of distress conditions; this will be done by operators and air traffic services units (ATSUs) using the existing provisions of Annex 6 and Annex 11 — *Air Traffic* Services. Annex 6 requires the operator to be notified when an aircraft is in distress. The operator should use this information to supplement its existing procedures and either validate the distress event, or establish contact with the crew to confirm the safety of the aeroplane. In the event that a distress condition is confirmed or suspected, the operator will contact the relevant air traffic control (ATC) centre who remains responsible for the activation of the alerting service and establishment of the relevant alert phase (uncertainty (INCERFA), alert (ALERFA), distress (DETRESFA)).

1.1.4 In due course, the LADR may host or serve as a system-wide information management (SWIM)-based conduit for additional information that may be of use to search and rescue (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 air traffic services units (ATSUs), rescue coordination centres (RCCs) and others as established by the State of the Operator. Additional elements which may be optionally provided by an autonomous distress tracking (ADT) device are also defined in order to ensure the information is received in a standardized format.

1.1.5 The initial implementation of the LADR is limited to position data from an activated ADT device caused by the aircraft reporting a distress condition or being manually activated by the flight crew. This should not be confused with an aircraft being designated as in a distress phase by air traffic control (ATC), as described in Annex 11, Chapter 5 (Alerting service).

1.1.6 The LADR system will allow accredited contributors to submit position information of an aircraft in distress or potentially in distress (1.4 refers). 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.

1.2 LADR STAKEHOLDERS

1.2.1 There will be three main categories of LADR stakeholders:

a) LADR administrator;

b) LADR contributors (data providers to LADR) inclusive of developmental submitter (1.4.1.2 refers); and

c) LADR data users (data consumers to LADR).

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

1.3 LADR ADMINISTRATOR

1.3.1 The LADR 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.

1.3.2 For administrative details such as the accreditation of a new user, the LADR administrator or delegated responsible organization will be available during regular working hours of the State in which they are located.

1.3.3 For technical issues related to access and use of the LADR, the LADR administrator, or delegated responsible organization, will be available 24 hours a day, 7 days a week 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.

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

1.4 LADR CONTRIBUTORS

1.4.1 Criteria for becoming a LADR contributor

1.4.1.1 LADR contributors will be those organizations who:

a) have ADT solutions that have been approved for use by a State;

b) are able to provide data to the LADR in accordance with the requirements defined by the LADR administrator; and

c) have been properly accredited.

1.4.1.2 Potential LADR contributors will be designated as developmental submitters until they can demonstrate that appropriate quality systems can verify the accuracy and integrity of the provided data. Functional requirements related to the developmental area used for this purpose are described in Chapter 3, 3.1.10.

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

1.4.2 Contributor accreditation

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

a) a State informs ICAO that it is undergoing the approval process of an ADT system and wishes that the LADR establishes the organization as a developmental submitter;

b) the LADR administrator provides all necessary documentation to fully specify the required data, formats and procedures for ADT data submissions;

c) the LADR administrator runs a verification test to ensure that the contributor, in developmental submitter mode, meets the LADR requirements for data submissions;

d) once the verification tests are successfully completed, the LADR administrator will set up the system to allow the contributor to submit data and monitor data submissions; and

e) once all requirements are met to the satisfaction of the LADR administrator, it informs the respective Member State of the suitability of the ADT system. The LADR administrator will also issue an accreditation to the ADT provider as a contributor.

1.4.2.2 Contributors will automatically obtain user status.

1.4.3 Contributor ongoing accreditation

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

1.5 LADR DATA USERS

1.5.1 Criteria for becoming a LADR user

1.5.1.1 LADR users are individuals that are associated with a LADR accredited entity. All user access to the LADR will be read-only. User access and available information will be subject to the entity type profile (see Table 1-1) and the privileges granted by the particular accredited entity.

Table 1-1. Access to data by user type

Entity (user) type profile	*Domain of data available to users*
Air operator	All ADT data for the operator's own aircraft, identified by the operator's three-letter designator.
Air navigation services provider (ANSP)	All ADT data for aircraft within the flight information region (FIR) managed by the ANSP. Additionally, any event that starts, is active or terminates within the FIR should be fully visible to the ANSP responsible for the FIR (including the data points that are outside of the FIR).
RCC	All ADT data in the LADR.
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.

1.5.1.2 An accredited entity will have one or more *super user* 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 (Chapter 3, 3.1.5 refers).

1.5.1.3 An accredited entity will need to have at least one super user that will act as the focal point for the LADR administrator.

1.5.1.4 Users will be approved and registered in the LADR by the super user. Users will be able to see the ADT data based on the corresponding entity type profile.

1.5.2 User (entity) accreditation

1.5.2.1 ICAO will accredit entities that will, in turn, accredit users. When an entity seeks ICAO accreditation to access the LADR, it will need to nominate at least one super user that will serve as the LADR focal point.

1.5.2.2 Table 1-2 contains the entities that are eligible for accreditation by the LADR administrator and the eligibility requirements for each entity.

Table 1-2. Requirements for user accreditation

Entity	*Requirement*
Air operator	— Be listed in *Designators for Aircraft Operating Agencies, Aeronautical Authorities and Services* (Doc 8585). — Maintain updated agency (operator) operational control contact information with ICAO.
ANSP	— Manage at least one ATSU. — Have ATSUs listed in *Location Indicators* (Doc 7910). — Maintain updated ATSU operational control contact information with ICAO.
RCC	— Be listed in the Cospas-Sarsat RCC database. — Maintain an updated RCC operational control contact information with ICAO.
Others, as determined by the State of the Operator	— Additional users which the State of the Operator requires to have access will need to be specifically identified by the State of the Operator.

1.5.2.3 An entity that meets the requirements in Table 1-2 and is seeking ICAO LADR accreditation will need to submit an official request to the LADR 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.

1.5.2.4 An entity and all users associated with that entity will retain accreditation for as long as the eligibility requirements in Table 1-2 remain valid.

Chapter 2

FUNCTIONAL OVERVIEW

2.1 BACKGROUND

This chapter outlines a high-level overview of the LADR, its functional blocks and the various actors that interact with the LADR. Detailed requirements defining the functional and non-functional requirements can be found in Chapter 3.

2.2 SYSTEM SCOPE

2.2.1 Figure 2-1 shows how the LADR fits in the context of the full ADT system, and the links to stakeholders.

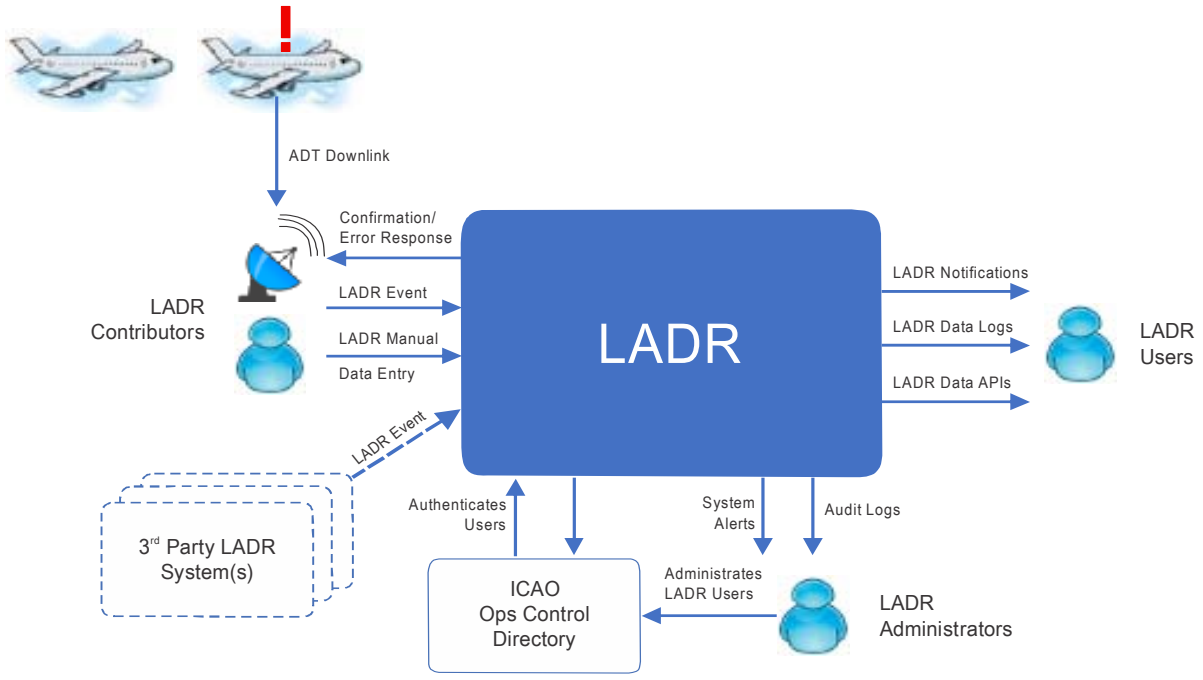

Figure 2-1. LADR integration with stakeholders

2.2.2 Actions that occur outside of the LADR are not considered in this document, unless they are required to define the functionality of the LADR itself.

2.3 SYSTEM FUNCTIONAL BLOCKS

Figure 2-2 shows the constituent elements of the LADR system defined as functions. The functions are further refined by the functional requirements listed in Chapter 3.

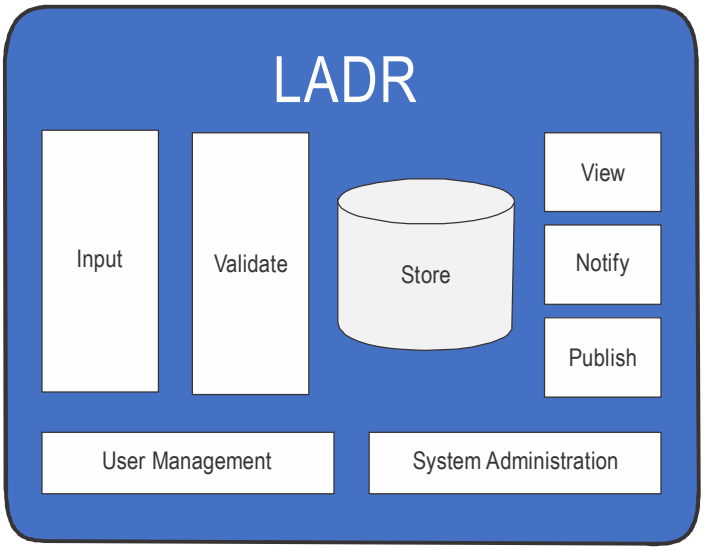

Figure 2-2. LADR functional diagram

Chapter 3

DETAILED REQUIREMENTS

3.1 FUNCTIONAL REQUIREMENTS

3.1.1 Data input

3.1.1.1 The system will receive data from one or more authorized LADR contributors in Flight Information Exchange Model (FIXM) 4.2 format and must be capable of encoding the mandatory data elements specified in Appendix A and the optional data elements in Appendix B.

3.1.1.2 Upon receipt of the data, a response will be sent to the LADR contributor in a synchronous manner, acknowledging receipt as well as any validation errors, if any (3.1.3).

Note. — This is not to be confused with a LADR user notification which informs registered users of new data being received into the repository.

3.1.1.3 All incoming data (valid or invalid) will be stored within a data audit log.

3.1.1.4 The system will monitor the connection to all LADR contributors using a system-to-system heartbeat, or similar concept. In the event that a contributor cannot be contacted, a notification will be sent to the LADR administrator.

3.1.1.5 The system should allow for feedback of issues experienced to be sent to the administrator for review and action. It will have the means to manually add additional information to a record such as call signs, flight numbers and 24-bit addresses (as detailed in Appendix B) to assist with the positive disambiguation of events.

3.1.2 Data storage

3.1.2.1 All mandatory data elements specified in Appendix A and optional data elements in Appendix B will be stored within a suitable persistent data store.

3.1.2.1.1 The data store will be capable of performing spatial queries to facilitate geometric LADR user filters e.g. a filter by FIR polygon.

3.1.2.1.2 The data store will also be capable of performing text-based queries to facilitate text-based LADR user filters e.g. filter by operator code.

3.1.2.2 The system will be capable of connecting to multiple ICAO authorized LADR systems which are geographically distinct. This type of architecture is not recommended; however, in the event that a State or collection of States determines that it wishes to pursue this option, sufficient information regarding how to connect to the system to facilitate this will be described.

3.1.3 Data validation

3.1.3.1 All messages originating from LADR contributors will be validated in accordance to the specified FIXM 4.2 format.

3.1.3.2 A submission will fail validation in the following situations:

a) message syntax is incorrect;

b) message is not complete;

c) system is incapable of processing all the submitted data in the message; or

d) system suspects the duplication of submitted data or messages.

3.1.3.3 LADR contributors will be informed of validation failures upon the submission of data into the system.

3.1.3.4 Validation failures will be stored in a validation audit log.

3.1.3.5 An appropriate means (e.g. e-mail) will be used to notify the LADR administrator that data validation failures have occurred.

3.1.4 Data publication

3.1.4.1 The last known position of an aircraft in distress will be made available to authorized LADR users. The minimum required information, per Annex 6, Part I, is the latitude and longitude with a time stamp.

3.1.4.2 Additional information stored within the LADR should be available to authorized LADR users, consistent with their user access privileges.

3.1.4.3 The information stored in the LADR will be made available for users to export to proprietary systems.

3.1.4.3.1 Data will be encoded in at least one suitable format, to mitigate implementation expense and complexity for LADR users to consume the data in existing geographic information system (GIS) systems such as Geoserver/ESRI ArcGIS, as well as browser-based mapping frameworks such as Open Layer. Example formats include (but are not limited to):

a) FIXM 4.2;

b) GML 3.2; and

c) GeoJSON.

3.1.4.3.2 A valid data set matching the filter associated to the LADR user profile will be provided via one or more web-service interface(s) in accordance with the SWIM-TI Yellow Profile e.g. req/res over transport layer security (TLS) and/or publish and subscribe of advanced message queuing protocol (AMQP) 1.0. More information on the SWIM-Technical Infrastructure (TI) Yellow Profile can be found in Appendix C.

Note. — For information on SWIM, see the Manual on System-Wide Information Management (SWIM) Concept (Doc 10039).

3.1.4.4 All invalid data recorded in the data audit log will be provided via a web-service interface in accordance with the SWIM-TI Yellow Profile User management.

3.1.5 Notifications

3.1.5.1 A notification will be issued to a LADR user when ADT data meets the requirements of a LADR user 'filter', as defined in the LADR user profile.

3.1.5.2 The notification will be triggered by the first received position from an activated ADT system, and the system should not normally send notifications for each position report received from the device.

3.1.5.2.1 Where an aircraft in distress transits from one FIR to a second (and any subsequent) FIR, a new notification will be triggered for the second (and subsequent) FIRs.

3.1.5.2.2 Users will typically have the option to subscribe to notifications. Operators will be required to receive notifications regarding activation of an ADT system on their aircraft in order to comply with the requirement to be notified if an aircraft is in distress, as specified in Annex 6, Part I, Appendix 9.

3.1.5.3 Notifications may be provided using the following means:

a) e-mail;

b) SWIM compliant notification to LADR users using a message queuing service such as AMQP 1.0;

Note. — There is no requirement for a push-pull message exchange pattern for LADR 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.

c) short message service (SMS); and

d) ATS message over aeronautical fixed telecommunication network (AFTN).

3.1.5.4 LADR users will receive notifications depending on the type of user account, according to Table 3-1.

Table 3-1. User notification restrictions

User Account Type	*Notification options*
Air operator	Limited to operators own aircraft.
ANSP	Events which start, are active or terminate within the FIR managed by the ANSP. *Note. — Data for an event which originated outside the FIR but terminated within the FIR will still be accessible, according to Table 1-1 for data access or Chapter 1, 1.5.2.1 for notification.*
RCC	No limitation, but option to filter based on SAR region (SRR).
State of the Operator	Any events relating to aircraft associated with operators of the State of the Operator.

3.1.5.5 Where notifications are generated based on a FIR or a portion of a FIR, an additional 80 NM buffer will be used in order to calculate which notifications are to be sent and to which LADR user.

3.1.5.6 Notifications should usually be sent only once for an event. Successive transmissions of an event at one minute (or shorter) intervals will not generate additional notifications. Events which transit from one FIR to a second or subsequent FIR should generate a second notification for the second or subsequent FIR.

3.1.5.7 If an event transmission stops and subsequently re-starts, the system will consider the restart as a separate event and send a new user notification. The interval between position reports that will constitute a stop and re-start will be defined during the testing phase and will be based on information received from accredited contributors.

3.1.5.8 A clear indication to show which stakeholders associated with an event have opted to receive notifications will be provided. This will allow other parties to know whether or not they are likely to be informed about the distress condition of the aircraft.

3.1.5.8.1 Where possible, acknowledgement of receipt of notification by the user should also be displayed in the system.

3.1.5.9 Users will have the facility to block notifications for a specific aircraft in order to stop erroneous notifications due to an intermittent/recurrent fault with the ADT system.

3.1.5.10 Users will have the facility to manage their own notification settings from within the LADR viewer.

3.1.5.11 The inclusion of historic data in the LADR (such as a request for Aireon data) should not generate a notification to users.

3.1.6 Distress event validation

The user will be able to indicate that it has investigated the event and determined one of the following:

a) a genuine distress event is taking place;

b) the event is a false activation and there is no longer any doubt regarding the safety of the aircraft ; or

c) information regarding the validity of the event could not be determined.

3.1.7 Web viewer

3.1.7.1 A secure browser-based web viewer will enable each LADR user to view the events relevant to them (based on the ‘filters’ associated to the LADR user profile) on an interactive two dimensional map.

3.1.7.2 Only authorized LADR users will be able to access the web viewer based on permissions of the ICAO Operations Control (OPS CTRL) Directory.

3.1.7.3 The web viewer will display the geographic position of the event (including the latest position and all previous positions received) on the map.

3.1.7.4 The user will be able to view a display of the associated properties of each position report in an event, in table format, by selecting the position report from the web viewer display.

3.1.7.4.1 Where additional information (e.g. altitude, airspeed) is available, the web viewer will display this also.

3.1.7.4.2 The web viewer will allow for customization of the displayed information such that each user will be able to select the parameters to be shown on selecting a data point within an event.

3.1.7.5 The web viewer will incorporate the facility to zoom in and out and pan over the map and context layers.

3.1.7.6 The web viewer will have the facility to display various backdrop map layers in order to provide additional context mapping to the event.

3.1.7.6.1 The LADR user will have the facility to turn on and off various backdrop map layers, as required.

3.1.7.6.2 The following layers will be included in the web viewer:

a) all world-wide airports based on the current aeronautical information regulation and control (AIRAC) cycle;

b) all world-wide FIRs based on the current AIRAC cycle;

c) all State boundaries;

d) all SAR region (SRR) boundaries; and

e) the graticules of latitude and longitude.

3.1.7.7 An audio alert should be generated by the LADR viewer to draw attention to the receipt of new data in the repository.

3.1.8 User management

3.1.8.1 User authentication will be made through the Data Network for Aviation (DNA) login mechanism (https://www4.icao.int/dna).

3.1.8.2 The LADR will incorporate OpenID Connect/OAuth 2.0 protocols.

3.1.8.3 The user roles and information will be stored in the LADR database and managed through the OPS CTRL Directory interface.

3.1.8.4 Authorization will be managed through OPS CTRL.

3.1.8.5 The user lists will be shared between the LADR and OPS CTRL. The latter will therefore need write access to the LADR/OPS CTRL user list.

3.1.8.6 The system will be capable of continuing to authenticate users and provide access, even if the OPS CTRL Directory is offline.

3.1.8.7 The system will not export user account data for any reason.

3.1.9 System administration

3.1.9.1 The LADR administrator will have the facility to search all types of audit logs via a system administrator interface.

3.1.9.2 Suitable system metrics will be maintained in order to monitor the performance of the system against the agreed system services level agreement.

3.1.10 General system requirements

3.1.10.1 The LADR will be hosted in a standalone production environment for access to live operational data by LADR contributors and users.

3.1.10.2 Furthermore, a standalone pre-production environment will be available for formal testing and accreditation of LADR contributors and users who wish to connect to the LADR or need to test updates to their existing systems.

3.1.10.3 A standalone integration environment will be used for the early and informal development and testing by LADR contributors and users who wish to connect to the LADR or need to test software updates to their existing systems.

3.1.10.4 The system will operate across two geographically independent sites to provide redundancy in case of natural disasters or other factors adversely impacting the operational readiness. The fact that the system operates across two geographically sites should be transparent to all LADR users and contributors

3.2 NON-FUNCTIONAL REQUIREMENTS

3.2.1 The system will be developed, tested and deployed to a level of quality that ensures that when data is submitted, it is accurately processed.

3.2.2 The system will be capable of scaling in a horizontal manner and without major disruption or change to the underlying architecture.

3.2.3 The system should be capable of processing a peak load of 1 000 events per minute based on an average ADT message size of 200 bytes, uncompressed.

3.2.4 Based on the ATS data retention requirements in Annex 10 — *Aeronautical Telecommunications*, the system will store all data (ADT event and audit logs) for a period of at least 30 days from its submission.

3.2.4.1 After 30 days from submission, the system should archive all data to an offline file storage system.

3.2.5 Excluding planned maintenance, the system should operate and be supported on a 24/7 basis, 365 days a year.

3.2.6 Excluding planned maintenance, the system should be available at least 99.9 percent of the time per calendar month.

3.2.7 The system may have up to four planned maintenance periods during a calendar year and each period should be no longer than two hours.

3.2.8 The system will have a recovery point objective of one hour, which will be measured from the point at which the decision to invoke the disaster recovery process is made.

3.2.9 All web service responses in the system should have an average time-to-first-byte of no longer than three seconds.

3.2.10 The time taken from when data is first received by the system to when it is made available to a LADR user (the “end-to-end latency”) should be no longer than 30 seconds.

3.2.11 The LADR 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.

3.2.12 Protection from malicious attempts to interfere with normal operation and authorized access (e.g. denial of service) will be provided.

3.2.13 Virus scanning of all messages entering the system should be provided.

3.2.14 All network traffic in and out of the system will be encrypted using suitable encryption transport technology such as TLS.

3.2.15 All password information received, transmitted or stored in the system will be encrypted using standard Internet encryption technology.

3.2.16 All security events should be logged in a security audit log.

3.2.17 Attempts at intrusions will be detected, and an attempt to terminate them will be made where possible.

3.2.18 All intrusions will be reported in such a way that the LADR administrator is immediately alerted.

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

Appendix A to Chapter 3

Mandatory Data Elements

The table below defines the mandatory data elements to be provided by a LADR data contributor.

Table 3-A-1. Mandatory data elements

Field	*Format*	*LADR functionality*	*Example*
Latitude	N/S DD MM.M’	Establish domain by geo referencing.	N45°30.1'
Longitude	E/W DDD MM.M’	Establish domain by geo referencing.	W073°33.9'
Date and time of transmission	DD/MM/YYYY/HH:MM:SS	Sequencing of messages and data retention.	07/12/2017
Date and time of receipt	DD/MM/YYYY/HH:MM:SS	Sequencing of messages and data retention (for corrupted/incomplete data).	07/12/2017
3LD	TTT	Establish State of the Operator domain.	MXA
Aircraft registration (with Nationality Mark)	TTTTTTT	Particular aircraft identification. (Completion of at least one field from the possible options to identify the aircraft is required.)	XA-BJH
Aircraft 24-bit address	TTTTTT		AC82EC
Selective calling system (SELCAL)	TTTTTT (TTTT)		ABCDEF (ABCD)
Flight call sign and flight number	TTTTTTT		BAW1234
Contributor code	NNN	Establish contributor domain for data validation.	001
Data source	TTTTTT	Enable identification of the source of data (manufacturer, type of ADT).	GCP-01

Appendix B to Chapter 3

OPTIONAL DATA ELEMENTS

An ADT system may be configured to provide additional data, as shown in Table 3-B-1.

This information could be vital in fully understanding the event, therefore ADT service providers are strongly encouraged to provide as much of the information listed in this table as possible.

The fields in the table below nevertheless remain optional. Where used, the format of the data supplied must match the indicated format to ensure the consistency and usability of the data.

Table 3-B-1. Optional data elements

Field	*Format*	*LADR functionality*	*Example*
Accuracy of position data		Optional if available from the ADT system.	
Altitude (ft)	NNNNN	Optional field; either altitude in m or ft (recommended).	35000
Altitude (m)	NNNNN		10000
Altitude source	XXXX	Required if *altitude* data supplied.	BARO GNSS
Groundspeed (kt)	NNN	Optional field.	350
Groundspeed (km/h)	NNN	Optional field.	550
Heading	DDD°	Optional field.	090
Emergency locator transmitter (ELT) Hex ID	HHHHHHHHHHHHHH	Carried ELT devices (may be more than one per aircraft).	1234567890ABCDE
ADT activation method	TTTTTT	Defined code which indicated if the activation was manual or automatic, and what parameter exceedance triggered the automatic activation, if applicable. Also incorporates cancellation message to provide information when the ADT system no longer transmits due to the activating condition no longer being fulfilled.	431832
Validated distress event flag	True/False	Operator editable to indicate their process has determined the aircraft is in a genuine distress state.	
Acknowledgment of notification	True/False	Indicates that the notification sent to the user has been received and viewed.	

Notes regarding the ADT Activation method code

Providing additional information on the means by which the ADT system was activated and began transmitting has been identified as being of potentially great value and is strongly encouraged by all contributors.

The proposal included is to determine, based on the mandatory fields of *Contributor Code* and *Data Source*, where to look for information regarding the activation codes (a look-up table would be provided by the contributor), as seen in the example below:

Contributor Code	*Data Source*	*ADT Activator (SLTTVV)*	*Interpretation of the ADT Activation code*
001	GCP-01	431401	Aircraft in-flight — Distress Alert — Battery — Voltage Low
001	GCP-01	431832	Aircraft In-flight — Distress Alert — Roll — 32 degrees
001	GCP-01	431100	Aircraft In-flight — Distress Alert — Manually activated by crew
001	GCP-01	531604	Aircraft Landing — Distress Alert — 429bus — (FW number 04)
001	GCP-01	401300	Aircraft In-flight — Normal — Cancel Alert

Aircraft recovery from distress condition

Cancellation of the transmission by the system (aircraft no longer in distress) would be indicated by the same field. As this data would be supplied at each data point received, the initial and subsequent points received by the LADR system would indicate the *state* of the aircraft, while the final data point received would show no distress condition and message cancelled (in this case).

Appendix C to Chapter 3

SWIM TI-YELLOW PROFILE BINDING REQUIREMENTS

Table 3-C-1 specifies WS-light interface binding mandatory requirements for the SWIM TI-Yellow Profile.

Table 3-C-1. SWIM TI-Yellow Profile binding mandatory requirements

TLS	SWIM-TIYP-0008	The Service Interface Binding shall support the following versions of the Transport Layer Security Protocol (TLS): +IETF RFC 5246 (TLS v1.2)
HTTP	SWIM-TIYP-0009	The Service Interface Binding shall support HTTP/1.1.
HTPP over TLS	SWIM-TIYP-0010	The Service Interface Binding shall comply with IETF RFC 2818 (HTTP over TLS).
TLS Authentication	SWIM-TIYP-0042	The Service Interface Binding shall support one of the following authentication mechanisms for TLS: + Mutual authentication with X.509 certificates + Server authentication with X.509 and Client authentication with HTTP Basic or HTTP Digest.
HTTP Status Code Header	SWIM-TIYP-0043	The Service Interface Binding shall be able to use the HTTP Status-Code header.
HTTP Reason Phrase Header	SWIM-TIYP-0044	The Service Interface Binding shall be able to use the HTTP Reason-Phrase header.

More information can be found using the following link from the EUROCONTROL SWIM Service Registry: https://eur-registry.swim.aero/reference/ectl-swim-tiyp-v1-0/requirements.

— END —

ISBN 978-92-9265-493-1